

Blackwater Terrestrial Ecology Survey Report

Flora and fauna seasonal surveys - Blackwater South

Prepared for BHP Billiton Mitsubishi Alliance
February 2022

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1 Introduction

1.1 Background

BHP Billiton Mitsubishi Alliance Coal Operations Pty Ltd (BMA) owns and operates the Blackwater Mine (BWM), situated approximately 20 km south of Blackwater, Queensland. The mine has been in operation since the 1960s and currently operates under an Environmental Authority (EA) EPML00717813, with existing coal production at c.16 million tonnes per annum (Mtpa).

BMA sought to obtain a baseline of ecology values within Mining Lease (ML) 70139, ML70167, Mineral Development Licence (MDL) 189 and MDL155 (Blackwater South) southward of the existing operation in order to inform any future assessments required.

BMA has identified that contemporary baseline information on terrestrial ecology addressing applicable environmental survey guidelines, was required to identify the presence of biodiversity values including threatened ecological communities and species. The objective of the environmental studies was to:

- identify the presence of matters of national and state environmental significance;
- map the distribution of those environmental values across Blackwater South as described above; and
- develop a GIS database of ecological information based on results of a field survey program.

EMM Consulting Pty Ltd (EMM) were commissioned by BMA to undertake seasonal terrestrial flora and fauna baseline surveys. These seasonal surveys were completed between 2018 and 2020 (collectively referred to as seasonal from hereon in) within the above listed leases (Blackwater South). These areas are referred to as the “survey area” for the purposes of this report and illustrated in Figure 1.1.

Prior to all field ecology surveys being undertaken, desktop ecology assessments were completed by EMM to identify biodiversity values of Federal and State significance that may occur in the survey area including certified regional ecosystems (REs), threatened ecological communities (TECs) and threatened species. Desktop assessments included a buffered area around the survey area to include all potential ecological values (hereafter study area).

1.2 Purpose of this report

The purpose of this report is to present information on all terrestrial ecology desktop assessments, field survey methods and survey results that have been undertaken by EMM to date in the survey area. The report then summarises the biodiversity values present in the survey area and their distribution. A focus is on prescribed matters under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Environmental Offsets Act 2014*.

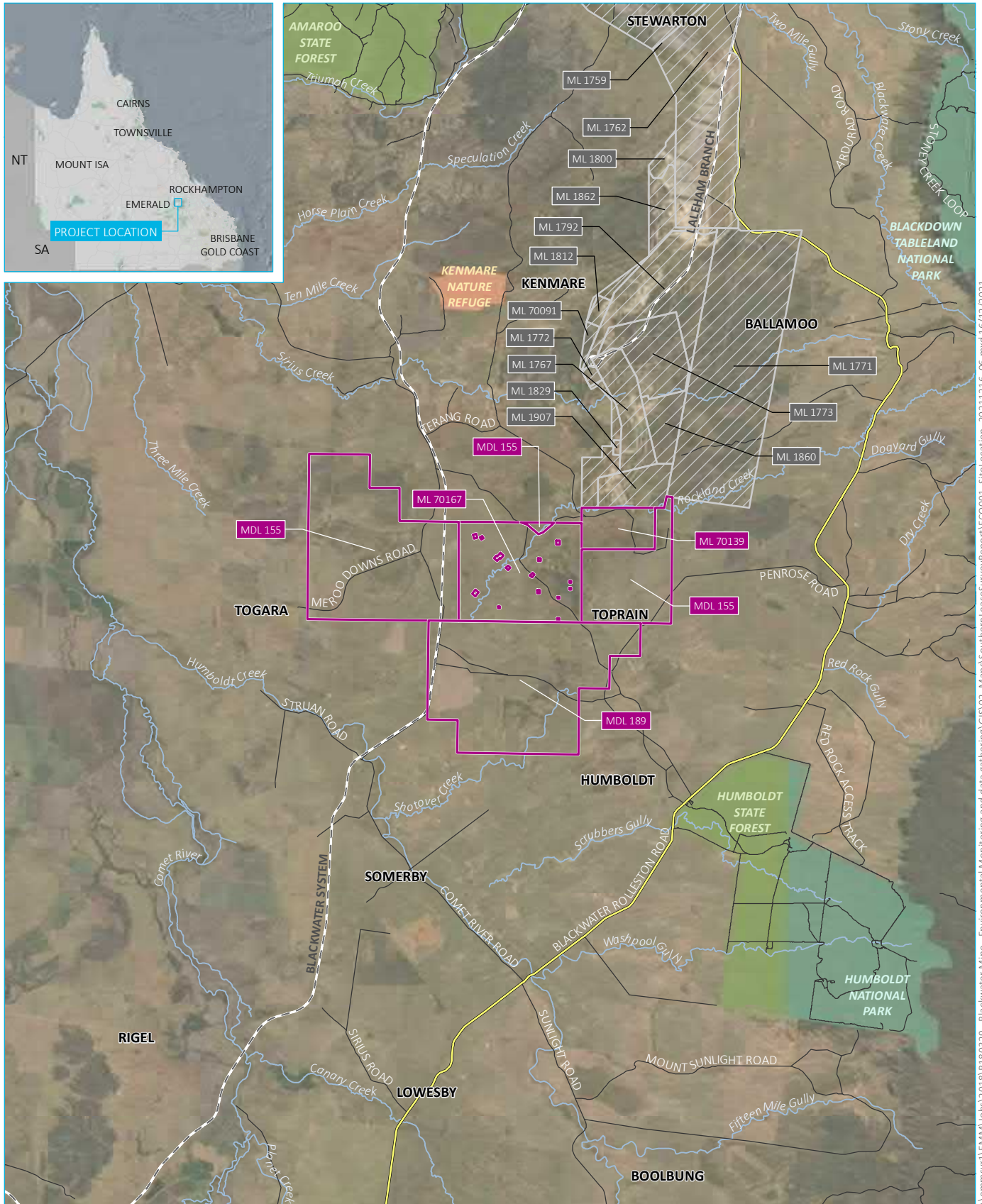
The seasonal ecology surveys included the validation of vegetation communities and targeted surveys for threatened flora and fauna species across the survey area.

This report includes information on:

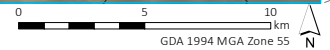
- survey area;
- desktop searches and results in the wider study area (survey area buffered by 25 km);
- field survey methods and survey locations;

- timing and weather conditions;
- survey results including ground-truthed regional ecosystems (REs), threatened ecological communities (TECs), fauna habitat assessments and habitat condition and recorded threatened flora and fauna species; and
- habitat mapping for threatened fauna species known or considered likely to occur.

The results of this report will represent baseline information regarding the presence of Matters of National Environmental Significance (MNES) and Matters of State Environmental Significance (MSES) associated with the survey area. The results will inform and support any future impact assessments and approvals required for any further development in the survey area.



Source: EMM (2020); DES (2020); DNRME (2020); GA (2011); ASGC (2006)



KEY

- Southern lease survey area
- Mining lease surface areas
- Rail line
- Major road
- Minor road
- Vehicular track
- Named watercourse
- National park
- State forest
- Nature refuge

Blackwater Mine southern leases and survey area

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 1.1



\\lemmsvr1\EMM\jobs\2018\B180329 - Blackwater Mine - Environmental Monitoring and data gathering\GIS\03_Maps\SouthernLeasesSurvey\Report\ECO001_SiteLocation_20211116_06.mxd 16/12/2021

2 Legislative context

A summary of the key legislation, policies and guidelines that have informed the design and implementation of field ecology surveys is provided in the following sections.

2.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation that provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as MNES.

If a proposed development or other action ('proposed action') is likely to have a significant impact upon a protected matter, then it must be referred for assessment under the EPBC Act. Protected matters under EPBC Act are:

- World Heritage Properties;
- National Heritage Places;
- wetlands of international importance (listed under the Ramsar Convention);
- listed threatened species and ecological communities;
- migratory species protected under international agreements;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- the environment, where nuclear actions are involved;
- a water resource, in relation to coal seam gas and large coal mining developments;
- the environment, where actions proposed are on, or will affect Commonwealth land and the environment; and
- the environment, where Commonwealth agencies are proposing to take an action.

2.1.1 Matters of National Environmental Significance - Significant Impact Guidelines 1.1

Under the EPBC Act an action will require approval from the minister if the action has, will have, or is likely to have, a significant impact on a MNES. The *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DoEE, 2013) outline a 'self-assessment' process, including detailed criteria, to assist persons in deciding whether or not referral may be required and if the proposed action may have a 'significant' impact on MNES.

The EPBC Act includes a requirement that where a significant impact to a MNES is assessed as likely to occur, an environmental offset is required to compensate for that impact.

These requirements were considered in scoping the baseline surveys at Blackwater, including consideration of critical habitat, important populations etc discussed in the guidelines

2.1.2 EPBC Act referral guidelines for the vulnerable Koala

Assessment of impacts to Koala (*Phascolarctos cinereus*) are addressed within the EPBC Act referral guidelines for the vulnerable Koala (DoEE 2014). The guidelines provide a 'koala habitat assessment tool' to assist in the determining the sensitivity, value and quality of lands potentially impacted under development proposals. The assessment tool is to be used to identify a 'habitat score' and determine whether habitat on the target site may be considered 'critical to the survival of the Koala' and therefore critical to the long-term survival and recovery of the species. A habitat score of five is the trigger at which a site may be described as 'critical habitat'. The score is based on Koala occurrences, vegetation structure and composition, habitat connectivity, key existing threats and the recovery value of the area.

These guidelines were considered in the scoping of ecological surveys.

2.1.3 EPBC Act Environmental Offsets Policy

Environmental offsets are required to be delivered in accordance with the *EPBC Act Environmental Offsets Policy* (DoEE 2012). The Environmental Offsets Policy outlines the Australian Government's approach to the use of environmental offsets ('offsets') under the EPBC Act. Offsets are defined as measures that compensate for the residual adverse impacts of an action on the environment. Where appropriate, offsets are considered during the assessment phase of an environmental impact assessment under the EPBC Act (DoEE 2012). Avoidance and mitigation measures are the primary strategies for managing the potential significant impact of a proposed action. Offsets do not reduce the likely impacts of a proposed action, but instead compensate for any residual significant impact.

Where significant impacts are found to occur to MNES, and environmental offsets are required, an offsets package should be provided. An offsets package is a suite of actions that a proponent undertakes in order to compensate for the residual significant impacts to the identified MNES. It can comprise a combination of direct offsets and other compensatory measures. Offsets should align with conservation priorities for the impacted protected matter and be tailored specifically to the attribute of the protected matter that is impacted in order to deliver a conservation gain (DoEE 2012).

To support any offset assessments that may be required it will be important to evaluate the specific MNES attributes that occur within the proposed disturbance area (e.g is it foraging habitat or breeding habitat) and the habitat quality of mapped habitat areas. This information is required to inform offset calculations.

2.2 Queensland Environmental Protection Act 1994 (EP Act)

An EA or EA amendment under the Qld EP Act will be required to authorise any future mining disturbance within the survey area. Prior to the granting of an EA, an environmental impact assessment is required to be undertaken to assess the potential for environmental impacts, and identify how those impacts will be avoided, reduced and mitigated. As part of the impact assessment, the presence of MSES and Environmentally Sensitive Areas (ESAs) within the proposed impact areas will need to be identified. Impact assessments would then be required to determine as to whether the proposed actions would result in a 'significant' residual impact to MSES. If a significant impact is considered likely to occur to MSES, environmental offsets will be conditioned through the EA, and they will need to be delivered in accordance with the *Environmental Offsets Act 2014* (EO Act).

To support future impact assessments, the terrestrial ecology surveys have looked to validate the presence and extent of REs across the survey area, presence or potential presence of listed flora and fauna species under Qld *Nature Conservation Act 1992* (NC Act) and their habitats and presence of other MSES values. A number of habitat quality assessments were also completed for selected patches of native vegetation communities across the survey area to inform future MSES offset assessments if required. Habitat quality assessments were undertaken applying methodology from the *Guide to determining terrestrial habitat quality* (DES 2017).

2.3 Queensland Vegetation Management Act 1999 (VM Act)

The purpose of the VM Act is to regulate the clearing of native vegetation in a way that conserves remnant vegetation in declared areas, ensures clearing does not cause land degradation, prevents the loss of biodiversity and maintains ecological processes.

The VM Act does not apply to clearing within a mining lease, however the framework established under the VM Act for the description and mapping of regulated vegetation including remnant and high value regrowth applies. Under the VM Act REs are assigned three statuses which are:

- Endangered RE;
- Of Concern RE; or
- Least Concern RE.

These statuses are taken from the RE description database, and respective definitions are provided in the Act. Within this report, the definition of a RE follows that described by Sattler and Williams (1999) i.e. a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil. For the purposes of this report both the VM Act status and Biodiversity Status (BD status) of a RE is noted.

Under the EP Act, mining projects have to consider both VM Act status of a RE when assessing if there may be significant impacts to MSES, and BD status when identifying the presence of ESAs for an EA. The flora surveys included an assessment of vegetation communities and whether they meet remnant status under VM Act.

2.4 Queensland Nature Conservation Act 1992 (NC Act)

2.4.1 Protected plants in trigger mapping

In Queensland, all plants that are native to Australia are protected plants under the NC Act to prevent whole plants or protected plant parts from being illegally removed from the wild or illegally traded. Clearing, growing, harvesting and trading of protected plants in Queensland is regulated by the *Nature Conservation (Wildlife Management) Regulation 2006*.

If a proposed area to be cleared contains native plants in the wild, and there is no relevant exemption, and the area is shown as high risk on the flora survey trigger map, a flora survey of the clearing impact area must be undertaken prior to any clearing. If the flora survey identifies the presence of a critically endangered, endangered, vulnerable or near threatened (CEEVNT) plant in the clearing impact area, or 100 m buffer, a clearing permit under NC Act is required prior to any clearing. A clearing permit authorises the clearing of an area of land rather than the individual species of plant present. Clearing that has complied with a permit will not be subject to any further survey or approval requirements once clearing commences. A proponent can then carry out re-clearing or routine maintenance for up to 10 years after the original authorised clearing. Where a significant residual impact to a protected plant is likely to occur, an offset may be required.

If the flora survey of the high risk area does not detect any CEEVNT plants in the clearing impact area, or the impacts on CEEVNT plants can be avoided (i.e. clearing will not take place within 100 m of the CEEVNT plants), a clearing permit is not required but an exempt clearing notification must be submitted to DES within one year of the survey being undertaken, and at least one week prior to the clearing commencing.

The notification requirement includes:

- location of the activity;

- details of the flora survey including timing, methods and results; and
- evidence the personnel that undertook the survey are suitably qualified.

At the time of surveys there were no high risk areas on the flora survey trigger map in the survey area. CEEVNT flora species were searched for while completing RE mapping surveys across the survey area. No formal protected plant surveys under State guideline were undertaken.

Subsequent to field survey effort, a cluster of high risk trigger areas have been mapped in the northeast of the survey area, just to the south of the old Blackwater south mine area and Rockland Dam (trigger mapping version 7.1). These areas are associated with records of *Solanum elaeagnifolium* mapped by EMM during the late spring/summer 2018 flora surveys. Formal protected plant meanders are not currently proposed as protected plant surveys are only valid for one year. As part of any upcoming approval applications, and within 12 months of vegetation clearing being required, formal protected plant surveys will be completed.

An exemption notification report or clearing permit under NC Act may also be required depending on survey findings.

2.4.2 Fauna breeding places

For a proposed activity that will have an unavoidable impact on breeding places of protected animals (which include all classes of native wildlife including least concern) a Species Management Program (SMP) is required to be prepared and approved by the Department of Environment and Science (DES) under the NC Act. DES has prepared an Information Sheet that outlines when a SMP is required.

Animal breeding places are defined in this document as: a bower; burrow; cave; hollow; nest; or other thing that is commonly used by the animal to incubate or rear the animal's offspring.

A Low Risk SMP can authorise tampering with animal breeding places for least concern species. A High Risk SMP will authorise tampering for all fauna breeding places including colonial breeders, special least concern and CEEVNT species. The duration of the SMP must be identified and must be relevant to the activity being undertaken and allow for a periodic review of the program. The standard term for a SMP is three years.

The purpose of a SMP is to:

- assess the threats to native animal breeding places resulting from a planned activity;
- incorporate management actions that will avoid or minimise both the immediate and the long-term impact of removing or altering an animal breeding place; and
- set monitoring and reporting requirements that demonstrate the management actions in the SMP are effectively implemented and produce the intended results.

The seasonal terrestrial ecology surveys have included habitat assessments and identification of animal breeding places. This information has been used to inform an evaluation of species likelihood of occurrence on the site, habitat mapping and will be used at a later date to support an assessment of potential impacts to fauna species and preparation of a SMP if required.

2.5 Queensland Environmental Offsets Act 2014

In Queensland there is an offsets framework governed by a range of legislation, policies and guidelines to support a determination as to when environmental offsets are required, and how they are to be delivered. A summary of the framework and guiding principles that apply to mining projects is summarised below.

The Queensland Offsets Framework includes:

- *Environmental Offsets Act 2014* (Qld) (EO Act);
- *Environmental Offsets Regulation 2014* (Qld) (EO Regulation);
- Queensland Environmental Offsets Policy (QEOP) (version 1.6); and
- Significant Residual Impact Guideline – for prescribed activities under NC Act, EP Act and Marine Parks Act (DEHP 2014).

Under the Queensland Environmental Offsets Framework an environmental offset is required when a significant, residual impact occurs to a MSES.

MSES are prescribed in Schedule 2 of the EO Regulation and include:

- regulated vegetation - prescribed regional ecosystems that:
 - are endangered or of concern; or
 - are prescribed regional ecosystems that intersect with an area shown as a wetland on the vegetation management wetlands map; or
 - are an area of essential habitat on the essential habitat map for an animal that is endangered wildlife or vulnerable wildlife or a plant that is endangered wildlife or vulnerable wildlife; or
 - is located within a defined distance from the defining banks of a relevant watercourse.
- connectivity areas;
- wetlands and watercourses, being:
 - a wetland in a wetland protection area; or
 - a wetland of high ecological significance shown on the map of referable wetlands; or
 - a wetland or watercourse in high ecological value waters.
- a designated precinct in a strategic environmental area;
- protected wildlife habitat, being:
 - an area that is shown as a high risk area on the flora survey trigger map and that contains plants that are endangered wildlife or vulnerable wildlife; or
 - an area that is not shown as a high risk area on the flora survey trigger map, to the extent the area contains plants that are endangered wildlife or vulnerable wildlife; or
 - a habitat for an animal that is endangered wildlife or vulnerable wildlife or a special least concern animal.
- protected areas;

- highly protected zones of State marine parks;
- fish habitat areas declared under the *Fisheries Act 1994*;
- waterways providing for fish passage;
- marine plants; and
- legally secured offset areas.

To support a determination if the project will result in a significant, residual impact to MSES the proposed activity is to be assessed under the *Significant Residual Impact Guidelines* (DEHP, 2014). These assessments would be conducted at a later date once BMA have confirmed a project footprint.

The ecological assessments have sought to identify and map the distribution of MSES within the survey area to support project planning being able to assess where avoidance and mitigation measures could be implemented, and future environmental impact assessments.

2.6 Biosecurity Act 2014

The *Biosecurity Act 2014* (Biosecurity Act) provides a legislative framework to manage feral fauna and pest flora, diseases and environmental contaminants, to address the impacts they have on the economy, environment, agriculture, tourism and society.

The Act prohibits or restricts the introduction and spread of declared plant and animal pests within Queensland. Weeds and pests pose one of the most significant threats to flora and fauna and agriculture within the survey area at present.

Field surveys assessed the presence of pest fauna and flora species and noted those listed under the Biosecurity Act.

2.7 Fisheries Act 1994

Waterways providing for fish passage in the survey area are mapped as a MSES within the report.

The Queensland *Fisheries Act 1994* governs the use, conservation and enhancement of Queensland's fisheries, resources and fish habitats. 'Waterway barrier works' are defined in the *Fisheries Act 1994* to mean a dam, weir, culvert or other barrier across a waterway if the barrier limits fish stock access and movement along a waterway. Whether a significant impact will occur to fish passage will depend upon the detailed design of the barrier works, whether they comply with the accepted development requirements for operational work that is constructing or raising waterway barrier works and whether the works are on-lease or off-lease (DAF 2017).

Waterways for the purposes of the *Fisheries Act 1994* are defined by the Queensland Government mapping layer Queensland Waterways for Waterway Barrier Works. Requirements pertaining to waterway barrier work permits under the *Fisheries Act 1994* don't apply on mining leases.

2.8 Survey guidelines

The timing and survey methods adopted for the seasonal flora and fauna surveys were guided by applicable State and Federal survey guidelines.

Targeted fauna surveys were designed and implemented in accordance with the following guidelines:

- *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland - Version 3.0* (Eyre et al. 2018).

- *Survey guidelines for Australia's threatened mammals* (DSEWPCa 2011).
- *Survey guidelines for Australia's threatened birds* (DEWHAa 2010).
- *Survey guidelines for Australia's threatened reptiles* (DSEWPCb 2011).
- *Survey guidelines for Australia's threatened bats* (DEWHAc 2010).
- *Referral guidelines for the vulnerable Koala* (DoE 2014a).
- *Draft referral guidelines for the nationally listed Brigalow Belt reptiles* (DSEWPCc 2011).

Vegetation community surveys to validate the presence of REs and therefore also assist to confirm presence of TECs completed to date were consistent with the Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, Version 5.1 (Neldner et al. 2020). Ground-truthed RE and TEC mapping has also supported the identification of potential habitats for threatened species and habitat modelling across survey area.

3 Methodology

3.1 Location

The survey area consists of ML70139, ML70167, MDL189 and MDL155 and covers an approximate area of 20,000 ha. The 'study area' (as applied in desktop searches) consists of a central line along the survey area and a 25 km buffer zone either side. The study area is a larger area surrounding the survey area on which database searches were undertaken.

The survey area is located south of the town of Blackwater which resides in the Queensland's Central Highland Region, 190 km west of Rockhampton and 74 km east of Emerald (Figure 1.1). The climate is recognised as a local steppe climate which is relatively dry with annual rainfall totals averaging 600 mm. The survey area is located within the Brigalow Belt Bioregion, and the Isaac-Comet Downs subregion.

3.2 Desktop assessment

Background research and desktop assessments have been undertaken to provide an understanding of the broader environmental values, landscape features and biodiversity attributes that are known or have the potential to occur in both the study area and survey area.

Desktop searches and assessments were initially completed in December 2018 to inform the first field survey program and guide survey effort and locations. These searches were updated in June 2020 to inform completion of this report and ensure that no new threatened species records have been added to the Wildlife Online database, and no updates to essential habitat or high-risk trigger mapping have been completed.

A buffer zone of 25 km was used to establish the study area as it encompasses a range of landscapes and vegetation communities adjacent to the survey area, including high quality habitat supporting protected areas such as Shotover State Forest, Humboldt State Forest and Humboldt National Park. This assists in identifying threatened TECs and species that may utilise the region and informed field survey procedures to encompass all potentially occurring MNES and MSES. However, results will include vegetation communities and habitat types that may not occur in the survey area due to the buffer taking in areas such as the Humboldt National Park which is a large protected area that contains terrain and vegetation communities not found in the survey area. This was taken into consideration when refining the likelihood of occurrence for ecological communities and species to occur in the survey area.

A desktop assessment was completed through the evaluation of a range of sources to gather information on the biodiversity values that may occur across the study area, with an emphasis on MNES and MSES.

Information sources reviewed are summarised below:

- DAWE Protected Matter Search Tool (PMST) (refer Appendix A) to assess whether matters protected by the EPBC Act are likely to occur in the study area;
- DES Wildlife Online to access a recorded list of wildlife in the study area. Wildlife Online species lists were also assessed for Shotover State Forest, Humboldt State Forest and Humboldt National Park as portions of these protected areas occur in the study area (refer Appendix A);
- Queensland Department of Natural Resources, Mines and Energy (DNRME) RE mapping of both remnant and high value regrowth (HVR) to determine the vegetation communities and extents that occur in the study area;

- Atlas of Living Australia (ALA) biodiversity database to access geographic records of flora and fauna species that occur in the study area;
- eBird database to access geographic records of birds and migratory birds that occur in the study area;
- DES website to determine mapped Essential Habitat areas;
- aerial imagery;
- Protected Plants High-risk Trigger Mapping; and
- wetland mapping by DES and Groundwater Dependent Ecosystem (GDE) Atlas mapping.

3.3 Fauna surveys

3.3.1 Fauna survey methods

i Baseline trapping survey methodology

Four baseline trap sites were installed across the survey area during each of the seasonal survey periods. The baseline trap sites were placed to adequately sample different habitat types and ecological condition across the survey area. An example is shown in Photograph 3.1.



Photograph 3.1 Baseline trap site showing pitfalls, funnels and drift fence

At each baseline trap site, several fauna survey methods were employed as summarised below. Trapping was conducted over four consecutive nights, as per the Terrestrial Vertebrate Fauna Survey Guidelines for Queensland, V3.0 (Eyre et al., 2018).

The survey methods at each baseline trap site are outlined below.

- Pitfall traps – four twenty litre buckets, with their tops flush with the surface of the soil, were set out at 7.5 m intervals with a drift fence in a “t-design”. Pitfall trapping targets small terrestrial mammals, as well as amphibians and reptiles. Traps were cleared early in the morning (soon after first light) before temperatures became too hot.

This ensures that heat stress of any trapped animals will be minimised and reduces the risk of diurnal predation of trapped animals. Shelter was also provided for captured animals in the bottom of each pitfall trap, and traps were not opened if there was a risk of rain.

- Funnel traps – six funnel traps, in pairs 3 m from each end of the drift fence were installed as part of the pitfall trapping array. Funnel traps capture reptiles that may not be caught in pitfall traps, such as snakes, dragons, large skinks and legless lizards. Checking of the traps proceeded as for pitfall trapping, but extra care was taken to ensure small reptiles were not hidden in the seams of the funnel and that small rodents have not chewed their way out, leaving a hole in the mesh. Soil was moistened under funnel to avoid dehydration of trapped animals.
- Elliott traps – twenty-five Elliott traps, 10 m apart were deployed in two parallel lines on either side of the trapping sites. Elliott traps were baited with universal bait (peanut butter and oats) and targeted small to medium sized terrestrial mammals. Traps were protected as much as possible from the elements including installation under bushes or in other sheltered areas which may also increase capture rates. Traps were cleared in the early morning to avoid heat stress and dehydration of captured animals.
- Camera traps – a single PIR-triggered camera trap was installed at each site. Camera traps were baited using chicken and apple. Target animals were primarily terrestrial mammals, but there is often significant ‘bycatch’ of reptiles and birds. The camera traps were situated in such a way as to avoid false-triggers; away from vegetation that can be moved in the breeze. Additional camera traps were set and moved around the broader site (targeting suitable areas of habitat such as farm dams or gilgai) and left for between one to three nights depending on the location. Seven cameras were used in autumn, with four at trap sites and three at dams/gilgai habitats. Eight cameras were used in the spring, with four at trap sites and four at dams or creekline habitats.
- Passive auditory recording – a single Anabat bat detector was installed at each trap site. Microbats rely on echolocation for orientation and foraging, and though the calls of almost all species are outside the range of human hearing, they can be detected by a bat detector. These devices were set to automatically record and store bat calls between dusk and dawn each night. The resulting library of recorded calls was then processed by an experienced technician and identified to species level where possible. The bat detectors were installed at a central location of each site and orientated into an area of open space. Additional Anabat bat detectors were set and moved around the broader site (targeting suitable areas of habitat such as farm dams or gilgai) and left for between one to three nights depending on the location.
- Diurnal bird surveys – each site was surveyed six times during each survey period by experienced observers. Each survey consisted of a 20-minute, 2 ha search. All birds seen and heard within the site were recorded, and each survey was performed at a different time of day to maximise detectability of all species present.

- Spotighting – non-intrusive search of between 30 minutes and one hour of each baseline trap site using spotlights was conducted at each trap site. Spotighting targeted nocturnal mammals, birds and herpetofauna. A red light was utilized where possible to reduce the stress of observed animals.
- Active searches – active diurnal searches each of 20 minutes were conducted at each baseline trap site during each survey period. Active searching targets reptiles and amphibians but may also detect small terrestrial mammals and signs or traces of cryptic species such as buttonquail. During active searches, the surveyors would scan for active animals and turn rocks and logs, look through leaf litter, under exfoliating bark and in crevices to find sheltering animals. All suitable microhabitat in a 50 x 50 m area was examined.
- Scat / scratch / secondary sign search – ecologists recorded any secondary sign encountered at each site during the survey period. Secondary signs can lead to the positive identification of mammals, reptiles and birds. Animals often reveal their presence through tracks left in soft substrate. Similarly, arboreal animals may leave distinctive scratches on tree trunks as they climb. Some *Petaurus spp.* leave feeding marks on tree trunks. Scats of many mammals can be identified, and in particular, the faecal pellets of Koalas often found at the base of trees are a sign of Koala presence. Hair, feathers bones or nests can often be identified to species level.

ii Targeted survey methodologies

At several additional sites across the survey area, specialised survey methods were used to target specific species and comply with relevant State and Commonwealth survey guidelines. These methods are described below.

- Harp trapping (Photograph 3.2) for threatened bat species in preferred habitats – harp trapping targets microchiropterans and may assist in the identification of species which cannot be identified by echolocation calls. Harp traps are most effective when placed in a concentrated flyway (for example, an animal track through dense vegetation). Two trap nights per sampling site were completed. The harp traps were moved over the duration of the survey program. All captured bats were released before dawn, and only handled by experienced and vaccinated personnel.



Photograph 3.2 Harp trap

- Spotlighting/diurnal search for Ornamental Snake – spotlighting and diurnal surveys involving the turning of rocks or logs were conducted in this species’ potential habitat, including gilgai mounds and depressions, the margins of wetlands and Brigalow and communities.
- Spotlighting/diurnal search for Yakka Skink and Collared Delma – spotlighting and diurnal surveys involving rock turning and searching of woody debris were conducted both on the baseline trap sites and in areas of suitable habitat.
- Camera traps in areas of gilgai – a network of camera traps (17 in total) were installed in areas of gilgai and suitable dam habitat during the autumn 2020 surveys for a month targeting these habitats for Australian Painted Snipe.
- Scratches/scat searches/transects for Koalas – these methodologies were employed to search for evidence of Koalas in suitable areas of habitat.
- Spotlighting and assessment of hollow-bearing trees for occupation by owls/mammals. Spotlighting involved walking through areas of potential habitat (i.e. tall Eucalypt woodland) with powerful spotlights and searching the canopy for eye-shine of active avian, mammal or reptile species. The spotlights were also periodically shone onto the ground to identify reptiles or amphibians that may be foraging on the ground.
- Wetland bird surveys – bird surveys were conducted around water sources and wetlands at the survey site. These surveys targeted finches, migratory shorebirds and the Australian Painted Snipe and employed a

similar methodology to the area searches described above. Several dams were searched across the site with surveys taking up to 30 minutes on each occasion.

3.3.2 General habitat assessments

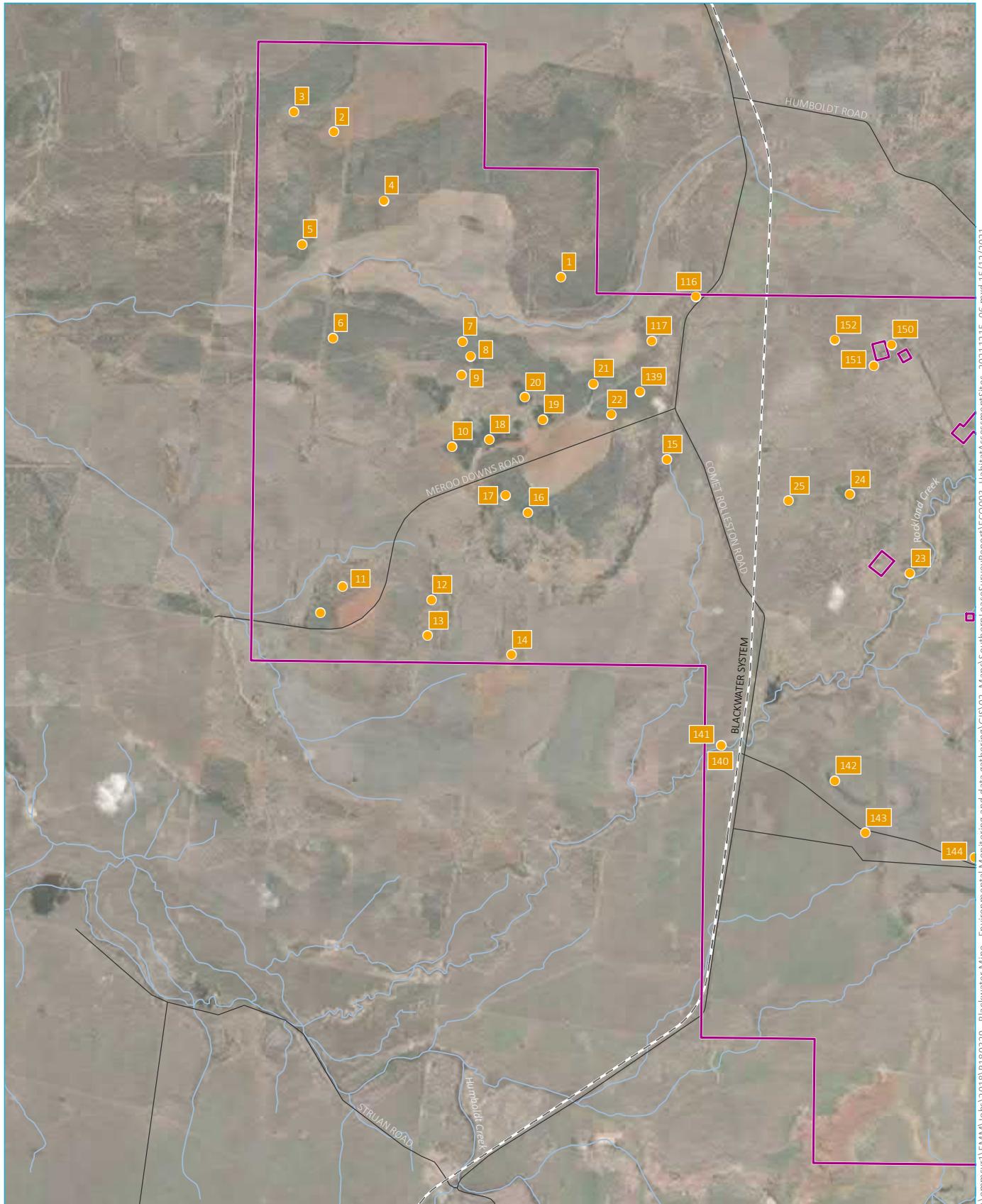
General habitat assessments were completed in conjunction with vegetation community assessments. This included a total of 103 general habitat assessments during the autumn 2020 flora survey period and 11 during the spring 2018 flora survey period. The primary goal of these assessments was to acknowledge and gauge the availability and suitability of threatened fauna habitat attributes across the survey area.

Specific habitat attributes were analysed at each site to confirm suitable habitat features for particular CEEVNT species and provide justification for the potential presence or absence of a species due to the presence or absence of suitable microhabitats.

BHP's habitat assessment criteria were used to ascertain available habitat features. The locations of habitat assessment sites are shown in Figure 3.1.

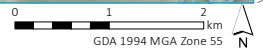
Habitat assessments included the recording of the following habitat attributes:

- the presence of fallen logs, leaf litter, rocks;
- vegetation groundcover;
- presence of cracking soils;
- presence rocky overhangs, caves, decorticating bark;
- foraging resources such as native grasses, preferred food trees for Koalas etc;
- available water sources;
- animal breeding places such as hollow-bearing trees, dens, nests;
- presence and abundance of weeds; and
- signs of pest animals.

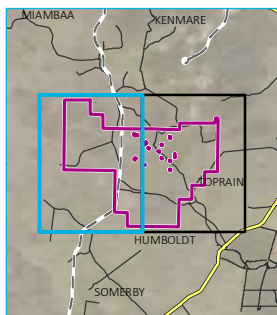


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Source: EMM (2020); DNRME (2020)



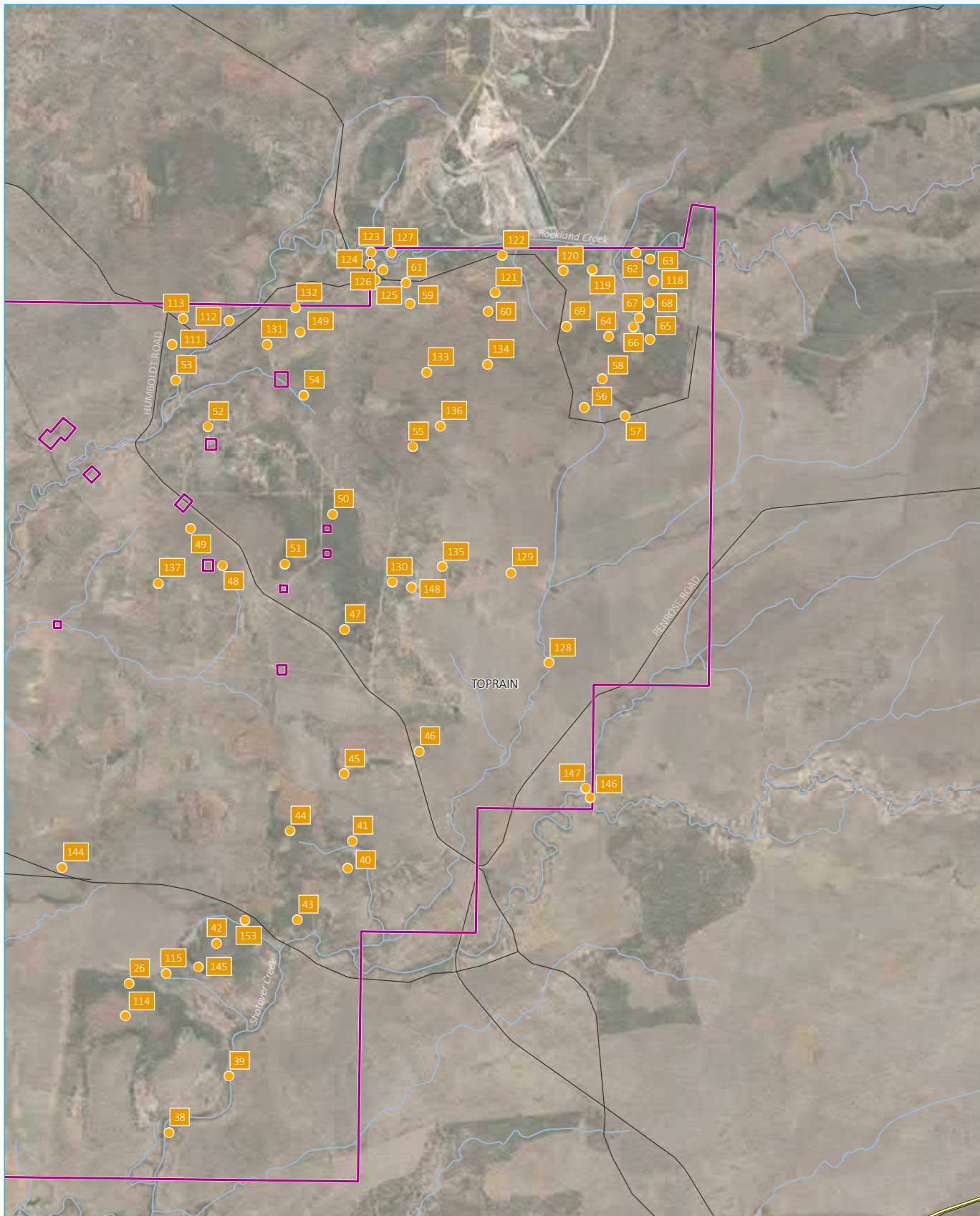
Habitat assessment sites -
map 1 of 2



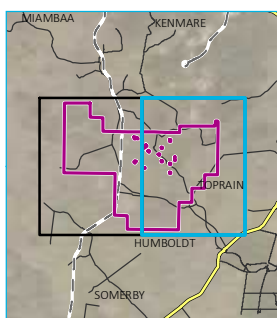
- KEY**
- Habitat assessment site
 - ▭ Survey area
 - - - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line

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Northern lease field ecology survey report
Figure 3.1





Source: EMM (2020); DNRME (2020)



- KEY**
- Habitat assessment site
 - ▭ Survey area
 - - - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line

Habitat assessment sites -
map 2 of 2

BHP Billiton Mitsubishi Alliance
Northern lease field ecology survey report
Figure 3.1



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3.3.3 Survey limitations

i Autumn season surveys

Initial autumn fauna surveys were conducted for four survey days between 25 March 2019 and 28 March 2019, but had to be curtailed due to wet weather precluding access to many parts of the survey area. Therefore to address this limitation, and meet seasonal guidelines (including four nights of consecutive fauna trapping effort), additional survey days were completed the following autumn season (2020). Both survey results have been summarised in this report.

ii Spring season surveys

Conditions were relatively dry leading up to the spring survey schedule, which is likely to have limited the presence and abundance of some species. For example, all gilgai habitats and most creeks in the survey area were dry. Dry conditions preceding the survey period also induced poor growing conditions for several flora species, and grassland habitats were dry with little foliage, limiting foraging resources for some species.

3.4 Flora surveys

Flora surveys were completed in two seasonal surveys to enable access to all vegetation communities and ensure appropriate survey seasonality was applied for threatened flora species. Undertaking two seasonal surveys increases the detectability of species with differing phenologies and encompass periods of high-growth, fruiting, and flowering.

The vegetation community survey methods were consistent with the Methodology for Survey and mapping of regional ecosystems and vegetation communities in Queensland, Version 5.1 (Neldner et al. 2020) including tertiary and quaternary sites as well as some BioCondition assessments. The objective was to validate the presence and extent of REs, and confirm conditional status of each patch. Where TEC associated communities were recognised, criteria thresholds for TECs were evaluated to confirm if the EPBC Act requirements are met for the applicable community.

The following sections provide information on the seasonal targeted flora surveys that were completed, survey methods and effort applied.

3.4.1 Flora survey methods

i Vegetation community surveys

The vegetation community survey methods were undertaken following the Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland, Version 5.1 (Neldner et al. 2020). Field methods included a combination of tertiary, quaternary and BioCondition sites. The intent of these surveys was to validate the presence of RE types, determine conditional status, and confirm extent.

Vegetation structure was measured for relevant attributes (i.e. canopy cover and height) to define whether the patch meets remnant classification under the VM Act. For the purpose of this survey some native vegetation was allocated as 'regrowth' as it does not meet 'remnant' status but is young regenerating native vegetation. These patches are non-remnant areas as per the VM Act, but support regenerating young native regrowth that is recognised as potential habitat for threatened species and as such is mapped for future planning purposes.

Tertiary Sites

Tertiary sites are used for classification and detailed descriptions of REs and vegetation communities, and involve collation of all location, environmental and overall structural information (median height and cover of each layer)

as well as a comprehensive list of woody species, individual woody species cover by layer and basal area measure of abundance. Generally, only the dominant or conspicuous species in the ground layer are recorded.

Quaternary Sites

Quaternary site assessments are used to rapidly assess REs and vegetation communities typically across large survey areas. Information collected includes dominant species in all structural layers, and structural features including height and cover percentage. General geological and landscape descriptions are also made such as soil type and landform which determine the land zone.

BioCondition Sites

The published methodology for assessing a vegetation community's condition is the BioCondition Assessment Manual, Version 2.2 (Eyre et al. 2015). The BioCondition methodology states:

The BioCondition methodology assesses vegetation community condition through the measurement of a range of attributes that can be compared to benchmark sites. The results for each attribute are combined to give a total score. BioCondition assessment describes vegetation community condition particularly to allow assessment and monitoring of ecological offsets and rehabilitation condition.

Field methodology undertaken was in accordance with the *Guide to determining terrestrial habitat quality* (DES 2017). Specifically, 0.5 ha plots were created at each selected site and the following attributes were recorded:

- number of large trees;
- tree canopy height;
- recruitment percentage of canopy species;
- tree canopy cover percentage;
- shrub layer cover percentage;
- total coarse woody debris;
- native plant species richness;
- non-native plant cover;
- native perennial grass cover percentage; and
- organic litter cover percentage.

Using these attributes, a final score of the overall habitat quality was formed through comparative analysis to state derived benchmarks according to each vegetation type.

TEC assessments

Where site vegetation was ground-truthed as a RE that is associated with a TEC under EPBC Act, assessments were completed to measure if the vegetation patch met the key diagnostic characteristics for the applicable TEC. Survey sites were initially selected based on desktop assessment (presence of corresponding TEC REs in the regulated mapping) as well as findings from quaternary assessments carried out in initial flora surveys – for example patches of vine thicket were not identified in the desktop assessment.

The key diagnostic characteristics for each respective community are listed below. Each TEC was assessed against these diagnostic features where available.

a Key diagnostic characteristics – Brigalow (*Acacia harpophylla* dominant and co-dominant)

A vegetation patch must include the following key diagnostic characteristics to be considered the Brigalow TEC:

1. The presence of *Acacia harpophylla* as one of the most abundant tree species in the patch. *A. harpophylla* is either dominant in the tree layer, or co-dominant with other species (notably *Casuarina cristata*, other species of *Acacia*, or species of *Eucalyptus*); **AND**
2. In Queensland - the patch is in one of the following Queensland bioregions (including outliers) and it meets the description of one of 16 Queensland 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 Queensland Herbarium (2013): In the Queensland 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; In the Queensland Southeast Queensland Bioregion – REs 12.8.23, 12.9-10.6 and 12.12.26; or, In the Queensland Mulga Lands Bioregion – RE 6.4.2; **AND/OR**
3. The vegetation in the patch is brigalow regrowth with species composition and structural elements broadly typical of one of the identified Queensland 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.

A patch must meet the following condition thresholds to be considered the Brigalow ecological community:

1. The patch is 0.5 ha or more in size; **AND**
2. 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.

b Key diagnostic characteristics – Poplar Box Grassy Woodland on Alluvial Plains community

A patch must include the following key diagnostic characteristics to be considered associated with the Poplar Box ecological community:

1. occurs in Riverine Plains, NSW South Western Slopes, Riverina and Murray Darling Depression IBRA bioregions;
2. associated with ancient and recent depositional alluvial plains with clay, clay-loam, loam and sandy loam, non-sodic soils;
3. a grassy woodland to grassy open woodland with a tree crown cover of 10% or more at patch scale;
4. a canopy (tree) layer, capable of reaching 10 m or more in height and dominated by *Eucalyptus populnea* (poplar box) or co-dominated with *E. populnea* hybrids;
5. mid layer (1-10 m) crown cover of shrubs to small trees of 20% or less; and
6. a ground layer (<1 m) mostly dominated across a patch by native grasses, other herbs and occasionally chenopods, ranging from sparse to thick (in response to canopy development, soil moisture, disturbance and/or management history).

A patch must meet the following minimum condition thresholds to be considered the Poplar Box TEC (Table 3.1):

Table 3.1 Poplar Box TEC

Category and rationale	Native cover and diversity thresholds	Minimum patch size thresholds
CLASS A HIGHEST QUALITY		
Class A1: Little to no perennial weed's diverse native understorey	<p>≥ 90% of perennial vegetation cover in ground layer¹ is native</p> <p>And</p> <p>≥ 30 native plant species per ha in ground layer</p>	≥ 1 ha
Class A2: A large patch with low perennial weeds and diverse native understorey	<p>≥ 70% of perennial vegetation cover in ground layer¹ is native</p> <p>And</p> <p>≥ 30 native plant spp. per ha in ground layer</p>	≥ 5 ha
Class A3: A large patch with high quality habitat features	<p>≥ 10 trees per ha with ≥ 30 cm dbh² (and/or with hollows)</p> <p>And</p> <p>smaller trees, saplings or seedlings suggestive of periodic recruitment</p> <p>And</p> <p>≥ 20 native plant spp. per ha ground layer</p>	≥ 5 ha
CLASS B MODERATE QUALITY		
A large patch with moderate quality native understorey	<p>≥ 50% of perennial vegetation cover in ground layer¹ is native And</p> <p>≥ 20 perennial native plant species per ha in ground layer</p> <p>Or</p> <p>≥ 10 trees per ha with ≥ 30 cm dbh² (or hollows)</p>	≥ 5 ha

1. **Perennial vegetation cover in the ground layer** (i.e. below the tree canopy) includes vascular plant species of the ground layer with life-cycle of more than two growing seasons. The ground layer includes herbs (i.e. grasses and forbs) and some low shrubs (woody plants ≤ 1 m high). Measurement of perennial ground layer vegetation cover excludes annuals, cryptogams (i.e. mosses, lichens and related flora), leaf litter or exposed soil.
2. **DBH** (diameter at breast height) refers to the tree diameter measured at 1.4 m above the ground.

c Key diagnostic characteristics – Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin

During the autumn 2020 field survey, additional RE types associated with Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin were identified. and Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions).

A flowchart is provided under the listing advice for the TEC (DSEWPaC, 2012) which assesses whether a patch of grassland meets criteria for inclusion as a TEC:

1. The patch must occur within one of the following Brigalow Belt subregions; **AND**
 - BBN 6 Northern Bowen Basin
 - BBN 9 Anakie Inlier

- BBN 10 Basalt Downs
 - BBN 11 Isaac-Comet Downs
 - BBN 12 Nebo-Connors Range
 - BBN 13 South Drummond Basin
 - BBS1 Claude River Downs
 - BBS 9 Buckland Basalts;
2. Trees must be absent or sparse such that projective foliage cover of trees in the patch is 10% or less; **AND**
 3. At least 200 native grass tussocks must be present in the patch.

A patch must meet the following condition thresholds to be considered of “best quality” for the TEC:

- The patch is 1 ha or more in size; **AND**
- There are at least four perennial native grass indicator species present; **AND**
- The total projective foliage cover of shrubs is less than 30%; **AND**
- Perennial non-woody introduced species make up less than 5% of the total perennial projective foliage cover.

A patch must meet the following condition thresholds to be considered of “good quality” for the TEC:

- The patch is 5 ha or more in size; **AND**
- There are at least three perennial native grass indicator species present; **AND**
- The total projective foliage cover of shrubs is less than 50%; **AND**
- Perennial non-woody introduced species make up less than 30% of the total perennial projective foliage cover.

d [Key diagnostic characteristics – Semi-evergreen vine thickets of the Brigalow Belt \(North and South\) and Nandewar Bioregions](#)

During the autumn 2020 field survey, additional RE types associated with Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions were identified.

There are no conditional criteria for excluding patches of this community from meeting TEC categorisation if the vegetation patch of a representative SEVT RE meets requirements defined within the VM Act as remnant vegetation in Queensland.

3.4.2 Protected plants

At the time of survey there were no high risk areas on the flora survey trigger map in the survey area. CEEVNT flora species were searched for while completing RE mapping exercises across the survey area. No formal protected plant meanders were undertaken.

Subsequent to survey, a cluster of high risk trigger areas have been mapped in the northeast of the survey area just to the south of the old Blackwater south mine area and Rockland Dam (trigger map version 7.1). These areas are associated with records of *Solanum elaeagnifolium* mapped by EMM during the spring 2018 surveys.

Incidental records of CEEVNT flora were recorded during informal searches. These searches were informed by the initial desktop assessment of likely candidate species and suitable habitats. Where an CEEVNT plant or possible

CEEVNT plant was recorded, the population extent within the survey area was recorded and a specimen was taken for submission to the Herbarium. These flora samples were provided to the Queensland Herbarium to confirm species identification.

If CEEVNT flora species were detected, the following additional details were noted:

- number of individuals (GPS coordinate for each individual or patch);
- habitat area (GPS polygon of habitat area);
- habitat description;
- overall health and measurement of individuals;
- reproductive status; and
- photos of individuals and habitat.

CEEVNT population surveys included taking GPS points or estimating density and recording the population extent within a specific area.

3.4.3 Survey limitations

i Autumn season surveys

Dry conditions preceding the autumn 2019 survey period induced poor growing conditions for several flora species. While woody perennial species are generally detectable and identifiable regardless of conditions, herbaceous groups such as grasses (Poaceae) become senescent and largely undetectable during and after dry conditions.

Additionally, the presence of fertile material (i.e. fruit and flowers) is required for positive identification. Incidental detection for three of the potentially occurring protected species in *Aristida annua*, *Dichanthium setosum* and *D. queenslandicum* was highly unlikely due to the preceding dry conditions.

Flora surveys and TEC assessments conducted in autumn 2020 identified some native grassland patches. As illustrated in Photograph 5.22, conditions were more suitable for identification of protected grasses during this time, with fertile material present. However based on presence of weed cover and in some patches woody regrowth EMM did not consider these patches to meet Native Grassland TEC criteria.

ii Spring season surveys

Wet conditions limited vehicle access to several sites particularly in the interior of the survey area. However, impacts to survey effort were considered insignificant.

3.4.4 Spatial data management

Field data was collected in ESRI Collector app. including points and polygons. Habitat assessments were collected in a spatial data form using Survey 123 that was designed to be compatible with BHP guidelines. The survey guidelines followed were BHP Procedure Coal Ecological Survey version 3 (December 2019), and data provided to BHP has been updated to follow version 4 of this document (November 2020).

4 Desktop assessment results

The following sections present the results of desktop assessments which were completed prior to the commencement of field surveys. Desktop assessments were undertaken across a broader study area (which included 25 km buffer to the survey area) and included an evaluation of all MSES and MNES.

4.1 World Heritage and National Heritage Properties

There are no World Heritage or National Heritage properties within the study area.

4.2 Protected Area estates

There are no nature refuges or national parks within the survey area. The Blackdown Tableland National Park is located approximately 20 km to the east of the survey area. The closest nature refuge, Kenmare Nature Refuge is located approximately 25 km north of the survey area.

There are no Strategic Environmental Areas (SEA) within the study area. SEAs include Cape York Peninsula, the Gulf Country, the Chanel Country, Fraser Island and Hinchinbrook Island and will not require further consideration.

4.3 Regional ecosystems

The certified RE mapping (DNRM 2021) was analysed and mapped for the survey area. An approximate extent of 2,084 ha remnant (Category B), 305 ha of high-value regrowth (Category C or Category R) is mapped across the survey area. Large portions of the survey area have historically been cleared, with only small patches of fragmented native remnant and regrowth communities remaining.

Based on a review of RE mapping, the survey area has the potential to support:

- five Endangered REs (VM Act and BD status); and
- three Of Concern REs (VM Act and BD status).

Certified RE mapping is illustrated in Figure 4.1 with many patches being mixed polygons. A summary of REs mapped as occurring in the survey area, with both VM Act and BD status noted, is provided in Table 4.1 below.

Table 4.1 Regional ecosystems (certified mapping) within survey area

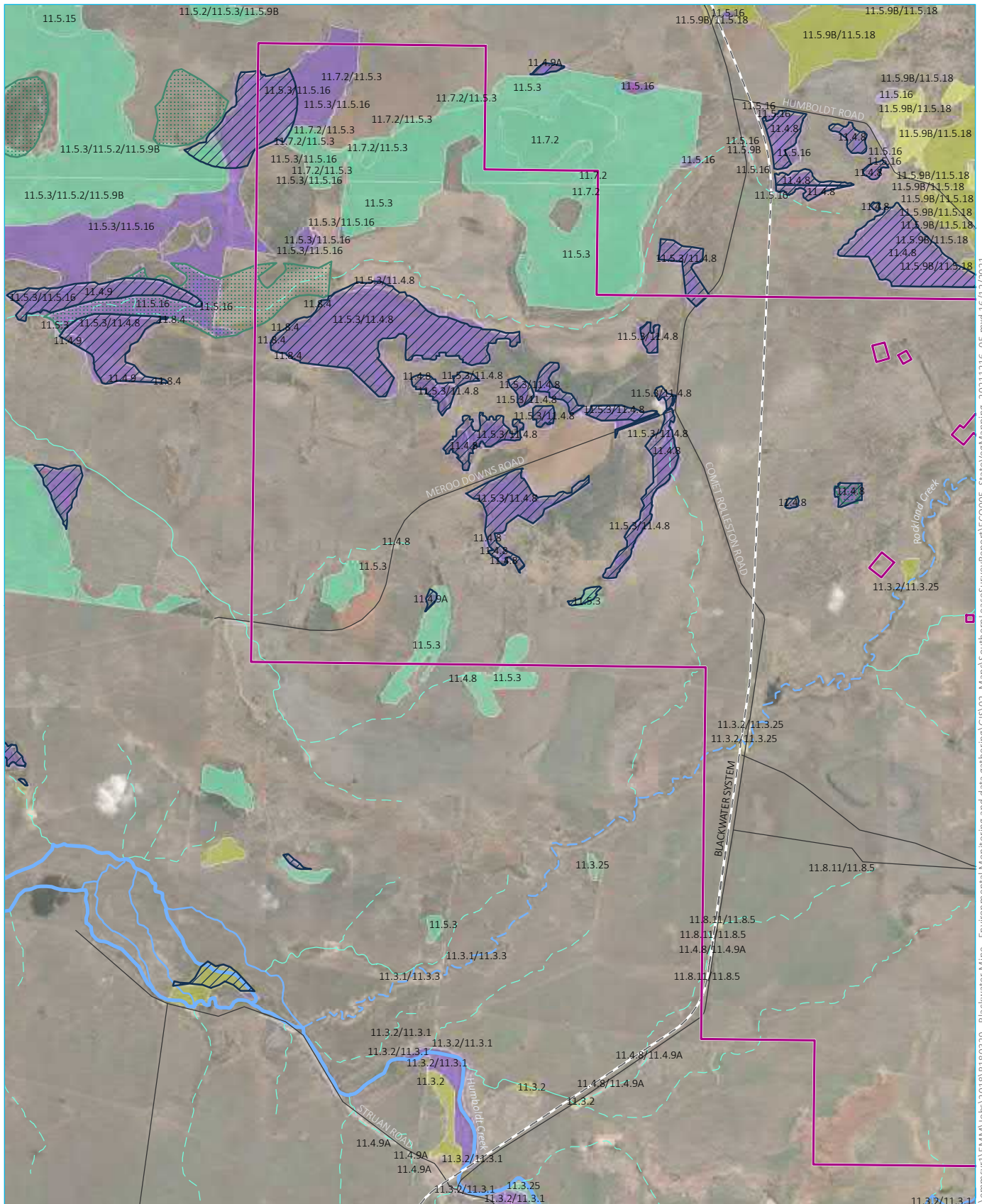
Regional ecosystem description	VM Act status	Biodiversity status	Associated TEC	Area (ha) in certified mapping
11.3.2/11.3.1 - <i>Eucalyptus populnea</i> woodland on alluvial plains	Of Concern	Of Concern	Poplar Box Grassy Woodland on Alluvial Plains	63.00
<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	Endangered	Endangered	Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	
11.3.2/11.3.25 - <i>Eucalyptus populnea</i> woodland on alluvial plains	Of Concern	Of Concern	Poplar Box Grassy Woodland on Alluvial Plains	246.40
<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	Least Concern	Of Concern	-	
11.4.8 - <i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains	Endangered	Endangered	Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	65.26

Table 4.1 Regional ecosystems (certified mapping) within survey area

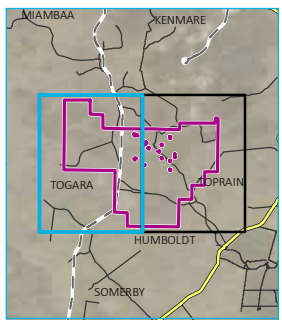
Regional ecosystem description	VM Act status	Biodiversity status	Associated TEC	Area (ha) in certified mapping
11.4.8/11.4.9a - <i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains	Endangered	Endangered	Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	217.30
<i>Acacia harpophylla</i> , <i>Lysiphillum carronii</i> +/- <i>Casuarina cristata</i> open forest to woodland	Endangered	Endangered	Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	
11.4.9a - <i>Acacia harpophylla</i> , <i>Lysiphillum carronii</i> +/- <i>Casuarina cristata</i> open forest to woodland	Endangered	Endangered	Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	3.00
11.5.3 - <i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces	Least Concern	No concern at present	-	550.20
11.5.3/11.4.8 - <i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces	Least Concern	No concern at present	-	488.35
<i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains	Endangered	Endangered	Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	
11.5.3/11.5.16 - <i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces	Least Concern	No concern at present	-	161.94
<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest in depressions on Cainozoic sand plains and remnant surfaces	Endangered	Endangered	Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	
11.5.9b - <i>Eucalyptus crebra</i> , <i>E. tenuipes</i> , <i>Lysicarpus angustifolius</i> +/- <i>Corymbia</i> spp. woodland	Least Concern	No concern at present	-	205.32
11.5.9b/11.5.18 - <i>Eucalyptus crebra</i> , <i>E. tenuipes</i> , <i>Lysicarpus angustifolius</i> +/- <i>Corymbia</i> spp. woodland	Least Concern	No concern at present	-	11.59
<i>Micromyrtus capricornia</i> shrubland on Cainozoic sand plains and/or remnant surfaces	Of Concern	Of Concern	-	
11.7.2 - <i>Acacia</i> spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	Least Concern	No concern at present	-	159.52
11.7.2/11.5.3 - <i>Acacia</i> spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	Least Concern	No concern at present	-	71.96
<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces	Least Concern	No concern at present	-	
11.8.4 - <i>Eucalyptus melanophloia</i> open woodland on Cainozoic igneous rocks.	Least Concern	No concern at present	-	1.42

Table 4.1 Regional ecosystems (certified mapping) within survey area

Regional ecosystem description	VM Act status	Biodiversity status	Associated TEC	Area (ha) in certified mapping
11.8.11/11.8.5 - <i>Dichanthium sericeum</i> grassland on Cainozoic igneous rocks	Of Concern	Of Concern	Natural grasslands of the Queensland Central Highlands and northern Fitzroy Basin	1.49
<i>Eucalyptus orgadophila</i> open woodland on Cainozoic igneous rocks	Least Concern	No concern at present		
11.9.5a - <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks	Endangered	Endangered	Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	93.19
11.10.3 - <i>Acacia catenulata</i> or <i>A. shirleyi</i> open forest on coarse-grained sedimentary rocks. Crests and scarps	Least Concern	No concern at present	-	49.32
Non-remnant				17,753.64



Source: EMM (2020); DNRME (2020); DES (2019)



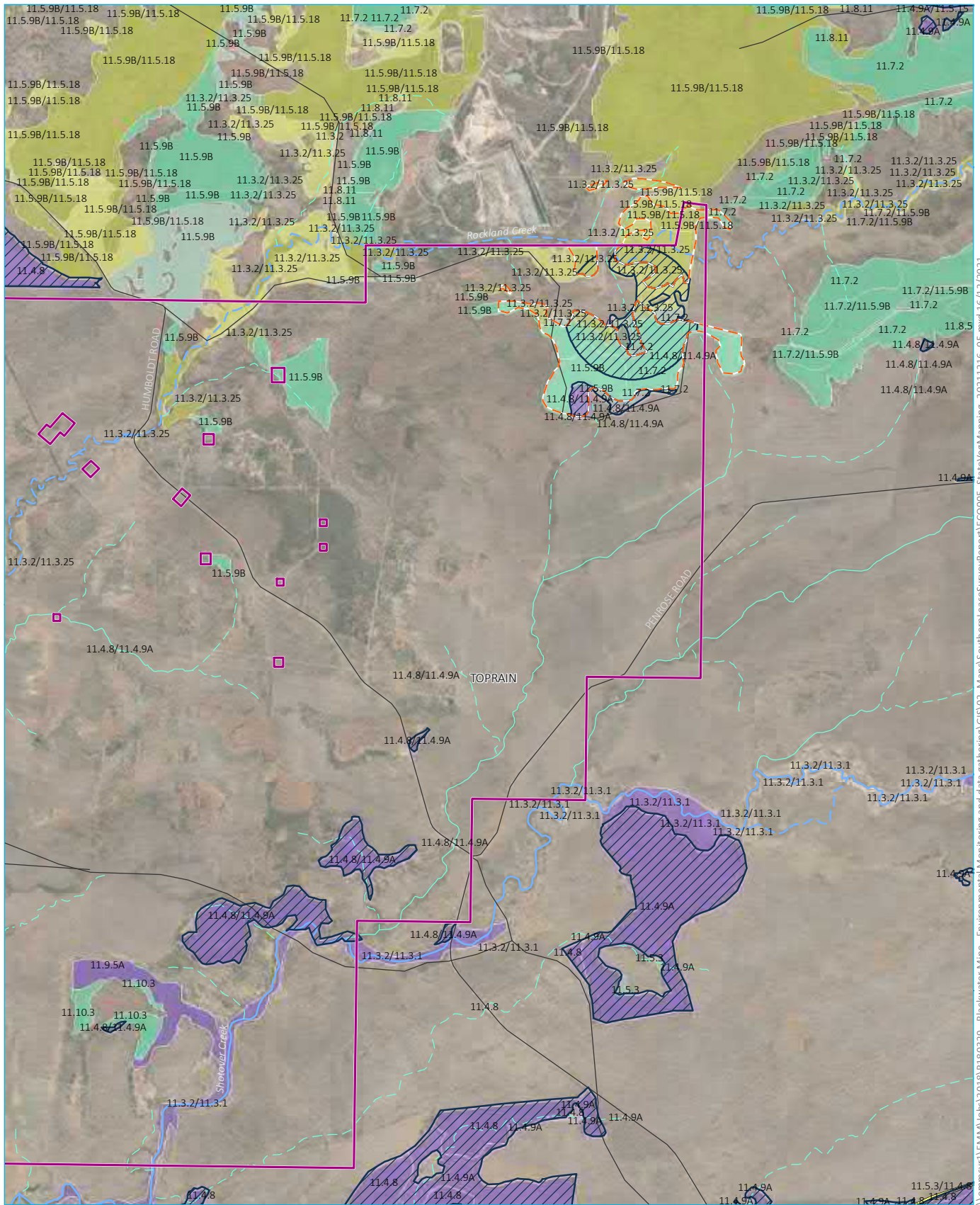
- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Stream order
 - 1st order
 - 2nd order
 - 3rd order
 - 4th order
 - 5th order
 - Protected plant high risk trigger area (version 7.1)
 - High ecological significance wetland
 - Essential habitat
 - Regional ecosystems (VM Act status) (version 11)
 - Remnant - endangered
 - HVR - endangered
 - Remnant - of concern
 - HVR - of concern
 - Remnant - least concern
 - HVR - least concern

Certified RE mapping
and watercourses/wetlands
map 1 of 2

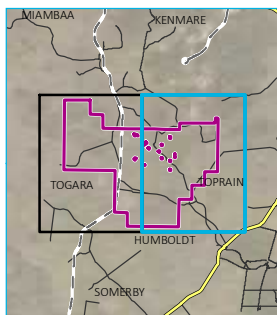
BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 4.1



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Source: EMM (2020); DNRME (2020); DES (2019)



- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Stream order
 - 1st order
 - 2nd order
 - 3rd order
 - 4th order
 - Protected plant high risk trigger area (version 7.1)
 - Essential habitat
 - Regional ecosystems (VM Act status) (version 11)
 - Remnant - endangered
 - HVR - endangered
 - Remnant - of concern
 - HVR - of concern
 - Remnant - least concern
 - HVR - least concern

Certified RE mapping
and watercourses/wetlands
map 2 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 4.1



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4.4 Threatened Ecological Communities (TECs)

Table 4.2 summarises the TECs with potential to occur in the survey area identified through PMST search. The table also includes REs in Table 4.1 which occur in the certified mapping, which have been highlighted in bold.

Table 4.2 TECs with potential to occur in survey area

TEC	EPBC Act status	Associated regional ecosystems
Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	Endangered	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, 11.12.21
Coolibah – Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	11.3.3, 11.3.15, 11.3.16, 11.3.28, 11.3.37
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	11.3.21, 11.4.4, 11.4.11, 11.8.11 , 11.9.9, 11.9.12, 11.11.17
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	11.3.11, 11.4.1, 11.8.13, 11.11.18, 11.2.3, 11.9.4
Weeping Myall Woodlands	Endangered	11.3.2 , 11.3.28
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	11.3.2 , 11.3.17, 11.4.7, 11.4.12, 12.3.10

4.5 Flora species

A list of threatened flora species considered to have potential to occur within the survey area based on desktop assessments is provided in Figure 4.1 and Figure 4.2.

Two CEEVNT flora species, *Cadellia pentastylis* and *Solanum elachophyllum* have been recorded during historical ecology surveys within or adjacent to the survey area. *Solanum elachophyllum* was recorded during historical surveys of the Ramp 30 extension area just to the southwest of the survey area (ELA 2018).

Table 4.3 Threatened flora species with potential to occur

Scientific name	Common name	EPBC Act status ¹	NC Act status ²	Species recorded in historic ecology surveys	Species recorded within study area (Wildlife Online)
<i>Acacia storyi</i>	-	-	NT	x	x
<i>Aristida annua</i>	-	V	V	x	✓
<i>Arthraxon hispidus</i>	-	V	V	x	x
<i>Baeckea trapeza</i>	-	-	V	x	x
<i>Bertya opposens</i>	-	V	-	x	x
<i>Bertya pedicellata</i>	-	-	NT	x	x
<i>Cadellia pentastylis</i>	Ooline	V	V	✓	✓
<i>Cerbera dumicola</i>	-	-	NT	x	x
<i>Daviesia discolor</i>	-	V	V	x	x
<i>Dichanthium queenslandicum</i>	King Blue-grass	E	V	x	✓

Table 4.3 Threatened flora species with potential to occur

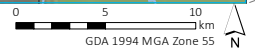
Scientific name	Common name	EPBC Act status ¹	NC Act status ²	Species recorded in historic ecology surveys	Species recorded within study area (Wildlife Online)
<i>Dichanthium setosum</i>	Bluegrass	V	-	x	x
<i>Homoranthus decumbens</i>	-	E	V	x	x
<i>Macrozamia platyrhachis</i>	-	E	E	x	x
<i>Marsdenia brevifolia</i>		V	V	x	x
<i>Polianthion minutiflorum</i>	-	V	V	x	✓
<i>Sannantha brachypoda</i>	-	-	V	x	x
<i>Solanum adenophorum</i>	-	-	E	x	x
<i>Solanum dissectum</i>	-	E	E	x	✓
<i>Solanum elachophyllum</i>	-	-	E	✓	

1. EPBC Act status: CE- critically endangered, E – endangered, V – vulnerable, M – migratory, Ma - marine

2. NC Act status: CE – critically endangered, E – endangered, V – vulnerable, NT – near threatened



Source: EMM (2020); DES (2020); DNRME (2020)



KEY

- | | | |
|--------------------|-------------------|--|
| Survey area | National park | Threatened flora species records (Wildnet 2020) |
| Desktop study area | State forest | <i>Aristida annua</i> |
| Rail line | Conservation park | <i>Cadellia pentastylis</i> |
| Major road | Nature refuge | <i>Dichanthium queenslandicum</i> |
| Minor road | | <i>Polianthion minutiflorum</i> |
| Named watercourse | | <i>Solanum dissectum</i> |

Flora database records within the vicinity of the survey area

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Southern lease field ecology survey report
Figure 4.2

4.6 Fauna species

A list of threatened fauna species considered to have potential to occur within the study area is provided in Table 4.4 and Figure 4.3.

The list also identifies those fauna species that have been noted as being previously recorded during historical ecology surveys within or adjacent to the survey area including by EMM.

Table 4.4 Threatened fauna species with potential to occur

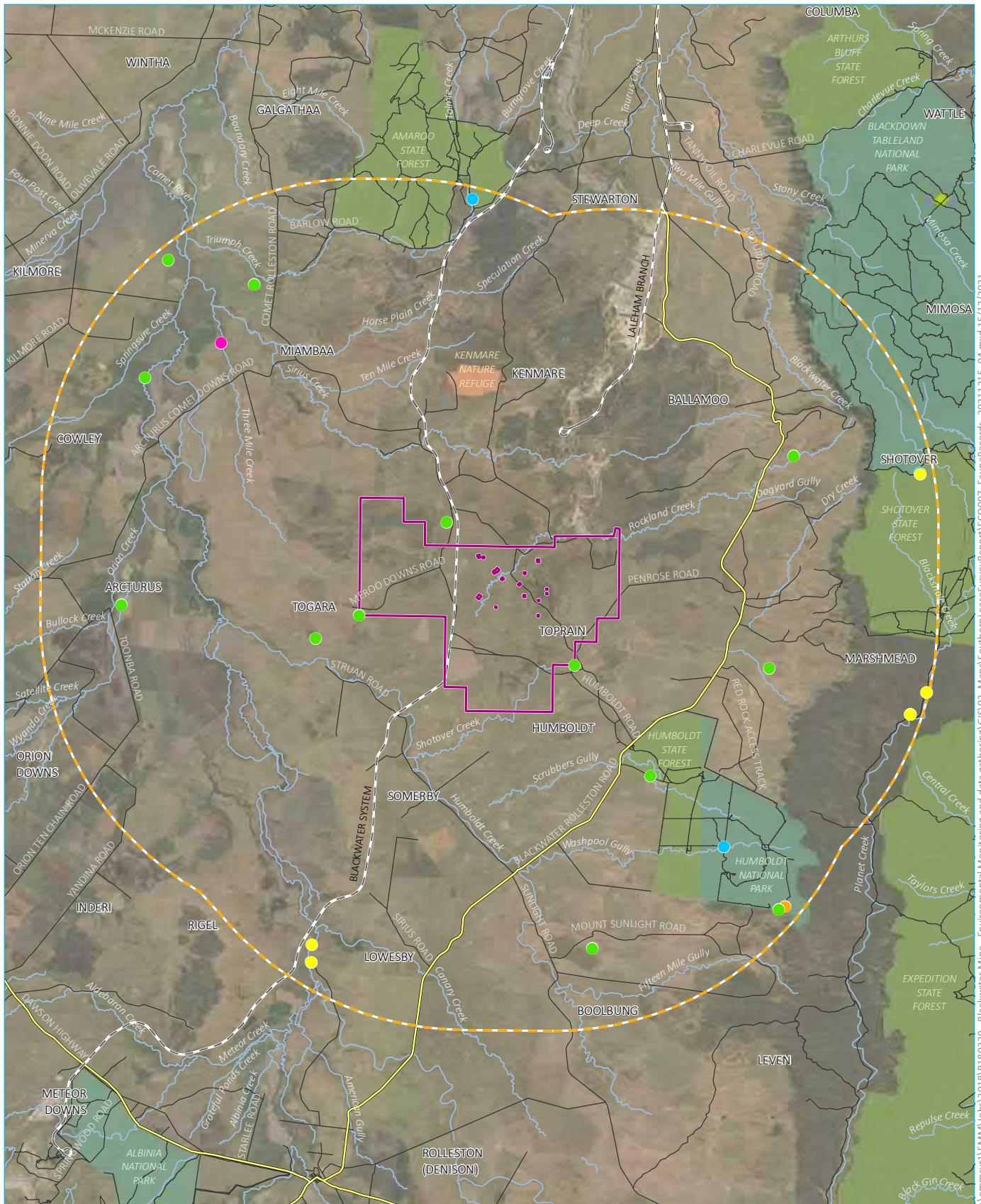
Scientific name	Common name	EPBC Act status ¹	NC Act status ²	Species recorded in historic ecology surveys of study area	Species recorded within study area (Wildlife Online)
Birds					
<i>Calidris ferruginea</i>	Curlew Sandpiper	CE	E	×	×
<i>Calyptorhynchus lathami erebus</i>	Glossy Black-Cockatoo (northern)	-	V	×	×
<i>Erythrotriorchis radiatus</i>	Red Goshawk	V	E	×	×
<i>Geophaps scripta</i>	Squatter Pigeon (southern)	V	V	✓	✓
<i>Grantiella picta</i>	Painted Honeyeater	V	V	×	×
<i>Hirundapus caudacutus</i>	White-throated Needle-tail	V	V	×	×
<i>Neochmia ruficauda</i>	Star Finch	E	E	×	×
<i>Ninox strenua</i>	Powerful Owl	-	V	×	×
<i>Poephila cincta</i>	Southern Black-throated Finch	E	E	×	×
<i>Rostratula australis</i>	Australian Painted Snipe	E	E	×	×
<i>Turnix melanogaster</i>	Black-breasted Button-quail	V	V	×	×
Small terrestrial mammals					
<i>Dasyurus hallucatus</i>	Northern Quoll	E	-	×	×
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	-	SLC	✓	✓
Arboreal mammals					
<i>Petauroides volans</i>	Southern Greater Glider	V	V	×	✓
<i>Phascolarctos cinereus</i>	Koala	V	V	×	✓
Bats					
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	×	×
<i>Macroderma gigas</i>	Ghost Bat	V	E	×	×
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat	V	V	×	×
Fish					
<i>Maccullochella peelii</i>	Murray Cod	V	-	×	×

Table 4.4 **Threatened fauna species with potential to occur**

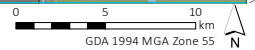
Scientific name	Common name	EPBC Act status ¹	NC Act status ²	Species recorded in historic ecology surveys of study area	Species recorded within study area (Wildlife Online)
Reptiles					
<i>Delma torquata</i>	Collared Delma	V	V	×	×
<i>Denisonia maculata</i>	Ornamental Snake	V	V	×	×
<i>Egernia rugosa</i>	Yakka Skink	V	V	×	×
<i>Elseya albagula</i>	Southern Snapping Turtle	CE	E	×	×
<i>Furina dunmalli</i>	Dunmall's Snake	V	V	×	×
<i>Rheodytes leukops</i>	Fitzroy River Turtle	V	V	×	×
<i>Strophurus taenicauda</i>	Golden-tailed Gecko	-	NT	×	×

1. EPBC Act status: CE- critically endangered, E – endangered, V – vulnerable, M – migratory, Ma - marine

2. NC Act status: CE – critically endangered, E – endangered, V – vulnerable, NT – near threatened, SLC – special least concern



Source: EMM (2020); DES (2020); DNRME (2020)



KEY

- | | | |
|--------------------|-------------------|--|
| Survey area | National park | Threatened fauna species records (Wildnet 2020) |
| Desktop study area | State forest | Greater Glider |
| Rail line | Conservation park | Koala |
| Major road | Nature refuge | Rufous Fantail |
| Minor road | | Short-beaked Echidna |
| Named watercourse | | Squatter Pigeon |

Fauna database records within the vicinity of the survey area

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Figure 4.3



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4.7 Pest flora and fauna

Database searches of the wider area encountered records of 142 introduced flora and 16 introduced fauna species. Many of these species are also listed as Restricted Matters under the *Biosecurity Act 2014* (Table 4.5) – 18 flora species and five fauna species being listed under the Act as a restricted matter.

Under the Act, a person who has control over a ‘Restricted Matter’ must not do the following:

- Category 3 – A person who has, or has a thing infested with, the ‘Restricted Matter’ in the person’s possession or under the person’s control must not distribute or dispose of the restricted matter unless the distribution or disposal is carried out via the methods set out in the Biosecurity Act;
- Category 4 – move the ‘Restricted Matter’, or cause or allow to be moved;
- Category 5 – keep in the person’s possession or under the person’s control; and
- Category 6 – give food to the ‘Restricted Matter.’

Table 4.5 Pest flora and fauna species with potential to occur

Scientific name	Common name	Biosecurity Act Category	Species recorded in PMST search	Species recorded in study area (Wildlife Online)
Fauna				
<i>Columbia livia</i>	Domestic Pigeon	-	✓	×
<i>Passer domesticus</i>	House Sparrow	-	×	✓
<i>Streptopelia chinensis</i>	Spotted Turtle-Dove	-	✓	×
<i>Sternus vulgaris</i>	Common Starling	-	✓	×
<i>Rhinella marina</i>	Cane Toad	-	✓	✓
<i>Bos taurus</i>	Domestic Cattle	-	✓	✓
<i>Canis lupus familiaris</i>	Domestic Dog	3, 4, 6	✓	✓
<i>Felis catus</i>	Domestic Cat	3, 4, 6	✓	✓
<i>Lepus capensis</i>	Brown Hare	-	✓	✓
<i>Mus musculus</i>	House Mouse	-	✓	✓
<i>Oryctolagus cuniculus</i>	European Rabbit	3, 4, 5, 6	✓	✓
<i>Rattus rattus</i>	Black Rat	-	✓	×
<i>Sus scrofa</i>	Feral Pig	3, 4, 6	✓	✓
<i>Vulpes</i>	Red Fox	3, 4, 5, 6	✓	✓
<i>Equus caballus</i>	Horse	-	×	✓
<i>Hemidactylus frenatus</i>	House Gecko	-	×	✓
Flora				
<i>Acacia nilotica</i> subsp <i>indica</i>	Prickly Acacia	3	✓	×
<i>Bryophyllum delagoense</i>	Mother of Millions	3	×	✓

Table 4.5 Pest flora and fauna species with potential to occur

Scientific name	Common name	Biosecurity Act Category	Species recorded in PMST search	Species recorded in study area (Wildlife Online)
<i>Bryophyllum x houghtonii</i>	Mother of Millions hybrid	3	x	✓
<i>Cryptostegia grandiflora</i>	Rubber Vine	3	✓	✓
<i>Harrisia martinii</i>	-	3	x	✓
<i>Harrisia pomanensis</i>	-	3	x	✓
<i>Jatropha gossypifolia</i>	Bellyache Bush	3	✓	x
<i>Lantana camara</i>	Lantana	3	✓	x
<i>Opuntia stricta</i>	Prickly Pear	3	✓	✓
<i>Opuntia tomentosa</i>	Velvety Tree Pear	3	✓	✓
<i>Opuntia aurantiaca</i>	Tiger Pear	3	✓	✓
<i>Opuntia streptacantha</i>	Cardona Pear	3	✓	✓
<i>Parkinsonia aculeata</i>	Parkinsonia	3	✓	✓
<i>Parthenium hysterophorus</i>	Parthenium	3	✓	✓
<i>Schinus terebinthifolius</i>	Broad-leaved Pepper Tree	3	x	✓
<i>Solanum elaeagnifolium</i>	Silverleaf Nightshade	3	x	✓
<i>Tamarix aphylla</i>	Athel Pine	3	x	✓
<i>Vachellia nilotica</i>	Prickly Acacia	3	✓	✓

4.8 Migratory species

A list of migratory and marine species considered to have potential to occur within the survey area is provided in Table 4.6. The list also identifies those migratory species that have been noted as being previously recorded during historical ecology surveys within or adjacent to the survey area including by EMM.

Table 4.6 Migratory species with potential to occur

Scientific name	Common name	EPBC Act status ¹	NC Act status ²	Species recorded in historic ecology surveys	Species recorded in study area (Wildlife Online)
<i>Actitis hypoleucos</i>	Common Sandpiper	Mi	SLC	x	x
<i>Apus pacificus</i>	Fork-tailed Swift	Mi	SLC	x	✓
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mi	SLC	✓	x
<i>Calidris ferruginea</i>	Curlew Sandpiper	CE, Mi	E	x	x
<i>Calidris melanotos</i>	Pectoral Sandpiper	Mi	SLC	x	x
<i>Cuculus optatus</i>	Oriental Cuckoo	Mi	SLC	x	x
<i>Gallinago hardwickii</i>	Latham's Snipe	Mi	SLC	✓	x

Table 4.6 Migratory species with potential to occur

Scientific name	Common name	EPBC Act status ¹	NC Act status ²	Species recorded in historic ecology surveys	Species recorded in study area (Wildlife Online)
<i>Hydroprogne caspia</i>	Caspian Tern	Mi	SLC	×	×
<i>Monarcha melanopsis</i>	Black-faced Monarch	Mi	SLC	×	×
<i>Monarcha trivirgatus</i>	Spectacled Monarch	Mi	SLC	×	×
<i>Motacilla flava</i>	Yellow Wagtail	Mi	SLC	×	×
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Mi	SLC	×	×
<i>Pandion haeliaetus (cristatus)</i>	Eastern Osprey	Mi	SLC	×	×
<i>Plegadis falcinellus</i>	Glossy Ibis	Mi	SLC	×	×
<i>Rhipidura rufifrons</i>	Rufous Fantail	Mi	SLC	✓	✓
<i>Tringa stagnatilis</i>	Marsh Sandpiper	Mi	SLC	×	×

1. EPBC Act status: CE- critically endangered, E – endangered, V – vulnerable, Mi - Migratory

2. NC Act status: CE – critically endangered, E – endangered, V – vulnerable, NT – near threatened, SLC – special least concern

4.9 Watercourses, watercourse vegetation and wetlands

There are several watercourses mapped as intersecting the survey area, and they are predominantly minor ephemeral stream orders (stream order 1 and 2). These watercourses would remain dry for most of the year and many do not support riparian vegetation due to historical clearing that has occurred across the survey area. Rockland Creek and Shotover Creek are larger watercourses (stream order 3 and above) present within the survey area and both creeks retain riparian vegetation. Watercourses are illustrated in Figure 4.1.

Two wetlands of ‘high ecological significance’ (HES) or ‘high ecological value waters’ under EP Act, which are prescribed as MSES, occur within the survey area. One patch (58.6 ha) occurs on the western boundary in Lot 8 WNA107 and the other patch (8.1 ha) occurs in Lot 7 SP187934. These areas are shown on Figure 4.1.

No areas of ‘vegetation management wetlands’ under VM Act occur within the survey area.

4.10 Connectivity

Connectivity is very limited in the survey area due to the cleared and fragmented nature of native vegetation. Connectivity predominantly occurs along creeklines. Proposed impacts to the extent and connectivity of remnant vegetation in the area will have to be analysed using the DES ‘landscape fragmentation and connectivity’ tool based on the proposed vegetation clearing footprint at the time of impact assessment.

4.11 Groundwater dependent ecosystems

Based on a review of the Groundwater Dependent Ecosystem Atlas (GDE Atlas) (BOM 2020b) it was identified there are areas within the western part of the survey area of moderate potential to support terrestrial GDEs. GDEs are ecosystems that rely upon groundwater for their continued existence. They may be 100% dependent on groundwater, such as aquifer GDEs, or may access groundwater intermittently to supplement their water requirements, such as riparian tree species in arid and semi-arid areas (IESC 2018).

The GDE Atlas was developed as a national dataset of Australian GDEs to inform groundwater planning and management. It is the first and only national inventory of GDEs in Australia. This mapping is produced at a high level

and requires ground-truthing at a site based scale to identify the potential for the terrestrial communities in those areas to have a dependency on groundwater, and what type of dependency that may be. Information on groundwater in these areas will also need to be evaluated to understand depth of groundwater and seasonal variation.

GDEs are considered and assessed separately to this report. Terrestrial and aquatic GDEs will be assessed through a separate aquatic ecology scope and reporting. Subterranean GDEs will be assessed as part of groundwater assessments and reporting.

4.12 Essential Habitat

There are several remnant vegetation polygons in the survey area mapped as Essential Habitat. These areas are shown on Figure 4.1. Essential Habitat areas total 1,054 ha within the survey area. Based on desktop searches the Essential Habitat is associated with the Ornamental Snake. Essential Habitat factors include:

- riparian woodland/open forest and shrub/woodland including Brigalow (*Acacia harpophylla*), into drier habitats in summer;
- altitude of 100-450 m;
- 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; and
- may occur in following Brigalow Belt REs – 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, 11.3.25, 11.3.27, 11.3.28, 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 and 11.12.6.

4.13 Protected plant high-risk trigger mapping

At the time of initial surveys there were no high risk trigger areas on the flora survey trigger map in the survey area. CEEVNT flora species were searched for while completing RE mapping exercises across the survey area. No formal protected plant meanders were undertaken.

Subsequent to survey, a cluster of risk trigger areas have been mapped in the northeast of the survey area just to the south of the old Blackwater south mine area and Rockland Dam (trigger map version 7.1). These areas are associated with records of *Solanum elaeagnifolium* mapped by EMM during the spring 2018 surveys. 318 ha occurs within the survey area.

The CEEVNT flora species that have potential to occur in the former high-risk trigger area are summarised in Table 4.5.

4.14 Fish passage

Any part of a waterway that is mapped by Queensland Government as providing for fish passage is a MSES.

Based on mapping there are a number of waterways across the survey area mapped with the potential to support fish passage including classes from 1 to 4, with 4 being of highest risk (Table 4.1).

An assessment of these watercourses will be conducted during aquatic field ecology surveys to identify their condition and potential to support fish passage (as part of a separate scope currently being undertaken). This is a high level assessment of the watercourse only. Any potential for impacts to fish passage will be assessed at a later stage as part of an approval impact assessment process.

There are no fish habitat areas within the vicinity of the survey area (the nearest being the Fitzroy River fish habitat area, 180 km to the east).

4.15 Legally secured offset areas

There are no legally secured offset areas within or adjacent to the survey area.

5 Field survey results

5.1 Survey timing and conditions

5.1.1 Climatic conditions

i Autumn season surveys

In 2019, autumn flora and fauna surveys were conducted in March and April. In the three months preceding field surveys, Blackwater Airport weather station recorded a total of 62 mm of rain in January, 14.6 mm in February, 179.6 mm in March and 14 mm in April (BOM 2020). Mean temperatures at Blackwater Airport in 2019 ranged between 21.4°C and 33.7°C during the March surveys and between 17.1°C and 28.9°C during April surveys (BOM 2020).

In 2020, autumn flora and fauna surveys were conducted in March and April. In the three months preceding field surveys, Blackwater Airport weather station (station 035134) recorded a total of 204.0 mm of rain in January, 66.2 mm in February, 1.6 mm in March and 0.2 mm in April (BOM 2020).

Mean temperatures at Blackwater Airport in 2020 ranged between 19.9°C and 31.8°C during the March surveys and between 17.6°C and 32.1°C during April surveys (BOM 2020). Temperatures during the March nocturnal surveys consistently dropped to below 20°C after 10-11pm and as such, targeted reptile surveys were performed in the warmer hours immediately after dusk.

ii Spring season surveys

Late spring/summer flora surveys were conducted in December 2018. According to rainfall averages at the Blackwater Airport weather station, the survey area received 89.6 mm of rain in October 2018, 59.0 mm in November 2018 and 56.6 mm in December 2018 (BOM 2020). Temperatures at Blackwater Airport ranged between 24.4°C and 40.7°C during the December surveys.

Spring fauna surveys were conducted in October and November 2019. In the three months preceding field surveys, Blackwater Airport weather station recorded a total of 17.2 mm in July, 1.4 mm in August, 0.0 mm in September, 14.0 mm in October and 1.4 mm in November 2019 (BOM 2020).

Climatic conditions over the surveys are summarised below in Table 5.1.

Table 5.1 Blackwater climatic conditions – Blackwater airport weather station (BOM 2020)

Month/year	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20
Rainfall (mm)	56.6	62.0	14.6	179.6	14.0	0.6	22.2	17.2	1.4	0.0	14.0	1.4	0.0	204	66.2	1.6	0.2
Mean minimum temperature (°C)	21.7	21.8	22.1	21.4	17.1	13.8	10.0	9.6	10.0	12.1	17.1	19.5	21.9	22.8	22.9	19.9	17.6
Mean maximum	34.8	33.8	36.2	33.7	28.9	26.6	23.1	24.5	25.9	30.5	33.4	36.0	38.2	35.3	33.7	31.8	32.1

Table 5.1 Blackwater climatic conditions – Blackwater airport weather station (BOM 2020)

Month/year	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20
temperature (°C)																	
Flora survey	■				■												■
Fauna survey					■						■	■					■

The fauna surveys conducted are part of a broader progressive seasonal survey plan that targets pre-determined survey locations at two key survey periods for Brigalow Belt bioregion, autumn (March-mid May) and spring (September-mid November). Spring surveys are required as warming temperatures prompt well-documented peaks in vertebrate activity including the commencement of breeding, which in turn increases detectability. Exact timing is dependent on the timing of the onset of spring, when temperatures begin to warm but before summer temperatures become too high as many species, especially reptiles, become less active (Eyre et al. 2018).

Autumn surveys should be undertaken after summer as the temperatures decrease and to take advantage of surveying post summer rains, but before the onset of cold winter nights. This coincides with another active period including dispersal and migration of many species. It is also more likely to be moist than during the spring-early summer period, and also coincides with grass seeding and growing season (important for granivores) (Eyre et al. 2018).

5.2 Survey effort

5.2.1 Fauna

The following sections provide information on the seasonal targeted fauna surveys that have been completed, the survey methods used, and the overall effort applied.

i Fauna survey team

The autumn surveys were conducted by EMM field ecologists Andrew Jensen, Ben Nottidge, Lui Weber, Bruce McLennan and Chagi Weerasena. The spring surveys were conducted by a team of three EMM field ecologists; Andrew Jensen, Ben Nottidge, and a combination of Lui Weber and Gus Daly (who completed the diurnal surveys) while Andrew Jensen, Ben Nottidge and Chagi Weerasena completed the nocturnal surveys.

Andrew Jensen has over 10 years’ experience conducting fauna surveys and is a specialist in avifauna. Ben Nottidge is a fauna ecologist with over 15 years experience including undertaking a range of targeted threatened fauna species surveys.

Ben has extensive experience surveying in the Brigalow Belt bioregion under Commonwealth and State guidelines and has a comprehensive knowledge of fauna species identification, habitat requirements and effective survey techniques. Lui Weber and Bruce McLennan are botanists with over 15 years’ experience and have also had experience supporting previous fauna surveys in the Brigalow Belt. Support ecologists Chagi Weerasena and Gus Daly have two years’ experience each in conducting field surveys, including several undertaken in the Brigalow Belt region. Curricula vitae for EMM field ecologists are provided in Appendix I.

ii Fauna survey timing

Fauna surveys were conducted as a part of a broader progressive seasonal survey plan that targeted pre-determined survey locations in two key survey periods, autumn season (March and April 2020) and spring season (October and November 2019), based on the Terrestrial Vertebrate Fauna Survey Guidelines for Queensland, V3.0 (Eyre et al. 2018), specifically the requirements for the Brigalow Belt bioregion. There are specific requirements around multi-seasonal survey as well as using a range of survey techniques that cater to range of faunal groups.

Survey effort was also based on species specific Commonwealth and State survey guidelines for threatened species, described in Section 2.8. How survey effort has considered these guidelines is summarised in Section 5.2.1 (iv).

The 'Desktop Ecology Assessments and Field Survey Program' report (EMM 2019) identified conservation significant species considered to have potential to occur within the survey area. Depending on species-specific seasonality, the potential of a species to occur in the survey area varies depending on the condition of the habitat. Species such as Painted Honeyeater (*Grantiella picta*) show seasonal migratory patterns and will typically occur in the region from April to September as they disperse out of their south-eastern Australia post breeding. Whereas some species, such as Squatter Pigeon (*Geophaps scripta scripta*), may occur year-round and only show low fluctuation levels of activity and/or abundance due to foraging resource availability.

A full list of all identified endangered, vulnerable and near threatened (CEEVNT) fauna species considered to have the potential to occur in the survey area and their seasonality requirements is available in the 'Desktop Ecology Assessments and Field Survey Program' report (EMM 2019). The desktop assessments have been refined post field survey and are summarised in Section 4.

A summary of survey effort relating to targeted threatened fauna species survey guidelines is provided in Section 5.2.1 (iv).

a Autumn season surveys

Initial autumn fauna surveys were conducted over three survey days between 25 March 2019 and 27 March 2019, but had to be curtailed due to wet weather precluding access to many parts of the survey area. Traps were installed on the initial day (25 March) and in place for two nights only before wet weather curtailed the survey. Remaining time during this survey period was spent on diurnal surveys (creekline searches for Koala, habitat assessments).

Therefore, to meet seasonal guidelines (including four nights of consecutive fauna trapping effort) surveys were postponed until the following autumn season (2020).

Fauna assessments in 2020 were completed over a total of 16 survey days, across three separate survey trips.

All autumn fauna surveys are summarised below in Table 5.2.

Table 5.2 Autumn fauna survey summary

Survey period	Survey effort
25-27 March 2019	<ul style="list-style-type: none"> • Diurnal surveys: <ul style="list-style-type: none"> – active searches done in cooler parts of the day (8.5 person hours) – bird surveys (9 person hours) – habitat assessments, scat and scratch searches etc (additional 140 person hours within survey area including flora survey) • Nocturnal surveys: <ul style="list-style-type: none"> – spotlighting in various woodland and gilgai habitats (4 person hours) – 500m of nocturnal transects along creekline vegetation – nine camera trap nights – six anabat nights and two harp trap nights • Trapping and additional diurnal surveys: <ul style="list-style-type: none"> – 24 pitfall trap nights – 36 funnel trap nights
22-28 March 2020	<ul style="list-style-type: none"> • Nocturnal surveys: <ul style="list-style-type: none"> – dam searches (5 person hours) – gilgai searches (45 person hours) – spotlighting in various woodland habitats (7.5 person hours) – 2,500m of nocturnal transects along creekline vegetation – 538 camera trap nights – 21 anabat nights and four harp trap nights
4-9 April 2020	<ul style="list-style-type: none"> • Diurnal surveys: <ul style="list-style-type: none"> – active searches done in cooler parts of the day (22 person hours) – bird surveys (8 person hours) – habitat assessments, scat and scratch searches etc (additional 200 person hours within survey area)
21-27 April 2020	<ul style="list-style-type: none"> • Trapping and additional diurnal surveys: <ul style="list-style-type: none"> – 64 pitfall trap nights – 96 funnel trap nights

b Spring season surveys

Fauna assessments in spring 2019 were completed over a total of 11 survey days across two separate trips. These are summarised below in Table 5.3:

Table 5.3 Spring 2019 fauna surveys summary

Survey period	Survey effort
28 October – 3 November 2019	<ul style="list-style-type: none"> • Diurnal surveys and trapping <ul style="list-style-type: none"> – active searches (13 person hours) – bird surveys (15 person hours) – 1,200m of diurnal transects along creekline vegetation – habitat assessments, scat and scratch searches etc (additional 108 person hours within survey area) – 64 pitfall trap nights – 104 funnel trap nights
5-10 November 2019	<ul style="list-style-type: none"> • Nocturnal surveys: <ul style="list-style-type: none"> – dam searches (1.5 person hours) – gilgai searches (38 person hours) – spotlighting in various woodland habitats (5.5 person hours) – 2,900m of nocturnal transects along creekline vegetation – 48 camera trap nights – 12 anabat nights – eight harp trap nights

iii Fauna survey sites

Fauna survey sites were selected by targeting areas of remnant and regrowth vegetation across the survey areas. Preliminary sites were chosen at a desktop level prior to the field visit through viewing aerial imagery and review of desktop information on key target species. Preliminary sites sought to achieve a broad geographic spread of survey locations across a range of habitats in the survey area, focussing appropriate survey and trapping methods to certain habitats based on an assessment of the likelihood of species presence in the ‘Desktop Ecology Assessments and Field Survey Program’ report (EMM 2019).

Site selection was then refined further in the field based on site-specific conditions and attributes to choose optimal locations for particular target species. For example, harp traps and Anabats were placed in likely flyways for bat species and Koala (*Phascolarctos cinereus*) spot assessment technique (SAT) surveys were undertaken along riparian areas supporting preferred food trees or patches of eucalypt woodland. Site selection was also guided by advice from the botanists and results from flora surveys completed.

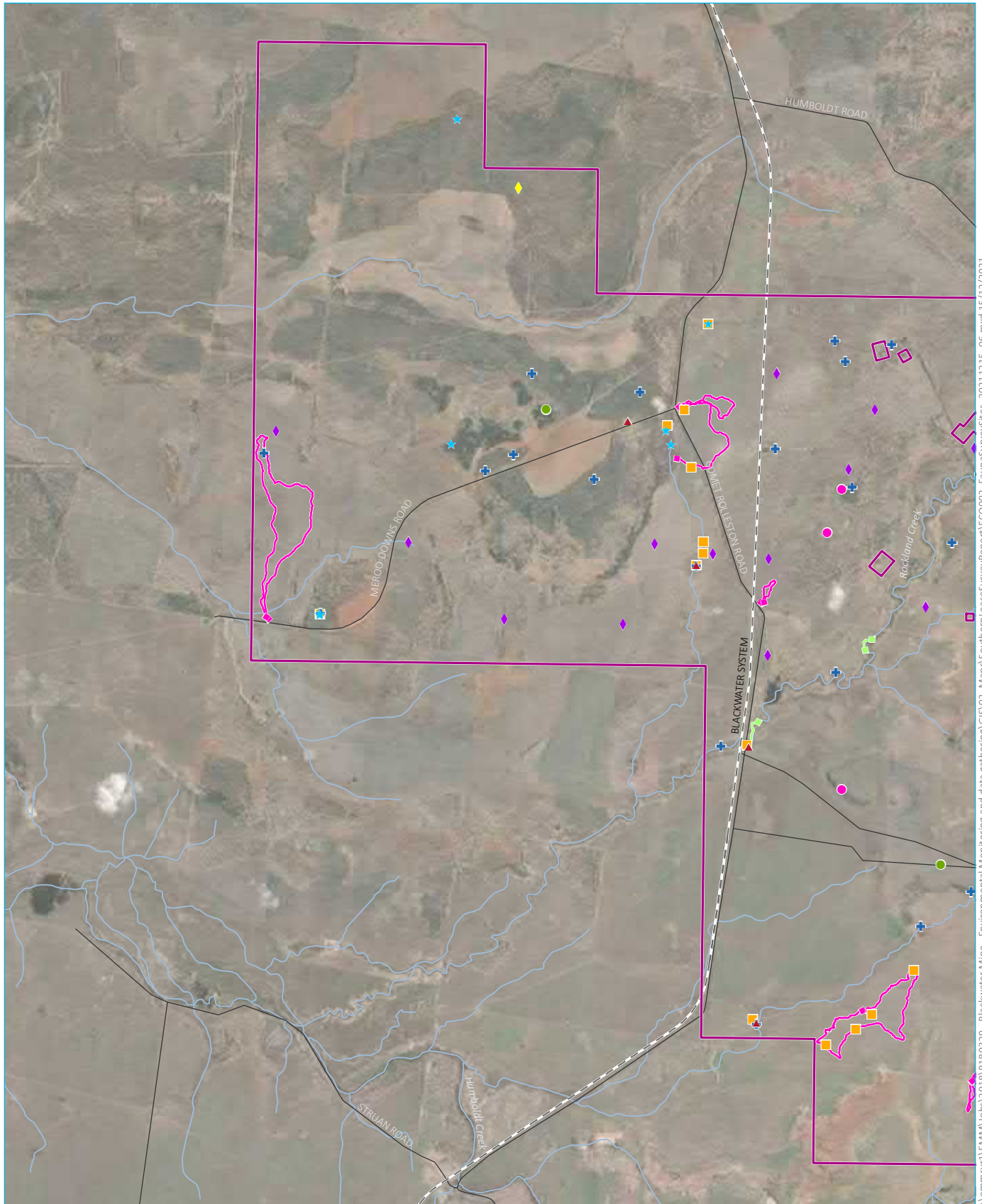
Upon site arrival, trapping sites were established on the first day to enable the full four consecutive nights of trapping to take place (weather dependent). While traversing the site, additional habitat areas were identified for subsequent targeted species surveys (eg well-formed and abundant gilgai for Ornamental Snake (*Denisonia maculata*)). On completion of the diurnal trapping survey site visits in November 2019, sites were further reviewed and refined for targeting during the March 2020 spotlighting surveys.

The following survey and trapping sites were completed as part of the seasonal surveys in the survey area during each of the autumn and spring survey campaigns:

- a total of four trapping sites (four trap nights completed at each site) in both autumn and spring (trap sites include funnel traps, pitfall traps, Elliot traps, camera trap and an Anabat device) – note four trap sites were commenced in autumn 2019 but had to be curtailed after only two nights of trapping;

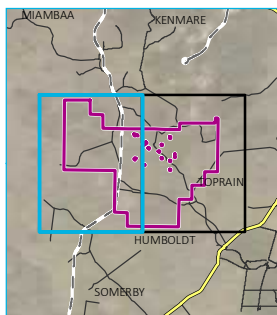
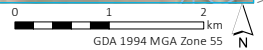
- one harp trap site (two traps per site) during autumn 2019, two harp trap sites during spring 2020 and one harp trap site during autumn 2020 to target microchiropterans such as the CEEVNT species Large-eared Pied Bat (*Chalinolobus dwyeri*) at each survey site location, being a total of eight harp trap nights;
- supplementary remote cameras and Anabats were installed around sites with habitat attributes that concentrate fauna activity (predominantly farm dams and waterways) – a total of 17 camera sites and 15 Anabat sites were installed over the course of autumn and spring surveys totalling 538 camera nights and 51 Anabat nights;
- dam and waterbody locations were targeted for active searches, bird surveys and supplementary camera traps/Anabat;
- active search locations in gilgai habitats targeting Ornamental Snake and Australian Painted Snipe (*Rostratula australis*);
- active diurnal searches of rocky scarp slopes with remnant vegetation for threatened reptiles (e.g. Yakka Skink (*Egernia rugosa*) and Collared Delma (*Delma torquata*));
- spotlighting surveys to target Ornamental Snake, Koala and Greater Glider (*Petauroides volans volans*); and
- active searches/transects of riparian habitats for Koala and other threatened species.

Full details of the survey methods are provided below and survey locations are illustrated in Figure 5.1.



\\lemmsvr1\EMM\Jobs\2018\B180329 - Blackwater Mine - Environmental Monitoring and data gathering\GIS\03_Maps\SouthernLeaseSurveyReport\ECO002_FaunaSurveySites_20211215_06.mxd 15/12/2021

Source: EMM (2021); DNRME (2021)



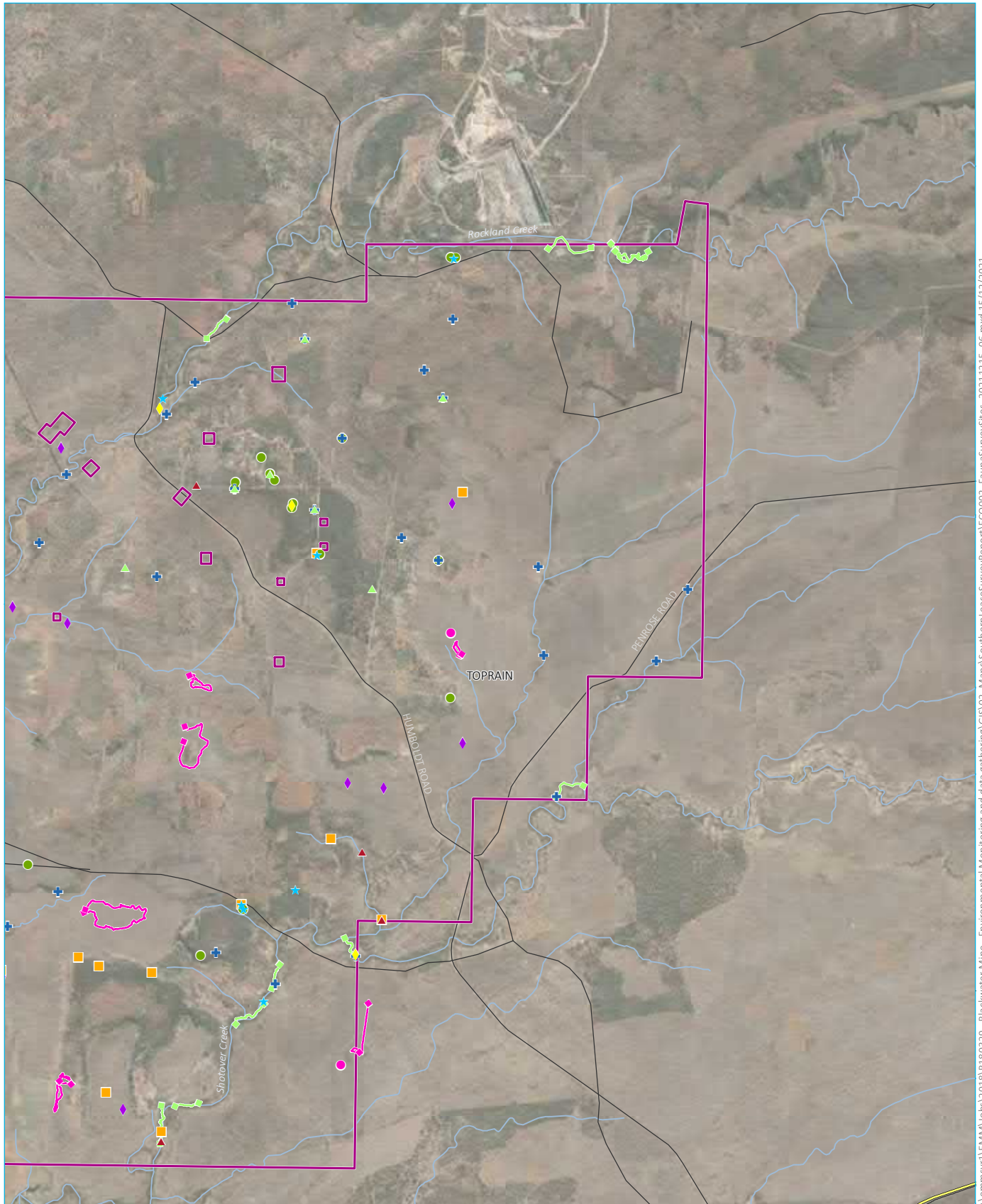
KEY

- | | | |
|---------------------------|---------------|-------------------------|
| Survey area | Trapping site | Camera |
| Rail line | Bird survey | Active search |
| Major road | Anabat | Ornamental Snake search |
| Minor road | Harp trap | Spotlighting |
| Watercourse/drainage line | | Spotlighting transect |
| | | Koala transect |

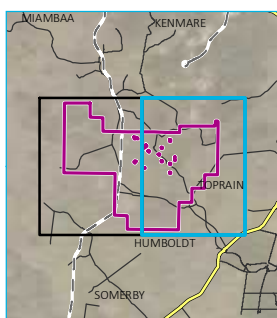
Fauna survey sites -
map 1 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.1





Source: EMM (2021); DNRME (2021)



KEY

- Survey area
- Rail line
- Major road
- Minor road
- Watercourse/drainage line

- Fauna survey type
- ★ Trapping site
 - + Bird survey
 - ▲ Anabat
 - ◆ Harp trap

- Camera
- Active search
- ◆ Ornamental Snake search
- ▲ Koala SAT
- Spotlighting
- ◆ Spotlighting transect
- ◆ Koala transect

0 1 2 km
GDA 1994 MGA Zone 55

Fauna survey sites -
map 2 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.1



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All vertebrate fauna species observed during targeted fauna surveys, flora surveys and incidentally when travelling between survey sites were recorded. A total of 201 fauna species were recorded including 10 amphibians, 28 reptiles, 14 non-volant mammals, 13 bats and 136 birds. A full list of fauna species recorded is provided as Appendix C.

iv Targeted survey effort – threatened fauna species

Based on the results of desktop assessments, as summarised in the 'Desktop Ecology Assessments and Field Survey Program' report (EMM 2019), EMM developed a survey program that incorporated targeted survey methods for those CEEVNT species which were recognised as potentially occurring within the survey area (see Appendix D) – this includes a number of species that although not recorded in the PMST or Wildlife Online searches in the study area, were conservatively considered to be potentially present. Survey effort for these species is summarised in Table 5.4.

Table 5.4 Fauna survey effort for key CEEVNT species

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
Ornamental Snake (<i>Denisonia maculata</i>)	<p><i>Survey methods for reptiles</i></p> <p>Pitfall trapping with 4 buckets at 7.5 m intervals on T-design; 45 m fence for 4 nights.</p> <p>Funnel trapping with 6 funnels 3 m in on distal ends of T-design; 45 m fence for 4 nights.</p> <p>Diurnal active search for 2 x 30 person-minute searches within 2 different 50 x 50 m quadrants of the survey site.</p> <p>Nocturnal active search for 2 x 30 person-minute searches within the 100 x 100 m survey site.</p> <p>Camera trapping with 1 camera per site for minimum of 4 nights.</p> <p>Scat and sign search can coincide with the systematic diurnal active searches, within 50 x 50 m quadrants of the survey site.</p> <p>Otherwise incidental sightings are noted (Eyre et al. 2018).</p>	<p><i>Survey methods for Brigalow Belt reptiles</i></p> <p>Targeting water-inundated gilgai, wetlands, riparian habitats and the surrounding environment (e.g. tracks) and large logs between dusk and early morning hours</p> <p>More effective on warm, humid evenings.</p> <p>Survey over a minimum of 1.5 person hours per hectare for habitats of average complexity per targeted species.</p> <p>Survey over a minimum of 3 nights.</p> <p><i>Active searches</i></p> <p>Actively look for reptiles whilst driving along roadways in your survey area especially following heavy rainfall events and during warm evenings for snakes.</p> <p><i>Pitfalls</i></p> <p>Six 20 litre (500 mm deep) buckets evenly distributed under a 30 m drift fence where optimal microhabitats occur.</p> <p>Place a funnel at each end of a pitfall line.</p> <p>At least 2 replicates per habitat type.</p> <p>Checked every morning and early evening (after the optimal foraging periods) over four days.</p>	<p>Autumn 2020</p> <p>Spotlighting surveys of trap sites totalling six person hours, spotlighting searches of gilgai habitats totalling 45 person hours and spotlighting searches at Melaleuca wetland totalling 1.5 person hours. This is a total of 51 person hours of spotlighting over five consecutive nights.</p> <p>Spring 2019</p> <p>Three person hours of diurnal active searches (1 x 30 minutes in different quadrants of trap sites). Four trap nights (funnels and pitfalls) at four trap sites, totalling 64 pitfall trap nights and 104 funnel trap nights.</p> <p>Spotlighting surveys of trap sites totalling 5.5 person hours, spotlighting searches around dams totalling 1.5 person hours and spotlighting searches of gilgai habitats totalling 38.25 person hours. This is a total of 45.25 person hours of spotlighting over five consecutive nights.</p> <p>Autumn 2019</p> <p>Six person hours of diurnal active searches (2 x 30 minutes in different quadrants of trap sites). Diurnal searches of gilgai totalling 2.5 person hours. Two trap nights (funnels and pitfalls) at three trap sites, totalling 24 pitfall trap nights and 36 funnel trap nights.</p> <p>Spotlighting surveys of trap sites totalling three person hours, spotlighting searches around dams totalling one person hour and spotlighting searches of gilgai habitats totalling three person hours. This is a total of seven person hours of spotlighting over one night.</p>	<p>The species has been shown to occur in cleared areas of gilgai and the Brigalow Belt reptile guideline include cleared areas of gilgai as potential habitat for this species. Multiple records in cleared gilgai were made within the survey area during both seasons.</p> <p>Diurnal searches are unlikely to be successful for this species in the survey area due to a lack of microhabitat in the form of timber/ground logs that would provide refuge when cracks aren't available. The survey area has been stick-raked well following historical clearing. If the species is present, it is likely to be resting in cracking soils of gilgai or creek lines.</p> <p>Melzer (2001 pers comm) found that intensive searches during the day in an area where the species was found in abundance at night, failed to detect the species. Spotlighting offers by far greatest chance of detecting this species. Both diurnal and nocturnal surveys were conducted for Ornamental Snake.</p> <p>The Commonwealth survey guidelines recommend surveys over a minimum of three nights targeting gilgai wetlands and riparian habitats of average complexity, especially following rainfall events. The seasonal surveys were conducted in these preferred habitats before and after rainfall events by spotlighting. Areas supporting known habitat (gilgai where records have been observed) are estimated at 1,865 ha and likely habitat (where there are suitable gilgai but no records) at 2,288.7 ha. The survey effort has been adapted to the scale of the survey area and condition. Ornamental Snake</p>

Table 5.4 Fauna survey effort for key CEEVNT species

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
			<p>Total</p> <p>In summary – 11.5 person hours of diurnal active searching (note the value of this activity was reduced as most gilgai held little microhabitat in the form of timber and snakes would have been utilising soil cracks), 103.25 person hours of nocturnal searches and 38 trap nights (combination of funnels and pitfalls over eleven trap sites in total).</p>	<p>shelters under logs and coarse woody debris/ground litter, ground timber is usually relatively common and habitat patches are within or connected to larger areas of remnant vegetation (DAWE 2020k).</p> <p>During the total 103.25 person hours spent on nocturnal survey effort, Ornamental Snake presence in the survey area has been confirmed. The species was identified in gilgai areas, some containing microhabitat. Therefore, adequate survey effort has been applied to determine Ornamental Snake populations and habitat distribution and condition.</p>
Koala (<i>Phascolarctos cinereus</i>)	<p><i>Survey methods for arboreal mammals</i></p> <p>Broadcast surveys for 2 sessions of call playback of relevant species at midpoint of survey site.</p> <p>Spotlighting for 2 x 30 person-minute searches within the 100 x 100 m survey area.</p> <p>Scat and sign search can coincide with the systematic diurnal active searches, within 50 x 50 m quadrates of the survey site.</p> <p>Otherwise incidental (Eyre et al. 2018).</p>	<p><i>Survey methods for Koalas</i></p> <p>Scat SAT for 2 person-minutes under 30 trees at each site.</p> <p>Diurnal strip transects where koala activity and density is high.</p> <p>Spotlighting.</p> <p>Broadcasting surveys during breeding season (August to February).</p> <p>Camera trapping where fresh signs have been detected.</p> <p>Indirect sightings such as scratches and scat (DoE 2014).</p>	<p>Autumn 2020</p> <p>500 m of nocturnal transects along Shotover Creek and 2,000 m of nocturnal transects along Rockland Creek.</p> <p>Broadcast surveys at spots along the creeklines were also undertaken.</p> <p>Additional incidental scat and scratch searches occurred in areas of Acacia woodland in the northeast of the survey area where the species was previously observed during spotlighting.</p> <p>Spring 2019</p> <p>2,900 m of diurnal transects along Shotover Creek and 1,200 m of diurnal transects along Rockland Creek.</p> <p>1,800 m of nocturnal transects along Shotover Creek and 3,100 m of</p>	<p>Koalas (or signs of Koala) were recorded along both major watercourses in the survey area (Rockland Creek and Shotover Creek) as well as in an area of Acacia woodland with plentiful emergent Eucalypt food tree species.</p> <p>Survey methods required have been implemented.</p>

Table 5.4 Fauna survey effort for key CEEVNT species

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
			<p>nocturnal transect along Rockland Creek with additional searches around two trap sites along Shotover Creek.</p> <p>Broadcast surveys at spots along the creeklines were also undertaken.</p> <p>Autumn 2019</p> <p>Two incidental SAT searches of Shotover Creek.</p> <p>500 m of nocturnal transects along Shotover Creek.</p> <p>Total</p> <p>A total of 12 km of transects of creekline vegetation along Shotover Creek and Rockland were completed over the autumn and spring surveys.</p>	
Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>)	<p><i>Survey methods for bats</i></p> <p>Echolocation call detection with 1 bat detector for 3 nights</p>	<p>Unattended bat detectors for 16 detector nights over a minimum of 4 nights.</p> <p>Attended bat detectors for 6 detector nights over a minimum of 3 nights.</p> <p>Harp traps and/or mist nets for 16 trap or net nights over a minimum of 4 nights.</p>	<p>Autumn 2020</p> <p>21 unattended detector nights over eight nights.</p> <p>Four harp trap nights over two nights.</p> <p>Spring 2019</p> <p>12 unattended detector nights over four nights.</p> <p>Eight harp trap nights over four nights.</p> <p>Autumn 2019</p> <p>Six unattended detector nights over three nights.</p> <p>Two harp trap nights over one night.</p> <p>Total</p> <p>23 unattended detector nights over nine nights.</p> <p>14 harp trap nights over seven nights.</p>	<p>The Large-eared Pied Bat requires a combination of sandstone cliffs and fertile woodland valley within close proximity of each other (DAWE 2020o). It is known from Blackdown Tablelands National Park, but habitat on site is suboptimal. There is limited potential for the species to occur in the survey area.</p> <p>Survey methods required have been implemented.</p> <p>Anabats did not detect the species.</p>
Glossy Black-Cockatoo (<i>Calyptorhynchus lathami</i>)	<p>Diurnal bird surveys for 5 hours over 1 day per 50 ha of project area.</p> <p>– Surveys can be conducted on foot by walking transects in the</p>	Not listed.	<p>Additionally, time driving around site contributes to survey effort for this species, searching for areas of <i>Allocasuarina</i> trees and individuals moving between patches of habitat.</p> <p>Autumn 2020</p>	<p>There is limited <i>Allocasuarina</i> food trees in the survey area for the Glossy-black Cockatoo. Where there are suitable food tree species, signs of species presence (e.g. chewed <i>Allocasuarina</i> cones) are easily found. These signs were not</p>

Table 5.4 Fauna survey effort for key CEEVNT species

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
	<p>Project Site, particularly in areas with <i>Allocasuarina</i> trees, water bodies, and large hollow-bearing eucalypts.</p> <p>– Surveys should encompass a dawn or dusk period.</p> <p>A search for foraging and nesting signs for 20 hours over 4 days per 50 ha of project area (Hourigan 2012).</p>		<p>7.5 person hours of dedicated bird surveys (trap sites and dam surveys) typically between 15 to 30 minutes per site depending on the nature of the site were completed. In total (including time on dedicated bird surveys), approximately 230.25 person hours were accumulated on site (including driving and walking around the leases) across the March/April 2020 surveys over 14 days in total (at all times of day from dawn to dusk).</p> <p>Spring 2019</p> <p>15 person hours of dedicated bird surveys (trap sites and dam surveys) typically between 15 to 30 minutes per site depending on the nature of the site were completed. In total (including time on dedicated bird surveys), approximately 108 person hours spent across the survey area.</p> <p>Autumn 2019</p> <p>8.5 person hours of dedicated bird surveys (trap sites and dam surveys). In total (including time on dedicated bird surveys), approximately 240 person hours spent across the survey area (including some time in December 2018).</p> <p>Summer 2018</p> <p>In total, approximately 100 person hours were accumulated on site (including driving and walking around the leases) across the December 2018 surveys from five days in total (at all times of day from dawn to dusk).</p> <p>Total</p> <p>Approximately 578.25 person hours have been spent across survey area to date. These</p>	<p>observed in areas of Belah (<i>Casuarina cristata</i>) in the survey area. Due to the absence of preferred foraging resources, lack of tree hollows, the likelihood of the species in the survey area is greatly reduced, and as such, diurnal bird survey effort in general is considered sufficient for this species.</p>

Table 5.4 Fauna survey effort for key CEEVNT species

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
			were accumulated across December 2018, March 2019, April 2019, October 2019, September 2019, March 2020 and April 2020 surveys over 38 days in total (at all times of day from dawn to dusk).	
Collared Delma (<i>Delma torquata</i>)	<p><i>Survey methods for reptiles</i></p> <p>Pitfall trapping with 4 buckets at 7.5 m intervals on T-design; 45 m fence for 4 nights.</p> <p>Funnel trapping with 6 funnels 3 m in on distal ends of T-design; 45 m fence for 4 nights.</p> <p>Diurnal active search for 2 x 30 person-minute searches within 2 different 50 x 50 m quadrants of the survey site.</p> <p>Nocturnal active search for 2 x 30 person-minute searches within the 100 x 100 m survey site.</p> <p>Camera trapping with 1 camera per site for minimum of 4 nights.</p>	<p><i>Survey methods for Brigalow Belt reptiles</i></p> <p>Searching microhabitats, such as carefully turning woody debris, rocks and artificial debris, raking the soil surface or leaf litter beneath trees and looking beneath peeling bark for reptiles or their sloughs.</p> <p>Optimal survey time is during the coolest parts of the day.</p> <p>Survey over a minimum of 1.5 person hours per hectare for habitats of average complexity per targeted species.</p> <p>Survey over a minimum of 3 days.</p> <p><i>Survey methods for Australia's threatened reptiles</i></p> <p>One-off hand searches (including raking through leaf litter) in appropriate habitats, together with pitfall trapping during late spring to summer. A series of pitfall trap lines comprising six 4–10 litre buckets and funnel traps spread along a 15 m fence would be an appropriate trap design.</p>	<p>Autumn 2020</p> <p>12 person hours of diurnal active searches at trap sites (3 x 15 minutes in different quadrants of trap sites) and 9.5 person hours of diurnal active searches in suitable areas. Four trap nights (funnels and pitfalls) at four trap sites, totalling 64 pitfall trap nights and 96 funnel trap nights.</p> <p>Spring 2019</p> <p>8.25 person hours of diurnal active searches (3 x 20 minutes in different quadrants of trap sites) and five person hours searching areas of rocky scarp. Four trap nights (funnels and pitfalls) at four trap sites, totalling 64 pitfall trap nights and 104 funnel trap nights.</p> <p>Spotlighting surveys of trap sites totalling 5.5 person hours, spotlighting searches around dams totalling 1.5 person hours and spotlighting searches of rocky scarps totalling six person hours. This is a total of 13 person hours of spotlighting over five consecutive nights.</p> <p>Autumn 2019</p> <p>Six person hours of diurnal active searches (2 x 30 minutes in different quadrants of trap sites). Two trap nights (funnels and pitfalls) at three trap sites, totalling 24 pitfall trap nights and 36 funnel trap nights.</p> <p>Spotlighting surveys of trap sites totalling three person hours and spotlighting</p>	<p>Limited open woodland habitat and fallen timber and rocky microhabitat, as well as sensitivity to grazing, reduce the likelihood of the species being present in the survey area.</p> <p>Survey methods and effort are considered to meet guideline requirements for this species, as habitats of average complexity for the species are not considered to be present.</p>

Table 5.4 Fauna survey effort for key CEEVNT species

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
			<p>searches around dams totalling one person hour.</p> <p>This is a total of four person hours of spotlighting over one night.</p> <p>Total</p> <p>In summary – 35.75 person hours of diurnal active searching, 17 person hours of nocturnal searches and 388 trap nights (combination of funnels and pitfalls over 11 trap sites in total).</p>	
Yakka Skink (<i>Egernia rugosa</i>)	<p>Diurnal search for 20 minutes per hectare in a single search.</p> <p>– Search 20% of suitable habitat when the project area is 50 ha or greater.</p> <p>– Search 40% of suitable habitat when the project area is less than 50 ha.</p> <ul style="list-style-type: none"> • Distant observation for 20 minutes per day scanning suitable microhabitat for 3 days. • Camera traps for 12 camera trap nights per colony over 4 nights. • Funnel traps for 60 trap nights per colony over 4 nights. 	<p><i>Survey methods for Brigalow Belt reptiles</i></p> <p>Searching microhabitats, such as carefully turning woody debris, rocks and artificial debris, raking the soil surface or leaf litter beneath trees and looking beneath peeling bark for reptiles or their sloughs.</p> <p>Optimal survey time is during the coolest parts of the day.</p> <p>Survey over a minimum of 1.5 person hours per hectare for habitats of average complexity per targeted species.</p> <p>Survey over a minimum of 3 days.</p> <p>Transects (number and size of area sampled) should be strategically designed / positioned in large habitat patches (>10 ha) to adequately sample representative microhabitats in each habitat type</p> <p>Target colony sites through diurnal surveys of suitable habitat</p> <p>One large Elliott-style trap (15.5 cm x 15 cm x 46 cm) and one cage trap placed as close as possible to burrow entrances</p>	<p>Autumn 2020</p> <p>12 person hours of diurnal active searches at trap sites (3 x 15 minutes in different quadrants of trap sites) and 9.5 person hours of diurnal active searches in suitable rocky habitat areas. Four trap nights (funnels and pitfalls) at four trap sites, totalling 64 pitfall trap nights and 96 funnel trap nights. Diurnal searches were completed in cooler parts of the day.</p> <p>Spring 2019</p> <p>8.25 person hours of diurnal active searches (3 x 20 minutes in different quadrants of trap sites) and five person hours searching areas of rocky scarp. Four trap nights (funnels and pitfalls) at four trap sites, totalling 64 pitfall trap nights and 104 funnel trap nights.</p> <p>Autumn 2019</p> <p>Six person hours of diurnal active searches (2 x 30 minutes in different quadrants of trap sites). Two trap nights (funnels and pitfalls) at three trap sites, totalling 24 pitfall trap nights and 36 funnel trap nights. Diurnal searches were completed in cooler parts of the day.</p>	<p>The survey area contains marginally suitable habitat for this species including acacia and eucalypt woodlands with logs, tree stumps and rocky areas. However, these areas are disjunct from other habitats and are minimal in extent. The species has not been identified in the survey area after survey effort conducted over the Spring and Autumn surveys therefore it is unlikely to occur.</p> <p>The majority of the survey area is land zone 4 and/or cleared of vegetation, or does not have suitable habitat factors (rocky areas or woody debris). The survey area includes some areas of eucalypt dominated woodlands on land zone 3 but these are typically limited to riparian corridors without extensive rocky areas or extensive woody debris.</p> <p>Survey methods are consistent with applicable survey guidelines and survey effort is considered appropriate as habitats of average complexity for the species are not considered to be present.</p>

Table 5.4 Fauna survey effort for key CEEVNT species

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
		<p>Check every morning and early evening (after the optimal foraging periods) over four days</p> <p><i>Survey methods for Australia's threatened reptiles</i></p> <p>Searching for burrow systems and communal defecation sites. The species can be confirmed by Elliott trapping around the burrows, by distant observation with binoculars or by shining a torch down the burrows at night.</p>	<p>Total</p> <p>In summary – 35.75 person hours of diurnal active searching (generally in cooler parts of day) and 388 trap nights (combination of funnels and pitfalls over 11 trap sites in total).</p>	
Greater Glider (<i>Petauroides volans</i>)	<p><i>Survey methods for arboreal mammals</i></p> <p>Spotlighting for 2 x 30 person-minute searches within 100 x 100 m survey site.</p>	No specific requirements for Greater Glider.	<p>Autumn 2020</p> <p>500 m of nocturnal transects along Shotover Creek and 2,000 m of nocturnal transects along Rockland Creek.</p> <p>Spring 2019</p> <p>1,800 m of nocturnal transects along Shotover Creek and 3,100 m of nocturnal transect along Rockland Creek with additional searches around two trap sites along Shotover Creek.</p> <p>Autumn 2019</p> <p>500 m of nocturnal transects along Shotover Creek.</p> <p>Total</p> <p>A total of 7.9 km of nocturnal transects of creekline vegetation along Shotover Creek and Rockland Creek were completed over the autumn and spring surveys.</p>	<p>In general, there are few large mature trees in the creeklines and the very low density of large hollows present reduces the value of the habitat for Greater Glider. Limited suitable denning habitat in tree hollows was recorded along Shotover Creek and Rockland Creek.</p> <p>No Greater Glider were observed during spotlighting surveys.</p> <p>Survey methods required have been implemented.</p>
Painted Honeyeater (<i>Grantiella picta</i>)	<p><i>Survey methods for diurnal birds</i></p> <p>Area searches for 4 hours over 4 days per 50 ha of suitable habitat.</p>	Not listed.	<p>Autumn 2020</p> <p>Three person hours of dedicated bird surveys (trap sites and dam surveys).</p> <p>Spring 2019</p> <p>15 person hours of dedicated bird surveys (trap sites and</p>	<p>Although targeted surveys did not record this species, areas of potential habitat exist within the survey area. This consists of acacia woodlands and riparian eucalypt vegetation with mistletoe species such as <i>Amyema quandang</i>.</p>

Table 5.4 Fauna survey effort for key CEEVNT species

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
			dam surveys), including broadcast surveys. Autumn 2019 8.5 person hours of dedicated bird surveys (trap sites and dam surveys). Total 26.5 person hours of dedicated bird surveys (trap sites and dam surveys) as well as additional time whilst walking around the survey area.	It feeds primarily on Mistletoe (Loranthaceae) fruits and its movements are highly dependent on fruit availability. Although potential habitat does occur (with mistletoe host species such as Brigalow and Belah present) the habitat is limited in extent within the survey area and it is not within the core range of this species. Extensive areas of remnant acacia or eucalypt woodlands do not occur in the Survey area. The species retains a low possibility of occurrence on a sporadic basis. The species is likely to be an infrequent and scarce visitor to the region, and there are no other records in the study area. Survey methods are consistent with guideline requirements for this species.
Australian Painted Snipe (<i>Rostratula australis</i>)	<i>Survey methods for diurnal birds</i> Diurnal bird surveys within the 100 x 100 m survey site by one observer for 5 minutes, on at least 6 occasions within a survey period.	Intensive vigilance is required to detect flushed birds. Area searches or transects through suitable wetlands; detection by sighting and flushing. Targeted stationary observations at dawn and dusk of suitable foraging locations within wetlands; detection by sighting. Also, a brief spotlight search shortly after dusk may detect birds. Stationary observations for 10 hours over 5 days for sites of less than 50 ha. Land-based area searches or line transects for 10 hours over 3 days for sites of less than 50 ha when wetland holds water but is not flooded.	Autumn 2020 Diurnal searches of dams totalling 2.5 person hours. Spotlighting searches around dams totalling 5 person hours and spotlighting searches of gilgai habitats totalling 45 person hours and 1.5 person hours searching a melaleuca wetland. 317 camera trap nights in gilgai or dam habitats. Spring 2019 Spotlighting surveys of dams totalling 1.5 person hours and spotlighting searches of gilgai habitats totalling 38.5 person hours. This is a total of 40 person hours of spotlighting over five consecutive nights. It should be noted that gilgai were dry during this period, but dams held water. 18 camera trap nights in gilgai or dam habitats. Autumn 2019	Although little is known about the movements of the species, Australian Painted Snipe are likely to move into areas of central Queensland on a seasonal basis when wet-season rainfall fills ephemeral habitats such as the gilgai. The species has been recorded from gilgai and dam edges in the northern leases at Blackwater. Survey methods and effort meets guideline requirements for this species.

Table 5.4 Fauna survey effort for key CEEVNT species

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
			<p>Diurnal searches of gilgai totalling 2.5 person hours.</p> <p>Spotlighting searches around dams totalling one person hour and spotlighting searches of gilgai habitats totalling three person hours. This is a total of four person hours of spotlighting over four consecutive nights.</p> <p>Four camera trap nights in gilgai or dam habitats.</p> <p>Total</p> <p>In summary, 5 person hours of diurnal active searching, 95.5 person hours of nocturnal searches of dams and gilgai habitats, and 339 camera trap nights.</p>	
Death Adder (<i>Acanthophis antarcticus</i>)	<p>500 km (or all suitable roads surveyed multiple times) of nocturnal vehicle transect over 2 nights.</p> <p>Pitfall and funnel trapping (e.g. 100 nights per ha).</p> <p>Surveys should be undertaken during the breeding period (September to March), preferably at night when the species is active (Rowland & Ferguson 2012).</p>	Not listed.	<p>Autumn 2020</p> <p>12 person hours of diurnal active searches at trap sites (3 x 15 minutes in different quadrants of trap sites) and 9.5 person hours of diurnal active searches in suitable areas. Four trap nights (funnels and pitfalls) at four trap sites, totalling 64 pitfall trap nights and 96 funnel trap nights.</p> <p>Spring 2019</p> <p>8.25 person hours of diurnal active searches (3 x 20 minutes in different quadrants of trap sites) and five person hours searching areas of rocky scarp. Four trap nights (funnels and pitfalls) at four trap sites, totalling 64 pitfall trap nights and 104 funnel trap nights.</p> <p>Spotlighting surveys of trap sites totalling 5.5 person hours, spotlighting searches around dams totalling 1.5 person hours and spotlighting searches of rocky scarps totalling six person hours. This is a total of 13 person</p>	<p>Due to the cryptic nature of the species and low detection rates, survey effort in guidelines is not likely to be feasible. The survey effort needs to be adapted to the scale of the survey area and its condition.</p> <p>This species is unlikely to occur on the site due to a lack of microhabitat in the form of timber/ground logs that would provide refuge. In addition the presence of Cane Toads is a limiting factor for the species.</p>

Table 5.4 Fauna survey effort for key CEEVNT species

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
			<p>hours of spotlighting over five consecutive nights.</p> <p>Autumn 2019</p> <p>Six person hours of diurnal active searches (2 x 30 minutes in different quadrants of trap sites). Two trap nights (funnels and pitfalls) at three trap sites, totalling 24 pitfall trap nights and 36 funnel trap nights.</p> <p>Spotlighting surveys of trap sites totalling three person hours and spotlighting searches around dams totalling one person hour.</p> <p>This is a total of four person hours of spotlighting over one night.</p> <p>Total</p> <p>In summary – 35.75 person hours of diurnal active searching, 17 person hours of nocturnal searches and 388 trap nights (combination of funnels and pitfalls over 11 trap sites in total).</p>	
Powerful Owl (<i>Ninox strenua</i>)	<p><i>Survey methods for nocturnal birds</i></p> <p>Broadcast surveys for two sessions of call playback at midpoint of survey site</p> <p>Spotlighting for 2 x 30 person-minute searches within 100 x 100m survey site.</p>	Not listed.	<p>Autumn 2020</p> <p>500 m of nocturnal transects along Shotover Creek and 2,000 m of nocturnal transects along Rockland Creek. Call playback was also used.</p> <p>Spring 2019</p> <p>1,800 m of nocturnal transects along Shotover Creek and 3,100 m of nocturnal transect along Rockland Creek with additional searches around two trap sites along Shotover Creek.</p> <p>Autumn 2019</p> <p>500 m of nocturnal transects along Shotover Creek.</p> <p>Total</p> <p>A total of 7.9 km of transects of creekline vegetation along Shotover Creek and Rockland</p>	<p>Habitat is suboptimal for this species and the survey area does not provide extensive tracts of vegetation.</p> <p>Survey methods and effort meets guideline requirements for this species. It is likely that if present in suitable creekline habitat, response to playback would have been elicited.</p>

Table 5.4 Fauna survey effort for key CEEVNT species

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
			Creek were completed over the autumn and spring surveys.	
Golden-tailed Gecko (<i>Strophurus taenicauda</i>)	<p><i>Survey methods for reptiles</i></p> <p>Pitfall trapping with 4 buckets at 7.5 m intervals on T-design; 45 m fence for 4 nights.</p> <p>Funnel trapping with 6 funnels 3 m in on distal ends of T-design; 45 m fence for 4 nights.</p> <p>Diurnal active search for 2 x 30 person-minute searches within 2 different 50 x 50 m quadrants of the survey site.</p> <p>Nocturnal active search for 2 x 30 person-minute searches within the 100 x 100 m survey site.</p> <p>Camera trapping with 1 camera per site for minimum of 4 nights.</p>	Not listed.	<p>Autumn 2020</p> <p>12 person hours of diurnal active searches at trap sites (3 x 15 minutes in different quadrants of trap sites) and 9.5 person hours of diurnal active searches in suitable areas. Four trap nights (funnels and pitfalls) at one trap site, totalling 16 pitfall trap nights and 24 funnel trap nights.</p> <p>Spring 2019</p> <p>8.25 person hours of diurnal active searches (3 x 20 minutes in different quadrants of trap sites).</p> <p>Spotlighting surveys of trap sites totalling 5.5 person hours.</p> <p>31 camera trap nights at trap site within Acacia woodland.</p> <p>Autumn 2019</p> <p>Six person hours of diurnal active searches (2x30 minutes in different quadrants of trap sites).</p> <p>Spotlighting surveys of trap sites totalling three person hours.</p> <p>Total</p> <p>In summary – 35.75 person hours of diurnal active searching, 8.5 person hours of nocturnal searches, 31 camera trap nights and 40 trap nights (combination of funnels and pitfalls over one trap site in total).</p>	<p>There is limited <i>Allocasuarina</i> trees in the survey area, with which the species is often associated, however Acacia woodland provides sufficient habitat for this species.</p> <p>Survey methods and effort meets guideline requirements for this species.</p>

5.2.2 Flora

i Flora survey team

Autumn 2019 surveys were conducted by EMM field ecologists Bruce McLennan and Gus Daly. Autumn 2020 surveys were conducted by EMM field ecologists Lui Weber and David Moore. Late Spring/Summer 2018 surveys were conducted by EMM field ecologists Bruce McLennan and Gus Daly.

Bruce McLennan has over 16 years' experience conducting vegetation community and threatened flora surveys in the Brigalow Belt bioregion. Bruce has a comprehensive knowledge of threatened flora species in the region and significant experience in undertaking RE and TEC assessments. Lui Weber has over 15 years of flora survey experience from a range of geographical locations including south-eastern Queensland and the Brigalow Belt regions.

David Moore has over 15 years' experience in ecology, environmental impact assessment and aquatic ecology in the Brigalow Belt bioregion. Dave's experience including undertaking RE and TEC surveys as well as threatened flora surveys. Support ecologist Gus Daly has two years' experience in undertaking flora field surveys. Curricula vitae are provided in Appendix I.

ii Flora survey timing

Flora surveys were conducted as a part of a broader progressive seasonal survey plan that targeted predetermined survey locations over two key survey periods, autumn season (March/April 2019 and 2020) and late Spring/Summer season (December 2018), and incorporated both pre and post wet-seasonal conditions. The two-phased survey, post-wet season (autumn) and pre-wet season (Summer), also increased chances of CEEVNT species detectability by surveying in differing environmental conditions and in-turn, seasonal preferences for growth phases and/or flowering and seeding events.

The 'Desktop Ecology Assessments and Field Survey Program' report (EMM 2019) identified REs, TECs and threatened flora species that had potential to occur in the survey area. Depending on the season, the potential of the species to occur in the survey area varied depending on the condition of the habitat. A full list of all identified CEEVNT flora species, REs and TECs with the potential to occur in the survey area, their seasonality requirements, can be found in the 'Desktop Ecology Assessments and Field Survey Program' report (EMM 2019), and has been refined post field survey and are summarised in Section 4.2.

a Autumn season surveys

Flora surveys were completed over a total of three days between 8 April and 10 April 2019. The timing of these surveys was selected in accordance with post wet-season survey planning to maximise the detectability of annual species and diminutive perennial species.

Additional flora surveys were completed over a total of 12 days (10 survey days) between 29 March 2020 and 9 April 2020. Following completion of flora and vegetation surveys in the survey area in March 2019, the Commonwealth Department of Environment and Energy (DoEE) (now DAWE) listed the Poplar Box Grassy Woodland on Alluvial Plains community as Endangered under the EPBC Act. REs corresponding to this TEC are present in the survey area. An assessment of the condition of these REs (native species composition, presence of invasive species, patch size etc) was required to determine whether these areas of vegetation meet the thresholds required for TEC status justification. The first half of the autumn survey period involved conducting the TEC threshold assessments, while the second half comprised the inclusion of an experienced botanist (Lui Weber) accompanying the fauna survey team to assist in habitat assessments.

b Late Spring/Summer season surveys

Summer flora surveys were completed over a total of five survey days between 3 December 2018 and 8 December 2018. These surveys focused on RE and TEC assessments and did include some surveys for threatened flora species.

iii Flora survey sites

Flora surveys of varying methods were completed at 64 sites during summer 2018 surveys, 30 during autumn 2019 surveys and 108 during autumn 2020 surveys. Flora survey type, number of sites and timing are summarised below in Table 5.5.

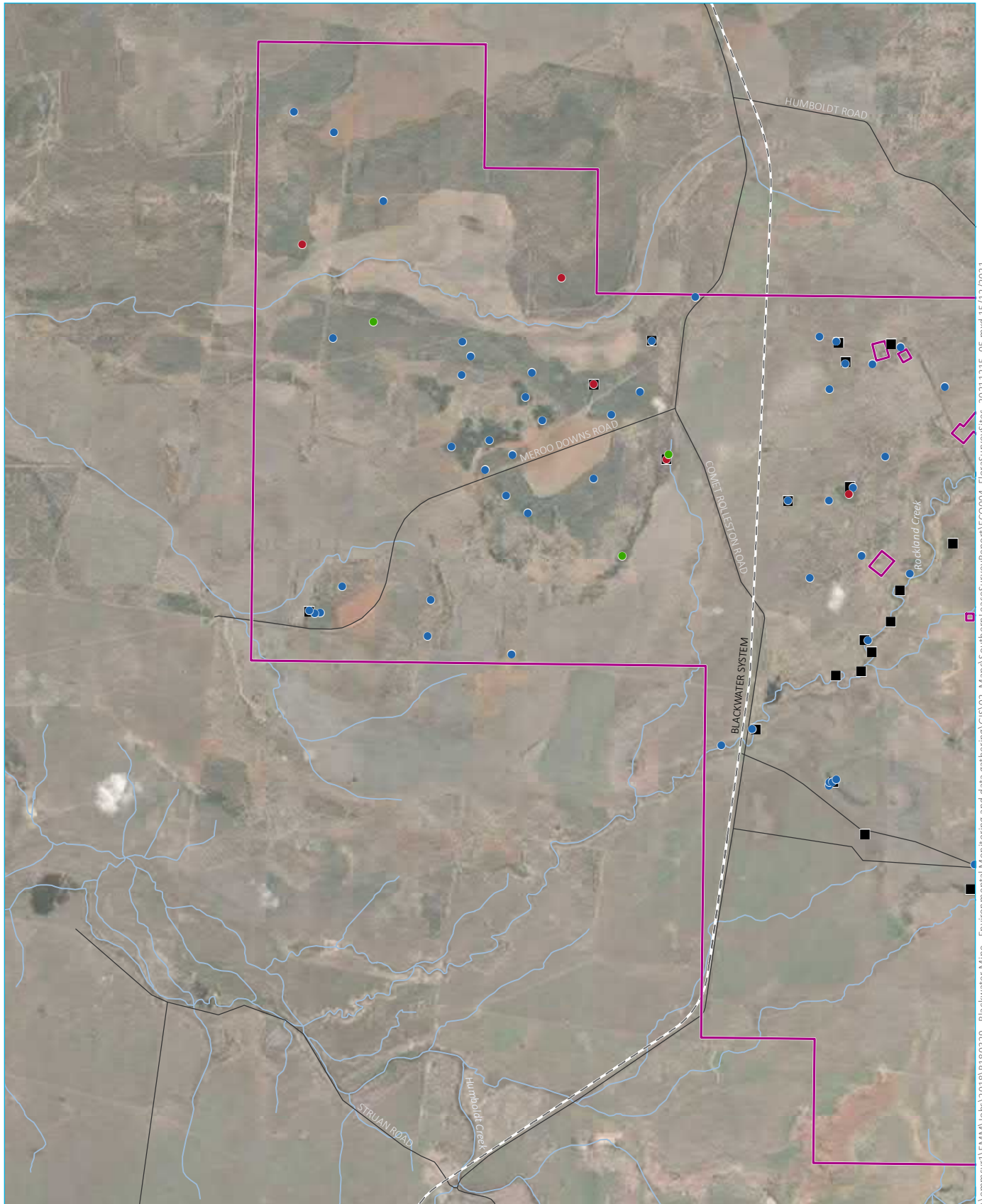
Survey sites were selected with consideration of desktop RE mapping, satellite imagery and previous field survey results to cover all unsurveyed vegetation communities and more accurately map their distribution across the survey area.

To ensure adequate representation of all vegetation community types and ecological conditions, areas targeted included both remnant and regrowth native vegetation as well as representative non-remnant areas with potential to support associated TEC communities and CEEVNT flora species.

Survey sites for flora across all field survey periods are shown on Figure 5.2 and TEC sites are shown on Figure 5.3.

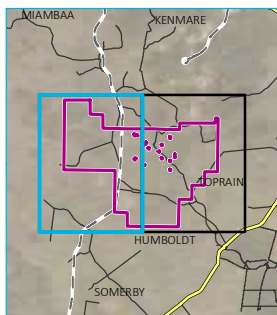
Table 5.5 Flora survey site summary

Survey type	Summer 2018	Autumn 2019	Autumn 2020	Total sites
Tertiary assessment	9	0	0	9
Quaternary assessment	49	17	84	150
BioCondition assessment	0	11	0	11
TEC assessment	6	2	29	37



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Source: EMM (2020); DNRME (2020)

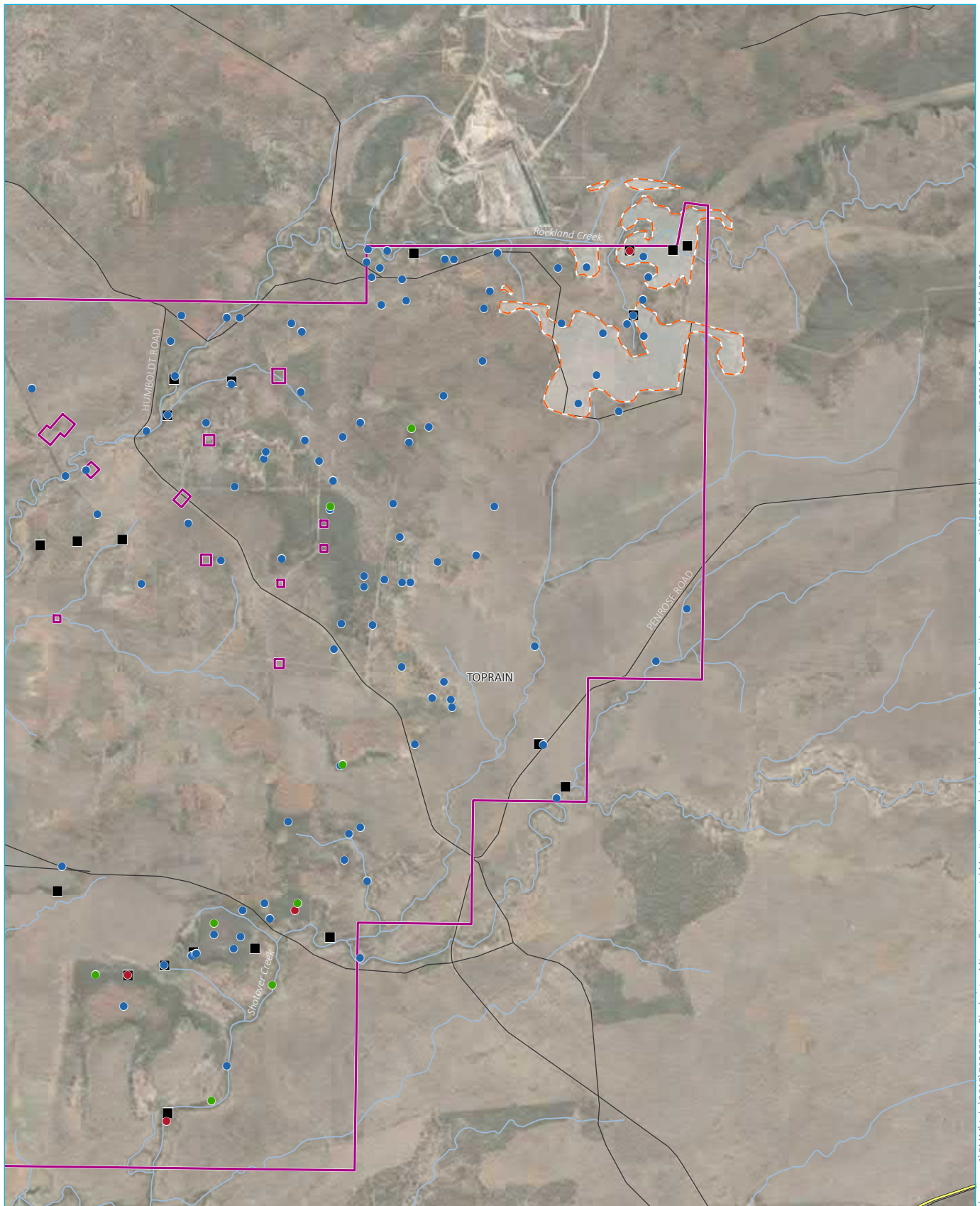


- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
- Flora survey type**
- Quaternary
 - Tertiary
 - BioCondition
 - TEC assessment

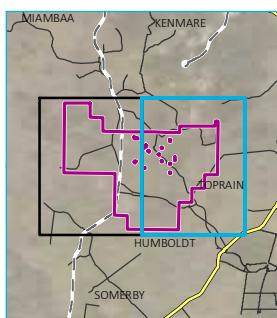
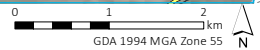
Flora survey sites -
map 1 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.2





Source: EMM (2020); DNRME (2020)



- Survey
- Rail
- Major road
- Minor road
- Watercourse/drainage
- Protected plant high risk trigger area

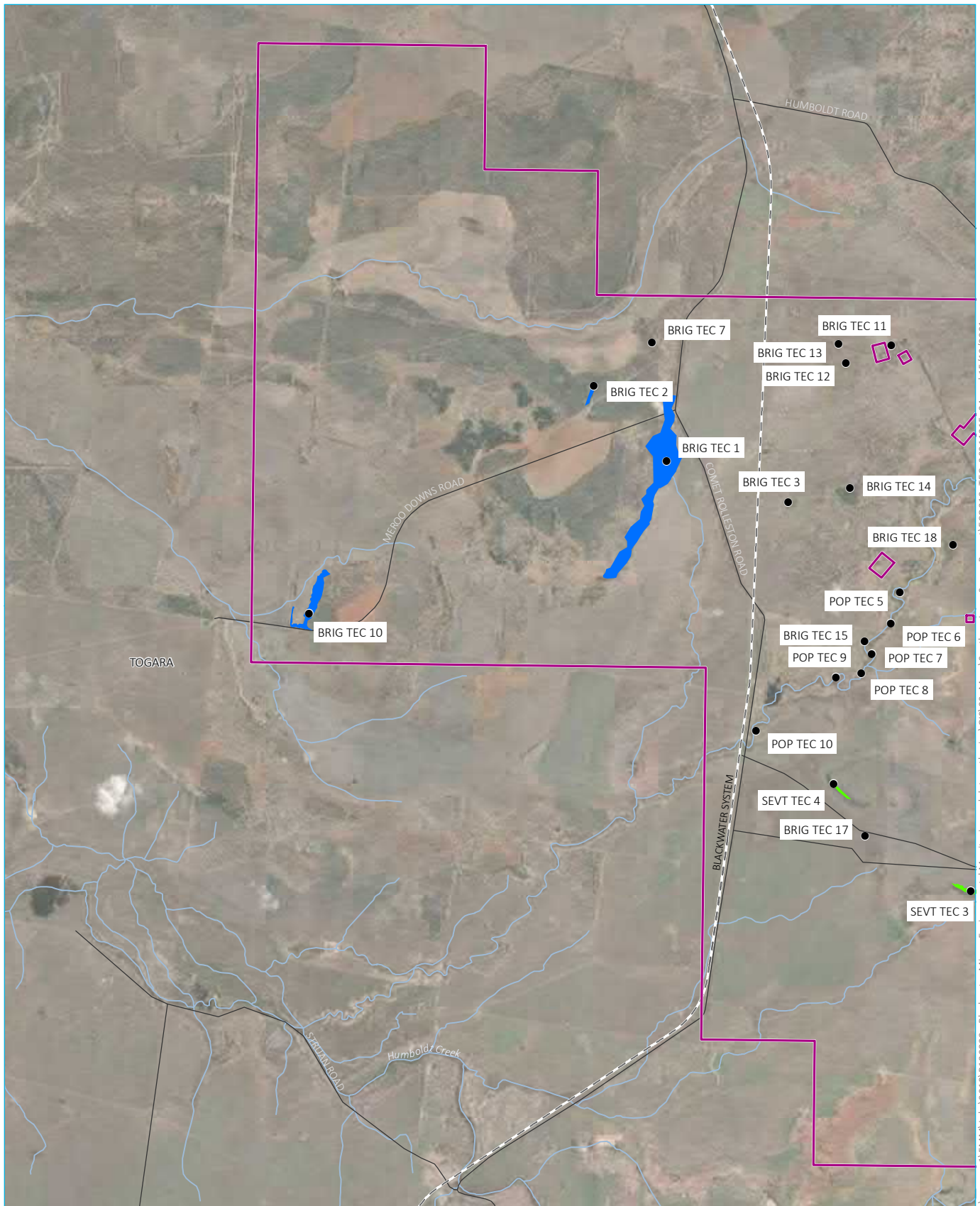
- Flora survey
- BioCondition
- TEC

Flora survey sites -
map 2 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.2

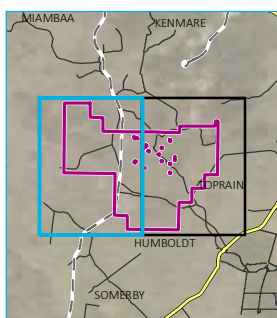


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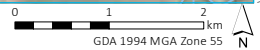


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Source: EMM (2021); DNRME (2021)



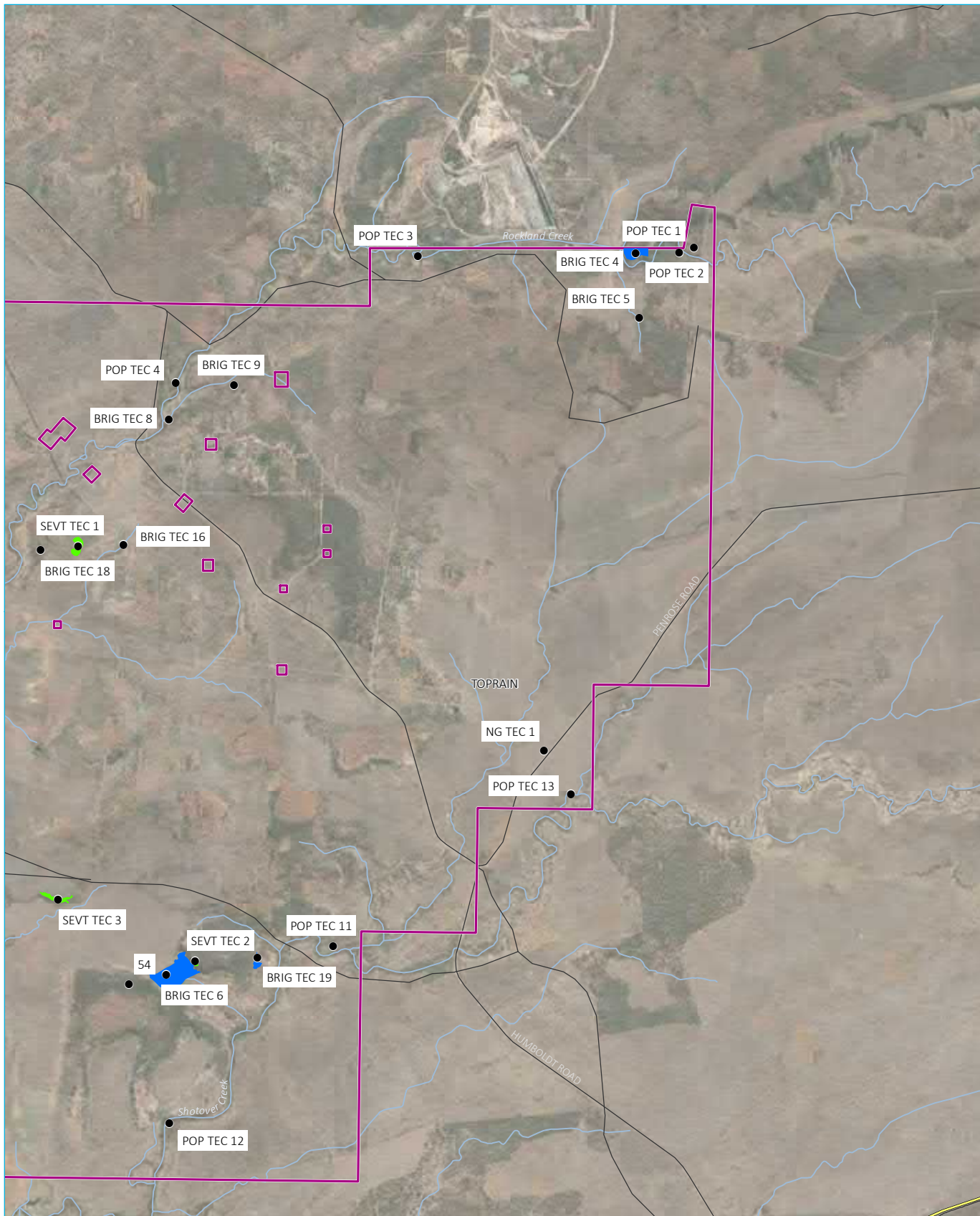
- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - TEC assessment site
- Threatened ecological communities**
- Brigalow
 - Semi-evergreen vine thicket



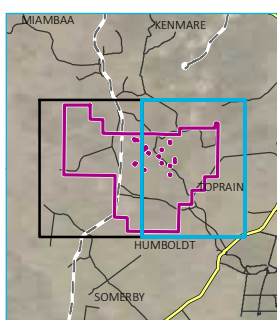
Threatened ecological community
assessment sites
map 1 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.3

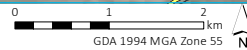




Source: EMM (2021); DNRME (2021)



- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - TEC assessment site
- Threatened ecological communities
- Brigalow
 - Semi-evergreen vine thicket



Threatened ecological community
assessment sites
map 2 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.3



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iv Targeted survey effort – threatened flora species

Table 5.6 summarises potential protected plants identified in the initial desktop searches, ‘Desktop Ecology Assessments and Field Survey Program’ report (EMM 2019) that were potentially present in the survey area (for example including those in EMM 2019 in the study area for the northern leases at Blackwater) and the suitability of the survey periods (December 2018 and March/April 2020) for these species. This includes a number of species that although not recorded in the PMST or Wildlife Online searches in the study area, were conservatively considered to be potentially present.

Fieldwork periods were targeted to provide an overlap with species that are difficult to detect or have known seasonality requirements. All species encountered on site (regardless of conservation status) were identified.

Table 5.6 Protected plants and seasonality requirements

Scientific name	Common name	EPBC Act status ¹	NC Act status ²	Species seasonality requirements
<i>Acacia storyi</i>	-	-	NT	Flowering specimens have been collected in April to September and maturing pods in August to December (DES 2020a). The species would be detectable year round if present.
<i>Aristida annua</i>	-	V	V	Flowers and fruits in March, and May-June (DAWE 2020a). Surveys were undertaken within an appropriate seasonal timeframe for the species.
<i>Arthraxon hispidus</i>	-	V	V	Fertile material has been collected from March to May and July and it flowers in summer/autumn. Surveys were undertaken within an appropriate seasonal timeframe for the species.
<i>Baeckea trapeza</i>	-	-	V	Flowering has been recorded for January and April; fruits in September and November (DES 2020b). The species would be detectable year round if present and identification does not rely on fertile material.
<i>Bertya opponens</i>	-	V	-	Flowering has been recorded from June to November, January and March and fruits between June, August and November (DAWE 2020b). The species would be detectable year round if present and identification does not rely on fertile material.
<i>Bertya pedicellata</i>	-	-	NT	Flowers have been recorded from March to November, fruits from August to November (DES 2020c). The species would be detectable year round if present and identification does not rely on fertile material.
<i>Cadellia pentastylis</i>	Ooline	V	V	Species was recorded in historic surveys commissioned by BMA in the Terang lease. This is part of the study area. Ooline flowers mainly from October to December in Queensland (October to November in New South Wales), but occasionally flowering extends through to early April. Fruiting records are from November to December (DAWE 2020c). The distinctive species would be detectable year round if present.

Table 5.6 Protected plants and seasonality requirements

Scientific name	Common name	EPBC Act status ¹	NC Act status ²	Species seasonality requirements
<i>Cerbera dumicola</i>	-	-	NT	Species was recorded during historical surveys on northern area of Terang lease in 2011. This is within the study area. Flowering has been recorded in October (DES 2020d). The species would be detectable year round if present and identification does not rely on fertile material.
<i>Daviesia discolor</i>	-	V	V	Flowering occurs from August to October and seedpods have been recorded in October (DoE 2008a). The species would be detectable year round and identification does not rely on fertile material.
<i>Dichanthium queenslandicum</i>	King Blue-grass	E	V	Flowers have been recorded throughout the year, particularly from March (DoE 2013). Surveys were undertaken within an appropriate seasonal timeframe for the species.
<i>Dichanthium setosum</i>	Bluegrass	V	-	A warm season perennial, the species commences growing in spring, flowers in summers and becomes dormant in late autumn (DAWE 2020d). Surveys were undertaken within an appropriate seasonal timeframe for the species.
<i>Eucalyptus raveretiana</i>	Black Ironbox	V	-	Has been recorded in flower from December to March. (DAWE 2020e). The species would be detectable year round if present and identification does not rely on fertile material.
<i>Homoranthus decumbens</i>	-	E	-	Flowers from September to December. There is no information available on its fruiting period. (DoE 2019q). The species would be detectable year round if present.
<i>Macrozamia platyrhachis</i>	-	E	-	This large, distinctive species seeds between March and April (Queensland Herbarium 2007). The species would be detectable year round if present and identification does not rely on fertile material.
<i>Marsdenia brevifolia</i>	-	V	V	Flowering occurs from October to February and fruiting from January to March (DAWE 2020g). The species would be detectable year round if present.
<i>Ochrosperma obovatum</i>	-	-	V	The biology is poorly known. Flowering has been recorded in June. Flowering is thought to be in response to rainfall (DES 2019j).
<i>Polianthion minutiflorum</i>	-	V	-	Flowers throughout the year. Fruits have been recorded in August and November (DoE 2008b). The habitat for the species in the study area is likely to be restricted to the Blackdown Tableland so it would not be present in the survey area.
<i>Sannantha brachypoda</i>	-	-	V	Unknown.

Table 5.6 Protected plants and seasonality requirements

Scientific name	Common name	EPBC Act status ¹	NC Act status ²	Species seasonality requirements
<i>Solanum adenophorum</i>	-	-	E	Flowers late spring to autumn (DES 2020l). The species would be detectable year round if present and does not require reproductive material for identification.
<i>Solanum dissectum</i>	-	E	E	Flowers July to November and fruits from March to July. (TSSC 2016a). The species would be detectable year round if present and fertile material is not required for identification.
<i>Solanum elachophyllum</i>	-	-	E	Flowers have been recorded in February, March, July and September and mature fruits in March- May, July and September-October (DES 2020m). The species would be detectable year round if present and does not require reproductive material for identification.

1. EPBC Act status: CE – critically endangered, E – endangered, V – vulnerable

2. NC Act status: CE – critically endangered, E – endangered, V – vulnerable, NT – near threatened

5.3 Survey results

5.3.1 Fauna

202 vertebrate fauna species were recorded during all surveys, comprising 136 birds, 14 non-volant mammals, 13 bats, 29 reptiles and 10 amphibians. Four CEEVNT, one special least concern and one migratory fauna species were recorded during field surveys. Recorded CEEVNT species comprised:

- **Ornamental Snake** - a total of nine Ornamental Snakes were observed in three separate areas of gilgai depressions during the spring 2019 surveys, and a total of seven Ornamental Snakes were recorded in three separate areas of gilgai during the autumn 2020 surveys.
- **Koala** - five Koalas were identified through direct observation and indirect evidence of Koalas, which includes scratches and scats, was identified along both Shotover Creek and Rockland Creek.
- **Golden-tailed Gecko** - three individuals were recorded during autumn 2020 spotlighting surveys within Lancewood (*Acacia shirleyi*) woodland.
- **White-throated Needletail** - four individuals were identified flying over Rockland Creek during the spring 2019 surveys.

i General habitat assessments

Two habitat components are especially important in determining the fauna assemblage of a certain area and driving the diversity and abundance of the species composition: physical structure of the vegetation community and substrate and resource availability.

Habitats with dense ground cover, a profuse shrub layer and plentiful large trees provide a complex structure. These habitats offer abundant denning or shelter sites in dense leaf litter, dense foliage, under exfoliating bark or in tree hollows. Additional habitat complexity is provided by the presence of ground dwelling plants, open bare areas, fallen logs and branches and rock crevices that provide sheltering opportunity for terrestrial species.

The community assemblage is also driven by the availability and variety of resources (such as food, water and breeding opportunities). Habitats with abundant and variable resources tend to support a greater species diversity. Additionally, certain species are driven by the presence or absence of preferred dietary items (e.g. Painted Honeyeater and mistletoes). Habitat usage can be extremely variable and driven by seasonal conditions or in response to a specific event such as recent rainfall and mass flowering events.

Most habitat observed across the survey area is considered of relative low quality due to broad-scale vegetation clearing, cattle grazing, weed encroachment and proximity of mining operations. Remaining vegetation in the survey area is largely fragmented with useful habitat limited in extent and typically constrained to riparian zones. Appendix B provides results of the habitat assessments.

Broad habitat groups have been described across the survey area with their features and ecological values discussed below. Threatened fauna species that have potential to occur in the broad habitat groups are also mentioned.

a Riparian vegetation

Vegetation along watercourses such as Shotover Creek and Rockland Creek (Photograph 5.1 and Photograph 5.2) consist of narrow linear patches. Riparian corridor widths vary from narrow strips along top of bank, to wider corridors a couple of hundred metres wide. Vegetation types in riparian zones consisted primarily of Eucalypt dominated communities, such as Queensland Blue Gum (*Eucalyptus tereticornis*) RE 11.3.25 and Poplar Box (*E. populnea*) RE 11.3.2, with patches of Brigalow communities (RE 11.3.1 and 11.4.9). Remaining watercourses or drainage lines across the site have sparse patches of regrowth along their lengths.

Shrubs were relatively sparse, but a grassy ground layer providing cover for ground fauna was observed in some of these riparian habitats. Large fallen timber was common in areas, providing potential shelter for a variety of ground fauna including reptiles (Photograph 5.3), amphibians and native rodents. In general, these habitats lacked a density of large hollow bearing trees, limiting the suitability of this habitat for some species (e.g. Greater Glider).



Photograph 5.1 Riparian corridor along Shotover Creek



Photograph 5.2 Riparian corridor along Rockland Creek



Photograph 5.3 Spotted Python (*Antaresia maculosa*) eating a frog (species unknown) along Rockland Creek

i Eucalypt woodland

Eucalypt woodlands were recorded at several sites across the survey area. Eucalypt woodlands provide seasonal food resources for nectar-feeding birds and flying-foxes, and where present, nest/roost sites in the form of tree hollows for birds (such as parrots), microbats, possums, gliders and other small arboreal mammals. These woodlands also provide potential habitat for Koalas.

Remnant woodland vegetation showed the most value as it occasionally exhibited large hollow bearing trees, representing potential fauna breeding places. However, the abundance of tree hollows was noted to be low throughout, reducing the quality of habitat for species such as Greater Glider as suitable denning habitat is significantly reduced (Photograph 5.4). Shrubs were relatively sparse in these habitats, but dense grassy understories were common which provide cover for terrestrial species such as Rufous Bettong (*Aepyprymnus rufescens*) which was observed in these habitats. Large fallen timber was common in areas, providing potential shelter for a variety of terrestrial fauna including reptiles and native rodents.

Many areas of this habitat were infested with weed species such as Buffel Grass (*Cenchrus ciliaris*) and Parthenium (*Parthenium hysterophorus*), which contributed significantly to breaching TEC thresholds for Poplar Box communities (Photograph 5.5). Grazing practices further reduced the quality of these eucalypt woodlands.



Photograph 5.4 **Remnant eucalypt woodland**



Photograph 5.5 Weed infestation along Rockland Creek

b Acacia woodland

Acacia communities were widespread across the survey area. Brigalow (*Acacia harpophylla*) dominated communities associated with clay soils were present in remnant patches across the survey area and met TEC criteria. Brigalow communities was also present in association with gilgai depressions (Photograph 5.6). Some patches offered abundant litter and fallen woody debris, providing microhabitat features for small mammals and reptiles. These areas possessing terrestrial debris, cracking clays, or gilgai are also considered potential habitat for the Ornamental Snake. However, habitat value was generally low in regrowth Acacia vegetation patches as they frequently showed limited groundcover and shrub-layers with exotic understorey and lacked hollow bearing trees. Sites possessing abundant coarse woody debris and leaf litter, cracking clays or gilgai are considered potential habitat for the Ornamental Snake.

A large patch of Acacia woodland, predominantly regrowth, exists on Lot13 WNA75. The woodland consists of Lancewood (*A. shirleyi*) and Bendee (*A. catenulata*), with emergent Eucalypt species spread throughout. Leaf litter and fallen woody debris was recorded at some sites, providing microhabitat features for small reptiles and terrestrial mammals (Photograph 5.7).

The edges of lateritic 'jump ups' possessed several habitat features not found anywhere else within the survey area. These sites were found primarily on boundaries of RE11.7.2 and RE11.7.1 communities and included steep rocky areas with multiple shallow caves and crevices providing cover for various mammals and reptile species. Notable least concern species recorded in these areas included Herbert's Rock-wallaby (*Petrogale herberti*).



Photograph 5.6 Brigalow (*Acacia harpophylla*) community on gilgai



Photograph 5.7 Acacia woodland with woody debris

c Gilgai

Areas of gilgai on clay soils are widespread across the survey area but vary significantly in state of degradation, persist in a highly degraded state exhibiting shallow, open gilgai with little remaining vegetation (Photograph 5.8). These areas primarily lack woody vegetation with only grasses such as Buffel Grass (*Cenchrus ciliaris*) and Umbrella Cane Grass (*Leptochloa digitata*) remaining. However, this ground-layer still provides some protection and cover for frogs, birds and reptile species. Some gilgai patches were also further degraded by the presence of cattle (Photograph 5.9).

Areas of gilgai in the survey area are known habitat for the Ornamental Snake with deeper, more heavily vegetated and deeper cracking areas most preferred (see Section 5.3.1 (iv)). Additionally, these gilgai provide suitable habitat for the Australian Painted Snipe and Latham's Snipe during suitably wet conditions (Photograph 5.10).



Photograph 5.8 Open gilgai area



Photograph 5.9 Gilgai degraded by cattle



Photograph 5.10 Inundated gilgai during post-wet (autumn) season

ii Other wetland habitats

Other wetland habitats across the survey area consisted of constructed farm dams. Small dams are spread across the survey area offering expanses of open water, aquatic plants and fringing vegetation.

Some dams provided shallow margins and areas of fringing grasses and reeds (Photograph 5.11). Aquatic flora included native water lillies. Waterbirds at these dams included various species such as Plumed Whistling-duck (*Dendrocygna eytoni*), Comb-crested Jacana (*Irediparra gallinacea*) and several waterfowl. These dams likely provide year-round access to wetland habitats for several bird species, including threatened species; Australian Painted Snipe and Latham's Snipe.

The quality of farm dams varied across the survey area. Some dams were unfenced and open to livestock, and the margins were bare due to overgrazing and trampling, with extensive soil erosion and reduced water quality. Others were fenced, but had steep sides and were generally of low value for waterbirds with limited shallow margins or fringing aquatic vegetation (Photograph 5.12).



Photograph 5.11 Farm dam on Lot 7 SP187934



Photograph 5.12 Farm dam on Lot 13 WNA75 with limited fringing vegetation

d Rocky escarpments

Rocky escarpments were identified on Lot 7 SP187934 and Lot 13 WNA75. On Lot 7 SP187934, the extrusive igneous rocks form cave habitat for Herbert's Rock-wallaby (*Petrogale herberti*) and Common Wallaroo (*Macropus robustus*) (Photograph 5.13). Abundant scats were present. The rocky escarpment on Lot 13 WNA75 contained abundant fallen woody debris which forms potential habitat for Golden-tailed Gecko (*Strophurus taenicauda*) (Photograph 5.14).



Photograph 5.13 Rocky outcrop on Lot 7 SP187934



Photograph 5.14 Rocky escarpment on Lot 13 WNA75

e Non-remnant vegetation

Field surveys confirmed 14,493 ha of non-remnant areas within the survey area. Previously cleared areas dominate much of the survey area with a large proportion recently or currently utilised for cattle grazing activities. Vast areas are completely dominated by Buffel Grass with some expanses supporting no other species of grasses. Small areas continue to support native grass species such as Queensland Bluegrass (*Dichanthium sericeum*) and Mitchell Grass (*Astrelba lappacea*) but these were recorded at relatively low densities.

With limited structural and floristic diversity, non-remnant grassland habitats supported limited fauna diversity in comparison to remnant habitats, but provide habitat for certain grassland-dependent species such as Eastern Grey Kangaroo (*Macropus giganteus*).

Much of these areas of non-remnant vegetation are considered of low ecological value but some species may occasionally use these areas i.e. Short-beaked Echidna (*Tachyglossus aculeatus*) and Ornamental Snake within cleared gilgai. Open habitat bird species such as Australasian Pipit (*Anthus novaeseelandiae*) and Horsfield's Bushlark (*Mirafra javanica*), as well as a few species of buttonquail, with Red-chested Buttonquail (*Turnix pyrrhotorax*) being the most frequently observed.

ii Anabat data

Anabat data was analysed by Balance! Environmental. Fourteen different species of microbat were recorded on Anabats deployed in the survey area. Thirteen species of microbats were recorded on Anabats deployed between 21 April 2020 and 25 April 2020. Thirteen species of microbats were recorded on Anabats deployed between 29 October 2019 and 2 November 2019. No CEEVNT microbats were recorded. Detailed Anabat results are provided in Appendix E.

iii Pest fauna species

Seven introduced terrestrial vertebrate species were recorded within the survey area, namely Cane Toad (*Rhinella marina*) Common Myna (*Acridotheres tristis*), Rabbit (*Oryctolagus cuniculus*), Brown Hare (*Lepus capensis*), Wild Dog (*Canis lupus familiaris*), House Mouse (*Mus musculus*) and indirect evidence of Feral Pig (*Sus scrofa*). Three of these species (Rabbit, Wild Dog and Feral Pig) are listed as 'restricted matters' under the *Biosecurity Act 2014*.

Cane Toad were recorded around farm dams and in gilgai habitats, usually in proximity to water. Multiple Cane Toads were captured in pitfall traps and Elliott traps at Trap Site 3 during the autumn 2020 surveys. Rabbit and Brown Hare were observed in open grassland habitats. Wild Dog were observed on the remote cameras at trap sites, attracted to the bait and are probably abundant and widespread across the survey area. A few Common Myna (*Acridotheres tristis*) were seen in proximity to the mine and homesteads.

iv CEEVNT fauna observations

Four CEEVNT, one migratory and one special least concern fauna species were recorded during field surveys. These CEEVNT species are discussed below. The sighting locations are shown in Figure 5.4.

a Ornamental Snake (CEEVNT)

This species is listed as vulnerable under the EPBC Act and NC Act. Ornamental Snake prefers woodlands and open forests associated with gilgai depressions on land zone 4. Gilgai formations are found where deep-cracking alluvial soils with high clay contents occur (DAWE 2020k).

Gilgai habitats occur throughout the survey area however limited gilgai contained microhabitat (fallen timber) which would offer shelter to Ornamental Snake at times when soil cracks aren't available (i.e. where the gilgai hold water throughout spring/summer and into autumn depending on seasonal rainfall). The species is known to be

recorded in cleared areas of gilgai. In addition, the Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles (DSEWPC 2011) includes cleared areas of gilgai as potential habitat for this species.

A total of nine Ornamental Snakes were observed in three separate areas of gilgai depressions during the spring 2019 surveys. These observations coincided with rainfall which was the likely cause of increased snake movement along with frog activity. Despite the rainfall, gilgai habitats remained relatively dry throughout. Once a snake was observed in a distinct area of gilgai, the survey effort moved to a new area to maximise coverage of the survey area for this species.

Conditions during the autumn 2020 surveys were good as water was present in some gilgai and many frogs were active. A total of seven Ornamental Snakes were recorded in three separate areas of gilgai during the autumn 2020 surveys (Photograph 5.15). Again as per previous surveys, once a snake was observed in a distinct area of gilgai, the survey effort was moved to others areas to maximise coverage of the survey area for this species and identify the potential extent of their presence across the area

All Ornamental Snake observations were in gilgai habitats, with the presence of cracking clays which offer refuge for the species. Generally the gilgai habitats had previously been stick-raked with little fallen ground timber. Other areas of gilgai in the survey area were noted as having sandier substrates with little cracking capability, limited cover and isolated in expanses of Buffel Grass rendering these areas less suitable for the species. No records were observed in these sandier gilgai and are considered to have low potential to support Ornamental Snake.



Photograph 5.15 Ornamental Snake observed in gilgai

b Koala (CEEVNT)

This species is listed as vulnerable under the EPBC Act and NC Act. Koala habitat can be broadly defined as any forest or woodlands containing food trees, which primarily includes tree species from within the Eucalyptus genus such as Queensland Blue Gum (*Eucalyptus tereticornis*) and Poplar Box (*E. populnea*) (DAWE 2020I).

Five Koalas were identified through direct observation. One was recorded during diurnal surveys in the spring 2019 surveys along Shotover Creek in a Queensland Blue Gum. The remaining four were identified during the autumn 2020 surveys in a large patch of Acacia woodland to the south of the existing Blackwater south mine within the

survey area. Two were identified during spotlighting surveys within Queensland Peppermint (*E. exserta*) and Poplar Box. Two were identified during diurnal active searches in Narrow-leaved Ironbark (*E. crebra*), one of these along an ephemeral drainage line (Photograph 5.16).

Indirect evidence of Koalas, which includes scratches and scats, was also identified in the survey area. A cluster of scat evidence was recorded under Queensland Blue Gums along Shotover Creek, within narrow slivers of RE 11.3.25 along the otherwise sparse Poplar Box woodland. Another cluster of scats was identified within Acacia woodland, where four Koalas were sighted. Scats were present underneath Queensland Peppermint, Poplar Box and Narrow-leaved Ironbark (Photograph 5.17). One was also heard during autumn 2020 spotlighting surveys within this area. No scratches were identified in this area due to the presence of only rough-barked eucalypts. Scratches on a Queensland Blue Gum were identified along Rockland Creek, towards to the north-eastern corner of the survey area (Photograph 5.18). Despite extensive transects along Rockland Creek, no other signs of Koalas were observed, and it is likely that its status in the survey area is limited to occasional transient individuals. The main riparian areas likely being key movement corridors for the species.



Photograph 5.16 Koala (*Phascolarctos cinereus*) in Queensland Blue Gum (*Eucalyptus tereticornis*)



Photograph 5.17 Koala scats recorded in Acacia woodland



Photograph 5.18 Koala scratches in Queensland Blue Gum

c **White-throated Needletail (CEEVNT, migratory, marine)**

This species is listed as vulnerable, migratory and marine under the EPBC Act. It is a large swift that spends its non-breeding season in Australasia. The species is almost exclusively aerial and can occur over most habitat types, particularly wooded areas (DAWE 2020i).

Four individuals were identified flying over Rockland Creek during the spring 2019 surveys. They are likely to be foraging on insects above wooded areas on the site. The species is likely to occur on a sporadic basis over the summer months within the seismic survey area, but is not within the core range of occupancy in Australia closer to the coast.

Foraging is exclusively aerial. Roosting occurs in dense forest canopies which are generally not present in survey area.

d **Golden-tailed Gecko (CEEVNT)**

This species is listed as near threatened under the NC Act. The Golden-tailed Gecko is found in open woodland and forest where it shelters under decorticated bark and hollows. This nocturnal species is arboreal and hides among decorticated bark during the day (DES 2020n).

Three individuals were recorded during autumn 2020 spotlighting surveys within Lancewood (*Acacia shirleyi*) woodland (Photograph 5.19). Diurnal active searches within Acacia woodlands were also undertaken, however no individuals were identified.



Photograph 5.19 **Golden-tailed Gecko (*Strophurus taenicauda*)**

e **Short-beaked Echidna (SLC)**

This species is listed as Special Least Concern (SLC) under the NC Act. The species has a widespread distribution throughout Australia, inhabiting forests, woodlands, heath, grasslands and arid environments (Australian Museum 2020).

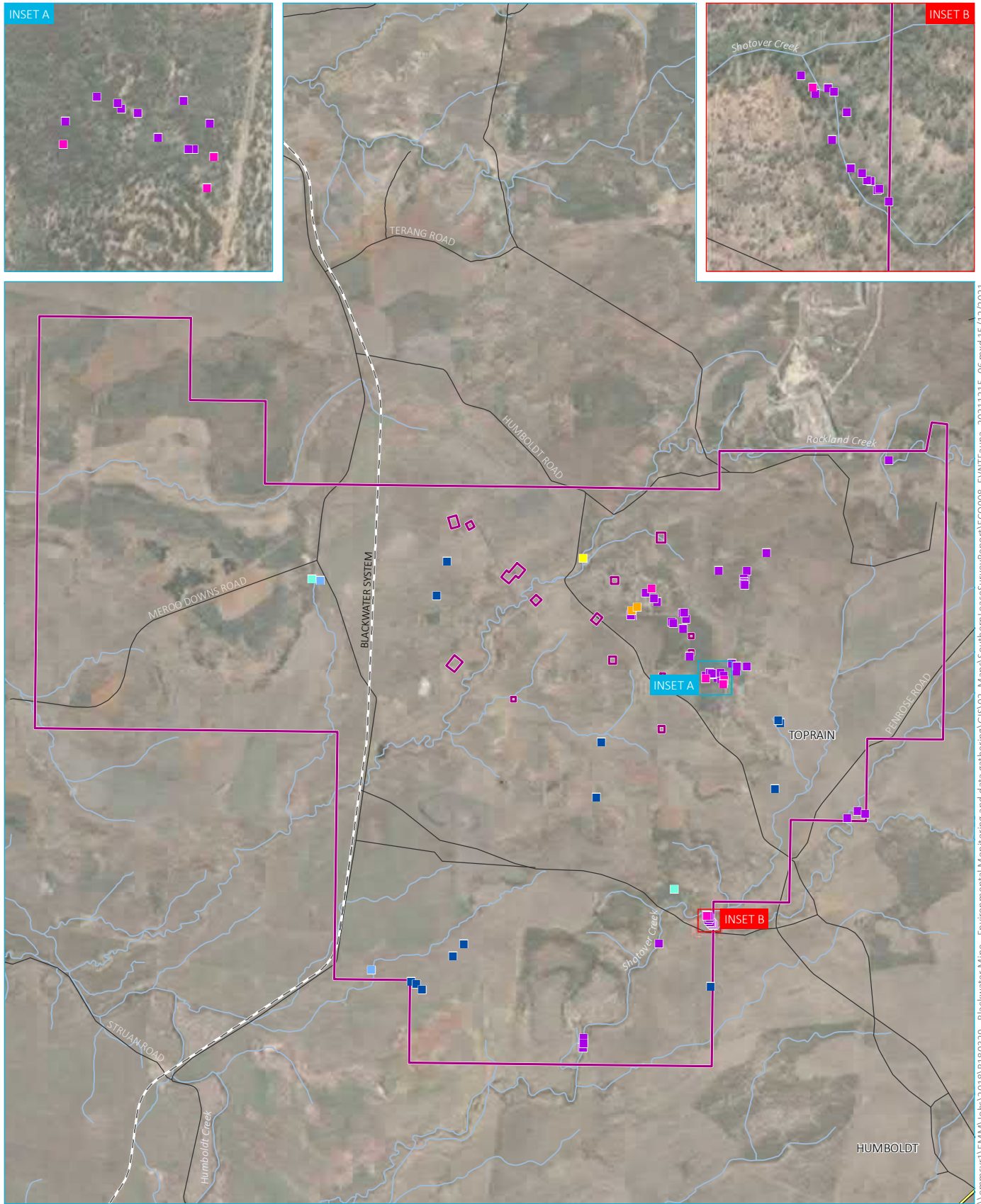
Indirect evidence (scat) was identified in Dawson Gum (*Eucalyptus cambageana*) woodland on Lot 9 SP187935. As this species can occur in a wide range of habitats, it has potential to occur across the entire survey area.

f **Latham's Snipe (Migratory)**

This species is listed as Migratory under the EPBC Act. It is a shorebird species that breeds primarily in Japan during the Austral winter and spends the Austral summer in eastern Australia. It is most commonly associated with wetlands, creeks or moist grasslands. It is a secretive, well-camouflaged species and is usually only revealed to an observer when disturbed into flight (DAWE 2020j).

This species was recorded twice during the autumn surveys, one in an area of gilgai on Lot 9 SP187935 and another on a dam on Lot7 SP187934.

Using similar though less specialised habitats to *R. australis*, this species is likely to regularly occur in wetland habitats across the survey area between September and April.



Source: EMM (2020); DNRME (2020)

KEY

- Survey area
- Rail line
- Major road
- Minor road
- Watercourse/drainage line

- EVNT fauna observations**
- Golden-tailed Gecko
 - Latham's Snipe
 - Ornamental Snake
 - Koala
 - Koala (indirect evidence)
 - Short-beaked Echidna (indirect evidence)
 - White-throated Needletail

EVNT fauna records

BHP Billiton Mitsubishi Alliance
 Southern lease field ecology survey report
 Figure 5.4



\\temmsvr1\EMM\Jobs\2018\B180329 - Blackwater Mine - Environmental Monitoring and data gathering\GIS\02_Maps\SouthernLeasesSurvey\Report\ECO008_EVNTFauna_20211215_06.mxd 15/12/2021

v Other potential CEEVNT species

Based on consideration of the desktop assessment results and field surveys, a more detailed evaluation has been completed to refine the likelihood of occurrence that fauna species and migratory species under the EPBC Act and NC Act would occur in the survey area that were listed in Sections 4.6 and 4.8.

Definitions used for the refined likelihood of occurrence (Appendix D) are described below:

1. **Known** – the species has been observed within the survey area either during historical surveys or during recent seasonal surveys by EMM;
2. **Likely** – suitable high quality habitat for a species occurs within the survey area and species records are present within the study area;
3. **Potential** – potential habitat for a species occurs within the survey area, but there is insufficient information to categorise the species as likely, or unlikely to occur;
4. **Unlikely** – a low to very low probability that a species occurs within the survey area due to the lack of suitable habitat or the survey area is outside of the species known range;
5. **Does not occur** – the species will not occur in the survey area (eg marine species in terrestrial survey area or sufficient evidence to demonstrate the value would not occur).

The full likelihood of occurrence assessments are provided in Appendix D and those species identified as ‘known’ or ‘likely’ to occur in the survey area are referred to as ‘candidate species’. Habitat mapping for candidate species is summarised in Section 5.2.4.

A number of CEEVNT species were originally assessed as potentially occurring in the survey area in the initial desktop assessment prior to field surveys being undertaken. Following the completion of autumn and spring surveys, a number of these species have been downgraded to being unlikely to occur in the survey area. These species are:

- Collared Delma;
- Yakka Skink; and
- Death Adder.

The rationale behind downgrading these species is provided in Appendix D.

The following species are retained as possibly occurring although not likely to occur on a regular basis if at all. As such, habitat maps for these species have not been prepared.

- Greater Glider – although the survey area does support potential foraging habitat, there are few large mature trees in the creeklines and a very low density of large hollows reducing the likelihood of their occurrence. Limited suitable denning habitat in tree hollows was recorded along Rockland Creek and Shotover Creek. Therefore the occurrence of this species is likely constrained by the lack of hollow bearing trees. Significant nocturnal survey effort has been undertaken in the south (Section 5.2.1 (iv)) and if present the species is not difficult to detect therefore the species is considered unlikely to occur.
- Squatter Pigeon - the species has relatively broad habitat preferences including non-remnant areas. Squatter Pigeon generally require open forest or scrub on sandy soils, dominated by native grasses, in close association with permanent water (DAWE 2020s). Where non-alluvial clay soils (land zone 4) occur, the species is less likely to be present unless the ground cover has been thinned to suitable levels (Squatter

Pigeon Workshop 2011; DoEE 2018). It often occurs around cattle yards and other disturbed areas, although is unlikely to occur far from wooded areas.

This species has broad habitat preferences, although in the survey area this is constrained by the nature of the ground cover (dense Buffel Grass) and soil type (extensive areas of gilgai with a clay substrate). Areas of denser woodland (e.g. patches of RE 11.7.2) are also unsuitable as the species favours more open woodland habitats. Although the species has been recorded during historical surveys, it has not been recorded during recent ecological surveys comprising of significant effort (Section 5.2.1 (iv)). Habitats in the survey area predominantly consist of areas of agricultural land, cleared areas of gilgai habitat on clay soils and dense woodland (such as large stands of *Acacia shirleyi*), none of which are suitable for this species which favours open grassy woodland on sandy soils, a habitat type not particularly abundant in the survey area. Another significant factor is likely the extensive areas of dense Buffel Grass dominating the survey area. Although the species could occur, and there are records from surrounding the survey area, the lack of records during extensive survey effort and significant time driving around the site on dirt roads and tracks, suggests the species is not abundant or regular in the survey area, and perhaps limited to sporadic occurrences dispersing from surrounding areas of more suitable open grassy woodland habitat on sandy soils.

- Glossy Black-cockatoo – there are limited Allocasuarina/Casuarina food trees in the survey area for the Glossy-black Cockatoo. Where there are suitable food tree species, signs of species presence (e.g. chewed Allocasuarina/Casuarina fruit) are easily found. These signs were not observed in areas of Belah (*Casuarina cristata*) in the survey area. Due to the absence of preferred foraging resources and the lack of tree hollows, the likelihood of the species in the survey area is greatly reduced and it is considered only to have potential to occur on an intermittent basis.
- Painted Honeyeater – although suitable habitat does occur, the survey area does not form part of the core range for this species, and any occurrence is likely to be of transitory individuals.
- Powerful Owl – although the survey area does support potential foraging habitat, few large mature trees in the creeklines and the very low density of large hollows present reduces the value of the habitat for Powerful Owl. Limited suitable nesting habitat in tree hollows was recorded along Rockland Creek and Shotover Creek. Therefore the occurrence of this species is likely constrained by the lack of hollow bearing trees. Significant nocturnal survey effort has been undertaken in the south (Section 3.4.6) and if present the species is not difficult to detect therefore the species is unlikely to occur beyond sporadic occurrences.

vi CEEVNT fauna species profiles and habitat mapping

Known and potential habitat for CEEVNT fauna species (which have been assessed as either ‘known’ or ‘likely’ to occur in the survey area) have been mapped across the survey area. Habitat mapping is consistent with BHP’s “Central Queensland Threatened Species Habitat Descriptions – version 4” (Kerswell et al, 2020).

Four CEEVNT fauna species, Koala, Ornamental Snake, Latham’s Snipe and Golden-tailed Gecko, were observed and are classified as ‘known to occur’. Australian Painted Snipe was classified as ‘likely to occur’ based on observations made in the northern lease and extensive areas of suitable habitat in the survey area. Two CEEVNT flora species, *Solanum elaeagnifolium* and *Bertya oppositifolia*, were recorded and are classified as ‘known to occur’.

It should also be noted that the criteria used has been reviewed against available DAWE definitions or relevant governmental documentation for each species (eg DAWE advice received on Koala habitat, or definitions of Ornamental Snake habitat in the Draft Referral guidelines for the nationally listed Brigalow Belt reptiles (DSEWPaC, 2011)). Where this has been applied is specified by species in the relevant subsections below.

Habitat has been stratified for the purposes of informing design, and prioritising avoidance and ecologically sensitive development. It should be noted that for the purposes of any future impact assessment against Matters

of National Environmental Significance – Significant impact guidelines 1.1 *Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013), preferred and suitable habitat would need to be combined to form a total area of habitat within the survey area and project footprint, against which the Project is assessed.

Habitat mapping has not been provided for the aerial species, White-throated Needletail and Fork-tailed Swift, as these species can occur in any airspace over the site. Similarly, Short-beaked Echidna is a widespread species which could occur anywhere across the survey area.

a Ornamental Snake

➤ Legal status

Listed as Vulnerable under the EPBC Act and NC Act.

➤ Relevant departmental documents

The following documents were considered in the preparation of this report:

- species profile on SPRAT database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1193;
- Draft Referral guidelines for the nationally listed Brigalow Belt reptiles (DSEWPac, 2011);
- Approved Conservation Advice for *Denisonia maculata* (Ornamental Snake). (DoE 2014b).

There is no Recovery Plan or Threat Abatement Plan in place for this species.

➤ BHP habitat definition

BHP's Central Queensland Threatened Species Habitat Descriptions (Kerswell et al, 2020) defines Ornamental Snake habitat as follows:

- **Preferred ornamental snake habitat** in central Queensland is defined as gilgai depressions (with or without the presence of brigalow or other canopy vegetation), mounds and wetlands on cracking clays (predominantly land zone 4) where essential microhabitat features are present including an abundance of deep soil cracks. Other microhabitat features such as fallen woody debris may or may not be present. Seasonal flooding of habitat areas is a requirement.
- **Suitable ornamental snake habitat** in central Queensland is defined as dispersal areas within 1 km of preferred habitat, which are currently or previously dominated by Brigalow or Coolibah communities where gilgais or soil cracks are infrequent and/or shallow, including non-remnant areas.
- **Marginal ornamental snake habitat** in central Queensland is defined as areas currently or previously dominated by brigalow or coolibah communities where gilgais or soil cracks are infrequent or are shallow or non-remnant areas where threats are high (high abundance of weed incursion and cattle compacting soils) but the species still have potential to occur, especially in times where water is present and prey abundance (frogs) is high.

➤ Distribution and breeding

The species is only known from the Brigalow Belt North and parts of the Brigalow Belt South biogeographical regions, predominantly in the drainage systems of the Fitzroy and Dawson Rivers. The species delivers live young, and breeding occurs primarily in the wetter months (DoE 2019b).

➤ Ecology and habitat

Ornamental Snake suitable habitat comprises open-forests to woodlands associated with gilgai formations and wetlands (mainly associated with Queensland Regional Ecosystem Land Zone 4).

These are commonly mapped as REs 11.3.3, 11.4.3, 11.4.6, 11.4.8, 11.4.9, 11.5.16 or mapped as cleared but where the above REs formerly occurred (DSEWPC 2011). The species also is found on lake margins and wetlands (DoE 2019b).

Ornamental Snake habitat is likely to be found in Brigalow, Gidgee (*Acacia cambagei*), Blackwood (*Acacia argyrodendron*) or Coolibah dominated vegetation communities. However, the species is also found in grassland associated with gilgais in cleared vegetation. Although there are records from riparian areas, the species' presumed preference for riparian habitat is questionable (DoE 2019b).

Sites where Ornamental Snakes have been recorded in abundance share the following habitat characteristics (Agnew 2010 pers. comm.):

- They are located within the lowest part of the catchment. The Ornamental Snake has been found in greatest numbers in shallow water where some aquatic vegetation is present, or where fringing groundcover vegetation has been inundated, especially in flooded gilgais where the dominant aquatic macrophyte is Bog Hyacinth (*Monochoria cyanea*).
- They have diversity of gilgai size and depth (if deep, then broad with gently sloping gradients at the sides).
- There are soils of high clay content and deep-cracking characteristics. Water retention capacity increases with an increase in the fine clay particle fraction of soils. This, in turn, influences certain habitat conditions that are important for the Ornamental Snake and the frog species it preys upon. Cracking clays with higher sand and more sodic cracking clays, often associated with Brigalow / Belah-dominated communities, have a lower fine clay particle fraction and are likely to have lesser water retention capacity.
- Ground timber is usually relatively common (especially piles adjacent to or close by to gilgais).
- Where burrowing frogs (*Cyclorana* species) are abundant.
- Habitat patches are typically greater than 10 hectares in area and are within, or connected, to larger areas of remnant vegetation.

The species is nocturnal, sheltering during the day under fallen timber and soil cracks. It is likely to be active year round except the cooler months, but will seek refuge during dry periods in soil cracks (DoE 2019b).

➤ Important populations

The Commonwealth environment department considers that an occurrence of important habitat for the Ornamental Snake is a surrogate for an 'important population' of the species.

The Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles (DSEWPC 2011) defines habitat for any one of the listed Brigalow Belt reptiles (of which Ornamental Snake is one) being considered important if it is:

- habitat where the species has been identified during a survey;
- near the limit of the species' known range;
- large patches of contiguous, suitable habitat and viable landscape corridors (necessary for the purposes of breeding, dispersal or maintaining the genetic diversity of the species over successive generations); or
- a habitat type where the species is identified during a survey, but which was previously thought not to support the species.

As such, the occurrence of the Ornamental Snake in the survey area constitutes an important population. The Draft Referral Guidelines go on to specify gilgai depressions and mounds (including connectivity between gilgais and other suitable habitat) as being known important habitat.

➤ Occurrence in the survey area and mapped habitat

Gilgai habitats throughout the site are generally lacking in microhabitat (fallen timber) which would offer shelter to Ornamental Snake at times when soil cracks aren't available (i.e. where the gilgai hold water throughout spring/summer and into autumn depending on seasonal rainfall), as the area has been extensively stick raked in the past. However, in most patches of gilgai at least some smaller sized pieces of timber were available, particularly in areas of Brigalow regrowth, and in some gilgai areas the species was observed to be seemingly sheltering in clumps of Umbrella Cane Grass (*Leptochloa digitata*).

The species was recorded only in cleared areas of gilgai. The Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles (DSEWPC 2011) include cleared areas of gilgai for this species. A total of fourteen Ornamental Snakes were observed in six separate areas of gilgai during the spring 2019 and autumn 2020 surveys. Areas of remnant and regrowth habitat are also included in areas of preferred habitat mapped where these communities are adjacent to gilgai areas. Remaining areas of Brigalow communities mapped across the survey area (Figure 5.10) are otherwise likely to be too isolated and small in size, or lack suitable microhabitat in the form of gilgai relief, for the snake to be present.

All Ornamental Snake observations were in gilgai habitats, with moderate areas of cracking clay present offering refuge for the species, although the species was also recorded in areas of gilgai with slightly sandier substrates and areas of ironstone (although soil cracks were present in all instances).

Nearby similar areas of gilgai in the vicinity, provided similar habitat values, and although the species was not recorded in these areas, its presence could not be ruled out (in some instances ground cover was well developed and visibility hindered accordingly). These areas are also mapped as preferred habitat.

Some of the gilgai in the survey area are isolated in expanses of Buffel Grass, and are quite degraded and likely to be of limited value to the species (little fallen timber, sandy substrates restricting the formation of soil cracks). These areas are not mapped as habitat and are likely to only have the occasional transient individual occurring on a rare basis, if at all.

Known RE associations for the Ornamental Snake are also shown on the habitat mapping figure (REs 11.4.3, 11.4.8, 11.4.9 and 11.5.16). In many instances these communities are contiguous with or mapped within preferred gilgai habitats and are included in the habitat calculations for the species (as gilgai are present). Other patches of these communities are isolated from areas of gilgai, and do not contain gilgai relief, and are not included in habitat calculations but are shown on the figure for reference.

Comparison with the Agnew (2010 pers. comms.) criteria for habitat characteristics where this species has been found to be abundant, is provided below:

- They have diversity of gilgai size and depth (if deep, then broad with gently sloping gradients at the sides) – many of the gilgai areas in the survey area are shallow in their profile, and unlikely to be preferred habitat for the species. Areas that have been mapped as preferred habitat (known and possible) include a diverse range of gilgai sizes and profiles.
- There are soils of high clay content and deep-cracking characteristics – areas mapped as preferred habitat (known and possible) have clay based soils, with cracking characteristics, which offers refugia for this species. Some of the gilgai areas are on sandier substrates with lower potential for soil cracks to form.

- Where burrowing frogs (*Cyclorana* species) are abundant – Green-striped Frog (*Cyclorana alboguttata*) was recorded frequently in the gilgai habitats during the autumn surveys, as well as other *Cyclorana* species and Ornate Burrowing Frog (*Platyplectrum ornatum*).
- Habitat patches are typically greater than 10 ha in area and are within, or connected, to larger areas of remnant vegetation – many of the patches of gilgai mapped as preferred habitat (known and possible) are large expanses of gilgai. In general, there is no remnant vegetation on areas of gilgai in the survey area. There are no large areas of gilgai habitat immediately outside the survey area, that are connected to gilgai within the survey area.

The Queensland Government has mapped suitability of habitat for Ornamental Snake across the state. The model is derived from RE mapping, wetland data, soil mapping and species records. The model introduces the terms “preferred habitat” and “general habitat” which have been adopted and customised for this report. Habitat is further split into known and possible – which is based on presence of records. Known or possible habitat is not carried forward into this report, and instead records are overlain across the habitat mapping.

This habitat mapping is consistent with BHP’s habitat mapping criteria (Kerswell *et al*, 2020) which has been cross-referenced subsequent to survey and initial habitat mapping taking place. Consistent with regulatory expectations, dispersal habitat is also mapped (and is captured under areas of suitable habitat).

Application of habitat mapping in the survey area consistent with Kerswell *et al* (2020) is summarised in Table 5.7 below.

Table 5.7 Summary of Ornamental Snake habitat mapping in the survey area

Habitat type	Habitat definition (Kerswell <i>et al</i> 2020)	Application to the survey area
Preferred	Gilgai depressions (with or without the presence of brigalow or other canopy vegetation), mounds and wetlands on cracking clays (predominantly land zone 4) where essential microhabitat features are present including an abundance of deep soil cracks. Other microhabitat features such as fallen woody debris may or may not be present. Seasonal flooding of habitat areas is a requirement.	<ul style="list-style-type: none"> • Preferred habitat comprises habitat of a size capable of supporting one or more breeding units, and/or important resources (such as major food sources), or the area is proximal to populations, or may act as a potentially important corridor. • Preferred habitat constitutes seasonally inundated gilgai depressions on cracking clay soils where microhabitat features (deep soil cracks or woody debris) are present (Kerswell <i>et al</i>, 2020).

Table 5.7 Summary of Ornamental Snake habitat mapping in the survey area

Habitat type	Habitat definition (Kerswell et al 2020)	Application to the survey area
Suitable	Dispersal areas within 1 km of preferred habitat, which are currently or previously dominated by brigalow or coolibah communities where gilgais or soil cracks are infrequent and/or shallow, including non-remnant areas.	<ul style="list-style-type: none"> • Areas of suitable/connectivity habitat have been mapped between areas of preferred habitat on the basis that movement between these areas is likely, and these areas will act as connective habitat. This is consistent with the Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles (DSEWPC 2011) which includes connective habitat as being important for the species. Mapping is based on aerial imagery and in-field observations. • This suitable/connectivity habitat forms areas of cracking clay soils along creeklines through the site, particularly where fallen timber is available for shelter. As discussed above, the species' preference for riparian areas is questionable, and as such, these areas are likely to be solely movement corridors rather than main areas of breeding and foraging habitat. • Dispersal habitat has been mapped based on field observations and aerial imagery, but also has used pre-clearing land zone mapping as a guide, with areas of gilgai soils/landzone 4 (tertiary-early Quaternary clay plains) also overlain on the habitat map shown below.
Marginal	Areas currently or previously dominated by brigalow or coolibah communities where gilgais or soil cracks are infrequent or are shallow or non-remnant areas where threats are high (high abundance of weed incursion and cattle compacting soils) but the species still have potential to occur, especially in times where water is present and prey abundance (frogs) is high.	<ul style="list-style-type: none"> • Some of the gilgai in the survey area are isolated in expanses of Buffel Grass, and are quite degraded and likely to be of limited value to the species, where threats are high (such as invasive pasture grasses and cattle compacting soils) as well as low quality microhabitat (little fallen timber, sandy substrates restricting the formation of soil cracks). • These areas are categorised as unsuitable gilgai habitat, and are not likely to provide habitat for the species. As such this habitat is not included in overall habitat calculations for this species.

A total of 4,154.37 ha of preferred habitat is mapped in the survey area. Additionally, 4,631.32 ha of suitable/connectivity habitat between areas of preferred habitat is also mapped. Mapping is based on aerial imagery and in-field observations. Further refinement of the boundary of these features could be made from the results of any soil mapping studies, based on the presence of clay/gilgai soils.

A summary of habitat assessments completed for Ornamental Snake in areas of confirmed gilgai is provided in Appendix K. Habitat mapping is provided on Figure 5.5.

b Koala

➤ Legal status

Listed as Vulnerable under the EPBC Act and NC Act.

➤ Relevant departmental documents

The following documents were considered in the preparation of this report:

- species profile on SPRAT database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85104;
- EPBC Referral Guidelines for the vulnerable Koala (DoE 2014a);
- Approved Conservation Advice for *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory) (Koala Northern Designatable Unit) (TSSC 2012a);
- Commonwealth Listing Advice for *Phascolarctos cinereus* (Koala) (TSSC 2012b); and
- Adams-Hosking, C, Grantham, H, Rhodes, J, McAlpine, C, & Moss, P (2011). Modelling climate-change-induced shifts in the distribution of the koala. *Wildlife Research* 38, 122-130.

There is no Recovery Plan or Threat Abatement Plan in place for this species.

No formal Queensland or Federal survey guidelines exist for Koala, although survey effort principles within the EPBC Referral Guidelines for the vulnerable Koala were referenced.

➤ BHP habitat definition

BHP's Central Queensland Threatened Species Habitat Descriptions (Kerswell et al, 2020) defines Koala habitat as follows:

- **Preferred koala habitat** in central Queensland is defined as contiguous remnant Eucalyptus open forest to woodlands on alluvial and/or cracked rock groundwater where palatable food tree species occur frequently (and are usually dominant). This specifically includes stream fringing open forest, open forest or woodland on alluvial terraces where *Eucalyptus tereticornis/camaldulensis* are dominant or common subdominant elements. Other important food species on the alluvial terraces can include *E. coolibah*, *E. crebra*, *E. melanophloia* and *E. populnea*. Preferred habitat areas located where aquifers persist through most drought cycles, substrates have high fertility and food tree species occur at relatively high frequencies have the potential to support moderate to high density koala populations. Preferred habitat areas represented as *Eucalyptus crebra/drepanophylla* tall woodland on hills and ranges with aquifers that persist in most drought cycles (commonly cracked rock aquifers) have the potential to support a low to moderate density koala population e.g. Clarke-Connors Ranges, Minerva Hills.
- **Suitable koala habitat** that provides food resources or aids to movement for the species in central Queensland is defined as remnant and regrowth Eucalyptus open forest to woodlands with more variable aquifers (often seasonal) and that have connectivity to other areas of suitable or preferred habitat.
- **Marginal koala habitat** in central Queensland is defined as all other fragmented and sparsely distributed woodlands and open woodlands, shrub lands and forests, with some food trees and which experience significant seasonal water deficits and/or are subject to periodic high intensity fires. An example marginal habitat type is *Acacia harpophylla* open forest with isolated *Eucalyptus tereticornis/camaldulensis*, *E.*

coolabah and/or *E. populnea*. These areas have the potential to support only very low density koala populations.

➤ Distribution and breeding

Koalas occur throughout northeast, central and southeast Queensland, extending south through Victoria into South Australia. The density of Koalas is generally denser towards the coast (DAWE 2020ag).

The survey area occurs within the Koala's inland distribution, as detailed in the Referral guidelines for the vulnerable koala (DoE 2014a). Within the inland context, the referral guidelines identify Koala habitat as Eucalypt forests and woodlands, as well as Acacia woodlands (with emergent food trees) in both riparian and non-riparian environments (DAWE 2020ag).

All REs in the Survey area except for those associated with semi-evergreen vine thicket and brigalow have the potential to provide Koala habitat under the guideline.

Home range sizes are variable, with those in poorer habitats being larger than in higher quality habitats. Home ranges overlap although the species is generally solitary. During the breeding season males will attempt to establish dominance over the home ranges of a number of females, and on average, male Koalas usually have larger home ranges than females (DAWE 2020ag).

Koalas generally move little under most conditions, however, longer movements through dispersing individuals (mostly young males) are recorded, with movements of several kilometres over land with little vegetation reported (DAWE 2020ag).

➤ Ecology and habitat

Koalas are leaf-eating specialists and have a distinct association with eucalypt woodland and forest habitat types containing suitable food trees. They also inhabit a range of other vegetation communities, including *Corymbia* and *Angophora* species. In the inland regions, Koalas also inhabit acacia woodlands (with emergent food trees) in both riparian and non-riparian environments (DoE 2019c).

Home range sizes are variable, with those in poorer habitats being larger than in higher quality habitats. Home ranges overlap although the species is generally solitary. During the breeding season males will attempt to establish dominance over the home ranges of a number of females, and on average, male Koalas usually have larger home ranges than females (DoE 2019c).

Koalas generally move little under most conditions, however longer movements through dispersing individuals (mostly young males) are recorded, with movements of several kilometres over land with little vegetation reported (DoE 2019c).

The Survey area occurs within the Koala's inland distribution, as detailed in the Referral guidelines for the vulnerable koala (DoEE 2014). Within the inland context, the referral guidelines identify Koala habitat as eucalypt forests and woodlands, as well as Acacia woodlands (with emergent food trees) in both riparian and non-riparian environments (DAWE 2021b). Conservatively, any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees (following EPBC Act referral guidelines for the vulnerable Koala (DoEE 2014)) is considered potential Koala habitat (including sparse Eucalypt regrowth). Koala food trees typically consist of the following genera in order of general preference:

- Eucalyptus.
- Corymbia.
- Angophora.

- Lophostemon.
- Melaleuca.

➤ Important populations

Assessment of impacts to Koala are addressed within the EPBC Act referral guidelines for the vulnerable Koala (DoE 2014a). The guidelines provide a 'koala habitat assessment tool' to assist in the determining the sensitivity, value and quality of lands potentially impacted under development proposals.

The 'EPBC Act referral guidelines for the vulnerable Koala' (DoE 2014a) does not refer to any 'important populations' of Koala. The guidelines provide a 'koala habitat assessment tool' to assist in the determining the sensitivity, value and quality of lands potentially impacted under development proposals.

The assessment tool is to be used to identify a 'habitat score' and determine whether habitat on the target site may be considered 'critical to the survival of the Koala' and therefore critical to the long-term survival and recovery of the species. A habitat score of five is the trigger at which a site may be described as 'critical habitat'. The score is based on Koala occurrences, vegetation structure and composition, habitat connectivity, key existing threats and the recovery value of the area.

➤ Occurrence in the survey area and mapped habitat

Koalas were identified directly and indirectly in the survey area. Five Koalas were identified through direct observation and indirect evidence of Koalas, which includes scratches and scats, was identified along both Shotover Creek and Rockland Creek.

DAWE define Koala habitat as any forest or woodland (including remnant, regrowth and modified vegetation communities) containing species that are Koala food trees or any shrubland with emergent Koala food trees – this definition includes mixed eucalypt regrowth.

As such Koala habitat in the survey area follows this definition. REs which do not contain food trees such as areas of Acacia woodland are assessed as being unsuitable where suitable Eucalypt species are not present. Regrowth vegetation has been included where food tree Eucalypt species are present. Additionally, areas of non-remnant habitat where Eucalypt scrub is present but has not been mapped as regrowth vegetation following the Queensland government mapping are included as habitat on the basis of review of aerial imagery and field validation of areas.

Koala habitat varies in quality throughout the survey area, with higher quality areas of habitat in alluvial areas (riparian corridors such as Rockland Creek and Shotover Creek). These areas comprise eucalypt dominated REs in LZ 3 where primary or secondary food trees are dominant in the canopy. Primary or secondary Koala food trees at Blackwater include Queensland Blue Gum and Poplar Box. Preferred habitat patches for Koala should typically be larger than 50 ha in size unless they form part of a group of connected patches (McAlpine et al. 2007). However, in the context of central Queensland, the importance of smaller areas of preferred habitat is recognised and as such, a patch size limitation is not applied here.

All vegetation communities which contain emergent eucalypt species suitable for this species are conservatively assessed to be potential habitat (preferred, marginal or suitable), including areas of regrowth and non-remnant areas where food trees are present, as the species was recorded on the margins of such regrowth areas (mainly adjacent to remnant vegetation areas). Habitat mapping is informed by RE mapping, although has been further refined from aerial imagery and in-field observations of food tree abundance.

It should be noted that breeding and foraging habitat is treated as one for this species as they are likely to share the same attributes. Likewise, although shelter trees are likely to be based on canopy cover and height, there is no identified range of trees known to be shelter trees (Crowther et al. 2014).

Remaining parts of the Survey area constitute non-remnant or pasture grassland areas, with occasional patches of Acacia dominated scrub and do not form habitat for this species. Communities of semi-evergreen vine thicket are also mapped as unsuitable.

Assessment of Koala habitat across the survey area is based upon the critical habitat mapping criteria within the EPBC Act referral guidelines for the vulnerable Koala (DoE 2014). An assessment of scoring is provided below in Table 5.8. This scoring could be refined once areas of clearing are known, and focus on individual patches of vegetation.

Table 5.8 Assessment of critical habitat for the Koala within the survey area

Attribute	Score (inland)	Status with survey area
Koala occurrence	+2 (high) – evidence of one or more Koalas in the last 5 years	Evidence of Koalas was attained in the form of five Koalas recorded and scratches and scats across the survey area. Therefore this attribute scores +2 for the survey area.
	+1 (medium) – evidence of one or more Koalas within 2 km of the edge of the impact area within the last 10 years	
	0 (low) – none of the above	
Vegetation composition	+2 (high) – has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species, OR 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	As discussed above, areas of vegetation dominated by eucalypts, occur along watercourses, and patches of RE11.3.2. In other communities, emergent Eucalypt food trees are present. Therefore this attribute scores +2 for the survey area.
	+1 (medium) – has forest, woodland or shrubland with emerging trees with only 1 species of known koala food tree present.	
	0 (low) – none of the above	
Habitat connectivity	+2 (high) – area is part of a contiguous landscape ≥ 1000 ha.	Creekline vegetation across the survey area is patchy and reduced in quality in many stretches. The survey area is further fragmented by the mine to the north and the presence of cleared agricultural land. This attribute therefore scores 0 for the survey area.
	+1 (medium) - area is part of a contiguous landscape < 1000 ha, but ≥ 500 ha.	
	0 (low) – none of the above	
Key existing threats	+2 (high) – little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	There is no evidence of Koala mortality from dogs or vehicles. This attribute therefore scores +2 for the survey area.
	+1 (medium) – evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, OR Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.	
	0 (low) – evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, OR Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	

Table 5.8 Assessment of critical habitat for the Koala within the survey area

Attribute	Score (inland)	Status with survey area
Recovery value	+2 (high) – habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 of the guidelines.	It is uncertain whether the habitat is important in achieving interim recovery objectives. The survey area clearly holds a population of Koala and in the inland context woodlands such as Acacia dominated communities with emergent Eucalypt species can be utilised. This attribute therefore scores +1 for the survey area.
	+1 (medium) – uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 of the guidelines.	
	0 (low) - habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 of the guidelines.	
Total score	A total score of (7) is recorded using the above criteria. A habitat score of five is the trigger at which a site may be described as ‘critical habitat’.	

An approximate total of 350.3 ha of preferred habitat is mapped in the survey area. An additional 3,507.7 ha of suitable habitat and 3,026.6 ha of marginal habitat containing emergent eucalypt species suitable for this species also occurs in the survey area. Habitat mapping is provided on Figure 5.6.

Application of habitat mapping in the survey area consistent with Kerswell et al (2020) is summarised in Table 5.9 below. This habitat mapping has been cross-referenced subsequent to survey and initial habitat mapping taking place.

Table 5.9 Summary of Koala habitat mapping in the survey area

Habitat type	Habitat definition (Kerswell et al 2020)	Application to the survey area
Preferred	Contiguous remnant Eucalyptus open forest to woodlands on alluvial and/or cracked rock groundwater where palatable food tree species occur frequently (and are usually dominant). This specifically includes stream fringing open forest, open forest or woodland on alluvial terraces where <i>Eucalyptus tereticornis/camaldulensis</i> are dominant or common subdominant elements. Other important food species on the alluvial terraces can include <i>E. coolibah</i> , <i>E. crebra</i> , <i>E. melanophloia</i> and <i>E. populnea</i> . Preferred habitat areas located where aquifers persist through most drought cycles, substrates have high fertility and food tree species occur at relatively high frequencies have the potential to support moderate to high density koala populations. Preferred habitat areas represented as <i>Eucalyptus crebra/drepanophylla</i> tall woodland on hills and ranges with aquifers that persist in most drought cycles (commonly cracked rock aquifers) have the potential to support a low to moderate density koala population e.g. Clarke-Connors Ranges, Minerva Hills.	Preferred habitat is mapped where records of individuals or signs (scratches and scats) occurred and in riparian communities with connectivity and abundant food trees. However, it is worth noting that large sections of creeklines were not suitable as vegetation had been cleared to the stream bank, or unsuitable vegetation communities were present and these sections are excluded (or mapped as suitable/marginal habitat if the areas still provide connectivity value between areas of preferred habitat). Areas of preferred habitat predominantly relate to remnant areas of: <ul style="list-style-type: none"> • RE 11.3.2 Sparse <i>Eucalyptus populnea</i> woodland on alluvial plains; • RE 11.3.25 Mid-dense <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines; • RE 11.3.25f Main river channels. Open water or exposed stream beds and bars. Usually devoid of emergent vegetation although scattered trees and shrubs such as <i>Melaleuca viminalis</i> or <i>Melaleuca</i> spp.; • RE 11.3.27d <i>Eucalyptus camaldulensis</i> and/or <i>E. tereticornis</i> woodland. A range of sedges and grasses occur in the ground layer.

Table 5.9 Summary of Koala habitat mapping in the survey area

Habitat type	Habitat definition (Kerswell et al 2020)	Application to the survey area
Suitable	Suitable koala habitat that provides food resources or aids to movement for the species in central Queensland is defined as remnant and regrowth Eucalyptus open forest to woodlands with more variable aquifers (often seasonal) and that have connectivity to other areas of suitable or preferred habitat.	<p>Communities comprising values that aid movement, but are less contiguous and less dominated by food tree species than preferred habitat, are mapped as suitable habitat. This includes communities dominated by <i>E. cambageana</i>, <i>E. thozetiana</i>, <i>E. orgadophila</i>.</p> <p>Areas of suitable habitat predominantly relate to regrowth areas of the preferred REs as well as the following remnant or regrowth REs:</p> <ul style="list-style-type: none"> • RE 11.4.7 <i>Eucalyptus populnea</i> with <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest to woodland on Cainozoic clay plains; • RE 11.5.3 <i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces; • RE 11.5.9 <i>Eucalyptus crebra</i> and other <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. woodland on Cainozoic sand plains and/or remnant surfaces; • RE 11.5.9a Sparse <i>Eucalyptus melanophloia</i> woodland on Cainozoic sand plains and/or remnant surfaces • RE 11.5.9b Sparse <i>Eucalyptus crebra</i>, <i>E. tenuipes</i>, <i>Lysicarpus angustifolius</i> +/- <i>Corymbia</i> spp. Woodland on Cainozoic sand plains and/or remnant surfaces; • RE 11.7.4 Mid-dense <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp., <i>Lysicarpus angustifolius</i> woodland on Cainozoic lateritic duricrust; and • RE 11.8.5 <i>Eucalyptus orgadophila</i> open woodland on Cainozoic igneous rocks.

Table 5.9 Summary of Koala habitat mapping in the survey area

Habitat type	Habitat definition (Kerswell et al 2020)	Application to the survey area
Marginal	<p>Marginal koala habitat in central Queensland is defined as all other fragmented and sparsely distributed woodlands and open woodlands, shrub lands and forests, with some food trees and which experience significant seasonal water deficits and/or are subject to periodic high intensity fires. An example marginal habitat type is <i>Acacia harpophylla</i> open forest with isolated <i>Eucalyptus tereticornis/camaldulensis</i>, <i>E. coolabah</i> and/or <i>E. populnea</i>. These areas have the potential to support only very low density koala populations.</p>	<p><i>A. harpophylla</i> and other <i>Acacia</i> dominated communities are shown on the figure below as marginal habitat (on the basis that emergent Eucalypt species may be present). As evidenced by records in the survey area, these communities still form habitat for Koala if emergent Eucalypts are present, and areas of these communities where Eucalypt species such as <i>E. exserta</i> and <i>E. populnea</i> are present in sufficient densities are elevated to suitable habitat.</p> <p>An area of <i>Acacia</i> sp. woodland with emergent Queensland Peppermint and Poplar Box which held three individuals during the autumn 2020 surveys is mapped as marginal habitat. The presence of these individuals in an <i>Acacia</i> dominated woodland with emergent eucalypt food tree species provides an indication of the likely distribution of the species in the region. Preferred habitats such as riparian corridors dominated by Queensland Blue Gum provide preferred habitat in regions such as the study area, but these less favourable communities can still provide habitat in an inland context, if suitable food trees are present.</p> <p>While meeting critical habitat criteria (as the species occurs in the survey area, and these communities hold two or more food tree species), these communities mapped as suitable or marginal habitat are generally of lower value for the species but still provide foraging or connectivity habitat. As shown on Figure 5.6 there are records of Koala from the southern lease surveys in this suitable or marginal habitat. The importance of any woodland type containing food tree species in landscapes such as the survey area, has to be considered, particularly as these lower value communities are typically found adjacent to preferred riparian corridors in the Survey area and provide connectivity to other areas of habitat</p>

c Australian Painted Snipe

➤ Legal status

Listed as Endangered under the EPBC Act and NC Act.

➤ Relevant departmental documents

The following documents were considered in the preparation of this report:

- species profile on SPRAT database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=77037;
- Approved Conservation Advice for *Rostratula australis* (DoE 2013d); and
- Commonwealth Listing Advice for *Rostratula australis* (TSSC 2013).

There is no Recovery Plan or Threat Abatement Plan in place for this species, although there is a draft National Recovery Plan in place (Commonwealth of Australia 2019).

➤ BHP habitat definition

BHP's Central Queensland Threatened Species Habitat Descriptions (Kerswell et al, 2020) defines Australian Painted Snipe habitat as follows:

- **Preferred Australian Painted Snipe habitat** in central Queensland is defined as shallow, permanent or ephemeral, freshwater wetlands which provide areas of bare, exposed wet mud and a mosaic of ground cover (tufted grasses, sedges, small woody plants). It should be noted that the presence and/or extent of preferred habitat will be influenced by seasonal conditions (expansion of permanent wetlands, or creation of ephemeral wetland habitat)
- **Suitable Australia Painted Snipe habitat** in central Queensland is defined as shallow permanent or ephemeral freshwater or brackish wetlands and other inundated/waterlogged areas with a variable ground cover (e.g. grasses, shrubs and rushes). Can include gilgais, lakes, springs, swamps, claypans, inundated or waterlogged grassland/saltmarsh, dams, rice fields, sewage farms and bore drains.

Habitat for this species does not include tall, dense reedbeds associated with stabilized water levels, wetlands that are cropped, and areas of low water quality due to nutrient run-off, agricultural chemicals and turbidity.

➤ Distribution and breeding

This species occurs in shallow freshwater wetlands, of both an ephemeral and permanent nature across all states of Australia, but most commonly in eastern Australia. The species is widespread, and is thought to be dispersive or migratory with dispersive movements attributed to local conditions (moving to flooded areas or permanent wetlands from drying areas or away from areas affected by drought). The species is thought to breed in response to climatic conditions rather than during a particular season, with breeding recorded in all months (DoE 2019k).

➤ Ecology and habitat

Habitat includes a variety of wetland types, namely shallow freshwater (occasionally brackish) wetlands, both ephemeral and permanent, such as lakes, swamps, claypans, inundated or waterlogged grassland/saltmarsh, dams,

rice crops, sewage farms and bore drains, generally with a good cover of grasses, rushes and reeds, low scrub, *Muehlenbeckia* spp. (lignum), open timber or samphire (DoE 2019k).

The species eats vegetation, seeds, insects, worms and molluscs, crustaceans and other invertebrates. It is crepuscular, active mainly at dawn and dusk, but is also active at night. It sits in cover of grasses or reeds during the day (DoE 2019k).

➤ Important populations

No important populations are defined, although under the EPBC Act Significant Impact Guidelines 1.1 (DoE 2013c), the need to define “a population of a species” is required for an Endangered species, rather than an important population.

A ‘population of a species’ is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

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

Important areas for this species historically have included the Murray-Darling Basin (in particular the Riverina region), the Channel Country and Fitzroy Basin of Queensland, south eastern South Australia and parts of Victoria (TSSC 2013). There is a marked concentration of records around population centres but this is likely to reflect both the abundance of wetlands on the coastal plain and perhaps more pertinently observer bias. It is therefore difficult to define populations, or important populations for this highly nomadic and secretive species.

➤ Occurrence in the survey area and mapped habitat

No records of Australian Painted Snipe are found in the survey area, although based on recent nearby records from the northern leases, Australian Painted Snipe is likely to utilise habitats in the survey area during seasonably suitable conditions when gilgai are inundated and potentially as suitable habitats further inland dry out.

Although little is known about the movements of the species, it is likely that this species will utilise ephemeral (gilgai) habitat on site in the wet season and post-wet season as the areas dry, then leave once these areas dry up.

Other areas of gilgai habitat were typically isolated patches, with a sandier substrate and infested with Buffel Grass or Cane Grass and were considered less suitable for this species. These areas of unsuitable gilgai habitat are not mapped as habitat for this species.

As evidenced by the two observations during surveys of the northern lease areas in 2019, there is potential that the species could be present year-round on dams that retain water and have suitable fringing vegetation cover.

Steep sided farm dams with no muddy edges, farm dams without fringing vegetation, or unfenced farm dams where cattle ingress has substantially degraded water quality or led to significant erosion and trampling, are not considered habitat for this species.

Dispersal habitat has not been mapped for this species as it does not require specific habitat features to assist dispersal between areas of suitable habitat.

Application of habitat mapping in the survey area consistent with Kerswell et al (2020) is summarised in Table 5.10 below. This habitat mapping has been cross-referenced subsequent to survey and initial habitat mapping taking place. It should be noted that the species is not likely to be present in the Survey area on a continuous basis, but habitat mapping criteria applies for when this nomadic species is present in the region.

Table 5.10 Summary of Australian Painted Snipe habitat mapping in the survey area

Habitat type	Habitat definition (Kerswell et al 2020)	Application to the survey area
Preferred	Shallow, permanent or ephemeral, freshwater wetlands which provide areas of bare, exposed wet mud and a mosaic of ground cover (tufted grasses, sedges, small woody plants). It should be noted that the presence and/or extent of preferred habitat will be influenced by seasonal conditions (expansion of permanent wetlands, or creation of ephemeral wetland habitat).	Preferred habitat for this species comprises shallow, permanent or ephemeral wetlands with areas of exposed bare mud and a mosaic of ground cover. Wetland habitats in the survey area comprise gilgai habitats therefore based on the habitat definitions from BHP this is included under suitable habitat below.
Suitable	Shallow permanent or ephemeral freshwater or brackish wetlands and other inundated/waterlogged areas with a variable ground cover (e.g. grasses, shrubs and rushes). Can include gilgais, lakes, springs, swamps, claypans, inundated or waterlogged grassland/saltmarsh, dams, rice fields, sewage farms and bore drains.	Suitable habitat relates to wetlands or inundated areas with variable ground cover, including areas of gilgai. Areas of gilgai habitat mapped as being suitable for the species, relate to large areas of gilgai which are generally more well developed, and when observed during wet conditions had a range of grasses and sedges around the margins offering shelter to the species. Suitable areas of habitat relating to farm dams, consists of dams where the topography of the dam lead to shallow sloping margins, where muddy edges form, and with ample cover in the form of fringing reeds and grasses. These farm dams were all fenced off to livestock (with water being pumped outside the fence to a trough) and as such the groundcover was more extensive, and there were fewer areas of erosion and higher water quality.

As evidenced across its range, this is a highly nomadic species in response to conditions, and it could be present in the area in some years and not in others. However, surveys in the northern lease areas in 2019 have confirmed utilisation in two different seasons, indicating some likely regularity to its presence in the survey area.

A total of 4,071.17 ha of suitable habitat is mapped in the survey area for Australian Painted Snipe. This is shown on Figure 5.7.

d White-throated Needletail

➤ Legal status

Listed as Vulnerable and Migratory under the EPBC Act and Vulnerable under the NC Act.

➤ Relevant departmental documents

The following documents were considered in the preparation of this report:

- species profile on SPRAT database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=682;
- Conservation Advice *Hirundapus caudacutus* White-throated Needletail (TSSC 2019); and

- Draft referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE 2015).

There is no Listing Advice or adopted or made Recovery Plan in place for this species.

➤ BHP habitat definition

Not defined.

➤ Distribution and breeding

The White-throated Needletail is widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of QLD and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (DAWE 2021f).

The species breeds in northern Asia and spends the non-breeding season (typically October – March inclusive) in Australia, favouring eastern and south-eastern areas of the country moving further south as the summer progresses (DAWE 2021f).

➤ Ecology and habitat

In Australia, the White-throated Needletail is almost exclusively aerial, occurring from heights of less than 1 m up to more than 1,000 m above the ground. The species is capable of ascending to altitudes of over 3,000 m (Tarburton 2014).

White-throated Needletail are predominantly aerial, and although they occur over most types of habitat, White-throated Needletails are recorded most often above wooded areas (DAWE 2021w). However, they forage over a wide range of habitats including cleared areas. The species has been recorded roosting in trees in forests and woodlands, both among dense foliage in the canopy or in hollows (Corben et al. 1982).

The species breeds in northern Asia and spends the non-breeding season (typically October – March inclusive) in Australia, favouring eastern and south-eastern areas of the country moving further south as the summer progresses (DAWE 2021w). Results of geolocator studies on White-throated Needletail (Yamaguchi et al 2021) have shown that birds are constantly on the move up and down the east coast of Australia and the Great Dividing Range, travelling up to 900 km in 24 hours between roost sites. They are also thought to fly after dark and as such are potentially susceptible to collision with wind turbines at this time (Tarburton 2021).

In the return autumn migration, the species is thought to spend more time at higher altitudes immediately prior to and during departure from Australia (Tarburton 2021) and additional based on geolocators many birds are thought to depart north for breeding grounds over central and northwest Australia instead of the arrival down the east coast.

➤ Important populations

DAWE does not specify what constitutes an important population for White-throated Needletail. As such, the EPBC Act Significant Impact Guidelines 1.1 (DoE 2013c) are used, which define an important population of a 'vulnerable' species as being populations that are:

- key source populations either for breeding or dispersal;
- necessary for maintaining genetic diversity; and/or
- near the limit of the species range.

The species occurs widely across eastern Australia, although does not breed in the country. The Survey area is not located near the edge of the species range. There is no evidence to indicate a population in the area is likely to be a key population for breeding, dispersal or maintaining genetic diversity in the species.

Due to their wide dispersal across eastern Australia, any population occurring in the survey area is unlikely to constitute an important population.

➤ Occurrence in the survey area and mapped habitat

No habitat map has been prepared for this species as it is an aerial insectivore that spend most of its time aloft, and could occur anywhere over the Survey area, therefore the whole Survey area is considered potential foraging habitat. Roosting habitat is extremely limited in the Survey area based on the lack of large mature trees, and restricted to riparian corridors. Four individuals were identified flying over Rockland Creek during the spring 2019 surveys.

The species does not breed in Australia, and as a wide ranging nomadic species, foraging habitat also provides a surrogate for dispersal habitat.

The species is thought to roost in trees amongst dense foliage in the canopy or in hollows (Corben et al.1982; Tarburton 1993, 2014). There is some potential for roosting habitat in the survey area although it is thought that the number of references to Needletails roosting in trees possibly over-emphasises such occurrences (DAWE 2021w). Roost sites are unlikely to be regular or repeated roost sites and as such, due to the extensive areas of retained potential roosting habitat, and the lack of site fidelity likely to be shown by this species there is limited potential for roosting habitat in the Survey area.

e Golden-tailed Gecko

➤ Legal status

Listed as Near Threatened under the NC Act.

➤ Relevant departmental documents

Not applicable.

➤ BHP habitat definition

Not defined.

➤ Distribution and breeding

This species occurs in the Brigalow Belt bioregion and is split into three subspecies. *Strophurus taenicauda albicocularis* was identified during surveys, and its distribution occupies the northern half of the Brigalow Belt range (DES 2020n).

➤ Ecology and habitat

Golden-tailed Gecko are arboreal and inhabit open woodland and open forest areas where they shelter under loose bark and hollow limbs. Golden-tailed Gecko prefers dry sclerophyll forests and woodlands, particularly Callitris and Brigalow woodlands on sandy soils. It is a nocturnal species but can be identified during diurnal surveys by searching under decortivating bark. The species feeds on small insects (DES 2020n).

➤ Important populations

Important populations are not defined.

➤ Occurrence in the survey area and mapped habitat

Preferred habitat for Golden-tailed Gecko is mapped around records of the species in the survey area, namely an area of Acacia woodland (RE11.7.2). Preferred habitat was extensive throughout the Acacia woodland patch, as Lancewood and Bendee provided the species sufficient shelter in furrows of the bark and in decorticating bark. Fallen woody debris was also abundant in this area.

The habitat is extended out to the boundary of the contiguous area of habitat the species was recorded in (i.e. the habitat around the central record location).

Suitable habitat for this species is represented by all other occurrences of these areas of the community in the survey area and also comprises areas on rocky escarpments in the RE11.7.2 vegetation community.

Marginal habitat relates to other Brigalow and Acacia dominated communities (including areas with Callitris) within the survey area (eg REs 11.3.1, 11.4.3, 11.4.7, 11.4.9, 11.5.16, 11.7.1, 11.9.5).

A total of 2,097.48 of suitable habitat is mapped in the survey area for Golden-tailed Gecko.

Habitat mapping is provided on Figure 5.8.

f Fork-tailed Swift

➤ Legal status

Listed as Migratory under the EPBC Act and Special Least Concern under the NC Act.

➤ Relevant departmental documents

The following documents were considered in the preparation of this report:

- species profile on SPRAT database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=678; and
- Draft referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE 2015).

There is no Listing Advice, Conservation Advice or adopted or made Recovery Plan in place for this species.

➤ BHP habitat definition

Not defined.

➤ Distribution and breeding

The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia. In Queensland, there are many coastal records of this species between Cooktown and Townsville, and they are also commonly found in drier habitat inland as far west as Longreach. In eastern Australia, it is recorded in all coastal regions of QLD and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (DAWE 2020y).

The species breeds in northern Asia and spends the non-breeding season (typically October – March inclusive) in Australia, moving further south as the summer progresses. In their breeding range, they nest on mountain cliffs or island rock caves, inside narrow crevices or in cracks on vertical cliff faces (DAWE 2021g).

➤ Ecology and habitat

In Australia, the Fork-tailed Swift is almost exclusively aerial, occurring from heights of less than 1 m up to more than 1,000 m above the ground. The species are capable of ascending to altitudes of over 3,000 m (Tarburton 2009).

The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia. It is almost exclusively aerial and occurs over inland plains and sometimes above foothills or in coastal areas. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes (DAWE 2020y)

➤ Important populations

DAWE does not specify what constitutes an important population for Fork-tailed Swift. In lieu of this, an assessment of an ecologically significant proportion of a population is required for a migratory species.

As such, the EPBC Act Significant Impact Guidelines 1.1 (DoE 2013c) are used, which define an ecologically significant proportion of a population of a 'migratory' species as being defined as:

- Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates).

The species occurs widely across Australia, although does not breed in the country. The Survey area is not located near the edge of the species range. There is no evidence to indicate a population in the area is likely to be a key population for breeding, dispersal or maintaining genetic diversity in the species. Migratory swifts are widely dispersed depending on weather and feeding patterns, and as such no site fidelity is expected. As such if the species occurs in the Survey area, it is unlikely to constitute an ecologically significant proportion of the population.

'Important habitat' for a migratory species is defined as:

- a) habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- b) habitat that is of critical importance to the species at particular life-cycle stages, and/or
- c) habitat utilised by a migratory species which is at the limit of the species range, and/or
- d) habitat within an area where the species is declining.

The species occurs widely across Australia, although does not breed in the country. The Survey area is not located near the edge of the species range. There is no evidence to indicate a population in the area is likely to be a key population for breeding, dispersal or maintaining genetic diversity in the species.

As such, any occurrence is unlikely to constitute an important population or important habitat.

➤ Occurrence in the survey area and mapped habitat

No habitat map has been prepared for this species as it is an aerial insectivore that spend most of its time aloft, and could occur anywhere over the Survey area, therefore the whole Survey area is considered potential foraging habitat.

The species does not breed in Australia, and as a wide ranging nomadic species, foraging habitat also provides a surrogate for dispersal habitat.

g Latham's Snipe

➤ Legal status

Listed as Migratory under the EPBC Act and Special Least Concern under the NC Act.

➤ Relevant departmental documents

The following documents were considered in the preparation of this report:

- species profile on SPRAT database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=863; and
- EPBC Act Policy Statement 3.21 Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (DoE 2017).

There is no Listing Advice, Conservation Advice or adopted or made Recovery Plan in place for this species.

➤ BHP habitat definition

Not defined.

➤ Distribution and breeding

This species is a non-breeding visitor to eastern Australia. It is a shorebird species that breeds primarily in Japan during the Austral winter and spends the Austral summer in eastern Australia.

➤ Ecology and habitat

It mainly occurs in permanent and ephemeral freshwater wetlands with low, dense vegetation but can also occur in saline or brackish wetlands that are artificial or modified (DAWE 2021). It is most commonly associated with wetlands, creeks or moist grasslands. It is a secretive, well-camouflaged species and is usually only revealed to an observer when disturbed into flight (DoE 2019I).

➤ Important populations

Latham's Snipe do not aggregate in large flocks as other shorebirds do, or use similar habitats, therefore habitat important to the species is not identified using Figure 2 of EPBC Act Policy Statement 3.21 Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (DoE 2017). Instead, important habitat for the species is described as "areas that have been identified as internationally important for the species, or areas that support at least 18 individuals of the species".

There is no evidence to indicate the Survey area is likely to constitute important habitat for the species.

The species occurs widely across eastern Australia, although does not breed in the country. The Survey area is not located near the edge of the species range. There is no evidence to indicate a population in the area is likely to be a key population for breeding, dispersal or maintaining genetic diversity in the species.

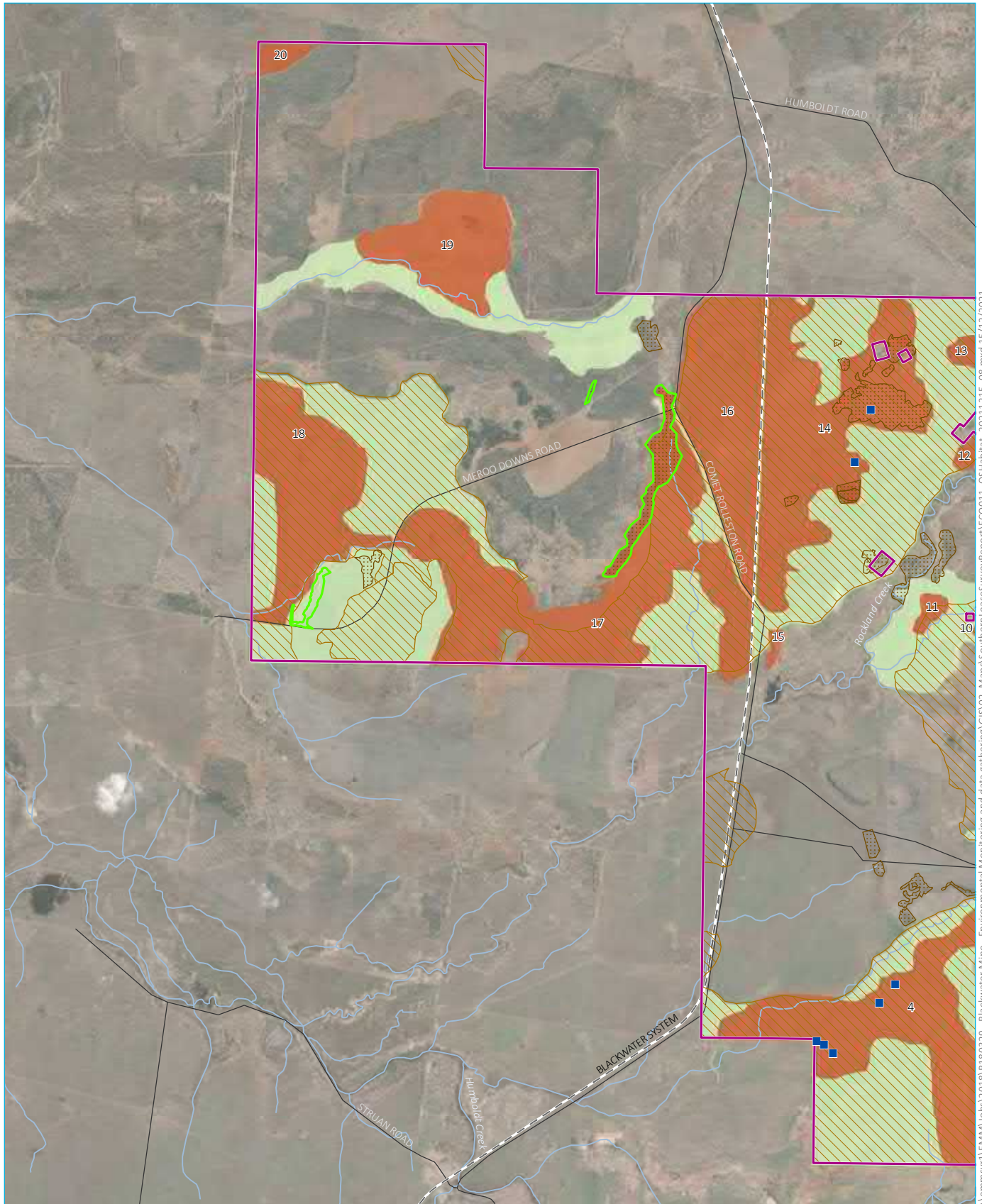
Six important sites are specified for the species based on surveys in Victoria, South Australia and Tasmania (DAWE, 2020).

As such, any occurrence is unlikely to constitute an important population or important habitat.

➤ **Occurrence in the survey area and mapped habitat**

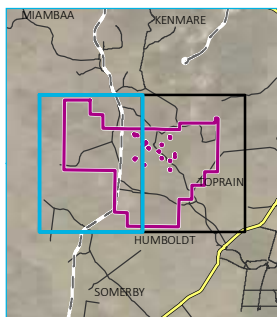
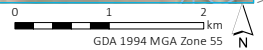
This species was recorded twice during the autumn surveys, one in an area of gilgai on Lot 9 SP187935 and another on a dam on Lot7 SP187934.

Using similar though less specialised habitats to *R. australis*, this species is likely to regularly occur in wetland habitats across the survey area between September and April. Habitat mapping is provided on Figure 5.9.



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Source: EMM (2021); DNRME (2021)

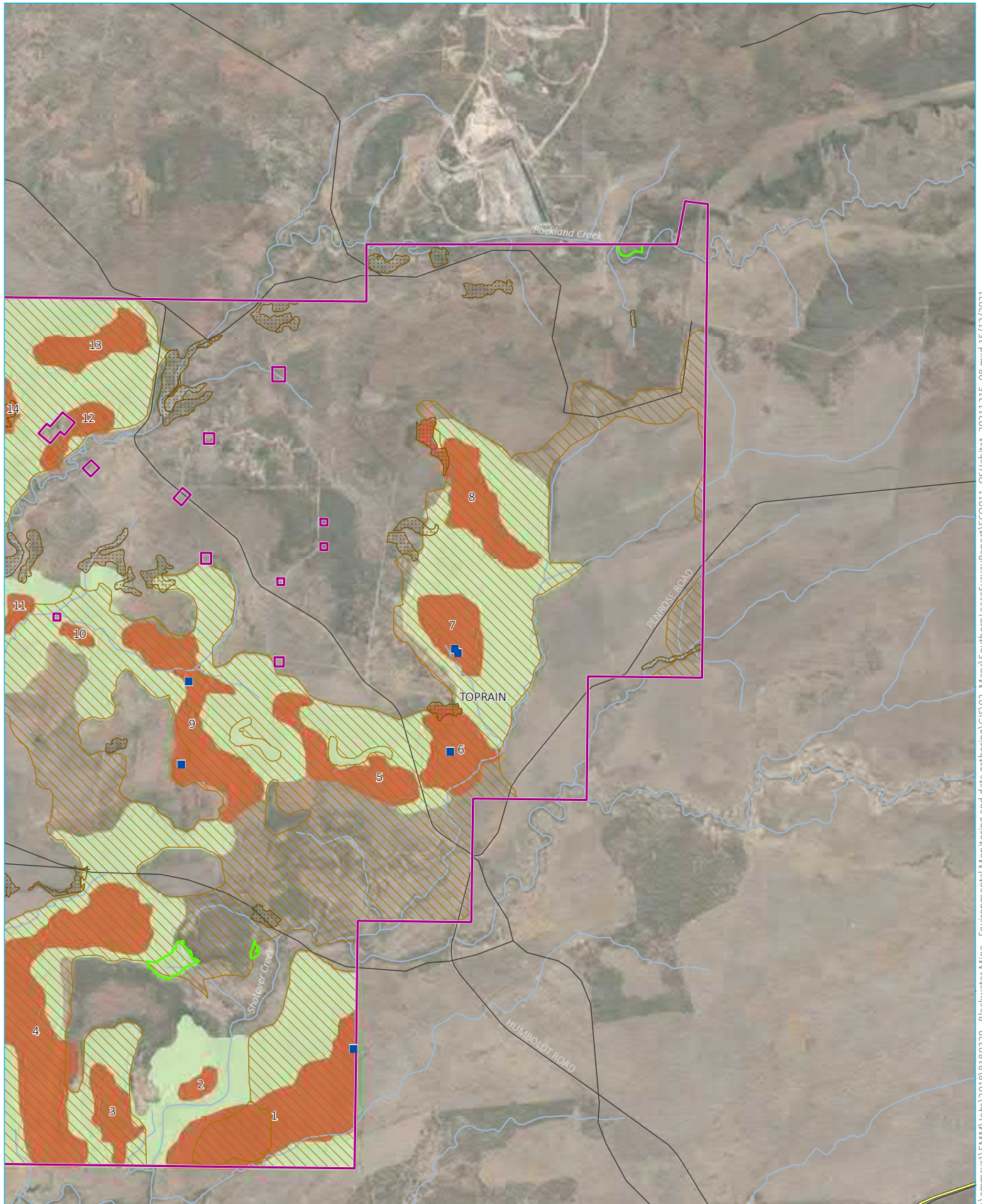


- Survey area
- Rail line
- Major road
- Minor road
- Watercourse/drainage line
- Regional ecosystems associated with Ornamental Snake (11.3.3, 11.4.3, 11.4.6,
- Gilgai soils - pre-clearing land zone 4
- Brigalow TEC
- Ornamental Snake record
- Ornamental Snake habitat
- Preferred
- Suitable/connectivity
- 0 Gilgai area number

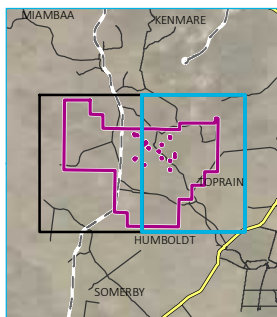
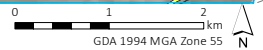
Habitat mapping -
Ornamental Snake
map 1 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.5





Source: EMM (2021); DNRME (2021)



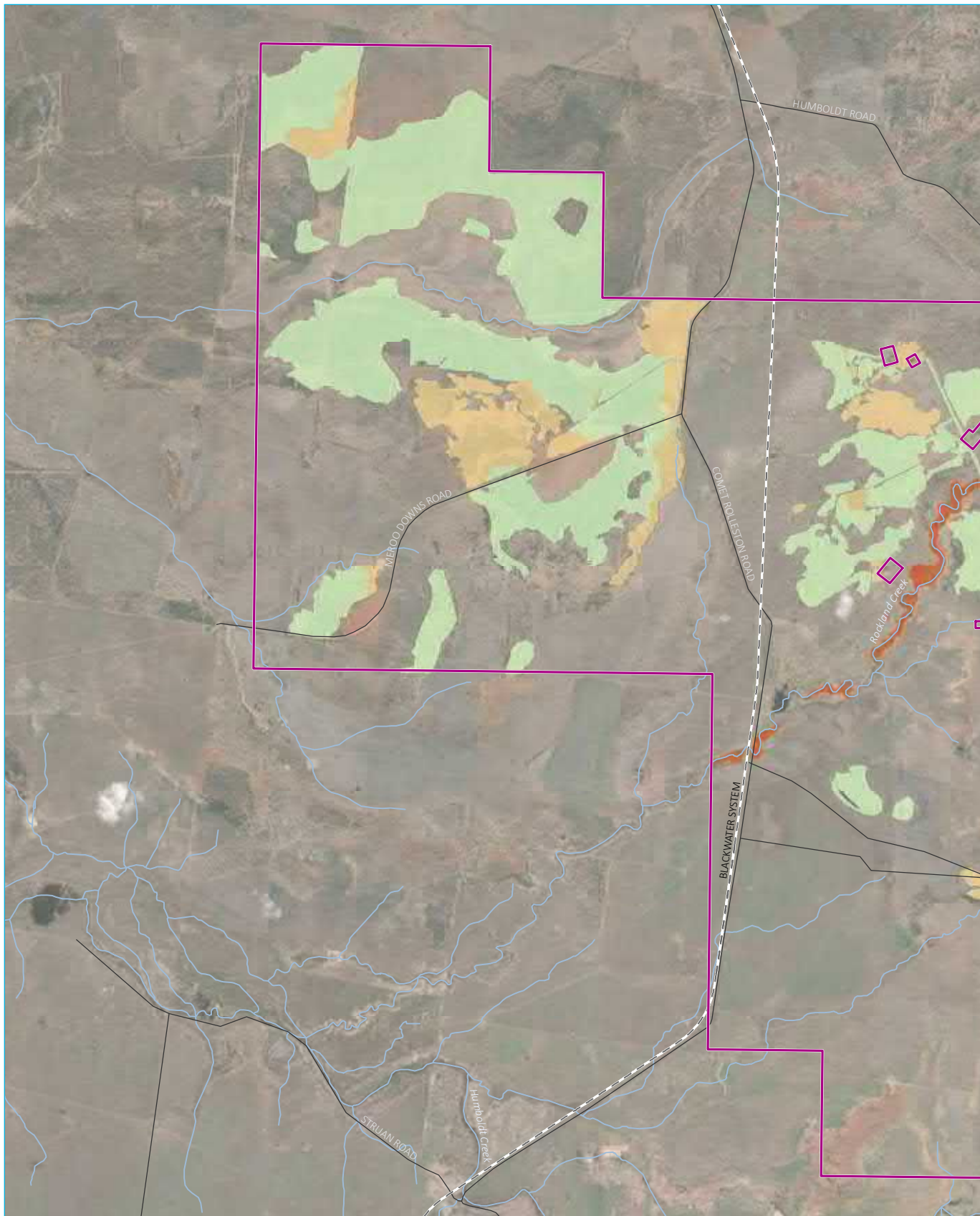
- Survey area
- Rail line
- Major road
- Minor road
- Watercourse/drainage line
- Regional ecosystems associated with Ornamental Snake (11.3.3, 11.4.3, 11.4.6,
- Gilgai soils - pre-clearing land zone 4
- Brigalow TEC
- Ornamental Snake record
- Ornamental Snake habitat
- Preferred
- Suitable/connectivity
- 0 Gilgai area number

Habitat mapping -
Ornamental Snake
map 2 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.5

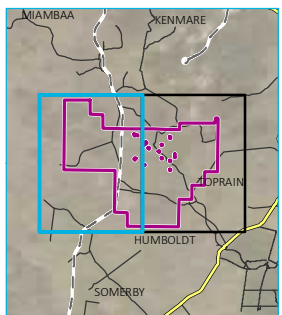


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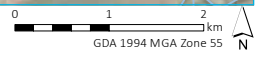


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Source: EMM (2021); DNRME (2021)



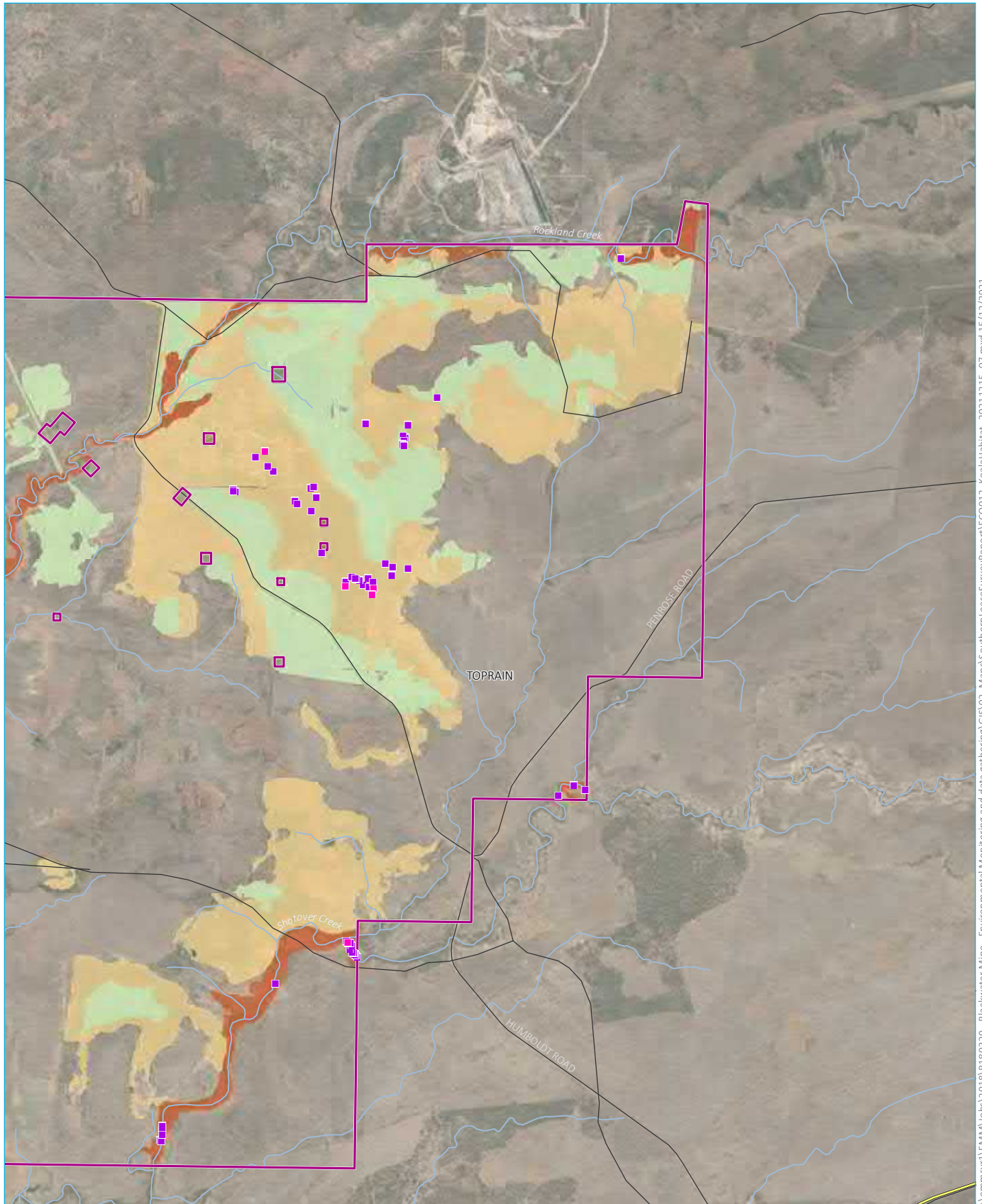
- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - Koala habitat**
 - Preferred
 - Suitable
 - Marginal



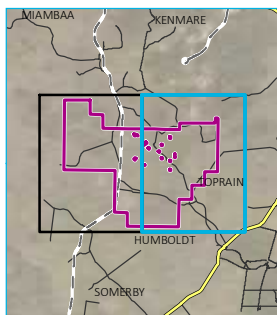
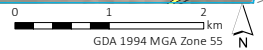
Habitat mapping -
Koala
map 1 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.6





Source: EMM (2021); DNRME (2021)



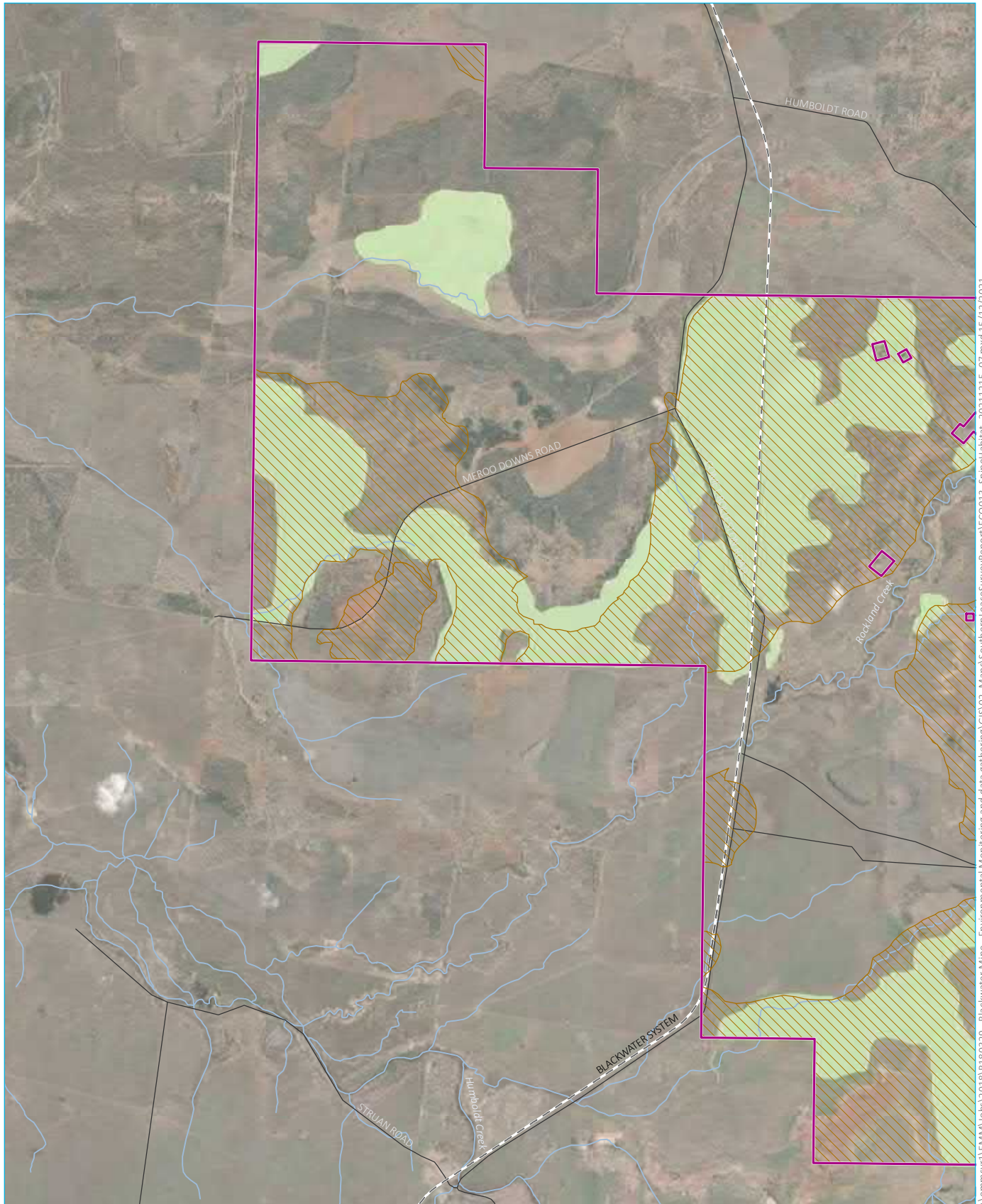
- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
- Koala records**
- Koala (observed)
 - Koala (indirect evidence)
- Koala habitat**
- Preferred
 - Suitable
 - Marginal

Habitat mapping -
Koala
map 2 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.6

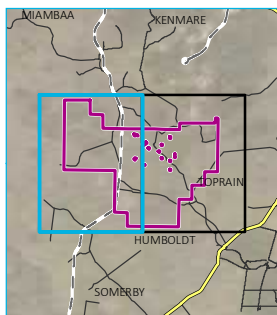
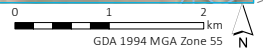


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Source: EMM (2021); DNRME (2021)

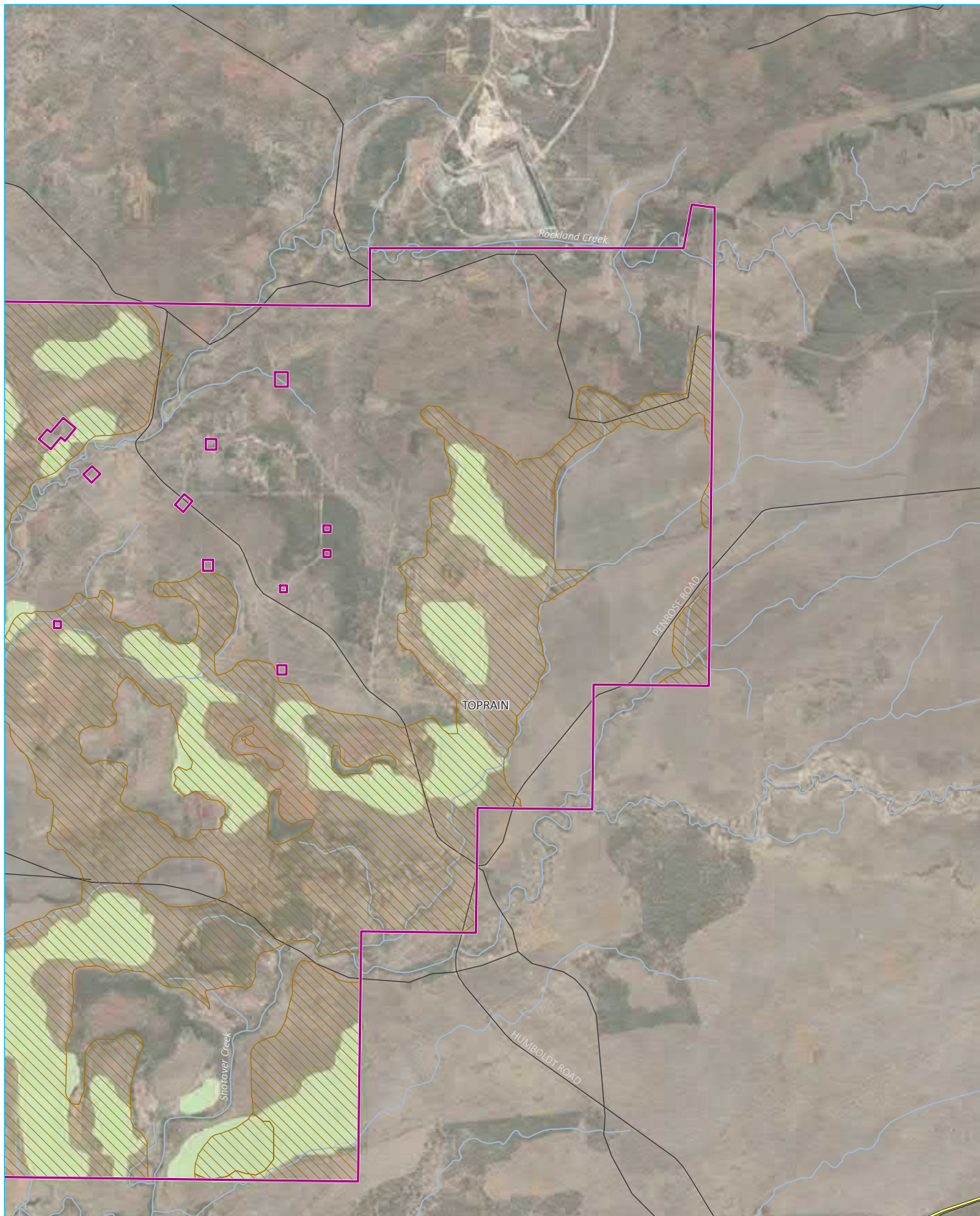


- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - Gilgai soils - pre-clearing land zone 4
 - Suitable Australian Painted Snipe habitat

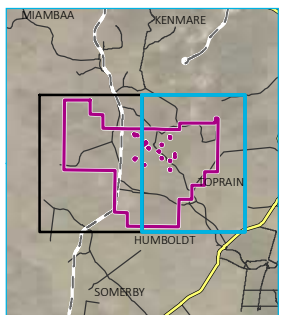
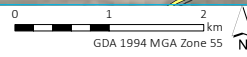
Habitat mapping -
Australian Painted Snipe
map 1 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.7





Source: EMM (2021); DNRME (2021)



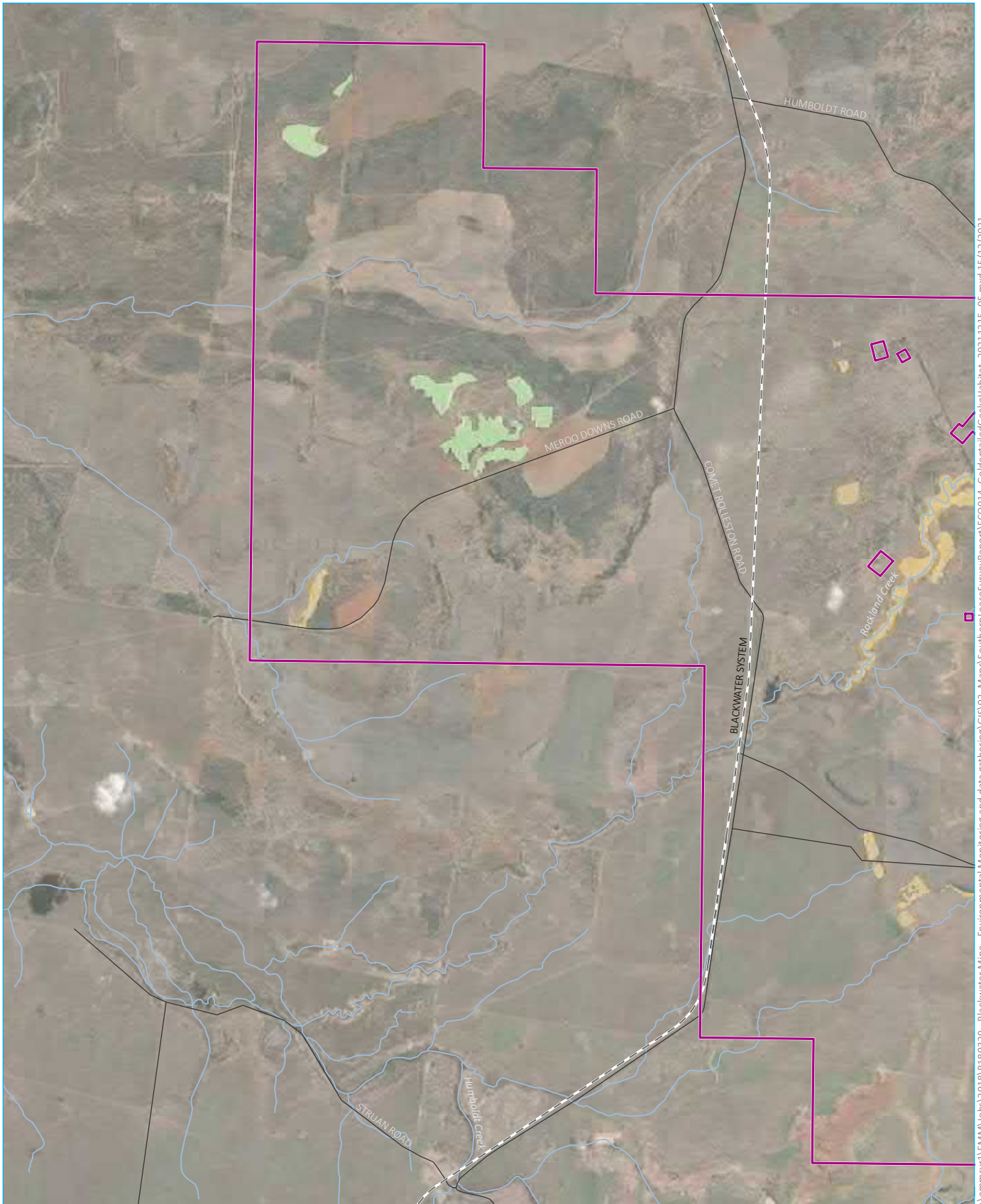
- KEY**
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 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - Gilgai soils - pre-clearing land zone 4
 - Suitable Australian Painted Snipe habitat

Habitat mapping -
Australian Painted Snipe
map 2 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.7

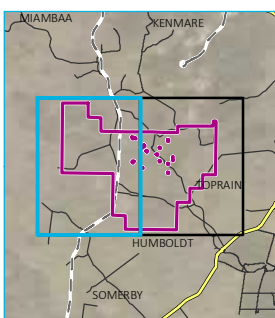


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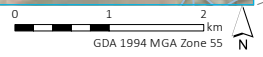


\\emmsvr1\EMM\jobs\2018\B180329 - Blackwater Mine - Environmental Monitoring and data gathering\GIS\02_Maps\SouthernLeaseSurveyReport\ECO014_Goldentailedgeckohabitat_2021.12.15_05.mxd 15/12/2021

Source: EMM (2021); DNRME (2021)



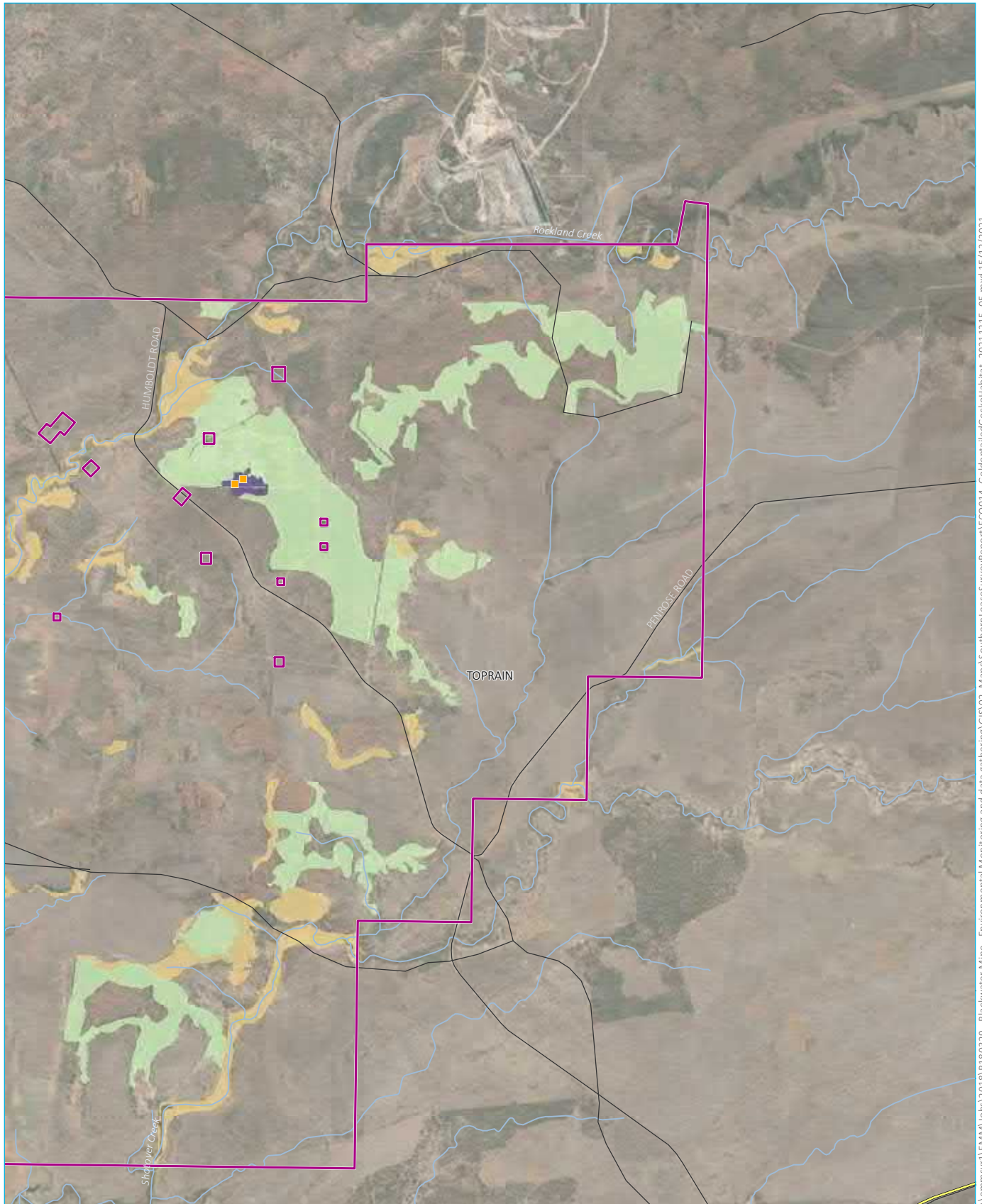
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 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - Golden-tailed Gecko habitat**
 - Suitable habitat
 - Marginal habitat



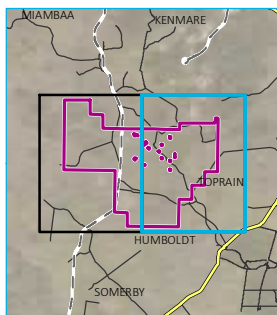
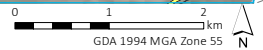
Habitat mapping -
Golden-tailed Gecko
map 1 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.8





Source: EMM (2021); DNRME (2021)



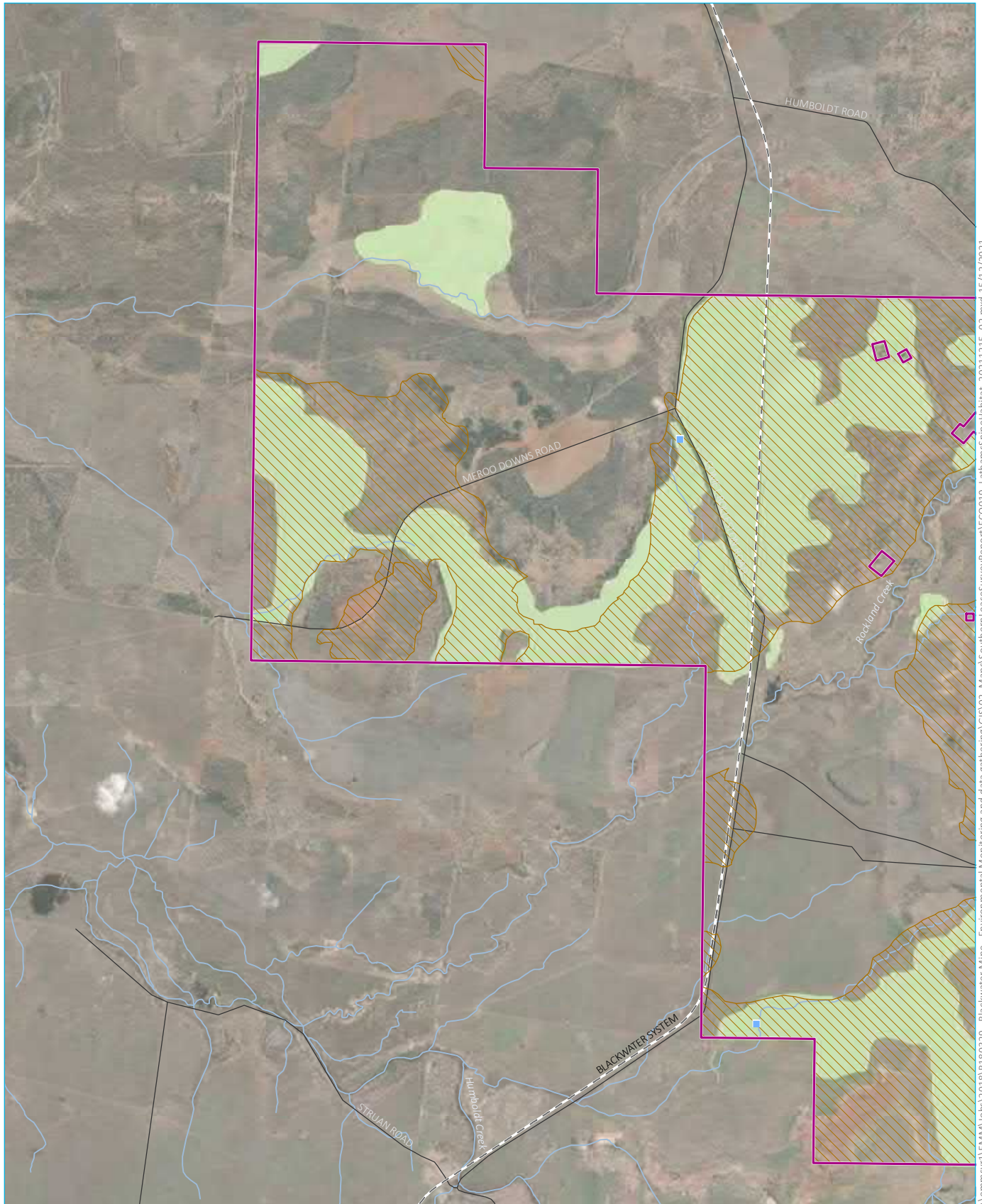
- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - Golden-tailed Gecko record
 - Golden-tailed Gecko habitat
 - Preferred (known) habitat
 - Suitable habitat
 - Marginal habitat

Habitat mapping -
Golden-tailed Gecko
map 2 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.8

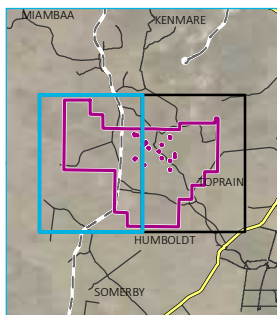


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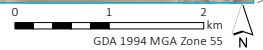


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Source: EMM (2021); DNRME (2021)



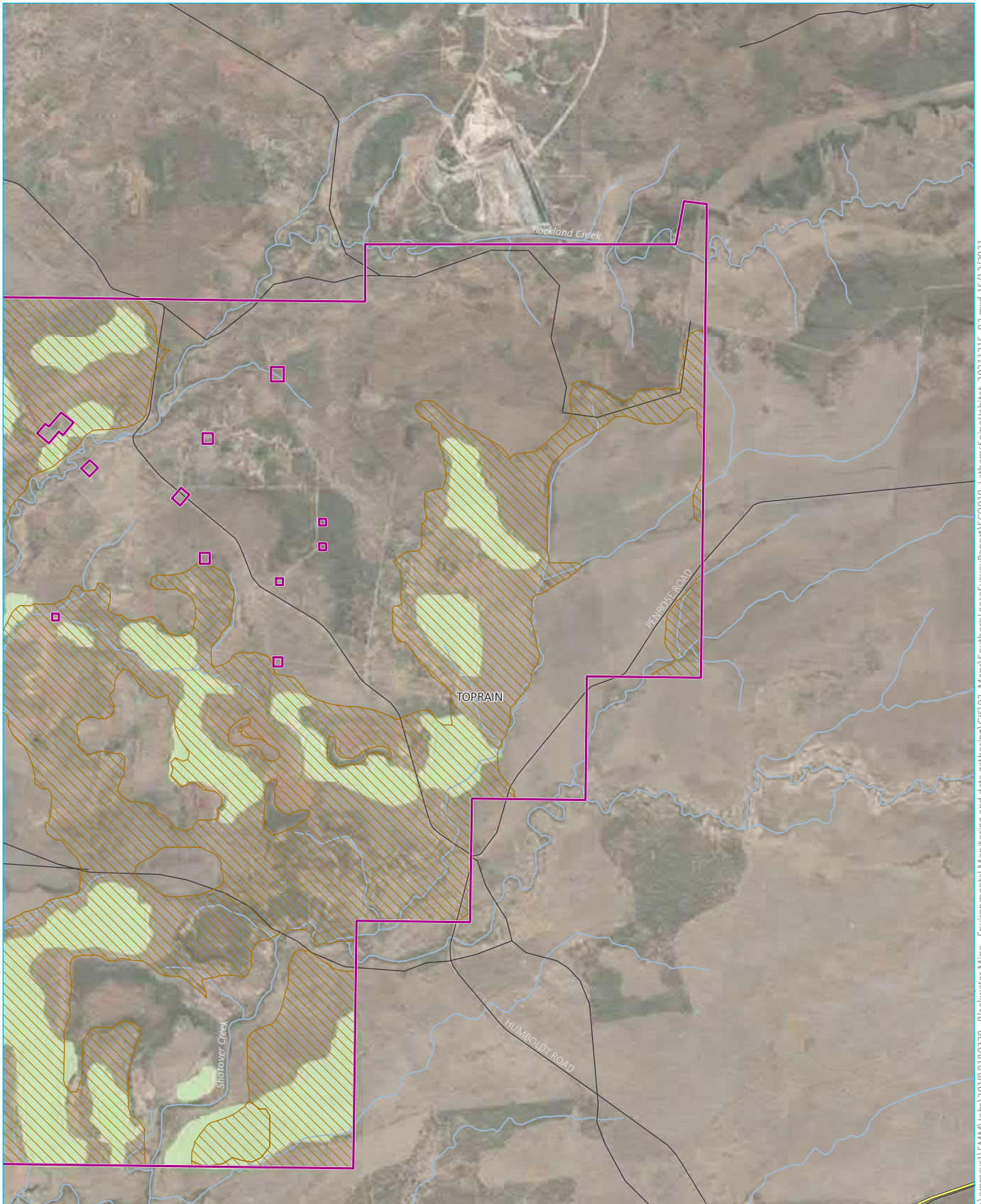
- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - Gilgai soils - pre-clearing land zone 4
 - Latham's Snipe record
 - Suitable Latham's Snipe habitat



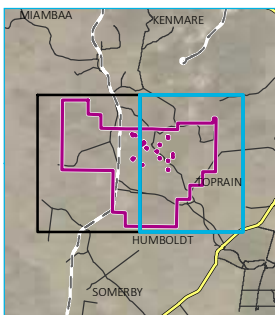
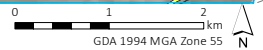
Habitat mapping -
Latham's Snipe
map 1 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.9





Source: EMM (2021); DNRME (2021)



- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - Gilgai soils - pre-clearing land zone 4
 - Suitable Latham's Snipe habitat

Habitat mapping -
Latham's Snipe
map 2 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.9



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5.3.2 Flora

i Vegetation communities

Vegetation assessments were completed at 159 sites consisting of nine tertiary assessments and 150 quaternary assessments. Additional TEC assessments were carried out at 37 sites as discussed below, and BioCondition assessments were conducted at 11 sites. Full vegetation assessments and BioCondition assessments are provided in Appendix F. TEC assessments are provided in Appendix G.

Ground-truthed vegetation classification results for each survey site included:

- 96 remnant sites;
- 48 regrowth site; and
- six non-remnant sites.

GTRE mapping confirmed that 14,492.8 ha of non-remnant, 2,281.2 ha of regrowth and 3,369.6 ha of remnant vegetation exists within the survey area. State RE mapping had 17,696.3 ha of non-remnant vegetation mapped in the survey area, however some of these areas were ground-truthed to be supporting remnant or regrowth vegetation.

While it was found that most of the native vegetation communities confirmed in the survey area met remnant status under VM Act, the majority were found in a degraded condition due to historical clearing and thinning for grazing practises, mining operations including access tracks and exploration, and weed encroachment. Non-native plants particularly Buffel Grass (*Cenchrus ciliaris*) dominated the ground-layer at most sites. Buffel Grass is a threat to these native vegetation communities particularly Brigalow as it outcompetes native grass species, reduces habitat complexity, and increases fuel loads and fire intensity.

Non-remnant sites are active grazing land and have been altered by both recent and long preceding vegetation clearance and raking of woody debris and rocks. These areas are now largely dominated by introduced Buffel Grass and continue to be grazed by livestock.

a Regional ecosystems

A total of 10 Endangered REs (VM Act and BD status) were ground-truthed across the field surveys, with nine Brigalow associated communities and two SEVT communities. One SEVT RE was listed as Endangered (BD status). The remaining vegetation within the survey area consisted of nine of concern REs (BD status) and eight no concern at present REs (BD status). Table 5.11 below presents the ground-truthed regional ecosystems identified within the survey area, the relevant VM Act and BD status, and associated TEC where applicable. Mixed RE polygons have been retained as some patches contained more than one community where boundaries were indistinguishable. Ground-truthed RE mapping is provided in Figure 5.10.

Table 5.11 Ground-truthed regional ecosystems

Regional ecosystem	Description	Area (ha)	Potential TEC	BD Status ¹	VM Act status ²
11.3.1	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	12.20 (regrowth) 688.41 (remnant)	Brigalow dominant and co-dominant	E	E
11.3.1/11.3.25	11.3.1 - <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	11.76 (remnant)	Brigalow dominant and co-dominant	E	E

Table 5.11 Ground-truthed regional ecosystems

Regional ecosystem	Description	Area (ha)	Potential TEC	BD Status ¹	VM Act status ²
	11.3.25 - <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines		-	OC	LC
11.3.1/11.4.9	11.3.1 - <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	6.33 (regrowth)	Brigalow dominant and co-dominant	E	E
	11.4.9 - <i>Acacia harpophylla</i> shrubby woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains		Brigalow dominant and co-dominant	E	E
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains	46.30 (regrowth) 27.44 (remnant)	Poplar Box Grassy Woodland on alluvial plains Weeping Myall Woodlands	OC	LC
11.3.2/11.3.1	11.3.2 - <i>Eucalyptus populnea</i> woodland on alluvial plains	533.49 (remnant)	Poplar Box Grassy Woodland on alluvial plains Weeping Myall Woodlands	OC	LC
	11.3.1 - <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains		Brigalow dominant and co-dominant	E	E
11.3.2/11.3.25	11.3.2 - <i>Eucalyptus populnea</i> woodland on alluvial plains	4.96 (regrowth)	Poplar Box Grassy Woodland on alluvial plains Weeping Myall Woodlands	OC	LC
	11.3.25 - <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines		-	OC	LC
11.3.2/11.4.9	11.3.2 - <i>Eucalyptus populnea</i> woodland on alluvial plains	57.65 (remnant)	Poplar Box Grassy Woodland on alluvial plains Weeping Myall Woodlands	OC	LC
	11.4.9 - <i>Acacia harpophylla</i> shrubby woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains		Brigalow dominant and co-dominant	E	E
11.3.25	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	856.30 (remnant)	-	OC	LC

Table 5.11 Ground-truthed regional ecosystems

Regional ecosystem	Description	Area (ha)	Potential TEC	BD Status ¹	VM Act status ²
11.3.25/11.3.1	11.3.25 - <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	10.97 (remnant)	-	OC	LC
	11.3.1 - <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains		Brigalow dominant and co-dominant	E	E
11.3.25/11.3.1/ 11.3.2	11.3.25 - <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	25.27 (remnant)	-	OC	LC
	11.3.1 - <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains		Brigalow dominant and co-dominant	E	E
	11.3.2 - <i>Eucalyptus populnea</i> woodland on alluvial plains		Poplar Box Grassy Woodland on alluvial plains Weeping Myall Woodlands	OC	LC
11.3.25/11.3.2/ 11.3.1	11.3.25 - <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	25.27 (remnant)	-	OC	LC
	11.3.2 - <i>Eucalyptus populnea</i> woodland on alluvial plains		Poplar Box Grassy Woodland on alluvial plains Weeping Myall Woodlands	OC	LC
	11.3.1 - <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains		Brigalow dominant and co-dominant	E	E
11.3.25/11.3.6	11.3.25 - <i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	10.63 (remnant)	-	OC	LC
	11.3.6 - <i>Eucalyptus melanophloia</i> woodland on alluvial plains		-	OC	LC
11.3.25f	Main river channels. Open water or exposed stream beds and bars. Usually devoid of emergent vegetation although scattered trees and shrubs such as <i>Melaleuca viminalis</i> or <i>Melaleuca spp.</i>	2.35 (remnant)	-	OC	LC

Table 5.11 Ground-truthed regional ecosystems

Regional ecosystem	Description	Area (ha)	Potential TEC	BD Status ¹	VM Act status ²
11.3.27d	<i>Eucalyptus camaldulensis</i> and/or <i>E. tereticornis</i> woodland. A range of sedges and grasses occur in the ground layer including <i>Fimbristylis vagans</i> , <i>Myriophyllum striatum</i> , <i>Nitella pseudoflabellata</i> and <i>Pseudoraphis sp.</i> Occurs fringing large lakes. Palustrine wetland	1.92 (remnant)	-	OC	LC
11.4.3a	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> shrubby open forest on Cainozoic clay plains	4.25 (remnant)	Brigalow dominant and co-dominant	E	E
11.4.7	<i>Eucalyptus populnea</i> with <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest to woodland on Cainozoic clay plains	29.19 (regrowth)	Brigalow dominant and co-dominant Poplar Box Grassy Woodland on Alluvial Plains	E	E
11.4.8	<i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains	102.82 (regrowth) 2.16 (regrowth) 105.20 (remnant)	Brigalow dominant and co-dominant	E	E
11.4.8a	Gilgai and small depressions on clay plains usually associated with <i>Acacia harpophylla</i> ecosystems. Generally support a range of sedges, grasses and, when wet, aquatic species. Palustrine wetland	8.16 (regrowth)	Brigalow dominant and co-dominant	E	E
11.4.9	<i>Acacia harpophylla</i> shrubby woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains	79.26 (regrowth) 26.25 (regrowth) 8.17 (remnant)	Brigalow dominant and co-dominant	E	E
11.5.3	<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces	618.29 (regrowth) 379.91 (remnant)	-	NC	LC
11.5.3/11.7.2	<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> woodland on Cainozoic sand plains and/or remnant surfaces	120.11 (regrowth)	-	NC	LC
	<i>Acacia spp.</i> woodland on Cainozoic lateritic duricrust. Scarp retreat zone		-	NC	LC
11.5.9	<i>Eucalyptus crebra</i> and other <i>Eucalyptus spp.</i> and <i>Corymbia spp.</i> woodland on Cainozoic sand plains and/or remnant surfaces	533.67 (regrowth) 71.67 (remnant)	-	NC	LC

Table 5.11 Ground-truthed regional ecosystems

Regional ecosystem	Description	Area (ha)	Potential TEC	BD Status ¹	VM Act status ²
11.5.9a	<i>Eucalyptus melanophloia</i> woodland	211.51 (regrowth) 13.85 (regrowth) 1,120.00 (remnant)	-	NC	LC
11.5.9b	<i>Eucalyptus crebra</i> , <i>E. tenuipes</i> , <i>Lysicarpus angustifolius</i> +/- <i>Corymbia</i> spp. woodland	0.35 (regrowth)	-	NC	LC
11.5.9/11.4.8	11.5.9 - <i>Eucalyptus crebra</i> and other <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. woodland on Cainozoic sand plains and/or remnant surfaces	11.80 (remnant)	-	NC	LC
	11.4.8 - Gilgai and small depressions on clay plains usually associated with <i>Acacia harpophylla</i> ecosystems. Generally supports a range of sedges, grasses and, when wet, aquatic species. Palustrine wetland		Brigalow dominant and co-dominant	E	E
11.5.9b/11.5.18	11.5.9b - <i>Eucalyptus crebra</i> , <i>E. tenuipes</i> , <i>Lysicarpus angustifolius</i> +/- <i>Corymbia</i> spp. woodland	1.68 (regrowth)	-	NC	LC
	11.5.18 - <i>Micromyrtus capricornia</i> shrubland on Cainozoic sand plains and/or remnant surfaces		-	OC	OC
11.5.10	<i>Melaleuca tamariscina</i> shrubland on Cainozoic sand plains and/or remnant surfaces	9.49 (regrowth) 8.33 (remnant)	-	OC	OC
11.5.15	Semi-evergreen vine thicket on Cainozoic sand plains and/or remnant surfaces	3.26 (remnant)	Semi-evergreen vine thickets of the Brigalow Belt and Nandewar Bioregions	E	LC
11.5.16	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest in depressions on Cainozoic sand plains and remnant surfaces	21.75 (regrowth)	Brigalow dominant and co-dominant	E	E
11.7.1	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> and <i>Eucalyptus thozetiana</i> or <i>E. microcarpa</i> woodland on lower scarp slopes on Cainozoic lateritic duricrust	6.50 (regrowth) 128.08 (remnant)	-	OC	LC
11.7.1x1	Semi-evergreen vine thicket on lower scarp slopes on Cainozoic lateritic duricrust	0.59 (remnant)	Semi-evergreen vine thickets of the Brigalow Belt and Nandewar Bioregions	OC	LC
11.7.2	<i>Acacia</i> spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	274.44 (regrowth) 26.13 (regrowth) 983.23 (remnant)	-	NC	LC

Table 5.11 Ground-truthed regional ecosystems

Regional ecosystem	Description	Area (ha)	Potential TEC	BD Status ¹	VM Act status ²
11.7.1/11.7.2	11.7.1 - <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> and <i>Eucalyptus thozetiana</i> or <i>E. microcarpa</i> woodland on lower scarp slopes on Cainozoic lateritic duricrust	65.53 (regrowth)	-	OC	LC
	11.7.2 - <i>Acacia spp.</i> woodland on Cainozoic lateritic duricrust. Scarp retreat zone		-	NC	LC
11.7.4	<i>Eucalyptus decorticans</i> and/or <i>Eucalyptus spp.</i> , <i>Corymbia spp.</i> , <i>Acacia spp.</i> , <i>Lysicarpus angustifolius</i> woodland on Cainozoic lateritic duricrust	53.42 (remnant)	-	NC	LC
11.7.5/11.7.2	11.7.5 - Shrubland on natural scalds on deeply weathered coarse-grained sedimentary rocks	10.14 (remnant)	-	NC	LC
	11.7.2 - <i>Acacia spp.</i> woodland on Cainozoic lateritic duricrust. Scarp retreat zone		-	NC	LC
11.8.5	<i>Eucalyptus orgadophila</i> open woodland on Cainozoic igneous rocks	15.10 (regrowth) 121.92 (remnant)	-	NC	LC
11.8.11	<i>Dichanthium sericeum</i> grassland on Cainozoic igneous rocks	2.78 (remnant) 0.21 (non-remnant)	Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	OC	OC
11.8.13	Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks	9.17 (regrowth)	Semi-evergreen vine thickets of the Brigalow Belt and Nandewar Bioregions	E	E
		4.20 (remnant)			
11.9.1	<i>Acacia harpophylla</i> , <i>-Eucalyptus cambageana</i> woodland to open forest on fine-grained sedimentary rocks	9.86 (regrowth)	Brigalow dominant and co-dominant	E	E
11.9.5	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks	27.46 (regrowth)	Brigalow dominant and co-dominant	E	E
		9.73 (remnant)			

1. Biodiversity Status: E – Endangered, OC – Of concern, NC – No concern at present

2. Vegetation Management Act status: E – Endangered, LC – Least concern

Table 5.12 provides profiles of each vegetation community recorded.

Table 5.12 Regional ecosystem profiles

Profiles

RE11.3.1 - *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains

This community is common adjacent to creeks and drainage lines across the survey area. Conditional status consisted primarily of remnant vegetation with a few areas of regrowth. Several patches were also identified as mixed communities, regularly associated with RE11.3.25 and RE11.3.2. Ground stratum of this community was commonly dominated by *Cenchrus ciliaris*.

The most regular canopy species of this community was *Acacia harpophylla* followed by *Terminalia oblongata*. Occasional emergent *Eucalyptus* spp. were also recorded but generally sparse.

Native shrubs diversity was moderate across different areas and commonly consisted of *Lysiphillum hookeri*, *Geijera parviflora*, and *Alectryon diversifolius*.

Native groundcover species were sparse and were generally dominated by *Cenchrus ciliaris*.

This community is recognised as potential habitat for the Endangered (EPBC Act) *Solanum elachophyllum*.



RE11.3.2 - *Eucalyptus populnea* woodland on alluvial plains.

This alluvial woodland community was recorded across the survey area adjacent to Rockland and Shotover Ck. Majority of these areas were degraded through previous clearing, weed encroachment and grazing activities. Due to the degraded conditions of these sites, all failed to meet TEC criteria.

A pre-requisite for the classification of this community is a distinct canopy layer of *Eucalyptus populnea* which was evident at all sites. This dominant layer of eucalypts was typically tall in the survey area with a maximum height of 22 m recorded.

The shrub layer of this community was generally sparse and the ground layer typically weedy with species such as *Cenchrus ciliaris* or *Megathyrsus maximus* recorded at every Quaternary assessment site.

This vegetation community is regarded as potential Koala habitat.



Table 5.12 Regional ecosystem profiles

Profiles

RE11.3.6 - *Eucalyptus melanophloia* woodland on alluvial plains. This ecosystem is limited to a small area along Rockland Ck as a part of mixed community with RE11.3.25.

The canopy was diverse with eucalypt species and included *Eucalyptus melanophloia*, *E. populnea*, *E. camaldulensis*, *E. tereticornis*, and *Corymbia tessellaris*.

Multiple weed species were recorded in the understorey including *Bothriochloa pertusa*, *Cenchrus ciliaris* and *Parthenium hysterophorus*.



RE11.3.25f - *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines.

This community was typically recorded as a narrow strip fringing watercourses and wetlands such as billabongs and anabranches.

The canopy of this community consisted of large *Eucalyptus camaldulensis* and *E. tereticornis* with the occasional *Corymbia tessellaris* or other eucalypt species. These large trees would often comprise of the only remaining old-growth trees remaining in the landscape, typically surrounded by heavily degraded habitats.

Other tree or shrub strata in this community were infrequent but typically consisted of *Geijera parviflora* and *Terminalia oblongata*, particularly when adjacent to Brigalow communities.

The ground layer is mostly degraded by heavy grazing and invasion by *Cenchrus ciliaris* and *Megathyrus maximus*.

Multiple Koalas have been recorded in this community within the survey area and it is considered high quality Koala habitat. The typically large retained eucalypt spp. also provide multiple species of birds and mammals with most of the available hollows within the survey area.



Table 5.12 Regional ecosystem profiles

Profiles

RE11.3.27d - *Eucalyptus camaldulensis* and/or *E. tereticornis* woodland. Occurs fringing large lakes. Palustrine wetland (e.g. vegetated swamp)

One small patch of this vegetation community was identified fringing a billabong off Rockland Ck.

The dominant canopy species recorded were *Eucalyptus tereticornis*, *E. camaldulensis*, and *E. populnea* with the occasional shrub in *Lysiphillum caronii*.

The groundlayer consisted of some native grasses and sedges that prefer moist areas such as *Leptochloa digitata* and *Cyprus exaltatus*. However, exotic grass cover increased with distance from the wetland.



RE11.4.3a - *Melaleuca bracteata* woodland associated with *Acacia harpophylla* communities

One small area of this community was recorded within the Memooloo property. It is characterised by vegetation almost completely dominated by *Melaleuca bracteata* situated in a seasonally inundated wetland.

Several aquatic plant species were recorded at the site including *Lemna minor*, *Alisma plantago-aquatica* and *Ammannia multiflora*.

This wetland provides nesting habitat for waterbirds such as Cormorants and Egrets.



RE11.4.7 - *Eucalyptus populnea* with *Acacia harpophylla* and/or *Casuarina cristata* open forest to woodland on Cainozoic clay plains

This ecosystem occurs in the survey area primarily as a Brigalow dominated community with co-dominant or emergent *Eucalyptus populnea*. It was limited within the survey area with only three small patches recorded. One area on the Togara property was assessed for and met Brigalow TEC conditional criteria.

Shrub strata in these patches were diverse and included *Eremophila mitchellii*, *Alectryon diversifolius*, and *Erythroxylum australe*.

Most patches suffered from heavy *Cenchrus ciliaris* encroachment but also supported native ground stratum species such as *Heteropogon contortus*, *Themeda triandra*, and *Digitaria brownii*.



Table 5.12 **Regional ecosystem profiles**

Profiles

RE11.4.8 (a) - *Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains

This Brigalow community is widespread in the survey area and has likely suffered from extensive clearance. It varies significantly in condition across the survey area from degraded regrowth to TEC. It is typically associated with cracking clays and gilgai depressions.

The vegetation structure when in good condition consists of a canopy of *Acacia harpophylla* with *Eucalyptus cambageana* present in the canopy layer or as large emergents.

Low tree and shrub layers are also typically dense and diverse in high quality patches and include *Eremophila mitchellii*, *Geijera parviflora*, *Erythroxylum australe* and *Carissa ovata*.

Native grasses of *Ancistrachne uncinata* and *Aristida jerichoensis* were recorded in high quality areas. However, most sites suffered from *Cenchrus ciliaris* encroachment and this was often the determining factor in exceeding TEC thresholds in remnant patches.

This community when associated with gilgai represents habitat for the Ornamental snake regardless of condition (including non-remnant). Additionally, multiple populations of *Solanum elachophyllum* have been recorded from this community.



RE11.4.9 - *Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains.

This ecosystem has been extensively cleared and degraded in the survey area. Only small patches primarily representing regrowth remain on cracking clay plains and around gilgai wetlands.

The canopy is typically co-dominated by *Acacia harpophylla* and *Terminalia oblongata*.

A diverse smaller tree and shrub layer was usually present including *Geijera parviflora* and *Santalum lanceolatum*. The ground layer had a selection of shrub and grass species including *Carrissa ovata* and *Echinocloa colona*. Most areas are heavily affected by exotic species such as *Cenchrus ciliaris* and *Megathyrsus maximus* in moister areas.

This ecosystem represents habitat for *Solanum elachophyllum* and Ornamental Snake.



Table 5.12 **Regional ecosystem profiles**

Profiles

RE11.5.3 - *Eucalyptus populnea* +/- *E. melanophloia* +/- *Corymbia clarksoniana* woodland on Cainozoic sand plains and/or remnant surfaces

This open woodland community is one of the most widespread in the survey area and was frequently recorded as disturbed regrowth.

The canopy layer of this ecosystem consisted of multiple eucalypt species that would co-dominate according to site. This included *Eucalyptus melanophloia*, *E. populnea* and *Corymbia clarksoniana*.

The shrub layer was typically sparse and included *Erythroxylum australe*, *Owenia acidula* and *Psyrax odorata*.

Ground dominance consisted of *Aristida jerichoensis* and *Ancistrachne uncinulata* in undisturbed areas and *Cenchrus ciliaris* disturbed sites.

This ecosystem is considered potential habitat for Koala.



RE11.5.9 (a,b) - *Eucalyptus crebra* and other *Eucalyptus spp.* and *Corymbia spp.* woodland on Cainozoic sand plains and/or remnant surfaces

This open ironbark community was widespread in the survey area. It varied conditionally across the site from remnant to regrowth and typically showed aspects of disturbance through vegetation clearance, weed encroachment and grazing.

The canopy layer consisted of co-dominate ironbark species in *Eucalyptus crebra* and *E. melanophloia*, with the occasional *Corymbia clarksoniana*. Where ironbark species had sole dominance of an area the site would acquire RE sub-classification as RE11.5.9a (*E. melanophloia*) or RE11.5.9b (*E. crebra*).

Common shrub and ground layer species recorded for this community consisted of *Petalostigma pubescens*, *Eremophila mitchellii*, *Heteropogon contortus* and *Cenchrus ciliaris*.

This vegetation community is considered potential habitat for Koala.



RE11.5.10 - *Melaleuca tamariscina* shrubland on Cainozoic sand plains and/or remnant surfaces

Three small patches of this shrubland ecosystem were recorded on the Memooloo property.

Vegetation structure consisted of a dense low layer (~4 m) of *Melaleuca tamariscina*.

Groundlayer species included native species of *Euphorbia tannensis* and *Themeda triandra* and introduced grasses of *Cenchrus ciliaris* and *Megathyrsus maximus*.



Table 5.12 Regional ecosystem profiles

Profiles

RE11.5.15 - Semi-evergreen vine thicket on Cainozoic sand plains and/or remnant surfaces

One patch of this vine thicket community was identified on the Memooloo property where it exists as a small, heavily thinned area of vegetation encompassed by open eucalypt woodland.

Tree species recorded included *Terminalia oblongata*, *Ventilago viminalis*, *Acacia excelsa*, *Lysiphyllum caronii* and shrubs of *Archidendropsis basaltica*, *Eremophila mitchellii*, *Hovea longipes*, *Erythroxylum australe*, and *Alectryon diversifolius*.

The ground layer was predominately *Cenchrus ciliaris* with occasional patches of *Carissa ovata*.



RE11.5.16 - *Acacia harpophylla* and/or *Casuarina cristata* open forest in depressions on Cainozoic sand plains and remnant surfaces

Three small regrowth areas of this Brigalow ecosystem were ground-truthed on the Memooloo property. None of these were within TEC thresholds due to exotic ground cover.

The vegetation structure consisted of a dense canopy primarily of *Acacia harpophylla* and the occasional *Owenia acidula* and *Cassia brewsteri*.

Shrubs strata consisted of *Eremophila mitchellii*, *Citrus glauca* and *Capparis mitchellii*. The ground layer was typically dominated by *Cenchrus ciliaris* with occasional *Carissa ovata*.

This vegetation community is considered potential habitat of *Solanum elaeagnifolium*.



RE11.5.18 - *Micromyrtus capricornia* open shrubland on Cainozoic sand plains and/or remnant surfaces

One patch of this community was ground-truthed on the Memooloo property as a mixed polygon with 11.5.9b.

The canopy structure was sparse and consisted of *Eucalyptus crebra*, *E. tenuipes*, *Lysicarpus angustifolius* and *Corymbia spp.*

The shrub strata was dense with *Micromyrtus capricornia*

No photo available.

Table 5.12 **Regional ecosystem profiles**

Profiles

RE11.7.1 - *Acacia harpophylla* and/or *Casuarina cristata* and *Eucalyptus thozetiana* or *E. microcarpa* woodland on lower scarp slopes on Cainozoic lateritic duricrust

This regional ecosystem was restricted to the Memooloo property where it was found on the scarp retreat slopes of lateritic jump-ups. Most sites were in remnant condition with limited weed cover likely due to the relatively low nutrient, shallow rocky soils.

Species composition typically consisted of *Eucalyptus thozetiana* and *Acacia catenulata* in two separate tree layers.

The shrub layer was relatively diverse with species such as *Geijera parviflora*, *Everistia vacciniifolia*, *Erythroxylum australe*, and *Hovea longipes* recorded.

The relatively undisturbed condition and limited grazing in most areas also retained a highly diverse native groundlayer. This included multiple grasses including *Eremochloa bimaculata*, *Aristida caput-medusae*, *Enneapogon truncatus*, and *Aristida jerichoensis*.

Although usually limited in cover, where weeds were recorded, they typically comprised of *Harissia martinii*, *Opuntia tomentosa* and *Cenchrus ciliaris*.

The rocky terrain of this community provides habitat for various reptiles and mammals including Herbert's rock-wallaby (*Petrogale herberti*). A few records of *Solanum elachophyllum* also exist within this community, particularly on the lower edge of the scarp retreat zone.



RE11.7.1x1 - Semi-evergreen vine thicket on lower scarp slopes on Cainozoic lateritic duricrust

This vine thicket ecosystem was recorded as a small remnant patch of vegetation on a south-westerly facing edge of a scarp retreat zone surrounded by RE11.7.1.

The community was characterised by a relatively low and sparse emergent layer of *Ventilago viminalis* and *Acacia catenulata*, with dense layers of stunted trees and shrubs including *Erythroxylum australe*, *Acalypha eremorum*, and *Croton insularis*.

The ground layer of this community was relatively sparse due to the dense shrub and low-tree strata.



Table 5.12 Regional ecosystem profiles

Profiles

RE11.7.2 - *Acacia spp.* woodland on Cainozoic lateritic duricrust. Scarp retreat zone

This ecosystem within the survey area is primarily a dense *Acacia* woodland located on lateritic jump-ups or scarp retreat zones with shallow soils that typically contain surface stones such as ironstone.

In the survey area, this ecosystems canopy consists almost exclusively of *Acacia catenulata* or *A. Shirleyi* with emergent eucalypt species present in some areas such as *Eucalyptus exserta* and *E. crebra*.

Shrub strata are generally sparse with species of *Erythroxylum australe*, *Denhamia oleaster*, *Croton phebaloides*, *Psydrax odorata* recorded.

The groundlayer varies according to site and may include multiple native species such as *Aristida caput-medusae*, *Sida fibulifira*, *Hibiscus sturtii*, *Waltheria indica*, and *Dysphania valida*, with disturbed sites completely dominated by *Cenchrus ciliaris*.

This community is habitat for multiple threatened species. Koalas have been recorded where this ecosystem supports emergent eucalypt species and Golden-tailed Gecko has been recorded in remnant areas. Furthermore, several specimens of *Bertya opponens* have been recorded.



RE11.7.4 - *Eucalyptus decorticans* and/or *Eucalyptus spp.*, *Corymbia spp.*, *Acacia spp.*, *Lysicarpus angustifolius* woodland on Cainozoic lateritic duricrust

One patch of this open eucalypt woodland community was ground-truthed on the Terang property.

It consisted of a sparse canopy of eucalypt species comprising of *Corymbia clarksoniana*, *Eucalyptus crebra*, and *E. exserta*.

Shrubs were relatively diverse but sparse and included *Geijera parviflora*, *Erythroxylum australe*, and *Psydrax odorata*.

The ground layer was dominated by *Aristida jerichoensis* and *Themeda triandra*.

This community is considered potential Koala habitat.



RE11.7.5 – Shrubland on natural scalds on deeply weathered coarse-grained sedimentary rocks

No photo available.

One patch of this community was ground-truthed on the Memooloo property as a mixed polygon with 11.7.2.

The shrub strata was dominant.

Table 5.12 **Regional ecosystem profiles**

Profiles

RE11.8.5 - *Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks

This very sparse woodland was recorded exclusively in association with basalt derived soils on the Memooloo property.

The canopy of this community comprised of very sparse *Eucalyptus orgadophila* and *Corymbia erythrophloia*.

Shrubs were typically sparse and typically included *Bursaria incana* and *Archidendropsis basaltica*.

The groundlayer comprised of a mixture of native and introduced species including *Themeda triandra*, *Cenchrus ciliaris*, and *Heteropogon contortus*.

This ecosystem recognised as potential albeit low-quality Koala habitat.



RE11.8.11 - *Dichanthium sericeum* grassland on Cainozoic igneous rocks

Three small areas of this grassland community were recorded from the Memooloo and Penrose properties. All sites met criteria and conditional thresholds for the Natural Grasslands TEC.

The ecologically dominant layer of this community is typically grass species. Sites within the survey area consisted primarily of native species with some minor encroachment of *Cenchrus ciliaris*. Native species recorded included *Dichanthium sericeum*, *Panicum decompositum*, *P. queenslandicum*, *Aristida leptopoda*, *A. latifolia*, *Bothriochloa erianthoides*, *B. decipiens*, and *Digitaria divaricatissima*.



Table 5.12 **Regional ecosystem profiles**

Profiles

RE11.8.13 - Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks

Four patches of this endangered vine thicket community typically associated with nutrient rich basalt soils were ground-truthed on the Memooloo property. One area has been classified as SEVT TEC as it met conditional thresholds.

This community is characterised by large emergent bottle tree species (*Brachychiton rupestris* and *B. australis*) with a diverse and rather dense tree and shrub strata below.

Dominant tree species recorded consisted of *Lysiphyllum hookeri*, *Ventilago viminalis*, and *Planchonella pubescens*. Shrub species included *Acalypha eremorum*, *Croton phebalioides* and *Alectryon diversifolia*.

The typical ground layer of this community is sparse due to dense shrub and tree layers; however, edges were influenced by exotic ground cover species of *Megathyrsus maximus* and *Cenchrus ciliaris*.



RE11.9.1 - *Acacia harpophylla*-*Eucalyptus cambageana* woodland to open forest on fine-grained sedimentary rocks

This brigalow community is similar in structure and species composition to RE11.4.8 but is associated with siltstones, mudstones, and sandstones rather than clay soils. Only three small regrowth patches of this community were ground-truthed in the survey area.

The canopy of this community consisted primarily of *Eucalyptus cambageana* with some areas of co-dominance with *Acacia harpophylla*.

Shrub strata included *Eremophila mitchellii*, *Geijera parviflora*, *Erythroxylum australe* and *Carissa ovata*.

Ground cover in these areas consisted mostly of *Cenchrus ciliaris* and *Carissa ovata*.



Table 5.12 Regional ecosystem profiles

Profiles

RE11.9.5 - *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks

This Brigalow community associated with soils derived from sedimentary rock was ground-truthed from four sites within the Memooloo property. Two of these areas are in good condition and met criteria for Brigalow TEC.

In the survey area, this community was dominated by *Acacia harpophylla* with no areas of *Casuarina cristata* recorded.

Shrub strata were relatively dense and diverse, consisting of *Geijera parviflora*, *Atalaya hemiglauca*, *Eremophila desertii*, *Carissa ovata*, and *Capparis lasiantha*.

Where TEC status was determined, native ground cover species were dominant and included species such as *Enteropogon acicularis* and *Salsola australis*. Areas of lower quality had heavy encroachment from *Cenchrus ciliaris*.

This community is also where *Solanum elaeagnifolium* was most frequently recorded within the survey area.



b Threatened Ecological Communities

Two TEC's were confirmed as present in the survey area being; Brigalow TEC and SEVT TEC.

Full TEC assessment results can be found in Appendix G. The extent of TECs is presented in Figure 5.11.

➤ **Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC**

Nineteen TEC assessments were conducted for the Brigalow TEC. Brigalow TEC was the most recorded TEC, with six patches totalling 104.8 ha mapped within the survey area (Photograph 5.20). Patches mainly consisted of open forest on fine-grained sedimentary rocks with co-dominant Poplar Box (*Eucalyptus populnea*) in some areas.

66 ha were remnant while 31.64 ha were regrowth Brigalow TEC. Some patches contained Buffel Grass (*Cenchrus ciliaris*), however abundance was low in these areas and therefore were within TEC thresholds.

Some patches of Brigalow did not meet TEC status due to weed encroachment from Buffel Grass, Parthenium weed (*Parthenium hysterophorus*) and Green Panic Grass (*Megathyrsus maximus*) (Photograph 5.21). TEC status was also rejected when Brigalow was not dominant and/or co-dominant in the canopy.



Photograph 5.20 Brigalow TEC



Photograph 5.21 Weed-infested Brigalow woodland

➤ Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin TEC

One TEC assessment was conducted for the Natural Grasslands TEC. *Dichanthium sericeum* dominated the ground layer, along with *Aristida* species including *Aristida latifolia* and *A. leptopoda* (Photograph 5.22). Other native species within the ground layer consisted of *Bothriochloa erianthoides*, *B. pertusa*, *B. ewartiana*, *Digitaria divaricatissima*, *Panicum decompositum*, *P. queenslandicum* and *Pimelea haemostachya*. Shrubs were absent in this. Coverage of non-native grass cover of Buffel Grass did not exceed 30%. While this meets the TEC condition threshold for introduced species, the patch size of 2.78 ha does not meet the ‘good quality’ patch size threshold of 5 ha. Therefore, the Grassland TEC assessment completed within the survey area has identified the patch does not meet TEC status.



Photograph 5.22 Grasslands

➤ Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions TEC (SEVT)

Four TEC assessments were conducted for the SEVT TEC. Four patches of SEVT TEC were recorded, totalling to 8.06 ha (Photograph 5.23). SEVT ecological communities were identified on the southern-facing slope of two mesas on Lot 7 SP187934. Species on the mesa slopes included *Terminalia oblongata*, *Alphitonia excelsa*, *Alectryon diversifolius*, *Ventilago viminalis*, *Lysiphyllum caronii*, *Hovea longipes* and *Eremophila mitchellii*. Low coverage of Buffel grass and other weeds was also recorded on these slopes. Another patch of 3.26 ha in size was located within sparse Poplar Box (*Eucalyptus populnea*) woodland on Lot 7 SP187934. Species included *Lysiphyllum hookeri*, *Ventilago viminalis*, *Geijera parviflora*, *Acalypha eremorum*, *Alectryon diversifolius*, *Croton phebaloides* and *Brachychiton rupestris*. The remaining patch was located on basaltic soils and formed a barrier between two other vegetation communities of open grassy woodland (primarily *Corymbia erythrophloia*) and Brigalow. Species composition of this patch was consistent with RE11.7.1x1 and a SEVT community.

All ground-truthed REs associated with SEVT ecological communities meet SEVT TEC classification when ‘remnant’ status according to the VM Act is met (i.e. canopy cover and height thresholds). Therefore, the combined areas mapped as SEVT within the survey area are all considered SEVT TECs.



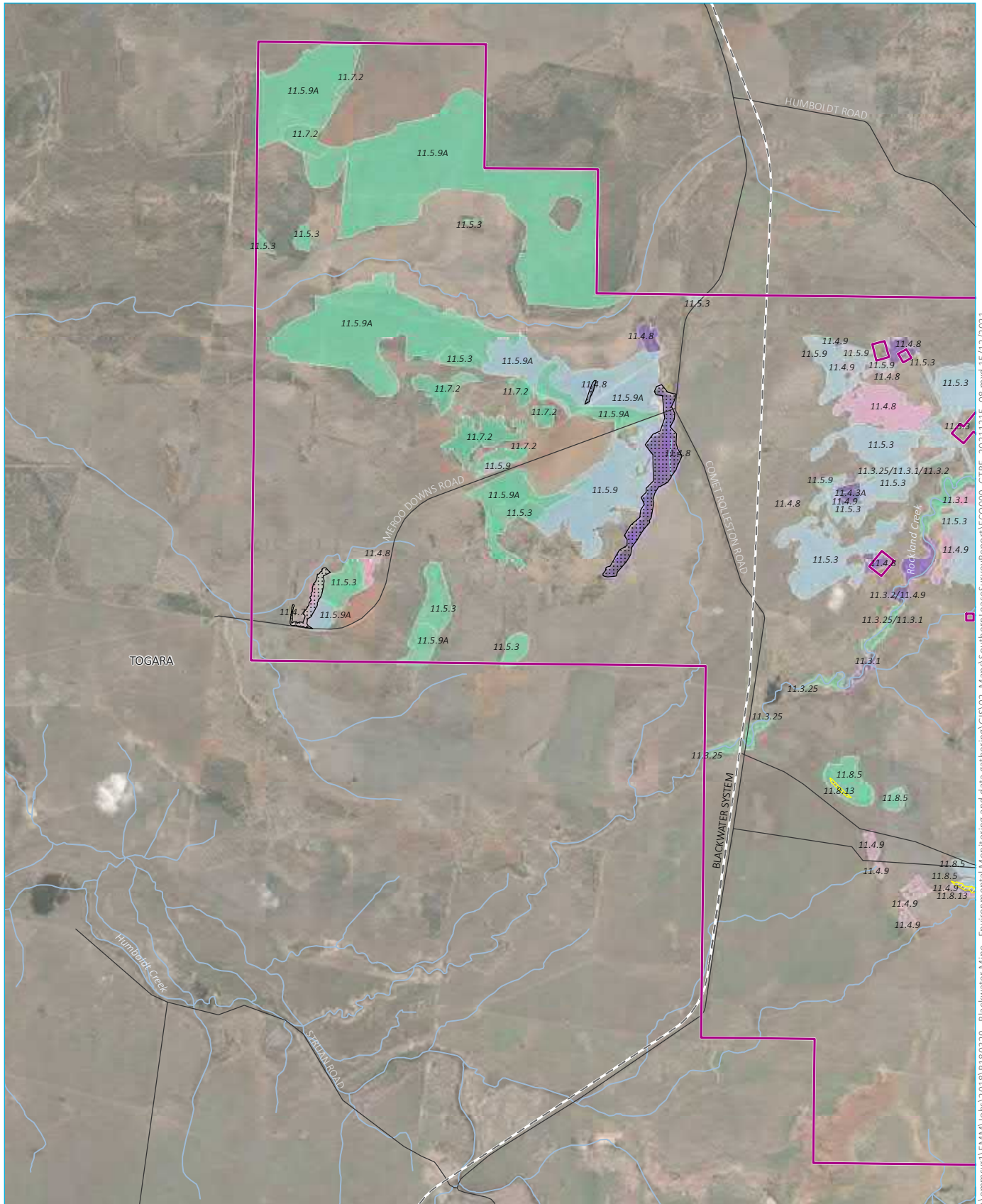
Photograph 5.23 SEVT TEC

➤ **Poplar Box Grassy Woodland on Alluvial Plains TEC**

Thirteen TEC assessments were conducted for the Poplar Box TEC. Poplar Box communities along Rockland Creek exhibited areas with the required canopy dominance of *Eucalyptus populnea*. However, Buffel Grass dominated the ground layer with a coverage of approximately 90% (Photograph 5.24). Other non-native species, including Guinea Grass and Parthenium weed, were also present in the ground layer. Poplar Box TEC condition thresholds state that if a patch contains less than 50% native ground cover, the patch must also have more than 20 native perennial species in the ground cover, more than 10 mature trees per hectare with a DBH greater than 30 cm and smaller trees suggestive of periodic recruitment. As ground cover was dominated by non-native species, and the patches did not meet the other TEC criteria, all vegetated areas where Poplar Box TEC assessments were completed within the survey area do not meet TEC status.

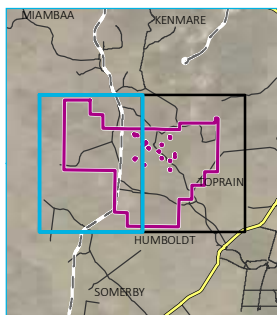
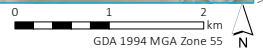


Photograph 5.24 Poplar Box community with Buffel Grass infestation



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Source: EMM (2020); DNRME (2020)



KEY

- Survey area
- Rail line
- Major road
- Minor road
- Watercourse/drainage line
- Threatened ecological communities**
- Brigalow
- Semi-evergreen vine thicket

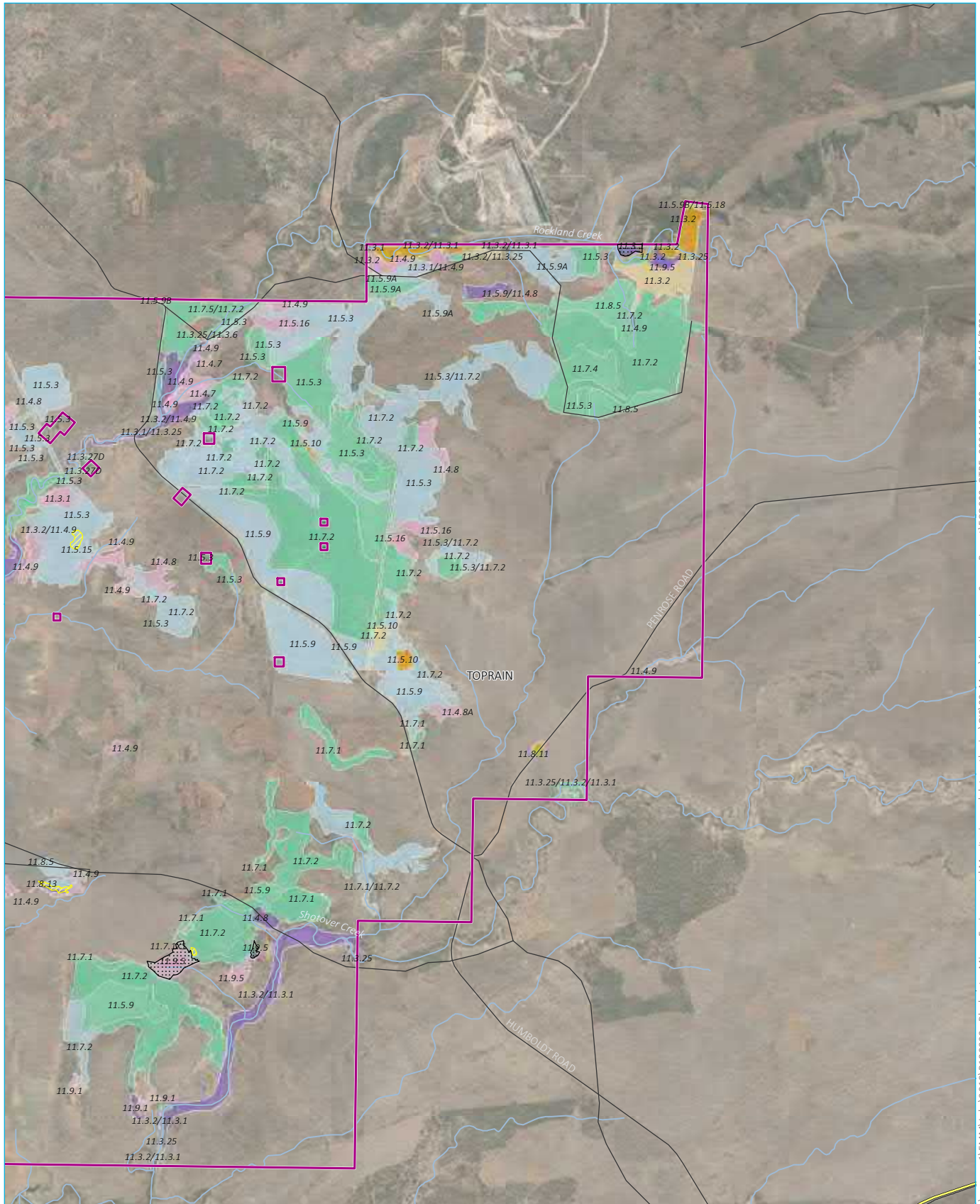
Ground-truthed regional ecosystems

- Remnant - endangered
- Regrowth - endangered
- Remnant - least concern
- Regrowth - least concern

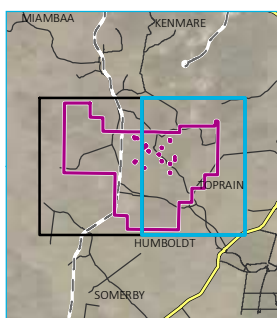
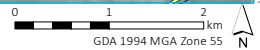
Ground-truthed regional ecosystems - map 1 of 2

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Southern lease field ecology survey report
Figure 5.10





Source: EMM (2020); DNRME (2020)



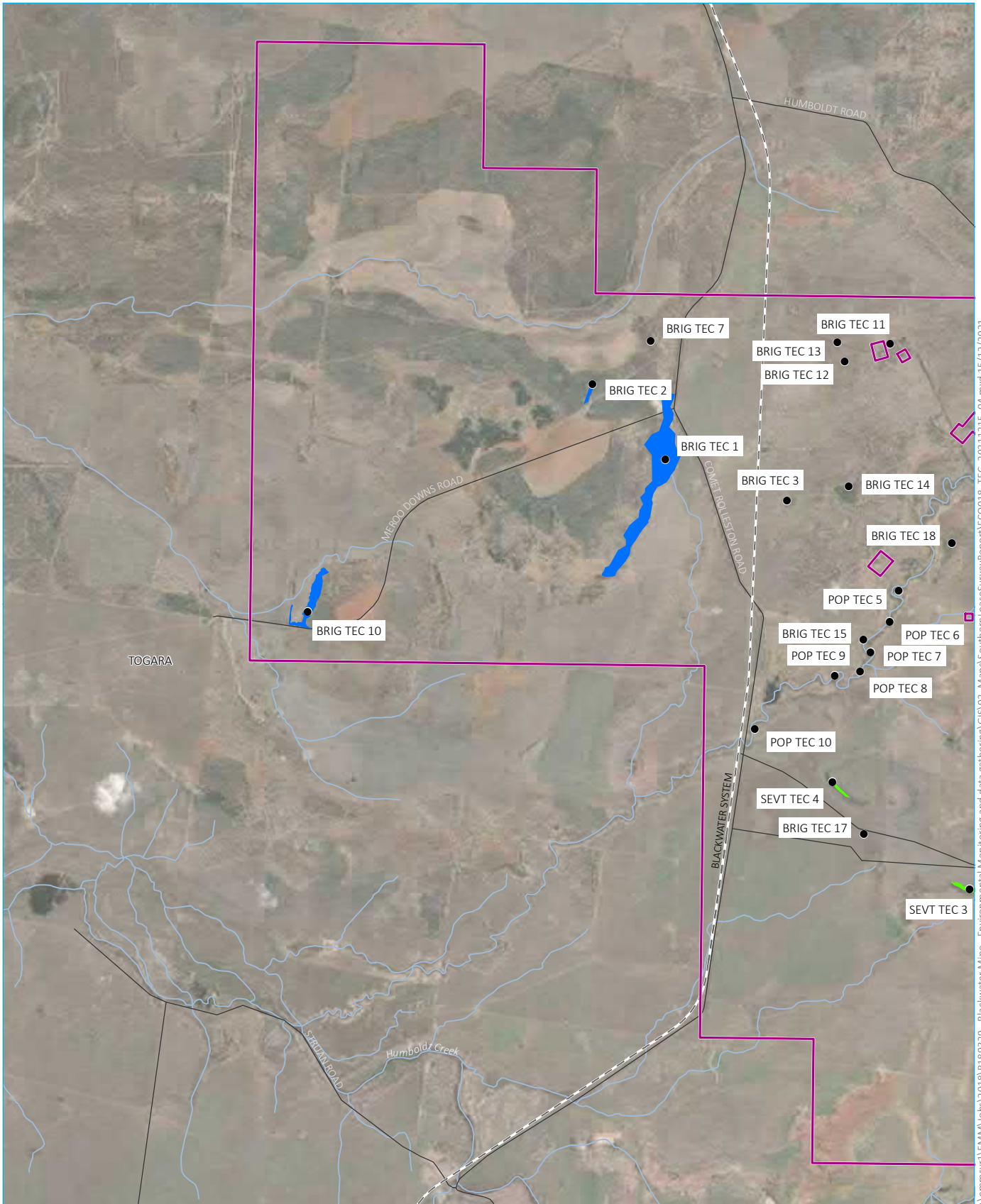
- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - Threatened ecological communities**
 - Brigalow
 - Semi-evergreen vine thicket
- Ground-truthed regional ecosystems**
 - Remnant - endangered
 - Regrowth - endangered
 - Remnant - of concern
 - Regrowth - of concern
 - Remnant - least concern
 - Regrowth - least concern

Ground-truthed regional ecosystems - map 2 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.10

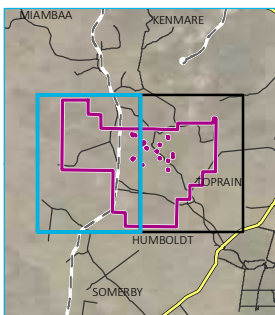
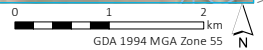


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Source: EMM (2021); DNRME (2021)

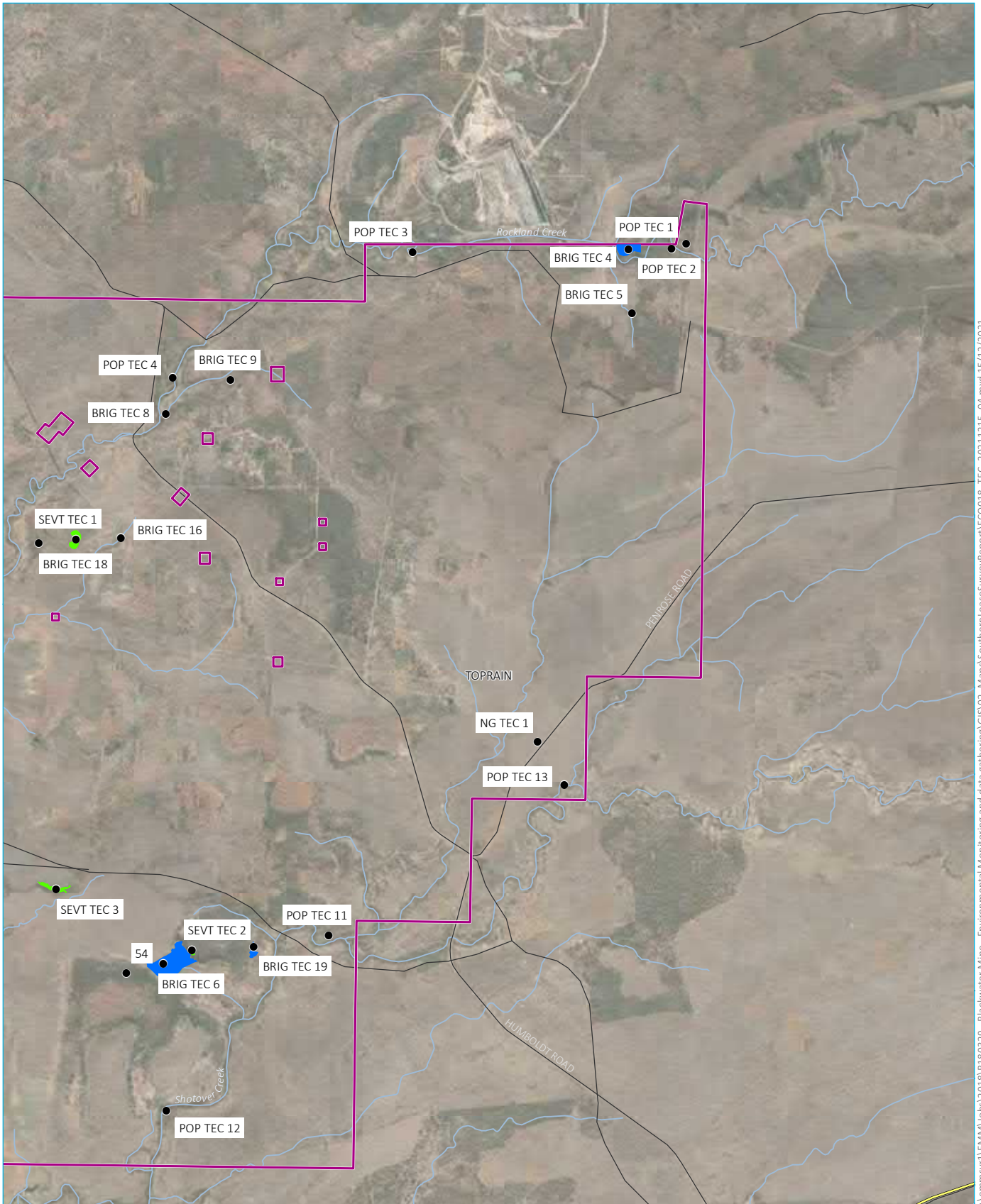


- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - TEC assessment site
- Threatened ecological communities**
- Brigalow
 - Semi-evergreen vine thicket

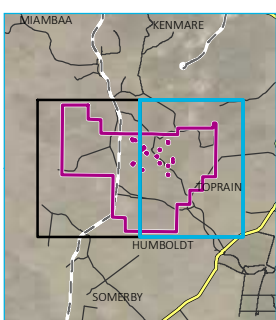
Threatened ecological communities
map 1 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.11

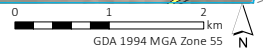




Source: EMM (2021); DNRME (2021)



- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - TEC assessment site
 - Threatened ecological communities
 - Brigalow
 - Semi-evergreen vine thicket



Threatened ecological communities
map 2 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.11



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ii Habitat quality assessments

Habitat quality assessments were completed at 11 survey sites. Habitat quality assessments were undertaken based on the Guide to determining terrestrial habitat quality: A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy Version 1.2 April 2017 (DEHP 2017).

Habitat quality assessments undertaken following this method enable a consistent assessment of habitat quality at an impact site, followed later at an offset site to quantify and compare scores. Habitat assessment is based on a combination of site condition, site context and can include a species habitat index (the ability of a site to support a species).

The final calculated score is ranked out of 10 where a score of 10 would represent a fully intact high quality habitat, 4 - 6 indicating good quality or medium value habitat, and 1 representative of a completely cleared area.

The eleven polygons assessed scored between 6 and 7, indicating moderate to good habitat quality across the sites. Most patches were affected by a lack of large trees which significantly lowered scoring outcomes. All sites showed evidence of disturbance either by cattle grazing, previous vegetation clearance, or weed encroachment. All forms of these disturbances contributed to lower score totals across the survey sites. Commonly recorded weeds in these areas consisted of Buffel Grass, Rubber Vine and Guinea Grass (*Megathyrsus maximus*).

The results of the habitat quality assessments following the Queensland Government toolkit are summarised below in Table 5.13 with full results published in Appendix H.

Table 5.13 Habitat quality assessment results

Site number	Certified mapped RE	Ground-truthed RE	Habitat quality score
46	11.4.8	11.4.8	7
47	11.4.8	11.4.8	7
48	11.5.3/11.4.8	11.5.9	6
49	Non-remnant	11.7.1	7
53	Non-remnant	11.3.2	7
55	11.9.5a	11.7.2	7
57	11.4.8/11.4.9a	11.7.2	6
58	Non-remnant	11.3.2	6
61	11.4.8/11.4.9a	11.7.1	7
62	Non-remnant	11.7.2	6
63	Non-remnant	11.7.2	7

iii Pest flora species

Weed species were widespread across the survey area. A total of seven Category 3 species listed under the Biosecurity Act were recorded including, *Harrisia Cactus (Harrisia martinii)*, *Parkinsonia Weed (Parkinsonia aculeata)*, *Parthenium*, *Prickly Pear (Opuntia stricta)* and *Velvety Tree Pear (Opuntia tomentosa)*.

Prickly Pears (*Opuntia spp.*) were common in Brigalow communities and *Harissia Cactus* were common in many areas of regrowth vegetation and pasture. *Parkinsonia* was recorded adjacent to several dams and wetlands.

Other non-listed introduced flora species were also recorded with the most numerous and widespread being the pastoral species of Buffel Grass which formed vast monoculture-like communities through cleared areas and

invaded almost all remaining patches of native vegetation. Green Panic Grass was also widespread among pastoral areas and within Acacia woodlands.

Most of the survey area is highly disturbed with a network of vehicle tracks traversing the properties along with persistent cattle grazing. These factors enhance the ability for weed species to propagate and increase the prevalence of weeds across the survey area.

iv CEEVNT flora observations

Although no high-risk trigger mapped areas were present within the survey area at the time of survey, informal random meanders were performed in areas of suitable habitat for CEEVNT flora species and observations made during vegetation community surveys. Two CEEVNT flora were recorded, *Solanum elachophyllum* and *Bertya opposens*, and are discussed in further detail below. The sighting locations are shown in Figure 5.12.

a *Solanum elachophyllum*

This species is classified as endangered under the NC Act. It is a small shrub with a maximum height of approximately 0.4 m and can be distinguished from other *Solanum* species by the very small leaves (Photograph 5.25). *Solanum elachophyllum* is endemic to Queensland with its natural distribution limited to the Leichardt district, confined to the sub-coastal area between Theodore and Middlemount. There are several records of the species east of Emerald, around the township of Blackwater and south to Moura. The total size of these populations is unknown. In this area it occurs almost exclusively on cracking clay soils in association with Brigalow communities including either *Eucalyptus thozetiana* or Dawson Gum (*Eucalyptus cambageana*). The main threatening processes include vegetation clearance, habitat alteration and invasive weed encroachment, particularly introduced pasture species such as Buffel Grass (DES 2020m).

This species was recorded at 31 separate locations across the survey area (Photograph 5.25) most frequently on clay or loamy soils in remnant and non-remnant vegetation in association with Brigalow, Blackwood (*Acacia argyrodendron*), or Australian Willow (*Geijera parviflora*). A large number of individuals were identified in non-remnant vegetation. Populations at each site ranged between 7 and 280 individuals with a total population of approximately 1,675 in the survey area (Table 5.14).

Table 5.14 *Solanum elachophyllum* record details

Ground-truthed regional ecosystem	Separate estimated population numbers	Estimated number of individuals
11.4.8	35, 45, 21, 15, 140	256
11.7.1/11.7.2	32, 7, 19	58
11.9.5	80, 10, 45, 100, 75, 15, 70, 9, 10, 13, 120, 40, 23, 60, 35, 24,	729
Non-remnant vegetation	82, 10, 130, 60, 280, 10, 60	632



Photograph 5.25 *Solanum elachophyllum*

b *Bertya opposens*

This species is classified as Vulnerable under the EPBC Act. It is a shrub growing to 4 m tall with its branches and stems densely covered with whitish to brown intertwined hairs (Photograph 5.26). The species occurs in Queensland and New South Wales. In Queensland, it is widely distributed within an area bounded by Emerald in the north and Charleville in the west. There are records in Blackwater Mine South, and in Amaroo State Forest. The total size of these populations is unknown. *Bertya opposens* has been recorded in a variety of habitats including lancewood woodland, mallee woodland, Eucalypt/Acacia open forest and semi-evergreen vine thicket. The main threats to this species include grazing, clearing and drought (DAWE 2020c).

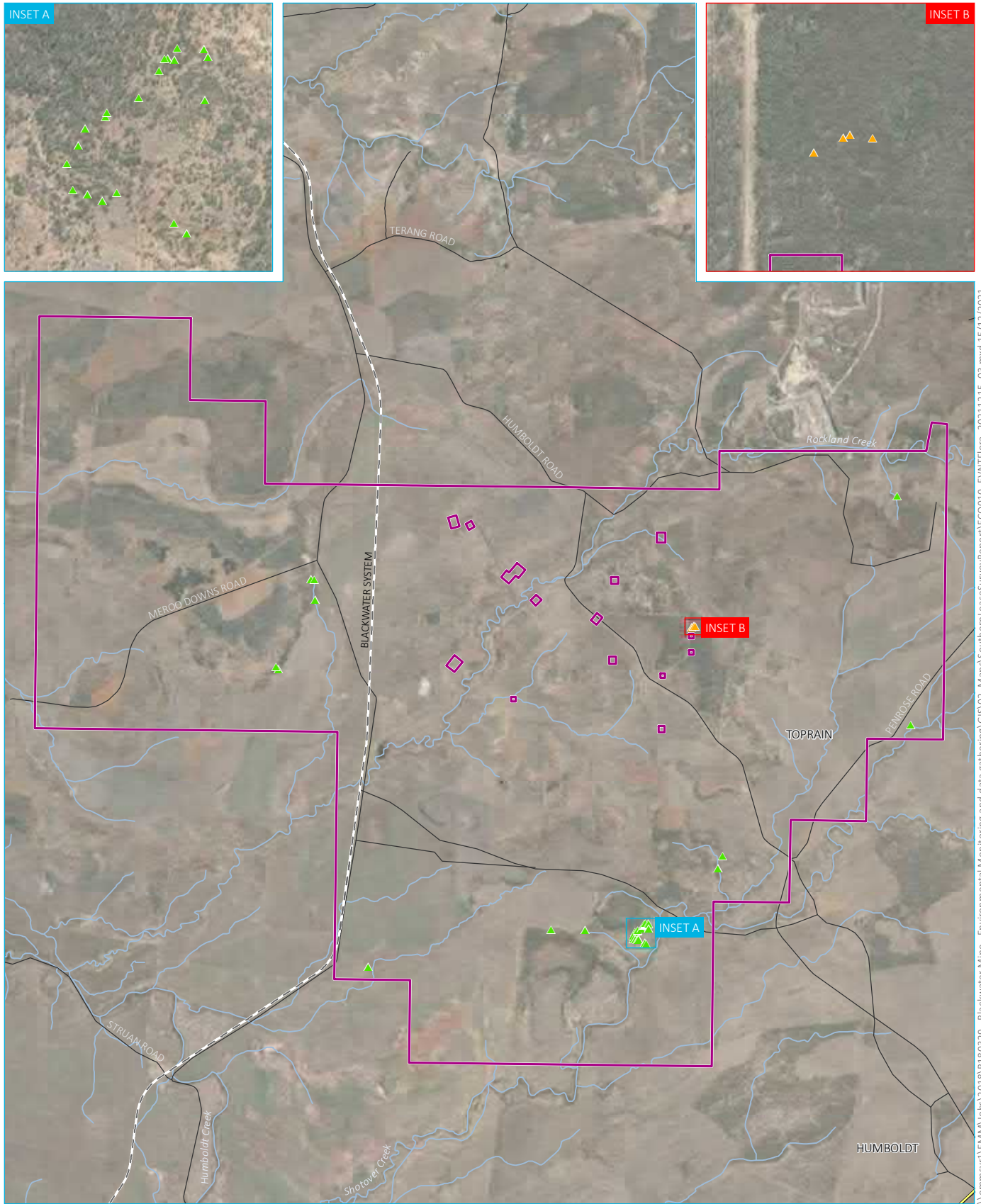
One patch of *Bertya opposens* was recorded in the survey area. Fourteen individuals were identified on remnant Acacia woodland within the shrub layer. It occurred in association with *Erythroxylum australe*, *Croton phebalioides* and *Geijera parviflora*.

Bertya opposens was also found just outside the survey area in separate surveys by EMM during 2018, in high densities along the periphery of disturbed areas in association with Lancewood dominated communities of RE11.7.2, particularly along vehicle tracks and other forms of ground disturbance. Most populations found consisted of varying age groups ranging from seedlings through to mature plants and in healthy condition.

Based on the areas where it was observed, and its abundance, it is likely there are additional populations of the species in areas that were not surveyed during this survey program. It is predicted the species will be restricted to Lancewood communities particularly where minor disturbance has occurred.



Photograph 5.26 *Bertya oppositifolia*



Source: EMM (2020); DNRME (2020)

KEY

- Survey area
- Rail line
- Major road
- Minor road
- Watercourse/drainage line

- EVNT flora observations**
- ▲ *Bertya opposens*
 - ▲ *Solanum elaeagnifolium*

0 1 2 km
GDA 1994 MGA Zone 55

EVNT flora records



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v Other potential CEEVNT species

Based on consideration of the desktop assessment results and field surveys, a more detailed evaluation has been completed to refine the likelihood of occurrence that TECs and flora species under the EPBC Act and NC Act would occur in the survey area that were listed in Sections 4.4 and 4.5.

Definitions used for the refined likelihood of occurrence (Appendix D) are described below:

1. **Known** – the species or ecological community has been observed within the survey area either during historical surveys or during recent seasonal surveys by EMM;
2. **Likely** – suitable high quality habitat for a species occurs within the survey area and species records are present within the study area;
3. **Potential** – potential habitat for a species occurs within the survey area, but there is insufficient information to categorise the species as likely, or unlikely to occur;
4. **Unlikely** – a low to very low probability that a species occurs within the survey area due to the lack of suitable habitat or the survey area is outside of the species or communities known range;
5. **Does not occur** – the species or community will not occur in the survey area (eg marine species in terrestrial survey area or sufficient evidence to demonstrate the value would not occur).

The full likelihood of occurrence assessments are provided in Appendix D and those species identified as 'known' or 'likely' to occur in the survey area are referred to as 'candidate species'. Habitat mapping for candidate species is summarised in Section 5.2.6.

As all vegetation across the survey area has been surveyed in detail, TECs are either known or do not occur.

vi CEEVNT community/flora species profiles and habitat mapping

Known and potential habitat for CEEVNT fauna species (which have been assessed as either 'known' or 'likely' to occur in the survey area) have been mapped across the survey area.

Two TECs and two CEEVNT flora species, *Solanum elaeagnifolium* and *Bertya oppositifolia*, were observed and are classified as 'known to occur'.

It should also be noted that the criteria used has been reviewed against available DAWE definitions or relevant governmental documentation for each species. Where this has been applied is specified by species in the relevant subsections below.

a Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC

➤ Legal status

Listed as Endangered under the EPBC Act.

➤ Relevant departmental documents

The following documents were considered in the preparation of this report:

- Community profile on SPRAT database: <http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=28>;

- Approved Conservation Advice for the Brigalow (*Acacia harpophylla* dominant and co-dominant) ecological community (DoE 2013b);
- Commonwealth Listing Advice on Brigalow (*Acacia harpophylla* dominant and co-dominant) (TSSC 2001a); and
- Brigalow Regrowth and the *Environment Protection and Biodiversity Conservation Act 1999* Information Sheet (Environment Australia 2001).

There is no Recovery Plan in place for this community.

➤ BHP habitat definition

Not available.

➤ Distribution

The Brigalow TEC extends from south of Charters Towers in Queensland, in a broad swathe east of Blackall, Charleville and Cunnamulla, and south to northern New South Wales near Narrabri and Bourke. In Queensland, the TEC occurs predominantly within the Brigalow Belt North, Brigalow Belt South, Darling Riverine Plains and Southeast Queensland bioregions, with smaller amounts in the Mitchell Grass Downs, Mulga Lands and Einasleigh Uplands bioregions (DAWE 2021a).

➤ Ecology and habitat

The Brigalow TEC is characterised by the presence of Brigalow (*Acacia harpophylla*) as one of the most abundant tree species. Brigalow is either, dominant in the tree layer, or co-dominant with other species – notably Belah (*Casuarina cristata*), other species of *Acacia*, or species of *Eucalyptus*. The Brigalow TEC has a considerable range of vegetation structure and composition united by a suite of species that tend to occur on acidic and salty clay soils (DoEE 2013). In Queensland the dominant soil type is cracking clay. The ground layer is typically sparse, and includes a variety of grasses and chenopods (Butler. 2007).

➤ Important populations

Within Queensland, 34 reserves contain remnant Brigalow TEC, the greatest extent of which is in Carnarvon National Park - 40% of the reserved Brigalow TEC in Queensland (Butler, 2007). However, 90% of extant Brigalow TEC occurs outside protected areas, with particularly important “off-reserve” areas located in state forests such as Yuleba, Junee, Blair Atholl and Barakula, with small remnants particularly including advanced regrowth also important (such as areas between Dysart and Nebo (Butler, 2007).

➤ Occurrence in the survey area

Six patches totalling 104.8 ha were mapped within the survey area. Patches mainly consisted of open forest on fine-grained sedimentary rocks with co-dominant Poplar Box (*Eucalyptus populnea*) in some areas. 66 ha were remnant while 31.64 ha were regrowth Brigalow TEC. Some patches contained Buffel Grass (*Cenchrus ciliaris*), however abundance was low in these areas and therefore were within TEC thresholds.

Some patches of Brigalow did not meet TEC status due to weed encroachment from Buffel Grass, Parthenium weed (*Parthenium hysterophorus*) and Green Panic Grass (*Megathyrsus maximus*). TEC status was also rejected when Brigalow was not dominant and/or co-dominant in the canopy.

Mapped Brigalow TEC is shown on Figure 5.11.

b Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions TEC (SEVT)

➤ Legal status

Listed as Endangered under the EPBC Act.

➤ Relevant departmental documents

The following documents were considered in the preparation of this report:

- Community profile on SPRAT database: <http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=24>; and
- Commonwealth Listing Advice on Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (TSSC 2001b).

There is no Conservation Advice or Recovery Plan in place for this community.

➤ BHP habitat definition

Not available.

➤ Distribution

The SEVT TEC extends from Townsville to northern New South Wales, mostly associated with the Brigalow Belt bioregion.

➤ Ecology and habitat

The SEVT TEC is associated with areas of rainfall between 500-750 mm annually. It occurs on undulating plains of sedimentary rocks, as well as basalt hills. The floristic composition varies regionally, with species richness decreasing as rainfall decreases or is more seasonal.

➤ Important populations

Within Queensland, 28 protected areas contain remnants of the listed SEVT community (about 22% of the community). The greatest extent (92%) is within five national parks (Bunya Mountains, Carnarvon, Dipperu, Expedition and Palmgrove).

➤ Occurrence in the survey area

Four TEC assessments were conducted for the SEVT TEC. Four patches of SEVT TEC were recorded, totalling to 8.06 ha (Photograph 5.23). SEVT ecological communities were identified on the southern-facing slope of two mesas on Lot 7 SP187934. Species on the mesa slopes included *Terminalia oblongata*, *Alphitonia excelsa*, *Alectryon diversifolius*, *Ventilago viminalis*, *Lysiphyllum caronii*, *Hovea longipes* and *Eremophila mitchellii*. Low coverage of Buffel grass and other weeds was also recorded on these slopes. Another patch of 3.26 ha in size was located within sparse Poplar Box (*Eucalyptus populnea*) woodland on Lot 7 SP187934. Species included *Lysiphyllum hookeri*, *Ventilago viminalis*, *Geijera parviflora*, *Acalypha eremorum*, *Alectryon diversifolius*, *Croton phebaloides* and *Brachychiton rupestris*. The remaining patch was located on basaltic soils and formed a barrier between two other vegetation communities of open grassy woodland (primarily *Corymbia erythrophloia*) and Brigalow. Species composition of this patch was consistent with RE11.7.1x1 and a SEVT community.

All ground-truthed REs associated with SEVT ecological communities meet SEVT TEC classification when 'remnant' status according to the VM Act is met (i.e. canopy cover and height thresholds). Therefore, the combined areas mapped as SEVT within the survey area are all considered SEVT TECs.

Mapped SEVT TEC is shown on Figure 5.11.

c *Solanum elachophyllum*

➤ Legal status

Listed as Endangered under the NC Act.

➤ Relevant departmental documents

Not applicable.

➤ BHP habitat definition

Not available.

➤ Distribution and phenology

Solanum elachophyllum is endemic to Queensland and confined to the central subcoastal part of the state, from Middlemount to Theodore. The species occurs within Junee State Forest and Taunton National Park (DES 2021).

There are several records of the species east of Emerald, around the township of Blackwater and south to Moura. The total size of these populations is unknown.

➤ Ecology and habitat

In this area it occurs almost exclusively on cracking clay soils in association with Brigalow communities including either *Eucalyptus thozetiana* or Dawson Gum (*Eucalyptus cambageana*). Its flowers have been recorded in February, March, July and September and mature fruits in March- May, July and September-October (DES 2021).

➤ Important populations

Important populations are not defined.

➤ Occurrence in the survey area and mapping

Known habitat for *Solanum elachophyllum* is mapped around records of the species in the survey area. The known habitat is extended out to the boundaries of the available suitable habitat in which the record is located.

Potential habitat for the species is represented by all other areas of mapped Brigalow communities in the survey area. Additionally, areas of non-remnant Brigalow communities (regrowth) are included as species habitat including areas associated with pre-clearance mapping. The species was not recorded in these areas, although habitat factors are suitable for its presence.

A total of 226.51 ha of known habitat and 2,101.68 ha of potential habitat is mapped in the survey area for *Solanum elachophyllum*. Habitat mapping is provided on Figure 5.13.

d *Bertya opposens*

➤ Legal status

Listed as Vulnerable under the EPBC Act.

➤ Relevant departmental documents

The following documents were considered in the preparation of this report:

- species profile on SPRAT database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=13792; and
- Approved Conservation Advice for *Bertya opposens* (DoE 2016).

➤ BHP habitat definition

Not available.

➤ Distribution and phenology

This species occurs in Queensland and New South Wales. In Queensland it is widely distributed within an area bounded by Emerald in the north and Charleville in the west, with an outlier near Charters Tower (DAWE 2020c).

Flowers have been recorded between June and August (DAWE 2020c).

➤ Ecology and habitat

The species has been recorded growing in a variety of community types including mixed shrubland, lancewood woodland, mallee woodland, Eucalypt/Acacia open forest with shrubby understorey, Eucalypt/Callitris open woodland and semi-evergreen vine-thicket. The soils are recorded as generally shallow sandy loams or red earths associated mostly with sandstone (DAWE 2020c).

➤ Important populations

Important populations are not defined.

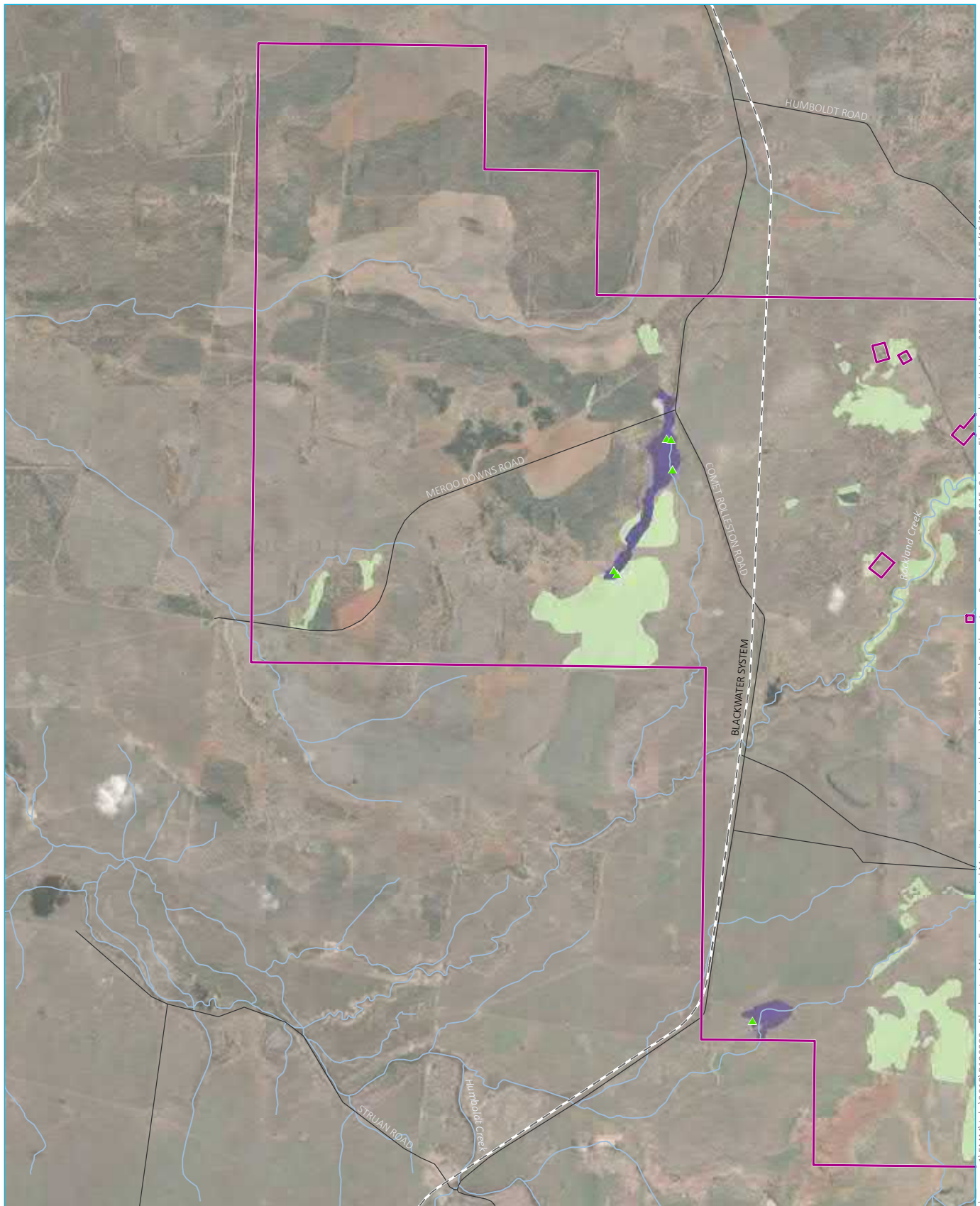
➤ Occurrence in the survey area and mapped habitat

Known habitat for *Bertya opposens* is mapped around records of the species in the survey area. The known habitat is extended out to the boundaries of the available suitable habitat in which the record is located.

Potential habitat for the species is represented by all other areas of mapped RE11.7.2 in the survey area. Additionally, areas of RE11.7.1 and RE11.7.1x1 are included as potential habitat due to suitable geology and community composition, and records to the north of the survey area adjacent to the old Blackwater South mine during surveys carried out by EMM in December 2018. The species was not recorded in areas of potential habitat, although habitat factors are suitable for its presence.

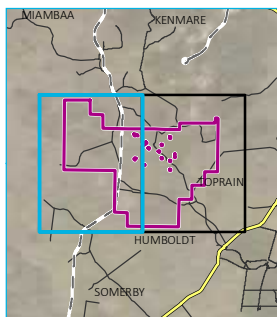
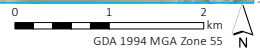
A total of 270.47 ha of known habitat and 1,366.23 ha of potential habitat is mapped in the survey area for *Bertya opposens*. Habitat mapping is provided on Figure 5.14.

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Source: EMM (2021); DNRME (2021)

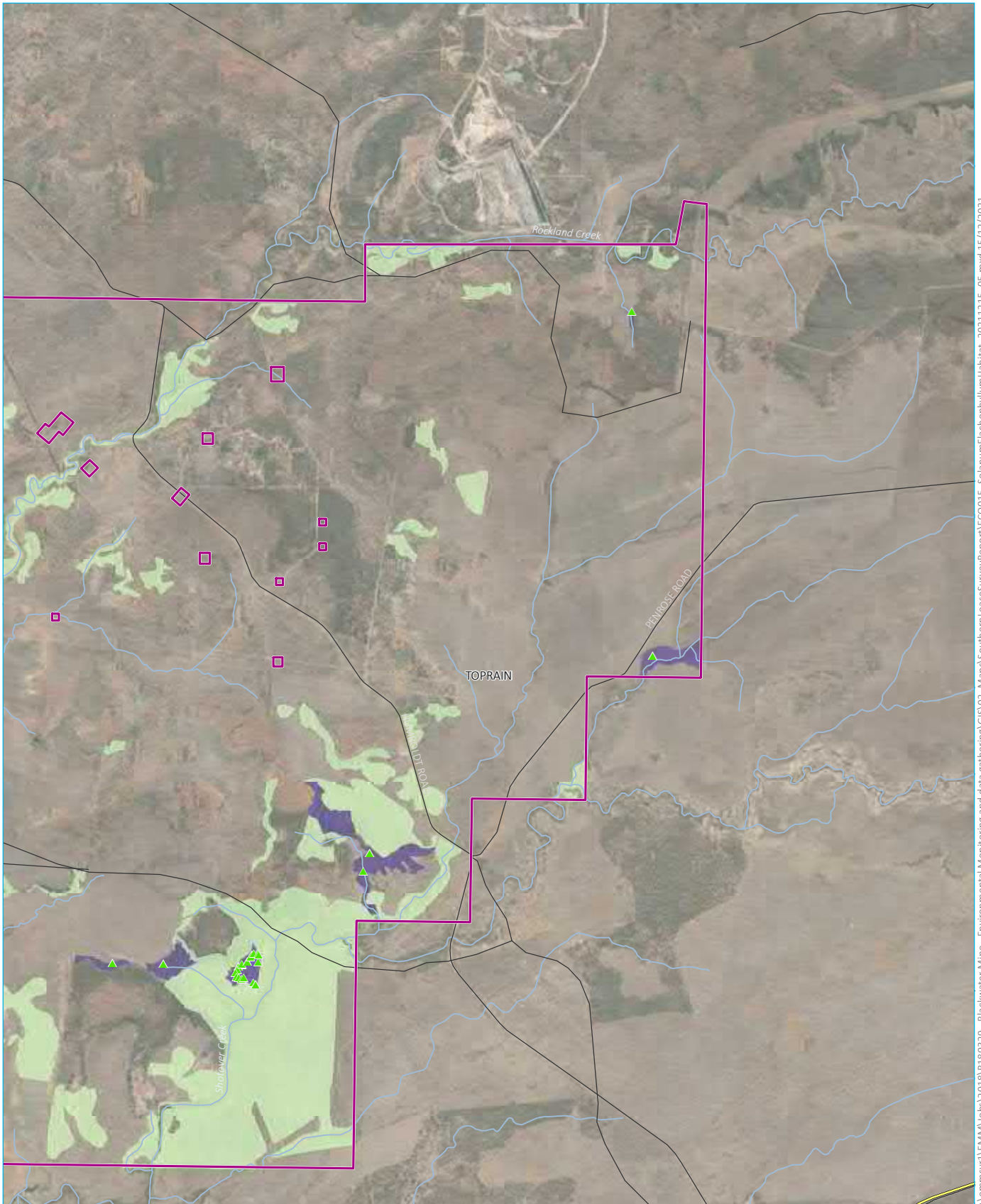


- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - ▲ *Solanum elachophyllum* record
 - Solanum elachophyllum* habitat
Known
 - Potential

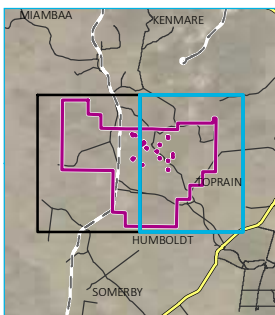
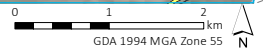
Habitat mapping -
Solanum elachophyllum
map 1 of 2

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Figure 5.13





Source: EMM (2021); DNRME (2021)



KEY

- Survey area
- Rail line
- Major road
- Minor road
- Watercourse/drainage line

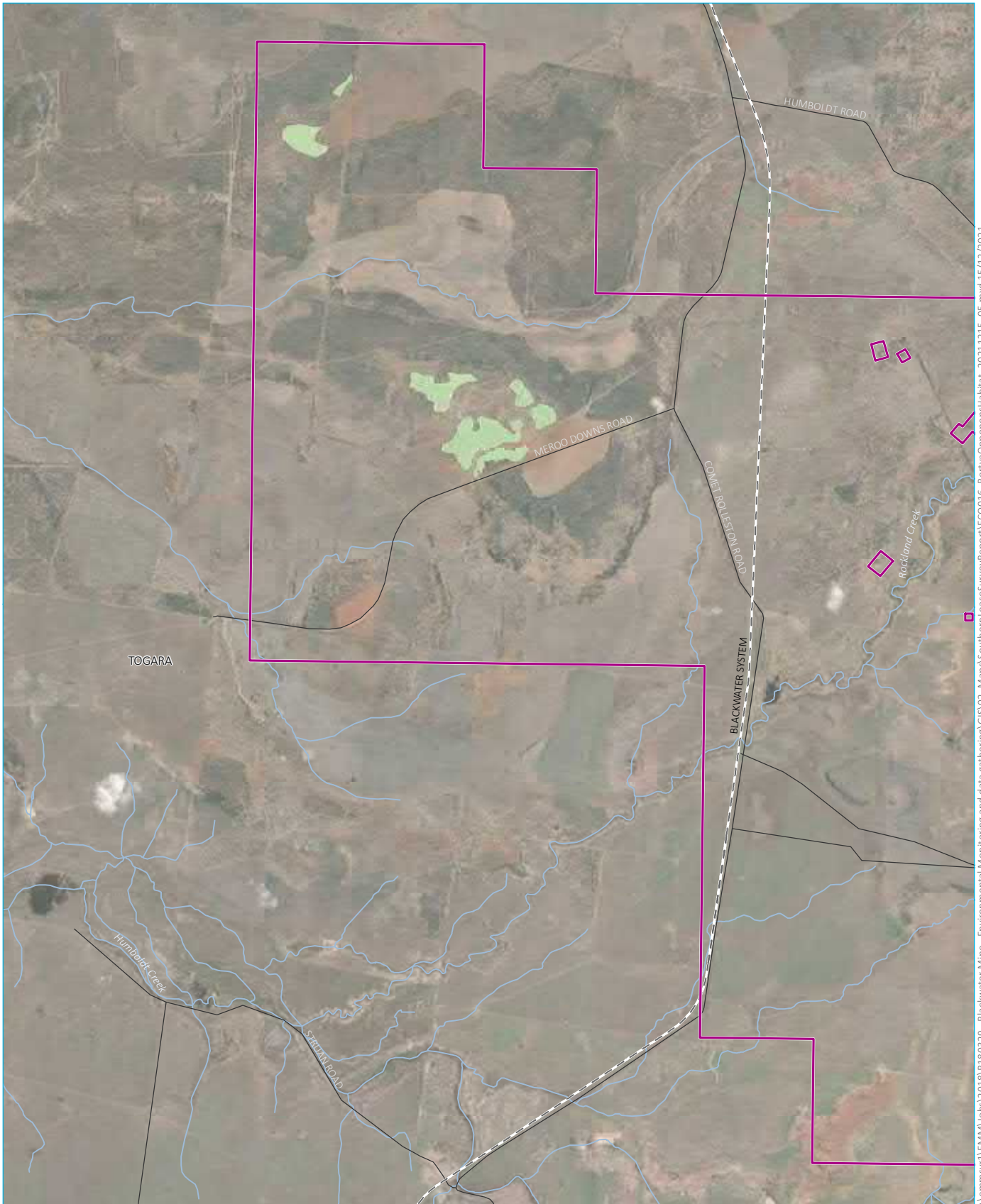
- ▲ *Solanum elachophyllum* record
- Solanum elachophyllum* habitat
- Known
- Potential

Habitat mapping -
Solanum elachophyllum
map 2 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.13

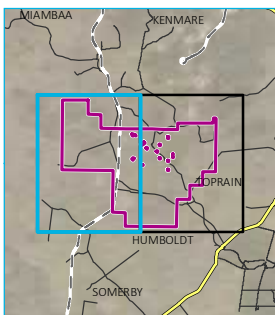


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Source: EMM (2021); DNRME (2021)

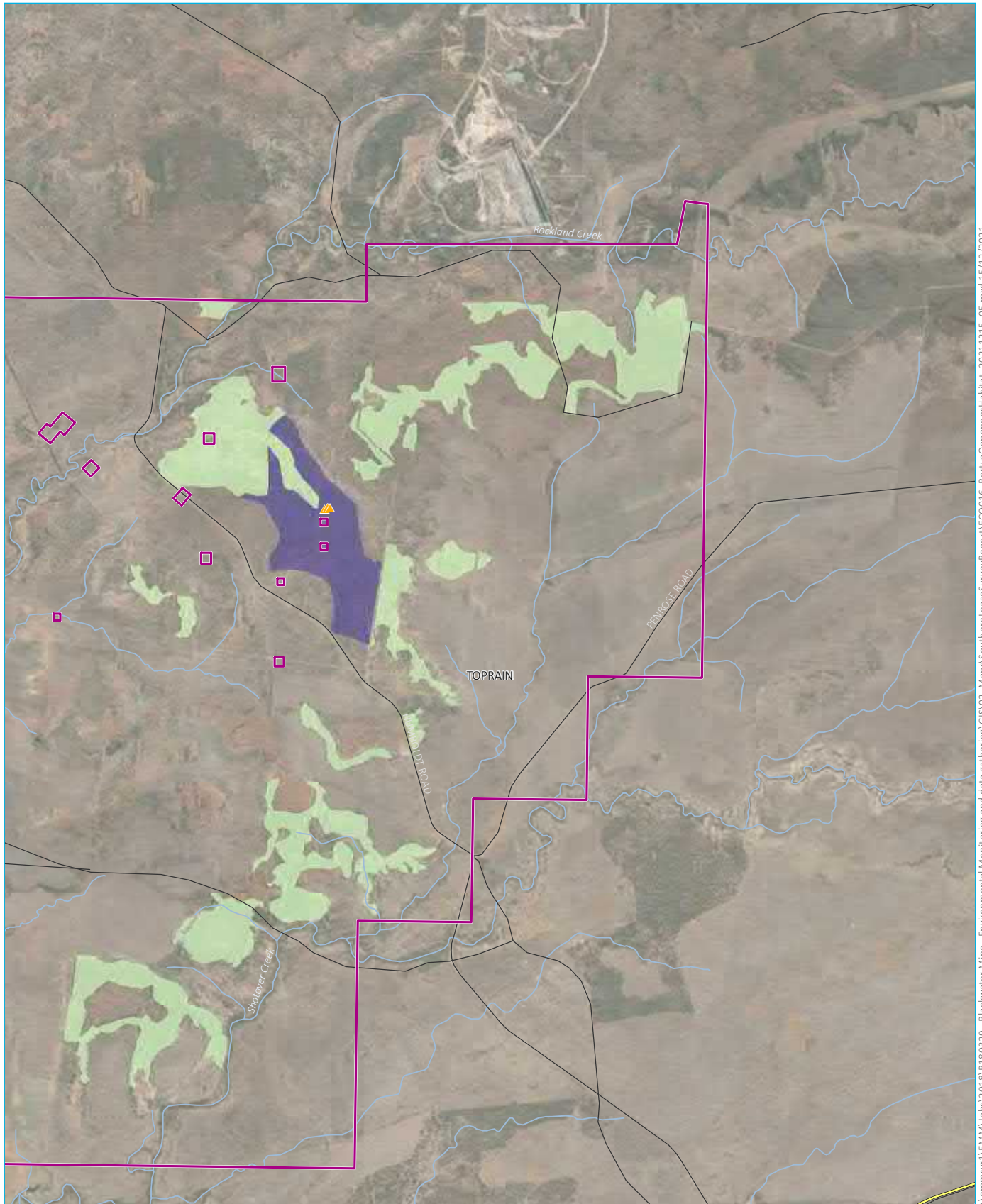


- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - Bertya opposens* habitat
 - Potential

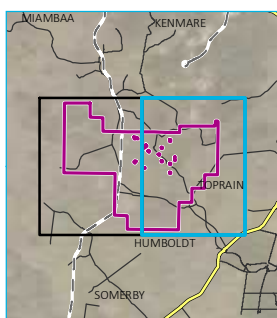
Habitat mapping -
Bertya opposens
map 1 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.14





Source: EMM (2021); DNRME (2021)



- KEY**
- Survey area
 - Rail line
 - Major road
 - Minor road
 - Watercourse/drainage line
 - ▲ *Bertya opposens* record
 - Bertya opposens* habitat**
 - Known
 - Potential

Habitat mapping -
Bertya opposens
map 2 of 2

BHP Billiton Mitsubishi Alliance
Southern lease field ecology survey report
Figure 5.14



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6 Summary of Matters of State Environmental Significance

A list of MSES based on desktop assessments and field survey results is provided in Table 6.1. Appendix J provides Government mapped MSES values. Regulated Vegetation is mapped separately on Figure 4.1 with ground-truthed vegetation mapping provided in Figure 5.10.

Table 6.1 MSES with potential to occur in the Blackwater South Survey Area

MSES	Description of MSES	Present/Absent	Details of MSES
Regulated vegetation	Endangered remnant vegetation (VM Act status).	Present	Patches of remnant Endangered REs occur in the survey area. Certified RE mapping is illustrated in Figure 4.1. Revised ground-truthed mapping is discussed in Section 5.2.1 and shown in Figure 5.10.
	Of Concern remnant vegetation (VM Act status).	Present	Patches of remnant Of Concern REs occur in the survey area. Certified RE mapping is illustrated in Figure 4.1. Revised ground-truthed mapping is discussed in Section 5.2.1 and shown in Figure 5.10.
	Remnant vegetation that intersects mapped wetland	Absent	No mapped remnant vegetation that intersects wetlands in the survey area.
Essential Habitat	Essential habitat is defined under the VM Act as the habitat of endangered, vulnerable or near-threatened wildlife prescribed under the NC Act. Essential habitat is mapped over areas of vegetation that are likely to contain either three or more essential habitat factors or the relevant species for which the area is mapped at any stage of its life cycle.	Present	Areas of essential habitat occur in the survey area. Refer Appendix A and Section 4.12. Essential habitat is for the Ornamental Snake. Essential habitat is mapped in Appendix J.
Watercourse vegetation	Remnant vegetation with set buffer distances of a stream order.	Present	Watercourse vegetation is limited in the survey area. Watercourse vegetation based on GTRE is provided in Appendix J.
Connectivity		-	Proposed impacts to connectivity of remnant vegetation in the area will have to be analysed using DES's 'landscape fragmentation and connectivity' tool based on the proposed vegetation clearing footprint. Connectivity is limited in the survey area due to remnant vegetation being smaller, linear patches and fragmented in nature.

Table 6.1 MSES with potential to occur in the Blackwater South Survey Area

MSES	Description of MSES	Present/Absent	Details of MSES
Wetlands	Wetlands in a wetland protection area or wetlands of high ecological significance shown on the map of referable wetlands under the Environmental Protection Regulation 2008 (note this has been replaced with the map of Queensland wetland environmental values under the Environmental Protection Regulation 2019). Wetlands and watercourses in high ecological value waters identified in the Environmental Protection (Water) Policy 2009, schedule 1.	Present	Two wetlands of 'high ecological significance' (HES) or 'high ecological value waters' under EP Act, which are prescribed as MSES, occur within the survey area.
Strategic Environmental Area	A designated precinct, in a strategic environmental area under the <i>Regional Planning Interests Regulation 2014</i> , schedule 2, part 5, s15(3)	Absent	There are no Strategic Environmental Areas (SEA) within the survey area. SEAs include Cape York Peninsula, the Gulf Country, the Chanel Country, Fraser Island and Hinchinbrook Island and will not require further consideration.
Protected Wildlife Habitat	Endangered, vulnerable and Special Least Concern species listed under <i>Nature Conservation Act 1992</i> (NC Act).	Present	A number of threatened flora and fauna species have potential to occur in the survey area. These are summarised in Appendix D and habitat mapping for candidate species is provided in Section 5.3.1.
Protected Areas	Protected areas (including all classes of protected area except coordinated conservation areas) under the <i>Nature Conservation Act 1992</i> .	Absent	Not located in the survey area.
State Marine Park	Marine national park, conservation park, scientific research, preservation or buffer zones under the <i>Marine Parks Act 2004</i> .	Absent	Not located in the survey area.
Declared Fish Habitat Areas	Areas within declared fish habitat areas that are management A areas or management B areas under the <i>Fisheries Regulation 2008</i>	Absent	Not located in the survey area.
Fish Passage	Many waterways are mapped within the survey area. Where works are proposed across waterways such as access roads that may have an impact on fish passage need to be assessed. Watercourses range from low to major risk depending on the catchment.	Present	There are watercourses of low, moderate, high and major risk of impact to fish passage in the survey area. Refer Appendix J for location of fish passage.
Marine Plants	Marine plants under the <i>Fisheries Act 1994</i> (excluding marine plants in an urban area)	Absent	Marine plants are not located in the survey area.

Table 6.1 MSES with potential to occur in the Blackwater South Survey Area

MSES	Description of MSES	Present/Absent	Details of MSES
Legally secured offset area	Legally secured offset areas as defined under the <i>Environmental Offsets Act 2014</i>	Absent	There are no legally secured offset areas within or near the survey area.

7 Conclusion

Habitat condition across the survey area is varied, with remnant vegetation including riparian communities along significant watercourses that intersect the survey area (including Shotover Creek and Rockland Creek) being of higher ecological condition. These watercourses are fringed predominately by riparian woodlands such as RE11.3.25 consisting of large Blue Gum species. These areas offer important vegetated corridors in a largely disturbed landscape and provide foraging resources for wildlife including the Koala.

Other remnant vegetation includes eucalypt and acacia dominated communities (remnant and regrowth areas) with Acacia communities being characterised as small fragmented areas of regrowth surrounded by grazing land or restricted to 'jump up' areas in the central portion of the survey area. Acacia communities generally consisted of Brigalow (*Acacia harpophylla*), Lancewood (*A. shirleyi*), or Bendee (*A. catenulata*) dominated communities, with emergent eucalypts such as Dawson Gum (*Eucalyptus cambageana*).

Cleared areas occupy large areas of the survey area and are currently utilised for agricultural activities, including grazing and cultivation. With limited structural and floristic diversity, non-remnant habitats support limited fauna diversity in comparison to remnant habitat. Within these cleared areas, extensive areas of gilgai depressions are widespread across the survey area particularly on clay soils but persist in a highly degraded state exhibiting shallow, open gilgai with little remaining vegetation. These gilgai have been degraded through native vegetation clearance, a resultant lack of fallen ground timber microhabitat. However, several individuals of the vulnerable listed Ornamental Snake were recorded in these habitats whilst spotlighting in November 2019 and March 2020.

Results of the field ecology surveys have found that while the southern lease survey area has large disturbed areas of poor condition, there are some areas which support ecological values of significance. The key ecological values identified during the flora, fauna and habitat assessments include:

a Vegetation communities

A total of 10 Endangered REs (VM Act and BD status) were ground-truthed across the field surveys, with eight Brigalow associated communities and four SEVT communities. The remaining vegetation within the survey area consisted of nine of concern REs (BD status) and eight no concern at present REs (BD status).

Remnant areas fringing creek lines are generally narrow linear tracts but hold some biodiversity value, predominately in the form of connectivity through the mostly cleared landscape. Although some of the sites assessed presented in relatively good condition, all possessed some level of weed encroachment, most commonly by Buffel Grass dominating the ground layer.

Remnant eucalypt woodlands exhibited a low density of hollow bearing trees and hollow logs and woody debris, representing potential fauna breeding places. Remnant Acacia woodland contained some emergent eucalypt species and abundant fallen woody debris for potential fauna breeding places. Some of these acacia dominated communities with emergent eucalypts were found to support Koala populations.

b Protected plants

Informal meanders identified two species of CEEVNT flora – *Solanum elachophyllum* and *Bertya opposens*. Approximately 1,675 *Solanum elachophyllum* individuals at 32 separate sites, mainly in Brigalow woodland, were found within the survey area. Fourteen individuals of *Bertya opposens* was identified in a patch in Acacia woodland.

Further investigation into the size of other local populations and threats will be required to inform future impact assessments and understand the importance of the populations within the Blackwater South survey area.

c Fauna habitat assessments

Habitat assessments were completed at 103 sites. Specific habitat attributes were analysed at each site to confirm suitable habitat features for particular CEEVNT species and provide justification for the potential presence or absence of a species due to the presence or absence of suitable microhabitats.

Some habitat observed across the survey area is considered of relative low quality due to broad-scale vegetation clearing, cattle grazing, weed encroachment and proximity of mining operations. Patches of suitable fauna habitat is available in the survey area as riparian vegetation, Acacia woodland, gilgai habitat and rocky escarpments.

Known and potential habitat for CEEVNT fauna species has been mapped across the site based on the presence of suitable habitat features and condition.

d CEEVNT fauna species

Four CEEVNT, one special least concern and one migratory fauna species were recorded during field surveys. Recorded CEEVNT species comprise Ornamental Snake, Koala, Golden-tailed Gecko and White-throated Needletail.

Ornamental Snake were found in areas of gilgai throughout the survey area. Microhabitat was available at some areas in the form of fallen woody debris while other gilgai were isolated in expanses of Buffel Grass and were quite degraded. Most gilgai patches provided suitable habitat for the Ornamental Snake.

Koala were recorded from direct and indirect observations in both seasonal surveys. Koala were recorded in Narrow-leaved Ironbark, Queensland Peppermint and Poplar Box within Acacia woodland. Another was recorded along Shotover Creek in Queensland Blue Gum. Scats were abundant underneath eucalypt species within the Acacia woodland. Scats and scratches were identified along Rockland Creek and Shotover Creek on Queensland Blue Gums.

Three Golden-tailed Gecko individuals were recorded within Lancewood woodland during the autumn 2020 survey. The woodland provided abundant habitat for the species.

Four White-throated Needletail individuals were identified flying over Rockland Creek during the spring 2019 survey.

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Appendix A

Desktop searches

A.1 PMST search results



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: 11/06/20 11:10:32

[Summary](#)

[Details](#)

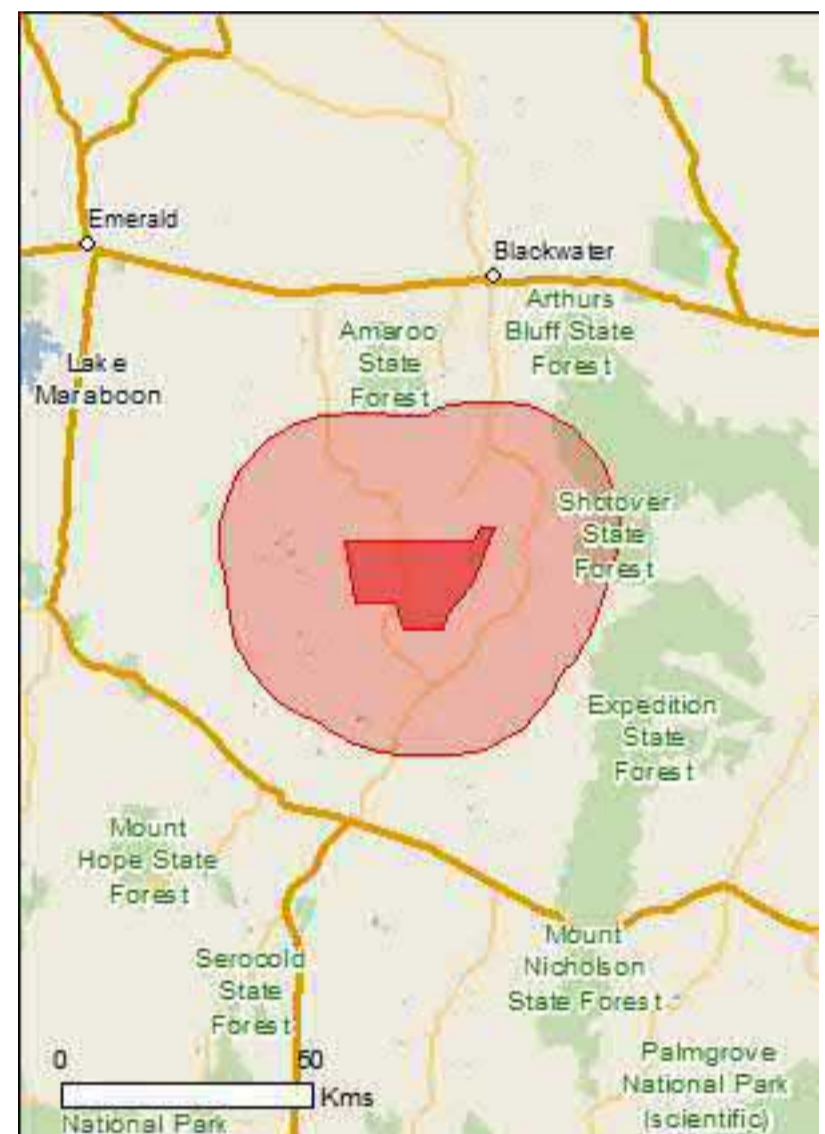
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

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[Coordinates](#)

Buffer: 25.0Km



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](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	6
Listed Threatened Species:	33
Listed Migratory Species:	14

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	20
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	27
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	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
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community may occur within area
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	Community likely to occur within area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area
Weeping Myall Woodlands	Endangered	Community likely to occur within area

Listed Threatened Species

[\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Plants		
Aristida annua [17906]	Vulnerable	Species or species habitat known to occur within area
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat likely to occur within area
Bertya opposens [13792]	Vulnerable	Species or species habitat likely to occur within area
Cadellia pentastylis Ooline [9828]	Vulnerable	Species or species habitat likely to occur within area
Daviesia discolor [3567]	Vulnerable	Species or species habitat known to occur within area
Dichanthium queenslandicum King Blue-grass [5481]	Endangered	Species or species habitat likely to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat may occur within area
Homoranthus decumbens a shrub [55186]	Endangered	Species or species habitat known to occur within area
Macrozamia platyrhachis cycad [3412]	Endangered	Species or species habitat likely to occur within area
Marsdenia brevifolia [64585]	Vulnerable	Species or species habitat may occur within area
Polianthion minutiflorum [82772]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence within area
Solanum dissectum [75720]	Endangered	Species or species habitat known to occur within area
Reptiles		
Delma torquata Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat likely to occur within area
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat known to occur within area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat known to occur within area
Elseya albagula Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat likely to occur within area
Furina dunmali Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area
Rheodytes leukops Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species

[[Resource Information](#)]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [\[Resource Information \]](#)

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [\[Resource Information \]](#)

Name	State
Blackdown Tableland	QLD
Humboldt	QLD
Kenmare	QLD

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
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
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
Lepus capensis Brown Hare [127]		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
Rattus rattus Black Rat, Ship Rat [84]		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
Plants		
Acacia nilotica subsp. indica Prickly Acacia [6196]		Species or species habitat may occur within area
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
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,		Species or species

Name	Status	Type of Presence
Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892] Opuntia spp. Prickly Pears [82753]		habitat likely to occur within area 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
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Vachellia nilotica Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

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

-24.006891 148.616496,-24.010028 148.843776,-23.986191 148.860942,-23.986191 148.882228,-24.077751 148.846522,-24.129147 148.795711,-24.152957 148.791591,-24.150451 148.721553,-24.107212 148.70576,-24.106585 148.635036,-24.008146 148.617869,-24.008146 148.617869,-24.006891 148.616496

Acknowledgements

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

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

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

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

A.2 Wildlife Online search results



Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point

Species: All

Type: Native

Status: Rare and threatened species

Records: All

Date: Since 1980

Latitude: -24.0663

Longitude: 148.7676

Distance: 25

Email: cweerasena@emmconsulting.com.au

Date submitted: Thursday 11 Jun 2020 10:45:55

Date extracted: Thursday 11 Jun 2020 10:50:02

The number of records retrieved = 9

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	5
plants	land plants	Apocynaceae	<i>Cerbera dumicola</i>			NT		2/2
plants	land plants	Mimosaceae	<i>Acacia storyi</i>			NT		1/1
plants	land plants	Myrtaceae	<i>Sannantha brachypoda</i>			V		5/4
plants	land plants	Poaceae	<i>Dichanthium queenslandicum</i>			V	E	1/1
plants	land plants	Poaceae	<i>Aristida annua</i>			V	V	1/1
plants	land plants	Solanaceae	<i>Solanum elachophyllum</i>			E		1/1
plants	land plants	Solanaceae	<i>Solanum dissectum</i>			E	E	3/3
plants	land plants	Surianaceae	<i>Cadellia pentastylis</i>	ooline		V	V	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.3 MSES search results



Queensland Government

Department of Environment and Science

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest
mdl: 155

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 point of interest.

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 values 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.

Please direct queries about these reports to: Planning.Support@des.qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government 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 the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.



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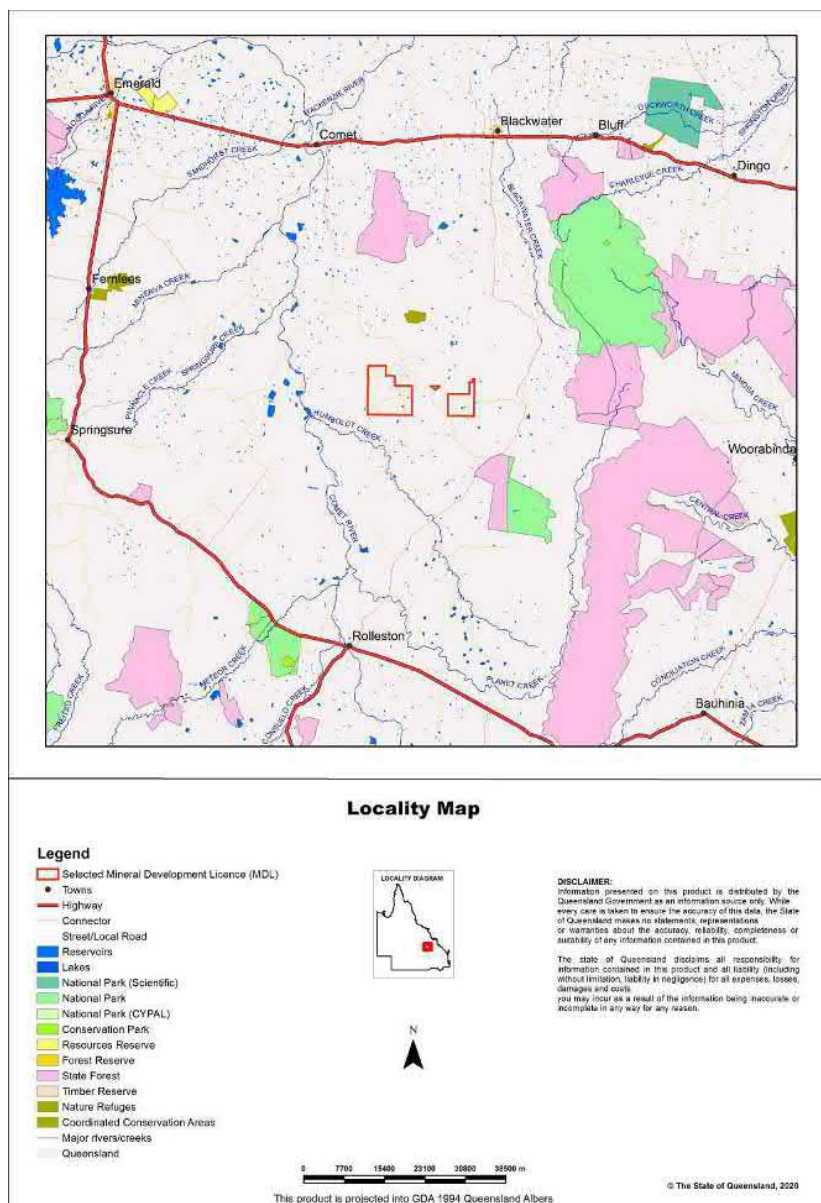
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Assessment Area Details

The following table provides an overview of the area of interest (AOI) with respect to selected topographic and environmental values.

Table 1: Summary table, details for AOI mdl: 155

Size (ha)	8,608.64
Local Government(s)	Central Highlands Regional
Bioregion(s)	Brigalow Belt
Subregion(s)	Isaac - Comet Downs
Catchment(s)	Fitzroy



Matters of State Environmental Significance (MSES)

MSES Categories

Queensland's State Planning Policy (SPP) includes a biodiversity State interest that states:

'The sustainable, long-term conservation of biodiversity is supported. Significant impacts on matters of national or state environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset.'

The MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The SPP defines matters of state environmental significance as:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992* ;
- Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the *Marine Parks Act 2004* ;
- Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;
- Threatened wildlife under the *Nature Conservation Act 1992* and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006;
- Regulated vegetation under the *Vegetation Management Act 1999* that is:
 - Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;
 - Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;
 - Category R areas on the regulated vegetation management map;
 - Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse and drainage feature map;
 - Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;
- Strategic Environmental Areas under the *Regional Planning Interests Act 2014* ;
- Wetlands 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 defined in the Environmental Protection (Water) Policy 2009, schedule 2;
- Legally secured offset areas.

MSES Values Present

The MSES values that are present in the area of interest are summarised in the table below:

Table 2: Summary of MSES present within the AOI

1a Protected Areas- estates	0.0 ha	0.0 %
1b Protected Areas- nature refuges	0.0 ha	0.0 %
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	58.86 ha	0.7%
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways **	0.0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	842.38 ha	9.8%
7b Special least concern animals	0.0 ha	0.0 %
7c i Koala habitat area - core (SEQ)	0.0 ha	0.0 %
7c ii Koala habitat area - locally refined (SEQ)	0.0 ha	0.0 %
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	810.34 ha	9.4%
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	63.85 ha	0.7%
8c Regulated Vegetation - Category R (GBR riverine regrowth)	0.63 ha	0.0%
8d Regulated Vegetation - Essential habitat	775.85 ha	9.0%
8e Regulated Vegetation - intersecting a watercourse **	27.0 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	13.49 ha	0.2%
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(no results)

1b. Protected Areas - nature refuges

(no results)

2. State Marine Parks - highly protected zones

(no results)

3. Fish habitat areas (A and B areas)

(no results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

MSES - Wetlands and Waterways

4. Strategic Environmental Areas (SEA)

(no results)

5. High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values

Natural wetlands that are 'High Ecological Significance' (HES) on the Map of Queensland Wetland Environmental Values are present.

6a. Wetlands in High Ecological Value (HEV) waters

(no results)

6b. Waterways in High Ecological Value (HEV) waters

(no results)

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

MSES - Species

7a. Threatened (endangered or vulnerable) wildlife

Values are present

7b. Special least concern animals

Not applicable

7c i. Koala habitat area - core (SEQ)

Not applicable

7c ii. Koala habitat area - locally refined (SEQ)

Not applicable

Threatened (endangered or vulnerable) wildlife habitat suitability models

Species	Common name	NCA status	Presence
<i>Boronia keysii</i>		V	None
<i>Calyptorhynchus lathami</i>	Glossy black cockatoo	V	None
<i>Casuarium casuarium johnsonii</i>	Sthn population cassowary	E	None
<i>Crinia tinnula</i>	Wallum froglet	V	None
<i>Denisonia maculata</i>	Ornamental snake	V	Core
<i>Litoria freycineti</i>	Wallum rocketfrog	V	None
<i>Litoria olongburensis</i>	Wallum sedgefrog	V	None
<i>Melaleuca irbyana</i>		E	None
<i>Petaurus gracilis</i>	Mahogany Glider	E	None
<i>Petrogale persephone</i>	Proserpine rock-wallaby	E	None
<i>Phascogale cinereus</i>	Koala - outside SEQ*	V	None
<i>Pezoporus wallicus wallicus</i>	Eastern ground parrot	V	None
<i>Taudactylus Pleione</i>	Kroombit tinkerfrog	E	None
<i>Xeromys myoides</i>	Water Mouse	V	None

*For koala model, this includes areas outside SEQ. Check 7c SEQ koala habitat for presence/absence.

Threatened (endangered or vulnerable) wildlife species records

Scientific name	Common name	NCA status	EPBC status	Migratory status
<i>Rostratula australis</i>	Australian painted snipe	E	E	

Special least concern animal species records

(no results)

*Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL).
Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)

Migratory status (M) - China and Australia Migratory Bird Agreement (C), Japan and Australia Migratory Bird Agreement (J), Republic of Korea and Australia Migratory Bird Agreement (R), Bonn Migratory Convention (B), Eastern Flyway (E)

To request a species list for an area, or search for a species profile, access Wildlife Online at:

<https://www.qld.gov.au/environment/plants-animals/species-list/>

Refer to **Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals** and **Map 3b - MSES - Species - Koala habitat area (SEQ)** for an overview of the relevant MSES.

MSES - Regulated Vegetation

For further information relating to regional ecosystems in general, go to:

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

For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:

<https://environment.ehp.qld.gov.au/regional-ecosystems/>

8a. Regulated Vegetation - Endangered/Of concern in Category B (remnant)

Regional ecosystem	Vegetation management polygon	Vegetation management status
11.5.3/11.4.8	E-subdom	rem_end
11.3.2/11.3.25	O-dom	rem_oc
11.5.3/11.5.16	E-subdom	rem_end
11.5.9b/11.5.18	O-subdom	rem_oc
11.4.8/11.4.9a	E-dom	rem_end
11.4.9a	E-dom	rem_end
11.4.8	E-dom	rem_end

8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)

Regional ecosystem	Vegetation management polygon	Vegetation management status
11.3.2/11.3.25	O-dom	hvr_oc
11.4.8/11.4.9a	E-dom	hvr_end
11.5.9b/11.5.18	O-subdom	hvr_oc

8c. Regulated Vegetation - Category R (GBR riverine regrowth)

Regulated vegetation map category	Map number	RVM rule
R	8649	4

8d. Regulated Vegetation - Essential habitat

Values are present

8e. Regulated Vegetation - intersecting a watercourse**

A vegetation management watercourse is mapped as present

8f. Regulated Vegetation - within 100m of a Vegetation Management wetland

Regulated vegetation map category	Map number	RVM rule
B	8649	2

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets

9a. Legally secured offset areas - offset register areas

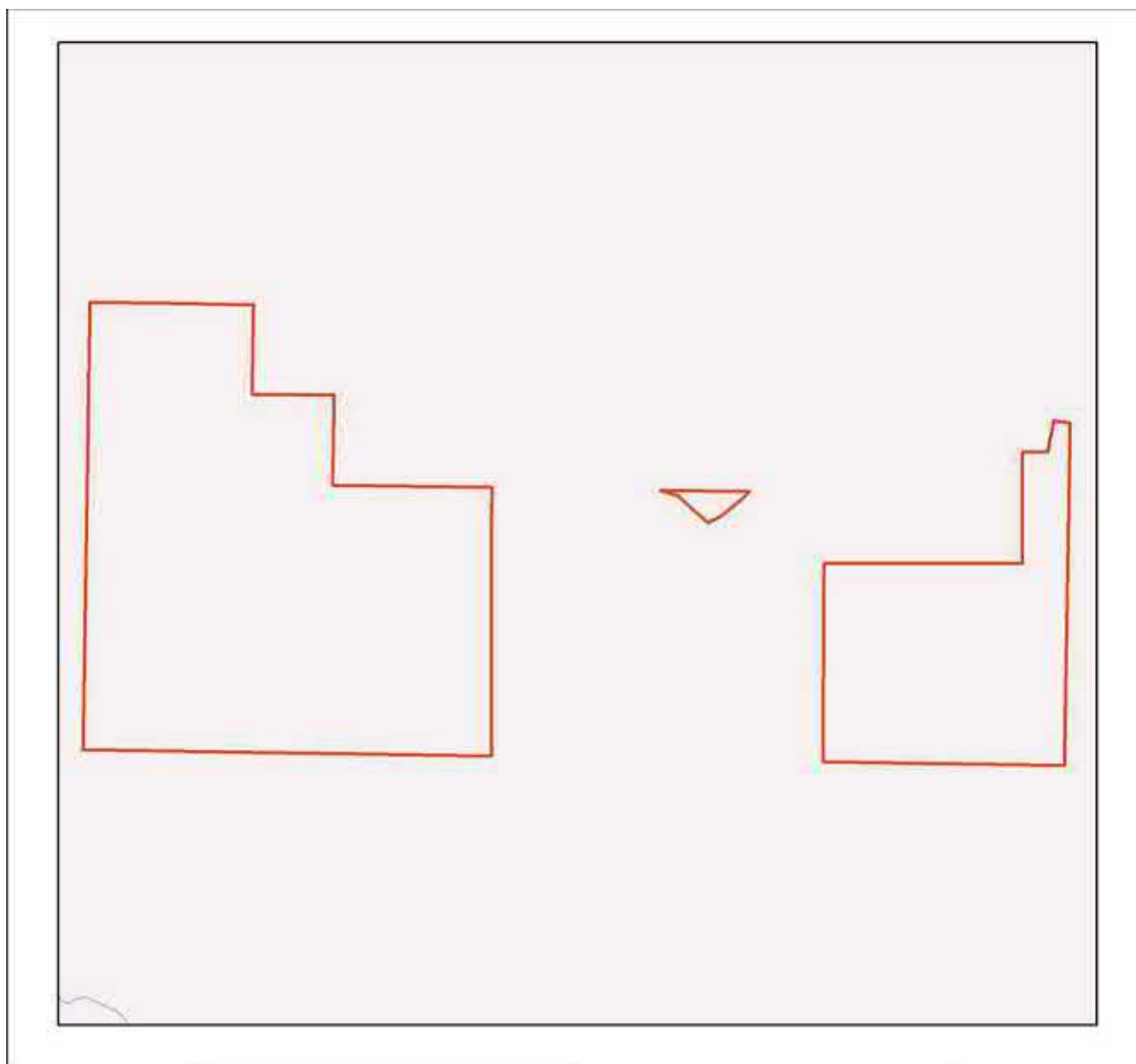
(no results)

9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation

(no results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

Map 1 - MSES - State Conservation Areas



MSES - State Conservation Areas

Area of Interest

- Selected Mineral Development Licence (MDL)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Protected area (estates)
- Declared fish habitat area (A and B areas)
- Marine park (highly protected)



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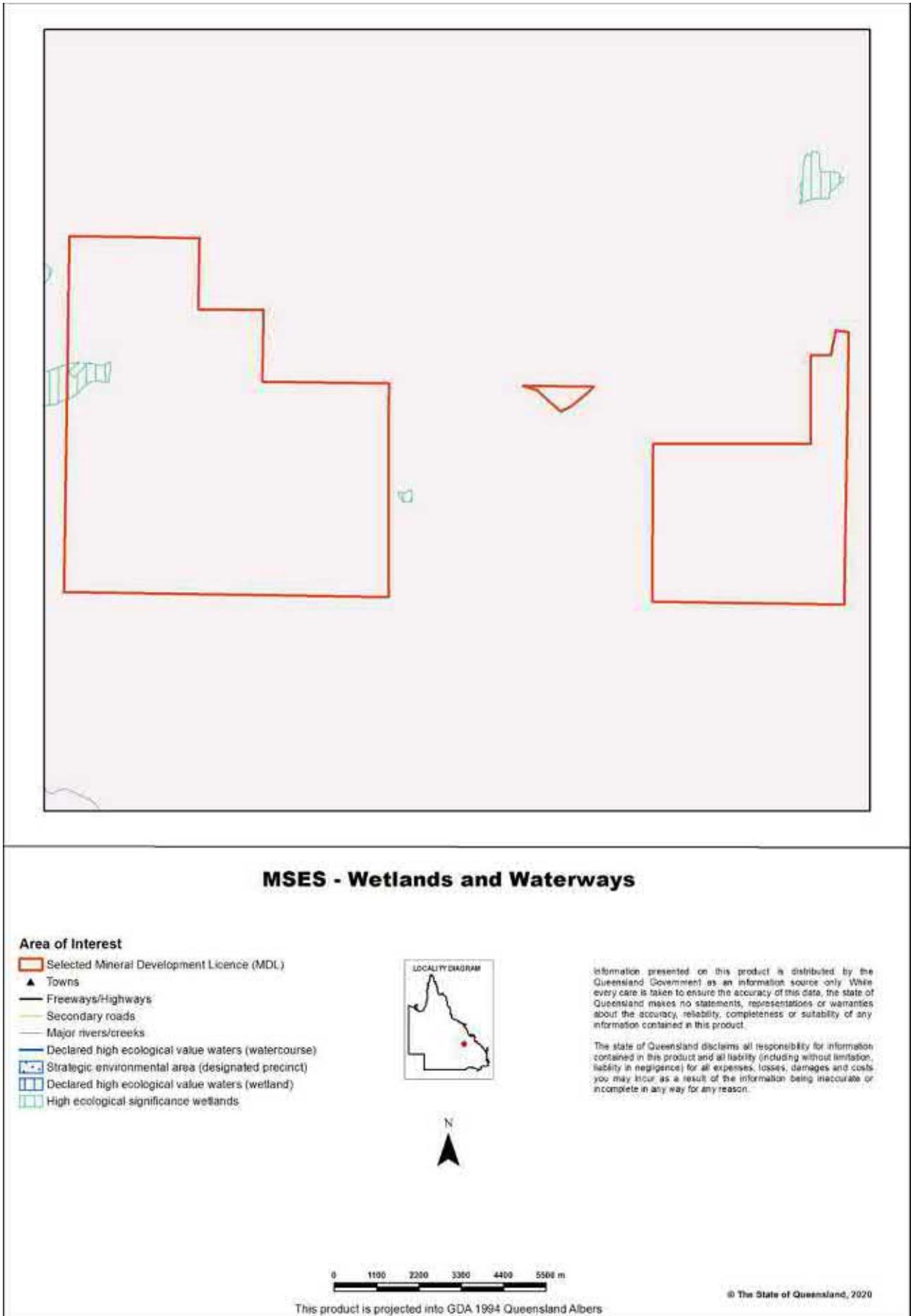
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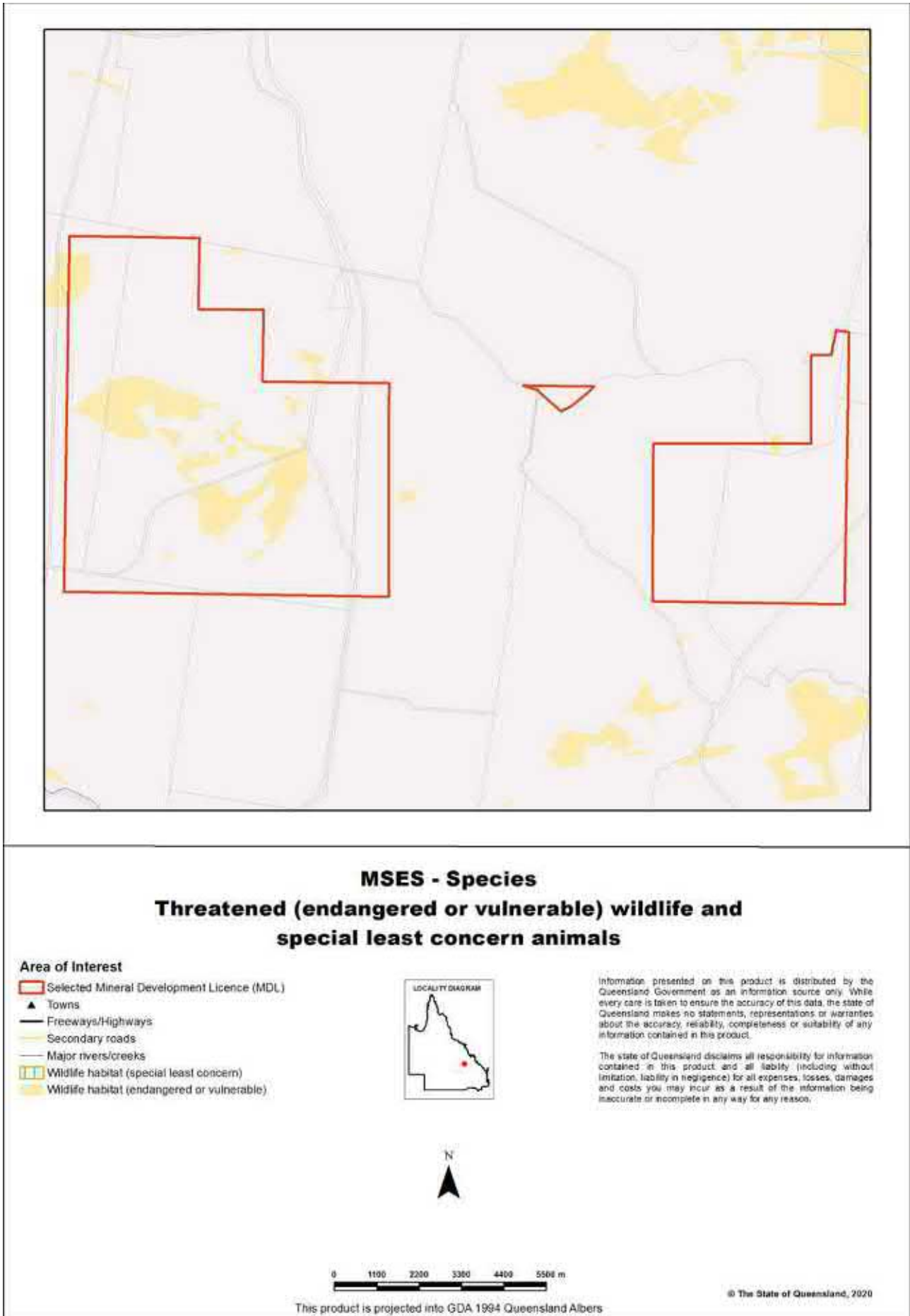
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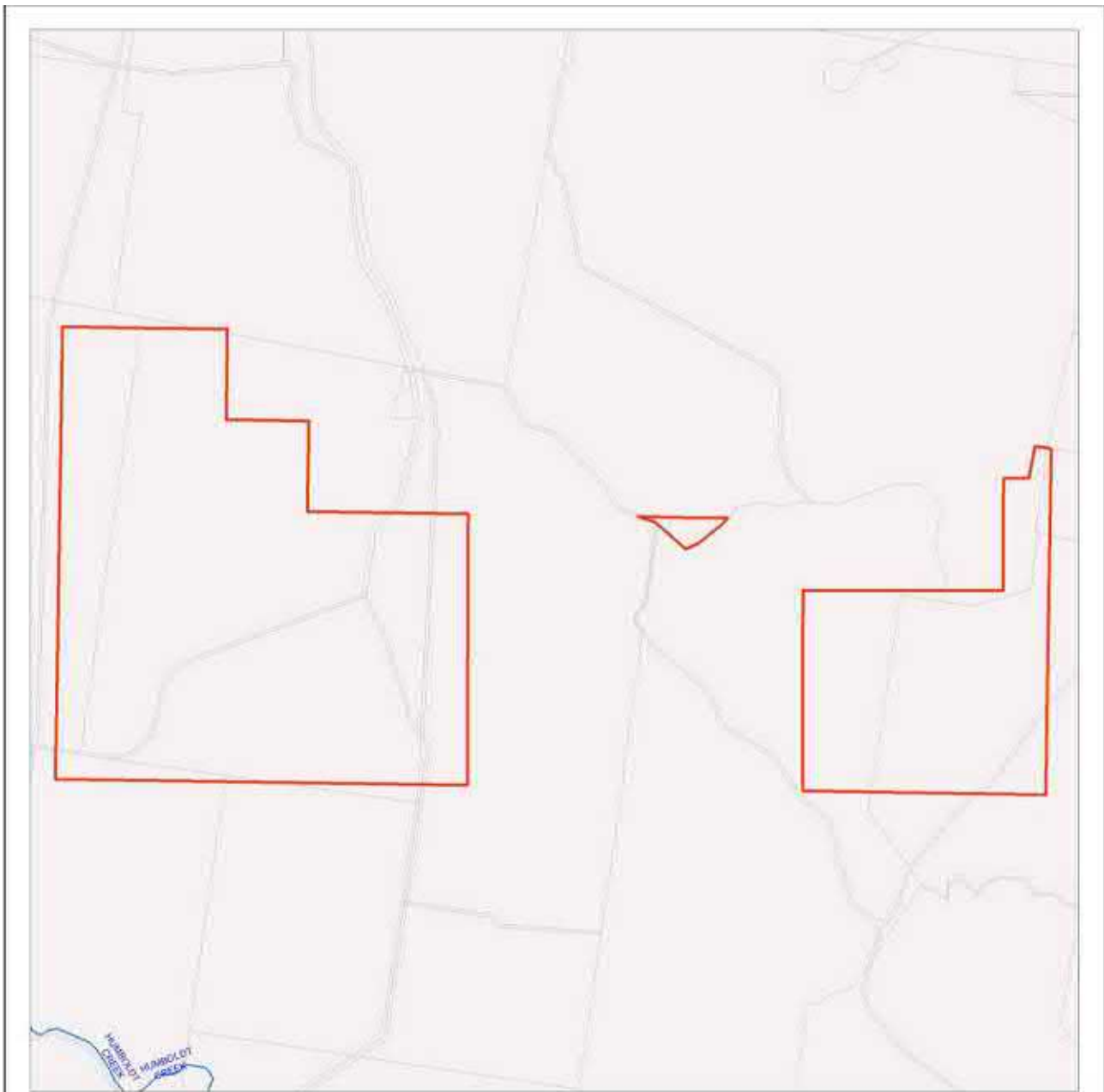
Map 2 - MSES - Wetlands and Waterways



Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals



Map 3b - MSES - Species - Koala habitat area (SEQ)



MSES - Species Koala habitat area (SEQ)

Area of Interest

- Selected Mineral Development Licence (MDL)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Koala habitat area (core)
- Koala habitat area (locally refined)



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The represented layers for SEQ 'koala habitat area-core' and 'koala habitat area-locally refined' in MSES are sourced directly from the regulatory mapping under the Nature Conservation (Koala) Conservation Plan 2017. Whilst every effort is made to ensure the information remains current, there may be delays between updating versions. Please refer to the original mapping for the most recent version. See <https://environment.des.qld.gov.au/wildlife/animals/living-with/koalas/mapping>

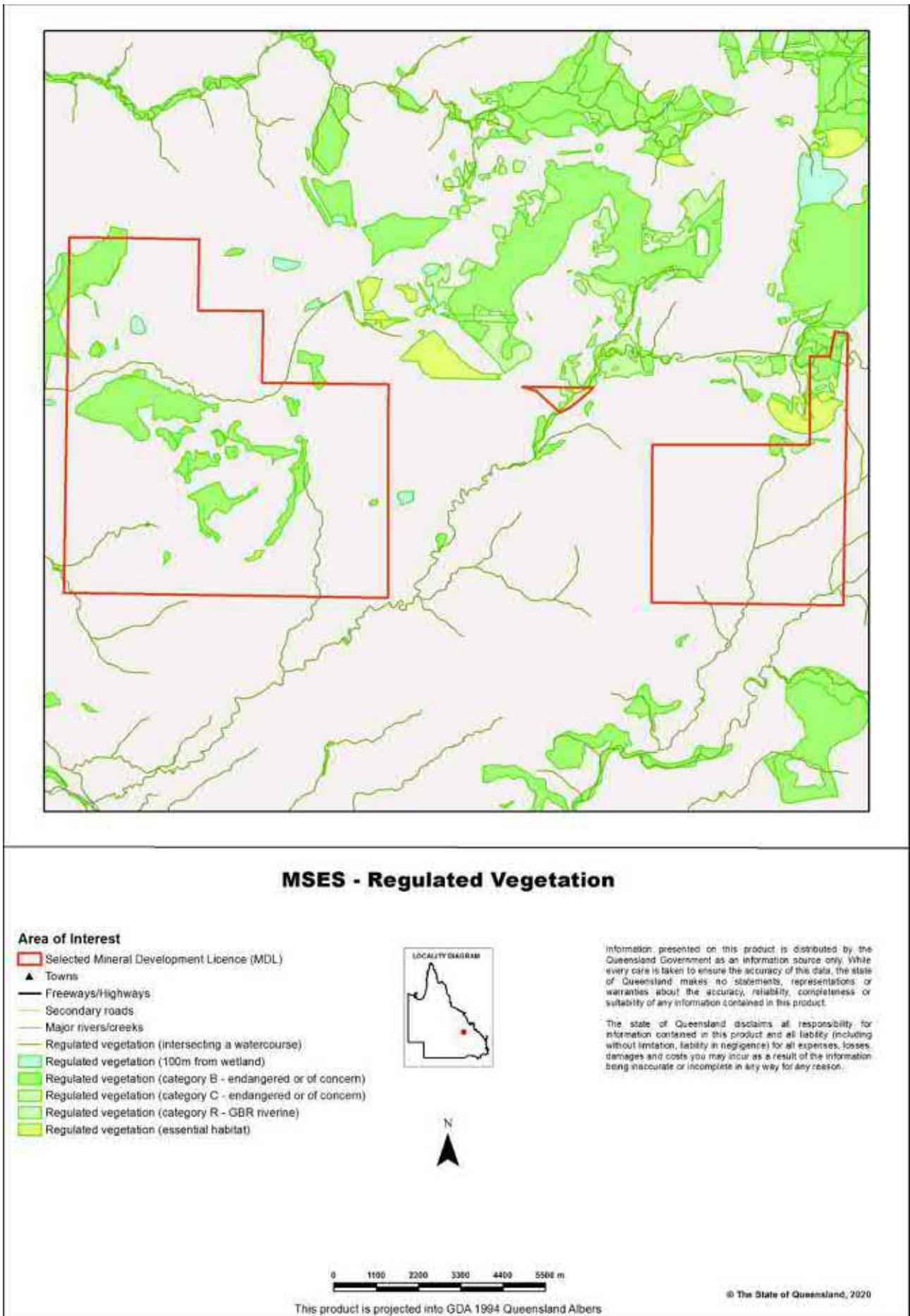
The koala habitat mapping within South East Queensland uses regional ecosystem linework compiled at a scale varying from 1:25,000 to 1:100,000. Linework should be used as a guide only. The positional accuracy of regional ecosystem data mapped at a scale of 1:100,000 is +/- 100 metres.



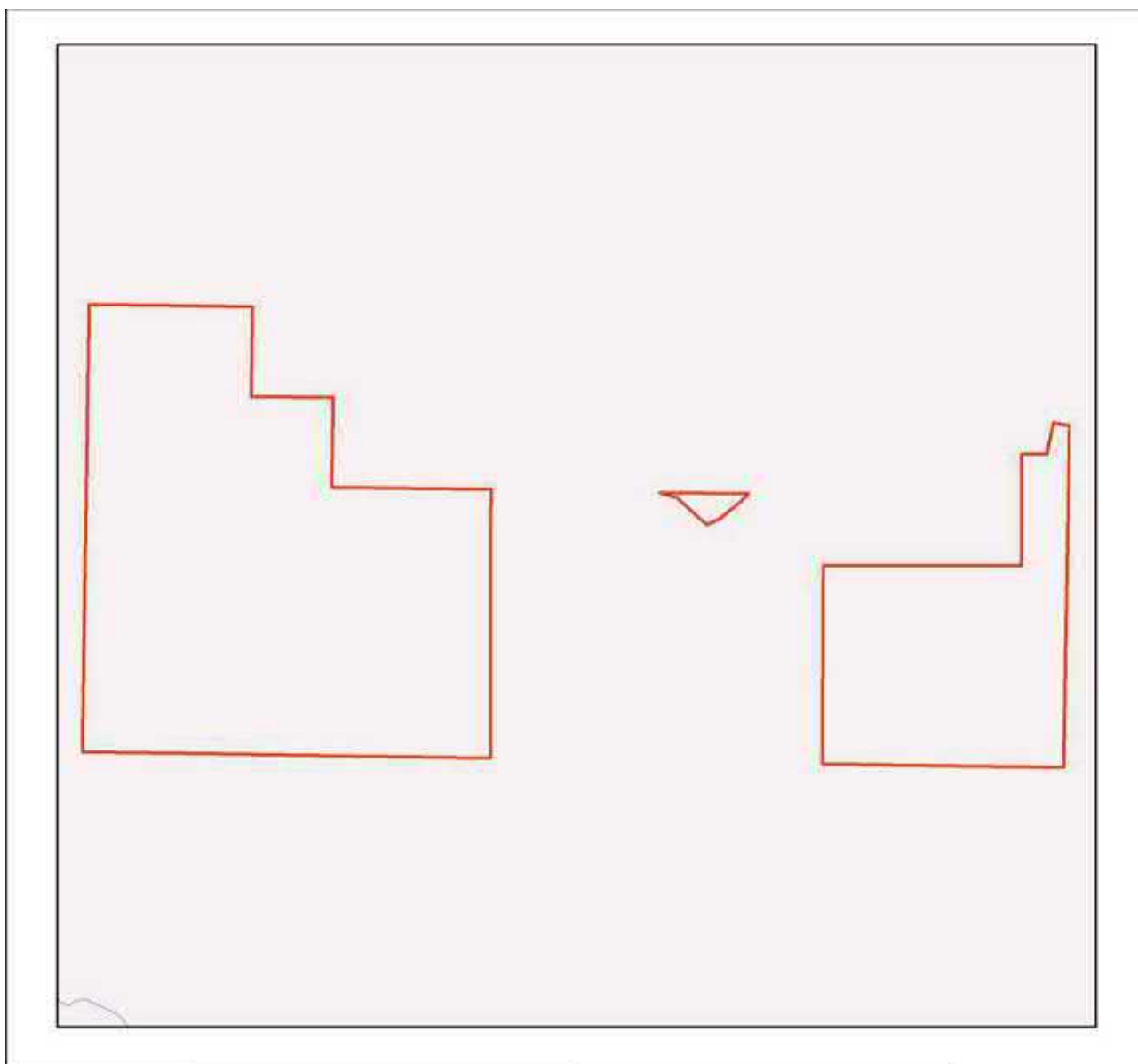
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Map 4 - MSES - Regulated Vegetation



Map 5 - MSES - Offset Areas



MSES - Offsets

Area of Interest

- Selected Mineral Development Licence (MDL)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Legally secured offset area (offset register)
- Legally secured offset area (vegetation offsets)



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Appendices

Appendix 1 - Matters of State Environmental Significance (MSES) methodology

MSES mapping is a regional-scale representation of the definition for MSES under the State Planning Policy (SPP). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" can be downloaded from:

<http://www.ehp.qld.gov.au/land/natural-resource/method-mapping-mses.html> .

Appendix 2 - Source Data

The datasets listed below are available on request from:

<http://qldspatial.information.qld.gov.au/catalogue/custom/index.page>

- Matters of State environmental significance

Note: MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of underlying environment databases and geo-referenced information sources. MSES mapping is a versioned product that is updated generally on a twice-yearly basis to incorporate the changes to underlying data sources. Several components of MSES mapping made for the current version may differ from the current underlying data sources. To ensure accuracy, or proper representation of MSES values, it is strongly recommended that users refer to the underlying data sources and review the current definition of MSES in the State Planning Policy, before applying the MSES mapping.

Individual MSES layers can be attributed to the following source data available at QSpatial:

MSES layers	current QSpatial data (http://qspatial.information.qld.gov.au)
Protected Areas-Estates and Nature Refuges	- Protected areas of Queensland - Nature Refuges - Queensland
Marine Park-Highly Protected Zones	Moreton Bay marine park zoning 2008
Fish Habitat Areas	Queensland fish habitat areas
Strategic Environmental Areas-designated	Regional Planning Interests Act - Strategic Environmental Areas
HES wetlands	Map of Queensland Wetland Environmental Values
Wetlands in HEV waters	HEV waters: - EPP Water (multiple locations) intent for waters Source Wetlands: - Queensland Wetland Mapping (Current version 4, 2015) Source Watercourses: - Vegetation management watercourse and drainage feature map (1:100000 and 1:250000)
Wildlife habitat (threatened and special least concern)	-WildNet database species records - habitat suitability models (various) - SEQ koala habitat areas under the Koala Conservation Plan 2019
VMA regulated regional ecosystems	Vegetation management regional ecosystem and remnant map
VMA Essential Habitat	Vegetation management - essential habitat map
VMA Wetlands	Vegetation management wetlands map
Legally secured offsets	Vegetation Management Act property maps of assessable vegetation. For offset register data-contact DES
Regulated Vegetation Map	Vegetation management - regulated vegetation management map

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
DES	- Department of Environment and Science
EP Act	- <i>Environmental Protection Act 1994</i>
EPP	- Environmental Protection Policy
GDA94	- Geocentric Datum of Australia 1994
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- <i>Nature Conservation Act 1992</i>
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- <i>Vegetation Management Act 1999</i>



Queensland Government

Department of Environment and Science

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest
mdl: 189

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 point of interest.

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 values 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.

Please direct queries about these reports to: Planning.Support@des.qld.gov.au

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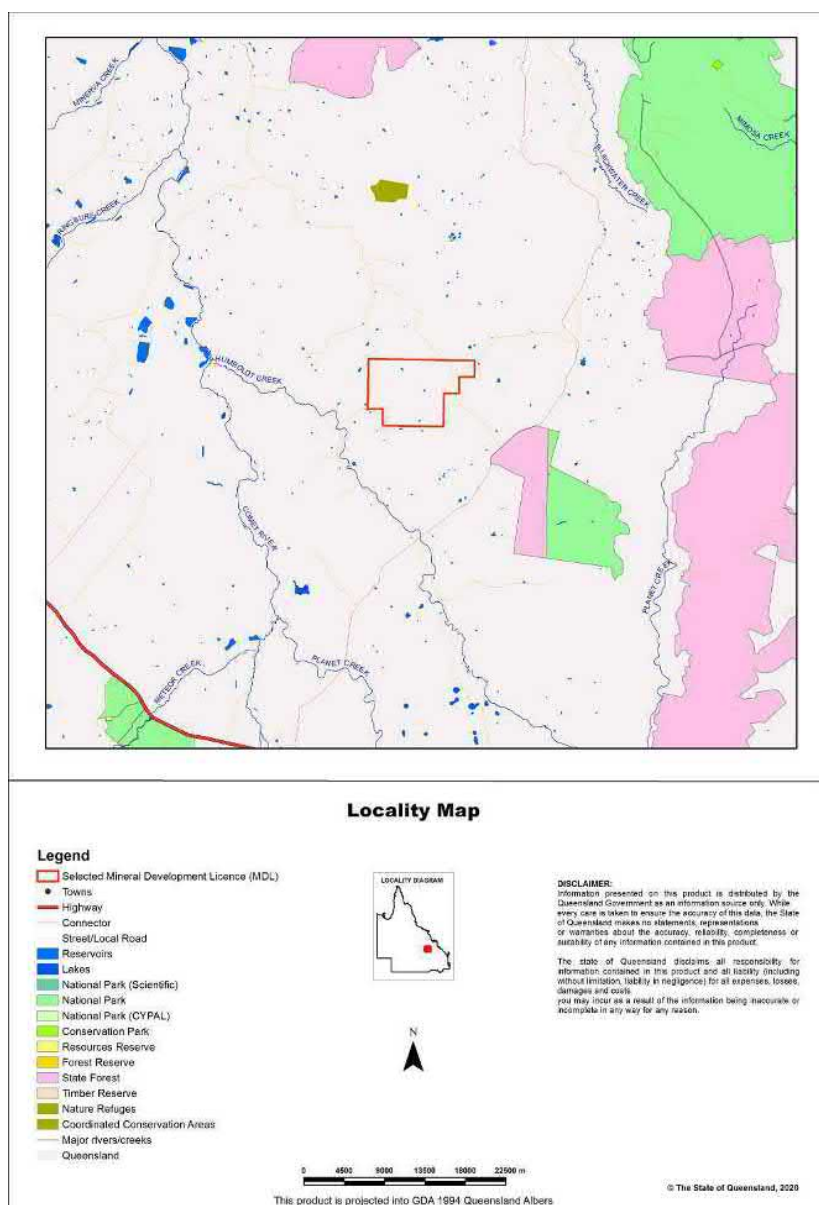
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Assessment Area Details

The following table provides an overview of the area of interest (AOI) with respect to selected topographic and environmental values.

Table 1: Summary table, details for AOI mdl: 189

Size (ha)	6,881.38
Local Government(s)	Central Highlands Regional
Bioregion(s)	Brigalow Belt
Subregion(s)	Isaac - Comet Downs
Catchment(s)	Fitzroy



Matters of State Environmental Significance (MSES)

MSES Categories

Queensland's State Planning Policy (SPP) includes a biodiversity State interest that states:

'The sustainable, long-term conservation of biodiversity is supported. Significant impacts on matters of national or state environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset.'

The MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The SPP defines matters of state environmental significance as:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992* ;
- Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the *Marine Parks Act 2004* ;
- Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;
- Threatened wildlife under the *Nature Conservation Act 1992* and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006;
- Regulated vegetation under the *Vegetation Management Act 1999* that is:
 - Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;
 - Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;
 - Category R areas on the regulated vegetation management map;
 - Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse and drainage feature map;
 - Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;
- Strategic Environmental Areas under the *Regional Planning Interests Act 2014* ;
- Wetlands 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 defined in the Environmental Protection (Water) Policy 2009, schedule 2;
- Legally secured offset areas.

MSES Values Present

The MSES values that are present in the area of interest are summarised in the table below:

Table 2: Summary of MSES present within the AOI

1a Protected Areas- estates	0.0 ha	0.0 %
1b Protected Areas- nature refuges	0.0 ha	0.0 %
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	0.0 ha	0.0 %
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways **	0.0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	187.43 ha	2.7%
7b Special least concern animals	0.0 ha	0.0 %
7c i Koala habitat area - core (SEQ)	0.0 ha	0.0 %
7c ii Koala habitat area - locally refined (SEQ)	0.0 ha	0.0 %
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	342.91 ha	5.0%
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	0.0 ha	0.0 %
8c Regulated Vegetation - Category R (GBR riverine regrowth)	7.1 ha	0.1%
8d Regulated Vegetation - Essential habitat	187.43 ha	2.7%
8e Regulated Vegetation - intersecting a watercourse **	39.2 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	0.0 ha	0.0 %
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(no results)

1b. Protected Areas - nature refuges

(no results)

2. State Marine Parks - highly protected zones

(no results)

3. Fish habitat areas (A and B areas)

(no results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

MSES - Wetlands and Waterways

4. Strategic Environmental Areas (SEA)

(no results)

5. High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values

(no results)

6a. Wetlands in High Ecological Value (HEV) waters

(no results)

6b. Waterways in High Ecological Value (HEV) waters

(no results)

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

MSES - Species

7a. Threatened (endangered or vulnerable) wildlife

Values are present

7b. Special least concern animals

Not applicable

7c i. Koala habitat area - core (SEQ)

Not applicable

7c ii. Koala habitat area - locally refined (SEQ)

Not applicable

Threatened (endangered or vulnerable) wildlife habitat suitability models

Species	Common name	NCA status	Presence
<i>Boronia keysii</i>		V	None
<i>Calyptorhynchus lathami</i>	Glossy black cockatoo	V	None
<i>Casuarius casuarius johnsonii</i>	Sthn population cassowary	E	None
<i>Crinia tinnula</i>	Wallum froglet	V	None
<i>Denisonia maculata</i>	Ornamental snake	V	Core
<i>Litoria freycineti</i>	Wallum rocketfrog	V	None
<i>Litoria olongburensis</i>	Wallum sedgefrog	V	None
<i>Melaleuca irbyana</i>		E	None
<i>Petaurus gracilis</i>	Mahogany Glider	E	None
<i>Petrogale persephone</i>	Proserpine rock-wallaby	E	None
<i>Phascolarctos cinereus</i>	Koala - outside SEQ*	V	None
<i>Pezoporus wallicus wallicus</i>	Eastern ground parrot	V	None
<i>Taudactylus Pleione</i>	Kroombit tinkerfrog	E	None
<i>Xeromys myoides</i>	Water Mouse	V	None

*For koala model, this includes areas outside SEQ. Check 7c SEQ koala habitat for presence/absence.

Threatened (endangered or vulnerable) wildlife species records

Scientific name	Common name	NCA status	EPBC status	Migratory status
<i>Phascolarctos cinereus</i>	koala	V	V	

Special least concern animal species records

(no results)

*Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL).
Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)

Migratory status (M) - China and Australia Migratory Bird Agreement (C), Japan and Australia Migratory Bird Agreement (J), Republic of Korea and Australia Migratory Bird Agreement (R), Bonn Migratory Convention (B), Eastern Flyway (E)

To request a species list for an area, or search for a species profile, access Wildlife Online at:

<https://www.qld.gov.au/environment/plants-animals/species-list/>

Refer to **Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals** and **Map 3b - MSES - Species - Koala habitat area (SEQ)** for an overview of the relevant MSES.

MSES - Regulated Vegetation

For further information relating to regional ecosystems in general, go to:

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

For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:

<https://environment.ehp.qld.gov.au/regional-ecosystems/>

8a. Regulated Vegetation - Endangered/Of concern in Category B (remnant)

Regional ecosystem	Vegetation management polygon	Vegetation management status
11.3.2/11.3.1	E-subdom	rem_end
11.9.5a	E-dom	rem_end
11.4.8/11.4.9a	E-dom	rem_end

8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)

Not applicable

8c. Regulated Vegetation - Category R (GBR riverine regrowth)

Regulated vegetation map category	Map number	RVM rule
R	8649	4

8d. Regulated Vegetation - Essential habitat

Values are present

8e. Regulated Vegetation - intersecting a watercourse**

A vegetation management watercourse is mapped as present

8f. Regulated Vegetation - within 100m of a Vegetation Management wetland

Not applicable

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets

9a. Legally secured offset areas - offset register areas

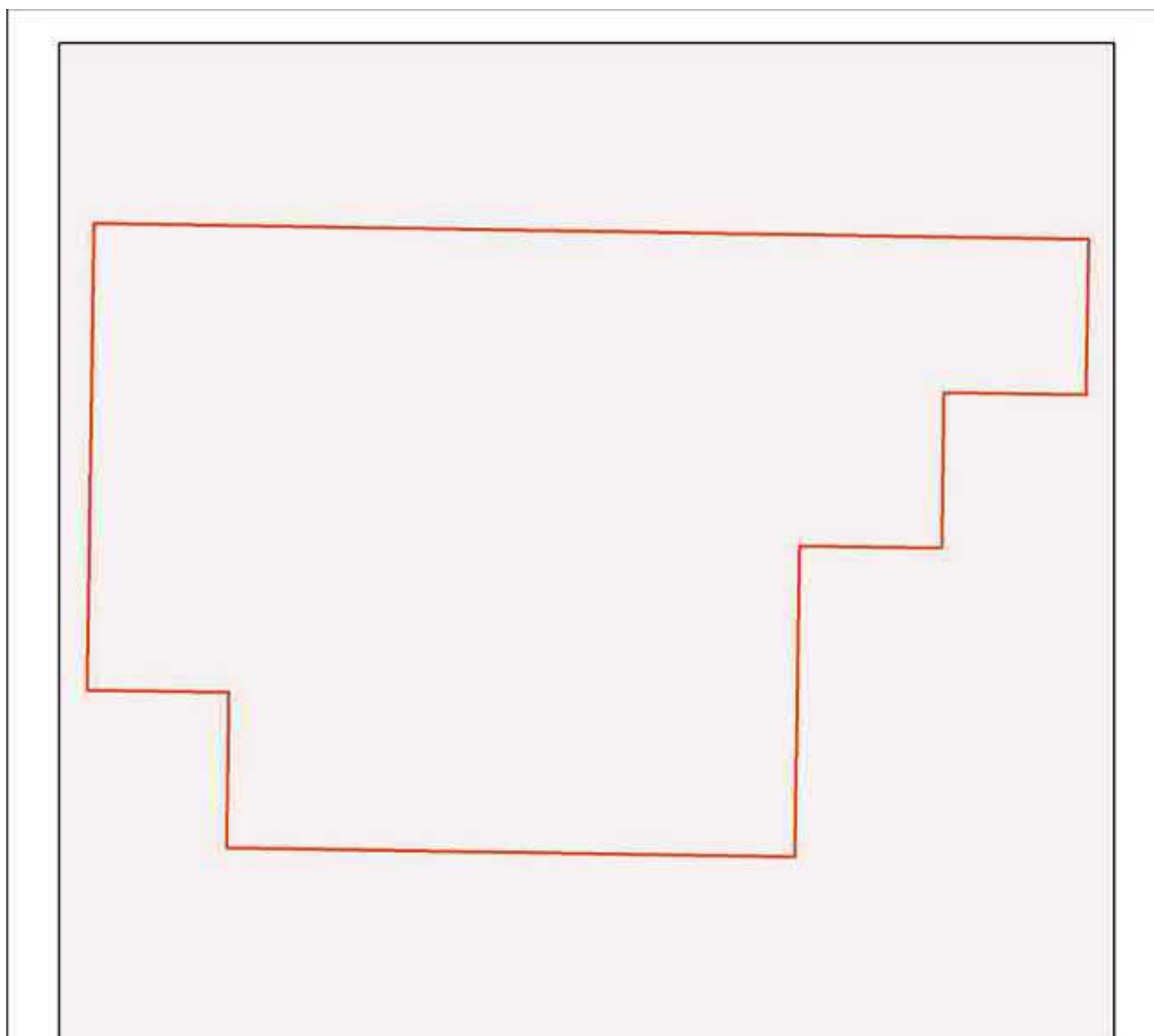
(no results)

9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation

(no results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

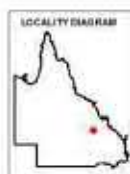
Map 1 - MSES - State Conservation Areas



MSES - State Conservation Areas

Area of Interest

- Selected Mineral Development Licence (MDL)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Protected area (estates)
- Declared fish habitat area (A and B areas)
- Marine park (highly protected)



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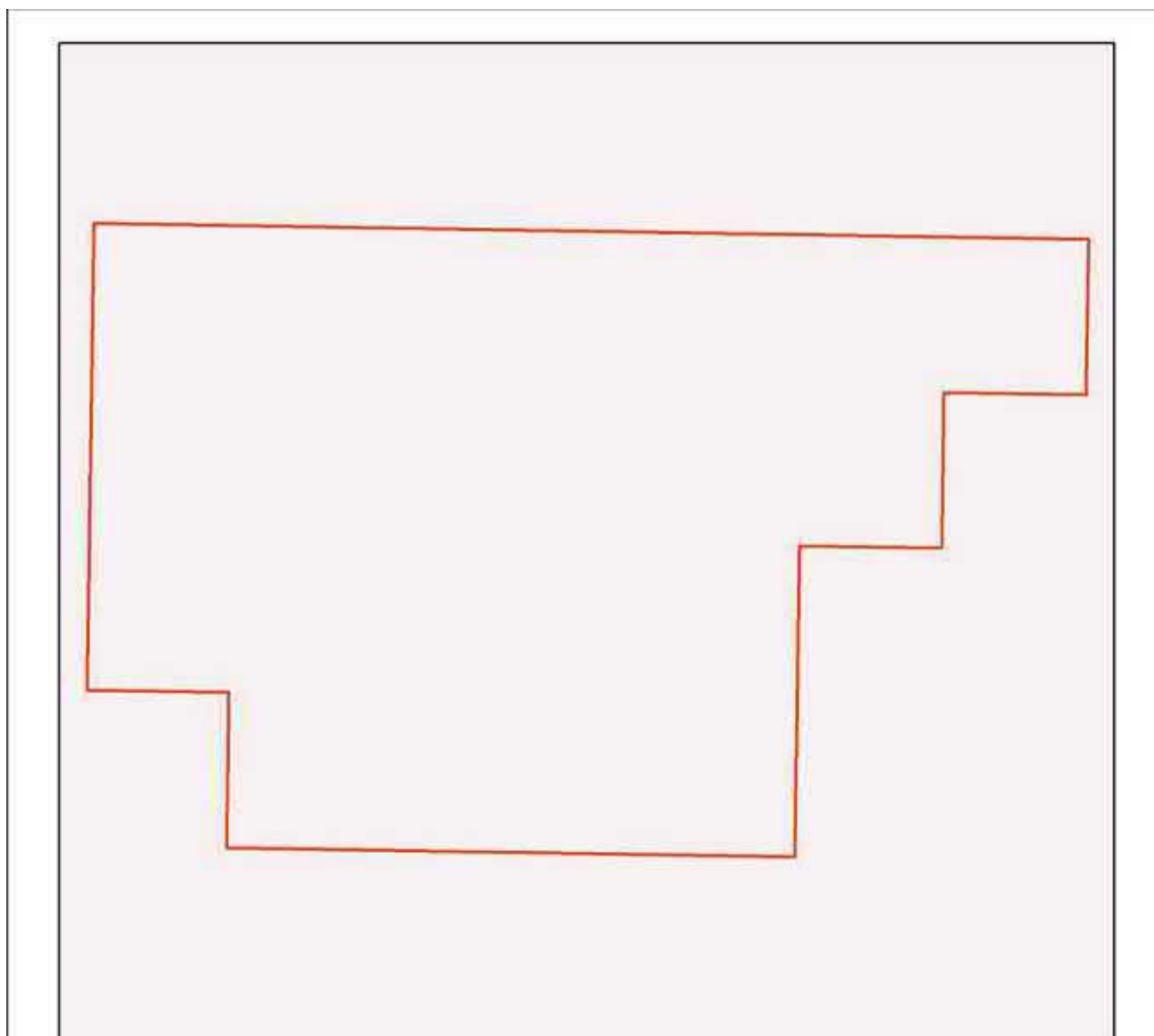
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Map 2 - MSES - Wetlands and Waterways



MSES - Wetlands and Waterways

Area of Interest

-  Selected Mineral Development Licence (MDL)
-  Towns
-  Freeways/Highways
-  Secondary roads
-  Major rivers/creeks
-  Declared high ecological value waters (watercourse)
-  Strategic environmental area (designated precinct)
-  Declared high ecological value waters (wetland)
-  High ecological significance wetlands



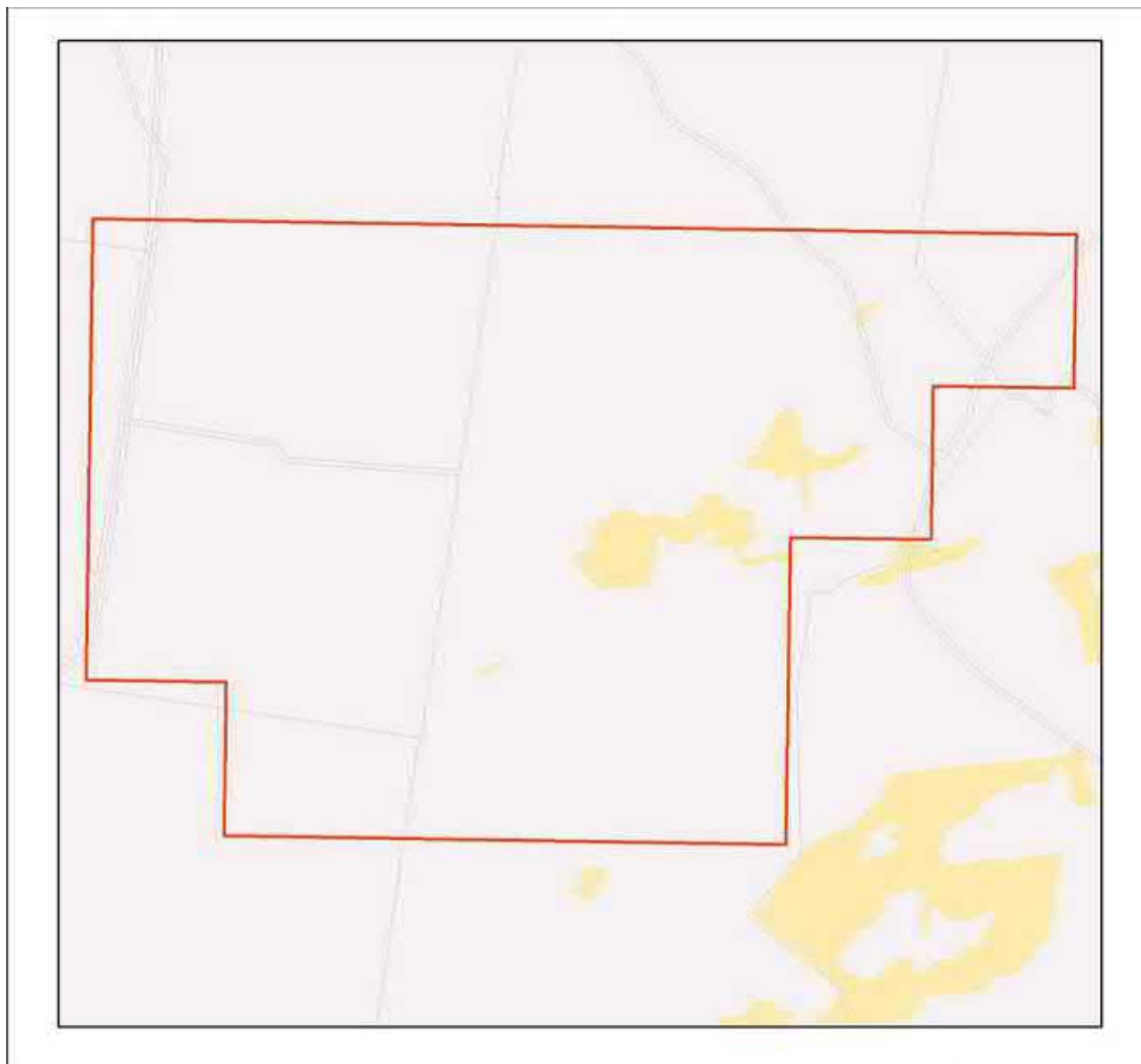
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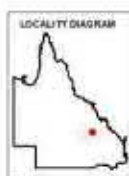
Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals



MSES - Species Threatened (endangered or vulnerable) wildlife and special least concern animals

Area of Interest

- Selected Mineral Development Licence (MDL)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (special least concern)
- Wildlife habitat (endangered or vulnerable)



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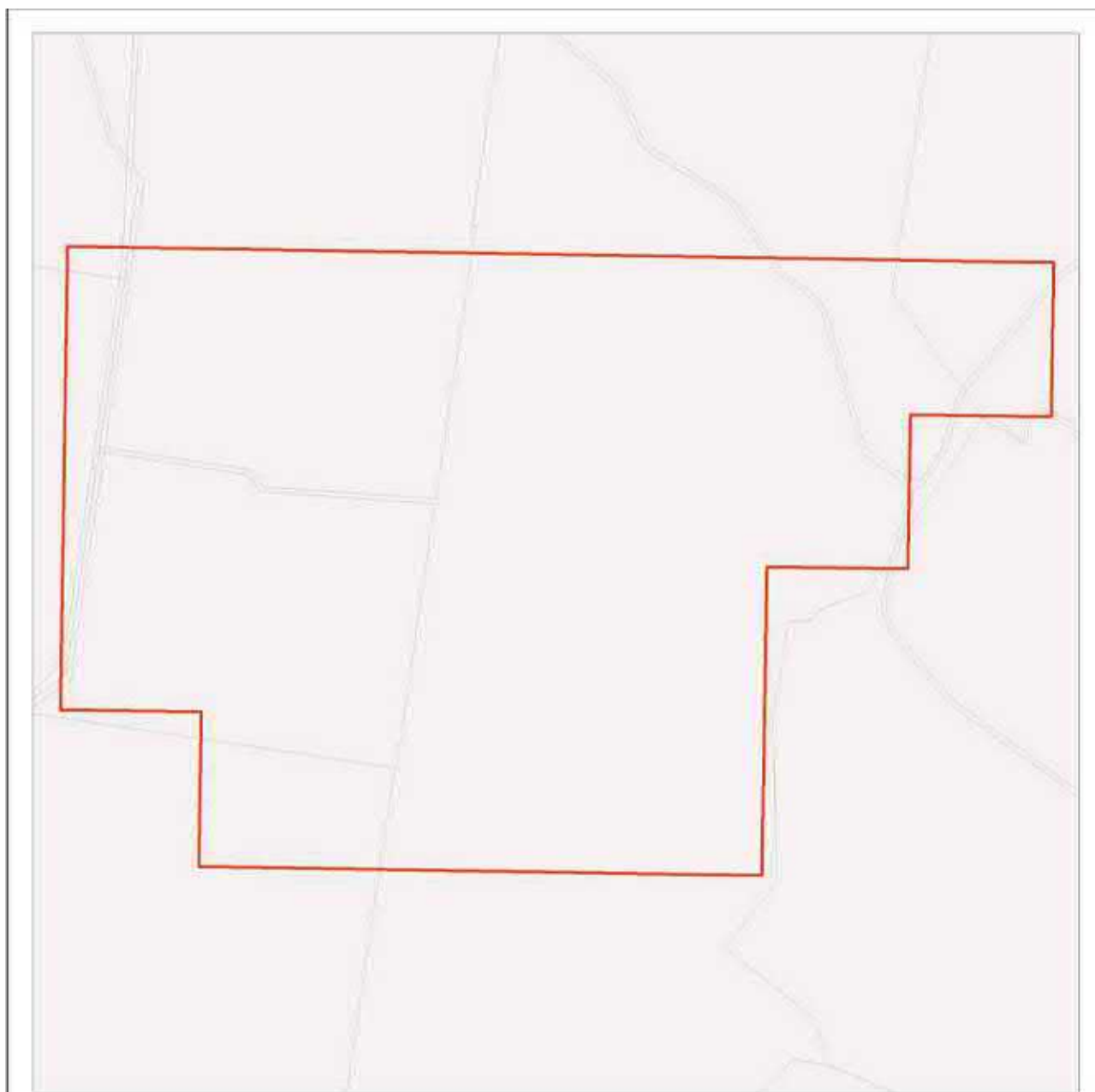
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Map 3b - MSES - Species - Koala habitat area (SEQ)



MSES - Species Koala habitat area (SEQ)

Area of Interest

- Selected Mineral Development Licence (MDL)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Koala habitat area (core)
- Koala habitat area (locally refined)



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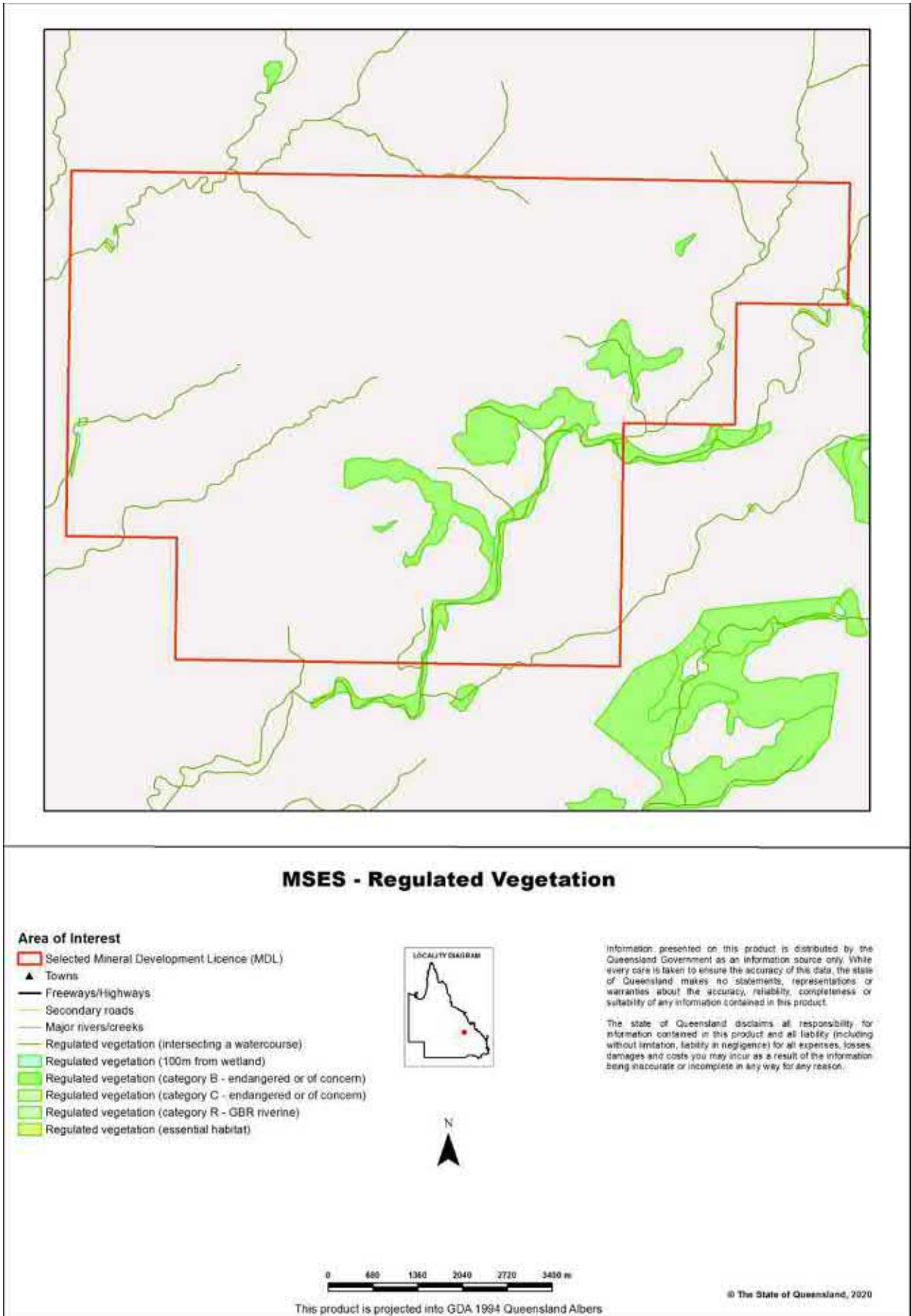
The koala habitat mapping within South East Queensland uses regional ecosystem linework compiled at a scale varying from 1:25,000 to 1:100,000. Linework should be used as a guide only. The positional accuracy of regional ecosystem data mapped at a scale of 1:100,000 is +/- 100 metres.



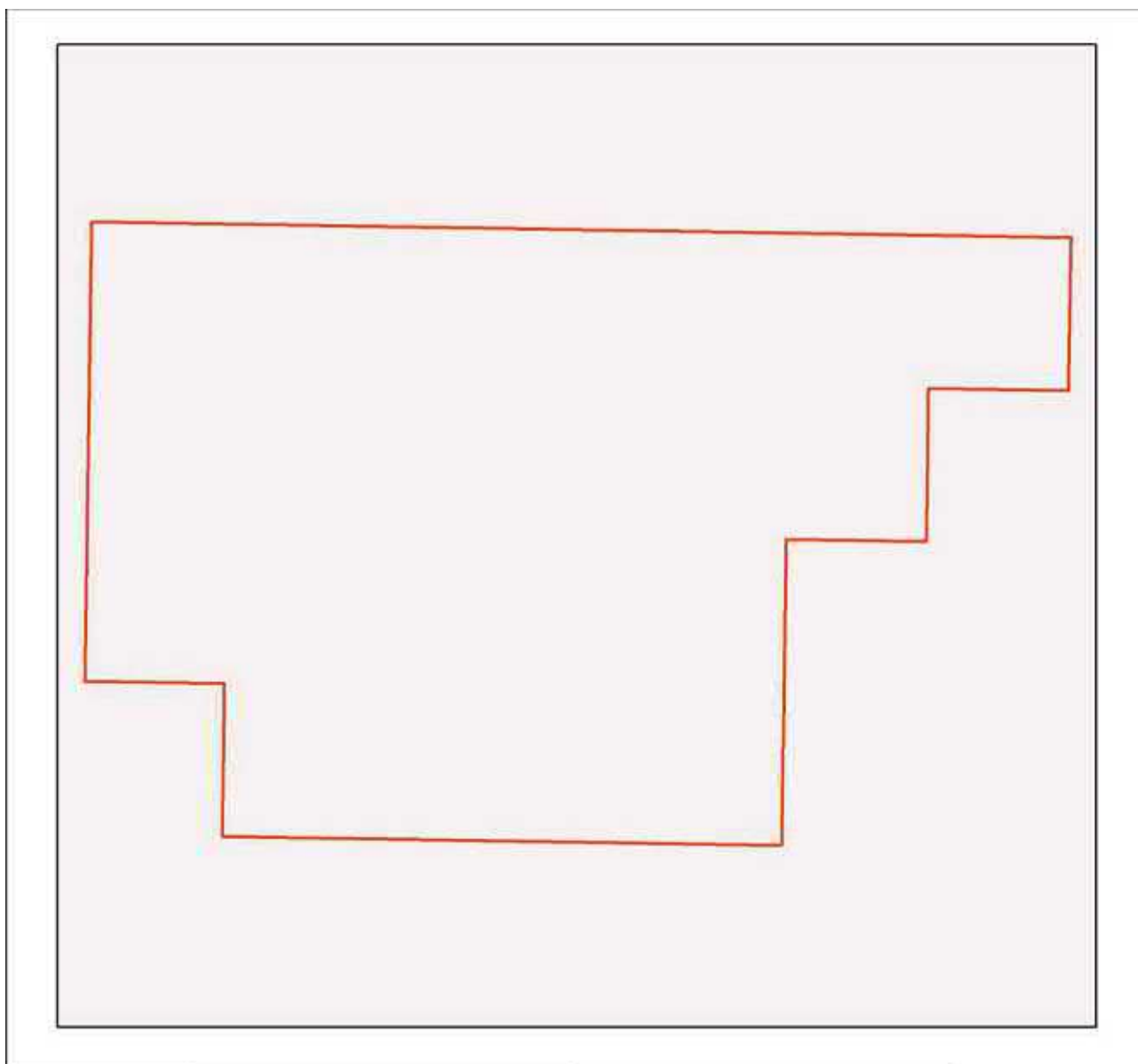
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Map 4 - MSES - Regulated Vegetation



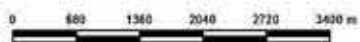
Map 5 - MSES - Offset Areas



MSES - Offsets

Area of Interest

- Selected Mineral Development Licence (MDL)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Legally secured offset area (offset register)
- Legally secured offset area (vegetation offsets)



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Appendices

Appendix 1 - Matters of State Environmental Significance (MSES) methodology

MSES mapping is a regional-scale representation of the definition for MSES under the State Planning Policy (SPP). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" can be downloaded from:

<http://www.ehp.qld.gov.au/land/natural-resource/method-mapping-mses.html> .

Appendix 2 - Source Data

The datasets listed below are available on request from:

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- Matters of State environmental significance

Note: MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of underlying environment databases and geo-referenced information sources. MSES mapping is a versioned product that is updated generally on a twice-yearly basis to incorporate the changes to underlying data sources. Several components of MSES mapping made for the current version may differ from the current underlying data sources. To ensure accuracy, or proper representation of MSES values, it is strongly recommended that users refer to the underlying data sources and review the current definition of MSES in the State Planning Policy, before applying the MSES mapping.

Individual MSES layers can be attributed to the following source data available at QSpatial:

MSES layers	current QSpatial data (http://qspatial.information.qld.gov.au)
Protected Areas-Estates and Nature Refuges	- Protected areas of Queensland - Nature Refuges - Queensland
Marine Park-Highly Protected Zones	Moreton Bay marine park zoning 2008
Fish Habitat Areas	Queensland fish habitat areas
Strategic Environmental Areas-designated	Regional Planning Interests Act - Strategic Environmental Areas
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Wetlands in HEV waters	HEV waters: - EPP Water (multiple locations) intent for waters Source Wetlands: - Queensland Wetland Mapping (Current version 4, 2015) Source Watercourses: - Vegetation management watercourse and drainage feature map (1:100000 and 1:250000)
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Regulated Vegetation Map	Vegetation management - regulated vegetation management map



Queensland Government

Department of Environment and Science

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest
ml: 70139

Environmental Reports - General Information

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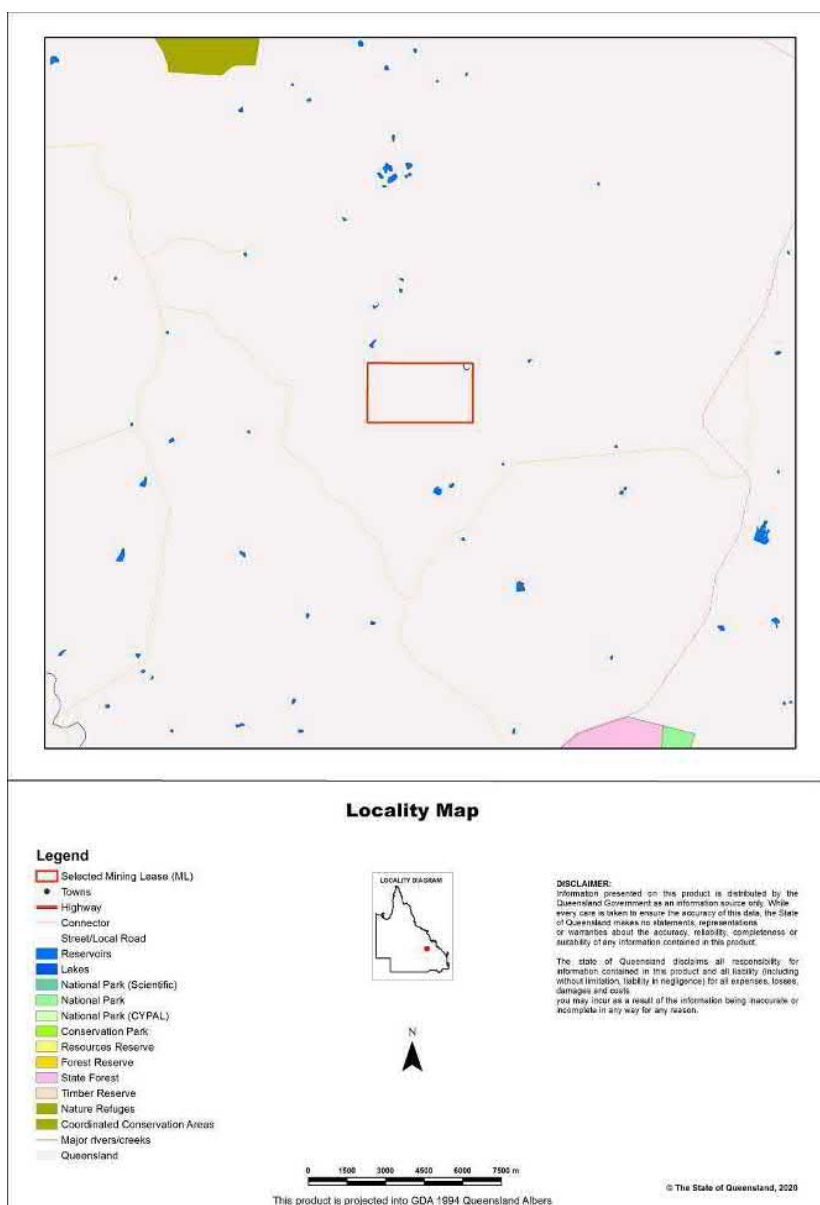
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Assessment Area Details

The following table provides an overview of the area of interest (AOI) with respect to selected topographic and environmental values.

Table 1: Summary table, details for AOI ml: 70139

Size (ha)	946.54
Local Government(s)	Central Highlands Regional
Bioregion(s)	Brigalow Belt
Subregion(s)	Isaac - Comet Downs
Catchment(s)	Fitzroy



Matters of State Environmental Significance (MSES)

MSES Categories

Queensland's State Planning Policy (SPP) includes a biodiversity State interest that states:

'The sustainable, long-term conservation of biodiversity is supported. Significant impacts on matters of national or state environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset.'

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The SPP defines matters of state environmental significance as:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992* ;
- Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the *Marine Parks Act 2004* ;
- Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;
- Threatened wildlife under the *Nature Conservation Act 1992* and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006;
- Regulated vegetation under the *Vegetation Management Act 1999* that is:
 - Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;
 - Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;
 - Category R areas on the regulated vegetation management map;
 - Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse and drainage feature map;
 - Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;
- Strategic Environmental Areas under the *Regional Planning Interests Act 2014* ;
- Wetlands 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 defined in the Environmental Protection (Water) Policy 2009, schedule 2;
- Legally secured offset areas.

MSES Values Present

The MSES values that are present in the area of interest are summarised in the table below:

Table 2: Summary of MSES present within the AOI

1a Protected Areas- estates	0.0 ha	0.0 %
1b Protected Areas- nature refuges	0.0 ha	0.0 %
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	0.0 ha	0.0 %
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways **	0.0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	6.94 ha	0.7%
7b Special least concern animals	0.0 ha	0.0 %
7c i Koala habitat area - core (SEQ)	0.0 ha	0.0 %
7c ii Koala habitat area - locally refined (SEQ)	0.0 ha	0.0 %
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	59.95 ha	6.3%
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	46.78 ha	4.9%
8c Regulated Vegetation - Category R (GBR riverine regrowth)	0.0 ha	0.0 %
8d Regulated Vegetation - Essential habitat	118.68 ha	12.5%
8e Regulated Vegetation - intersecting a watercourse **	5.5 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	0.0 ha	0.0 %
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(no results)

1b. Protected Areas - nature refuges

(no results)

2. State Marine Parks - highly protected zones

(no results)

3. Fish habitat areas (A and B areas)

(no results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

MSES - Wetlands and Waterways

4. Strategic Environmental Areas (SEA)

(no results)

5. High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values

(no results)

6a. Wetlands in High Ecological Value (HEV) waters

(no results)

6b. Waterways in High Ecological Value (HEV) waters

(no results)

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

MSES - Species

7a. Threatened (endangered or vulnerable) wildlife

Values are present

7b. Special least concern animals

Not applicable

7c i. Koala habitat area - core (SEQ)

Not applicable

7c ii. Koala habitat area - locally refined (SEQ)

Not applicable

Threatened (endangered or vulnerable) wildlife habitat suitability models

Species	Common name	NCA status	Presence
<i>Boronia keysii</i>		V	None
<i>Calyptorhynchus lathami</i>	Glossy black cockatoo	V	None
<i>Casuarius casuarium johnsonii</i>	Sthn population cassowary	E	None
<i>Crinia tinnula</i>	Wallum froglet	V	None
<i>Denisonia maculata</i>	Ornamental snake	V	Core
<i>Litoria freycineti</i>	Wallum rocketfrog	V	None
<i>Litoria olongburensis</i>	Wallum sedgefrog	V	None
<i>Melaleuca irbyana</i>		E	None
<i>Petaurus gracilis</i>	Mahogany Glider	E	None
<i>Petrogale persephone</i>	Proserpine rock-wallaby	E	None
<i>Phascolarctos cinereus</i>	Koala - outside SEQ*	V	None
<i>Pezoporus wallicus wallicus</i>	Eastern ground parrot	V	None
<i>Taudactylus Pleione</i>	Kroombit tinkerfrog	E	None
<i>Xeromys myoides</i>	Water Mouse	V	None

*For koala model, this includes areas outside SEQ. Check 7c SEQ koala habitat for presence/absence.

Threatened (endangered or vulnerable) wildlife species records

(no results)

Special least concern animal species records

(no results)

*Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL).
Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)

Migratory status (M) - China and Australia Migratory Bird Agreement (C), Japan and Australia Migratory Bird Agreement (J), Republic of Korea and Australia Migratory Bird Agreement (R), Bonn Migratory Convention (B), Eastern Flyway (E)

To request a species list for an area, or search for a species profile, access Wildlife Online at:

<https://www.qld.gov.au/environment/plants-animals/species-list/>

Refer to **Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals** and **Map 3b - MSES - Species - Koala habitat area (SEQ)** for an overview of the relevant MSES.

MSES - Regulated Vegetation

For further information relating to regional ecosystems in general, go to:

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

For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:

<https://environment.ehp.qld.gov.au/regional-ecosystems/>

8a. Regulated Vegetation - Endangered/Of concern in Category B (remnant)

Regional ecosystem	Vegetation management polygon	Vegetation management status
11.3.2/11.3.25	O-dom	rem_oc
11.4.8/11.4.9a	E-dom	rem_end

8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)

Regional ecosystem	Vegetation management polygon	Vegetation management status
11.3.2/11.3.25	O-dom	hvr_oc
11.4.8/11.4.9a	E-dom	hvr_end

8c. Regulated Vegetation - Category R (GBR riverine regrowth)

Not applicable

8d. Regulated Vegetation - Essential habitat

Values are present

8e. Regulated Vegetation - intersecting a watercourse**

A vegetation management watercourse is mapped as present

8f. Regulated Vegetation - within 100m of a Vegetation Management wetland

Not applicable

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets

9a. Legally secured offset areas - offset register areas

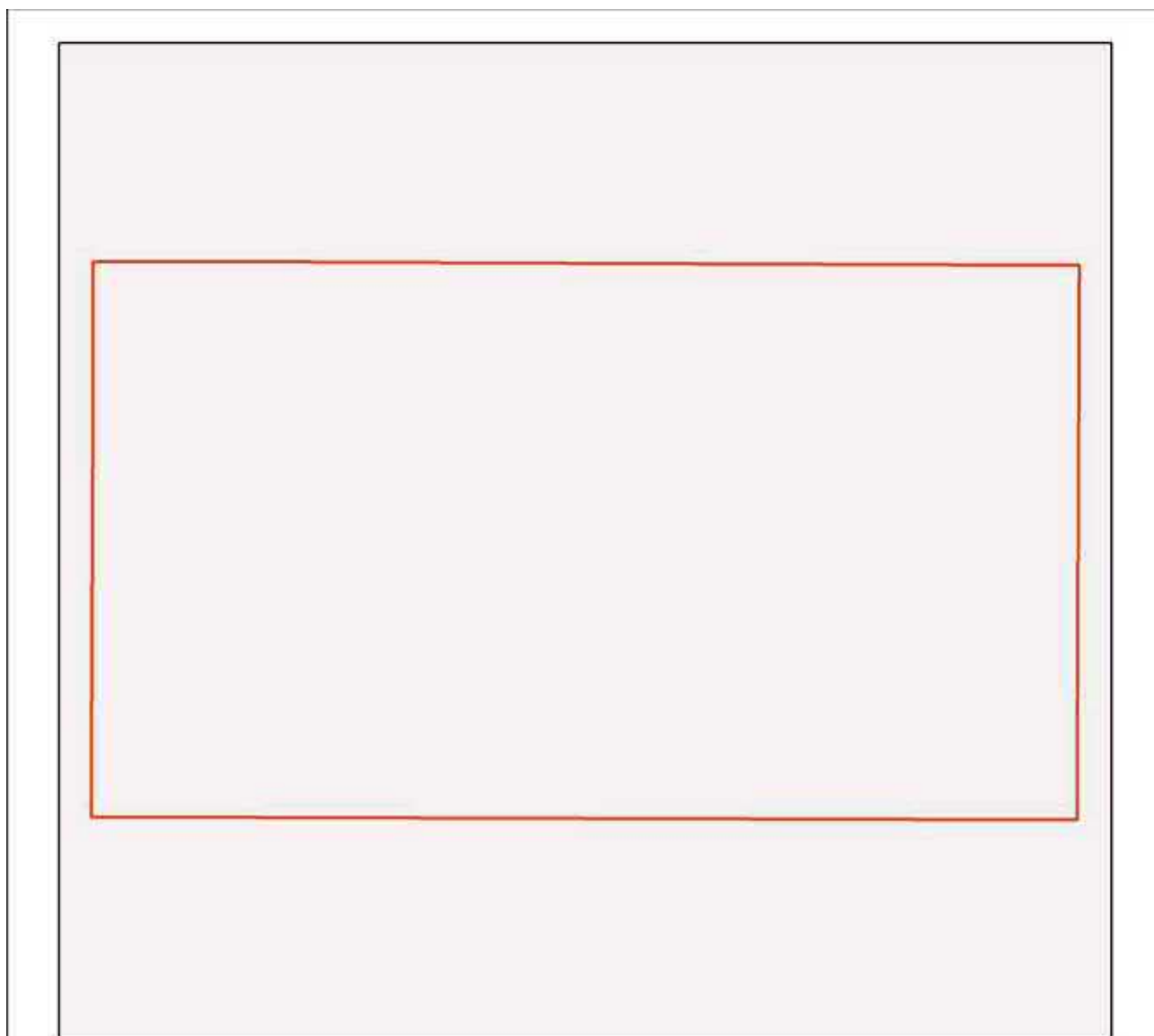
(no results)

9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation

(no results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

Map 1 - MSES - State Conservation Areas



MSES - State Conservation Areas

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Protected area (estates)
- Declared fish habitat area (A and B areas)
- Marine park (highly protected)



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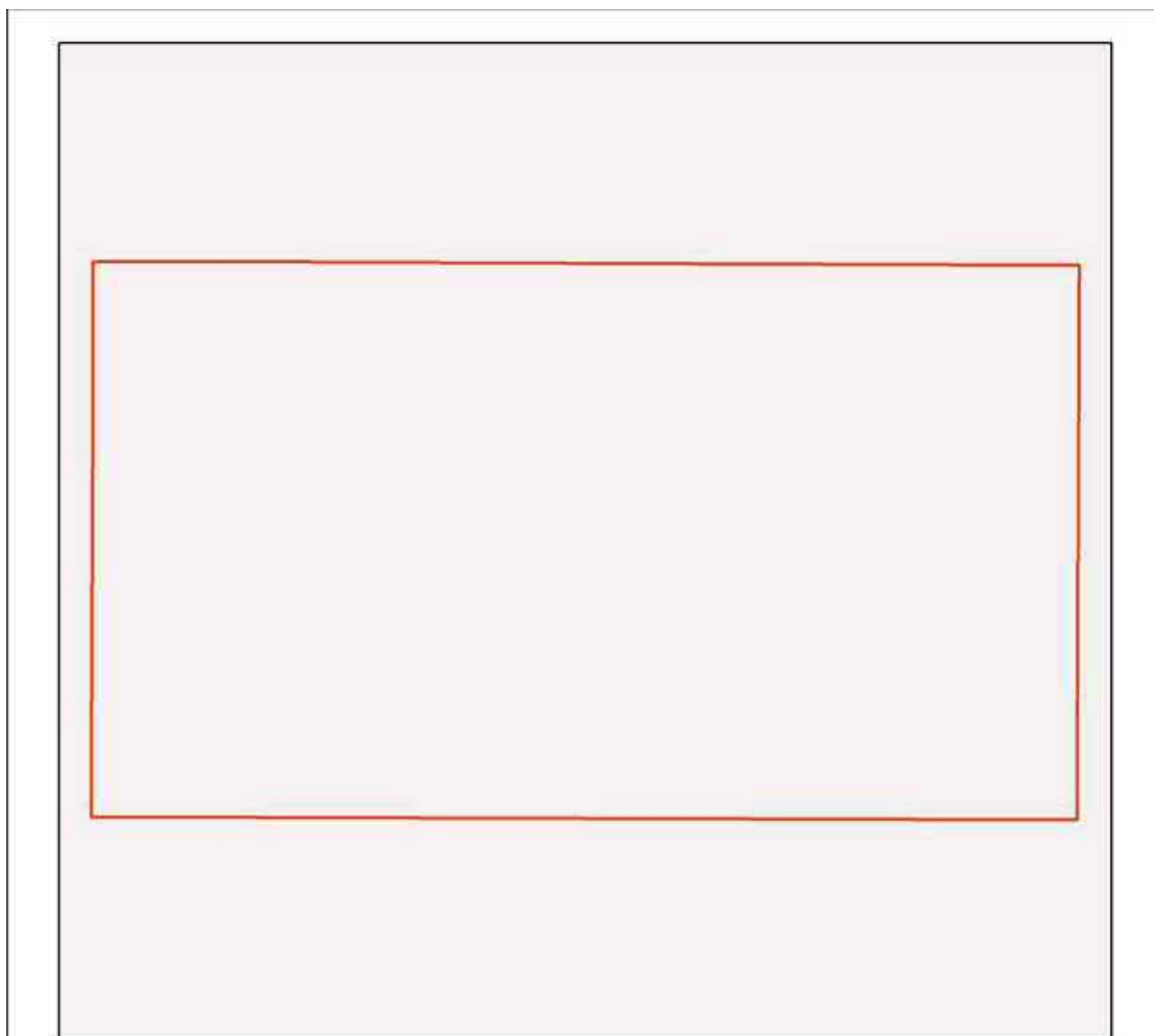
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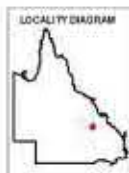
Map 2 - MSES - Wetlands and Waterways



MSES - Wetlands and Waterways

Area of Interest

-  Selected Mining Lease (ML)
-  Towns
-  Freeways/Highways
-  Secondary roads
-  Major rivers/creeks
-  Declared high ecological value waters (watercourse)
-  Strategic environmental area (designated precinct)
-  Declared high ecological value waters (wetland)
-  High ecological significance wetlands



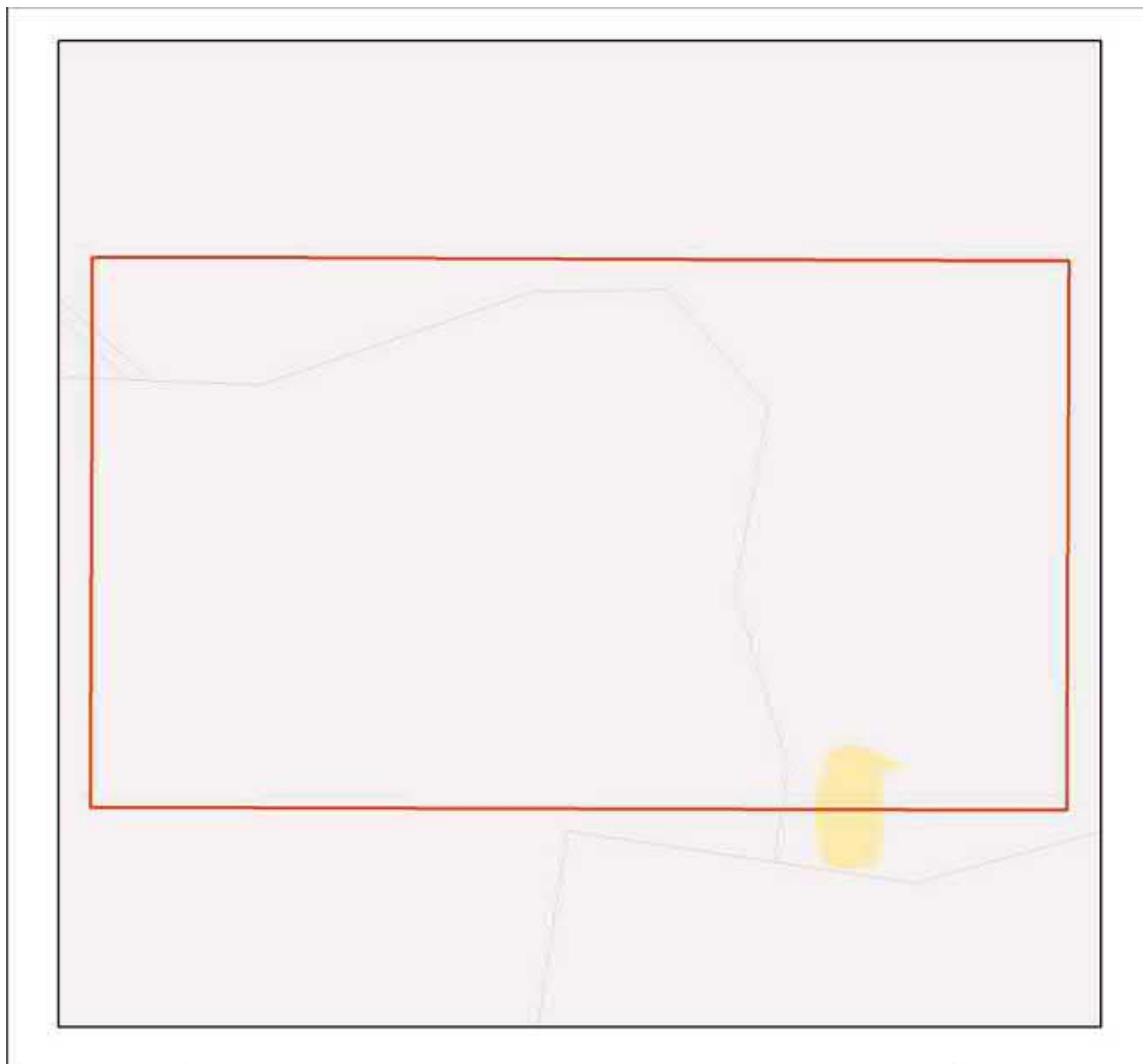
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Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals



MSES - Species Threatened (endangered or vulnerable) wildlife and special least concern animals

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (special least concern)
- Wildlife habitat (endangered or vulnerable)



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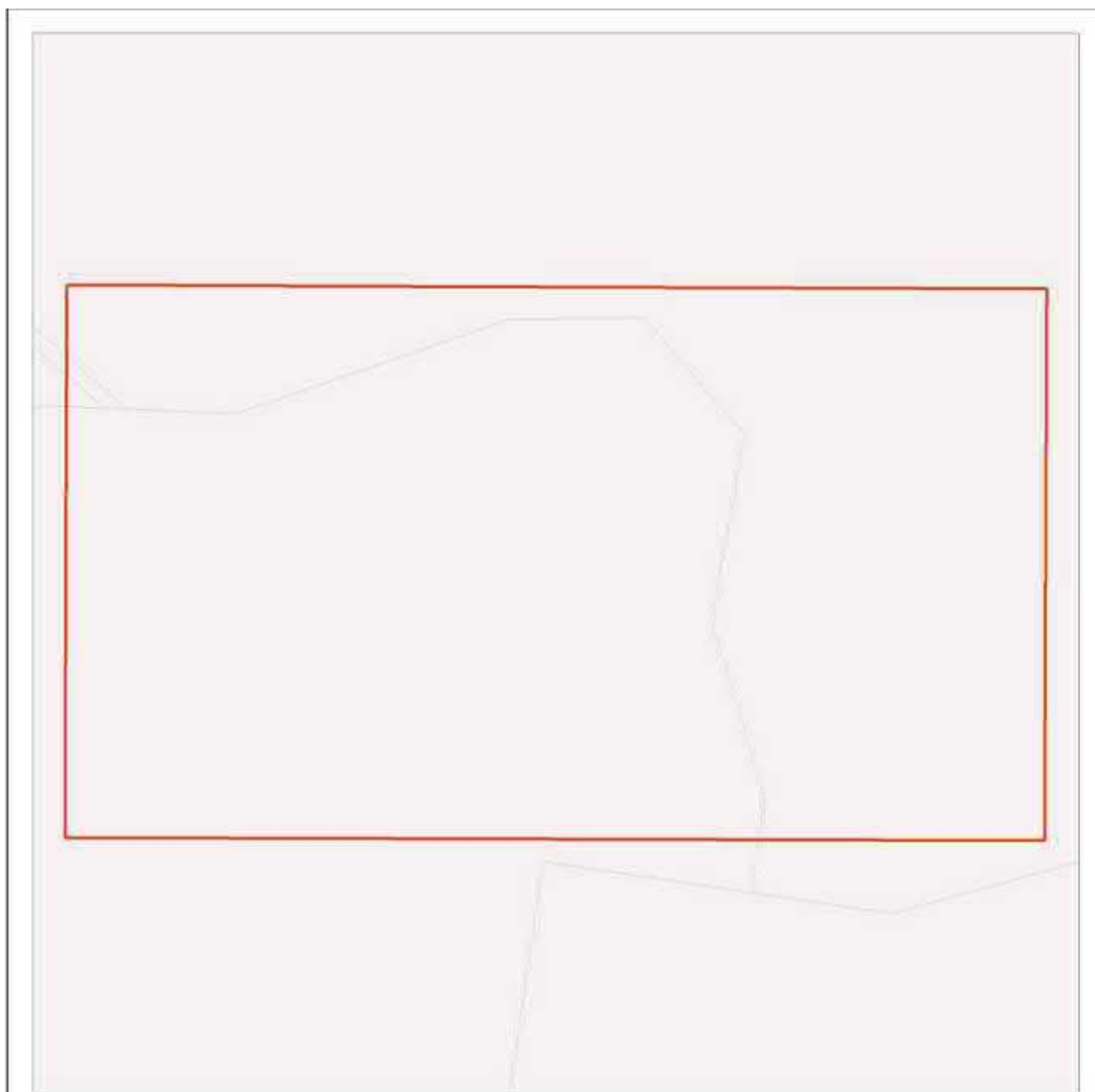
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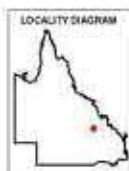
Map 3b - MSES - Species - Koala habitat area (SEQ)



MSES - Species Koala habitat area (SEQ)

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Koala habitat area (core)
- Koala habitat area (locally refined)



The koala habitat mapping within South East Queensland uses regional ecosystem linework compiled at a scale varying from 1:25,000 to 1:100,000. Linework should be used as a guide only. The positional accuracy of regional ecosystem data mapped at a scale of 1:100,000 is +/- 100 metres.

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The represented layers for SEQ 'koala habitat area-core' and 'koala habitat area-locally refined' in MSES are sourced directly from the regulatory mapping under the Nature Conservation (Koala) Conservation Plan 2017. Whilst every effort is made to ensure the information remains current, there may be delays between updating versions. Please refer to the original mapping for the most recent version. See <https://environment.dea.qld.gov.au/wildlife/animals/living-with/koalas/mapping>

Map 4 - MSES - Regulated Vegetation



MSES - Regulated Vegetation

Area of Interest

- Selected Mining Lease (ML)
- ▲ Towns
- Freeways/highways
- Secondary roads
- Major rivers/creeks
- Regulated vegetation (intersecting a watercourse)
- Regulated vegetation (100m from wetland)
- Regulated vegetation (category B - endangered or of concern)
- Regulated vegetation (category C - endangered or of concern)
- Regulated vegetation (category R - GBR riverine)
- Regulated vegetation (essential habitat)



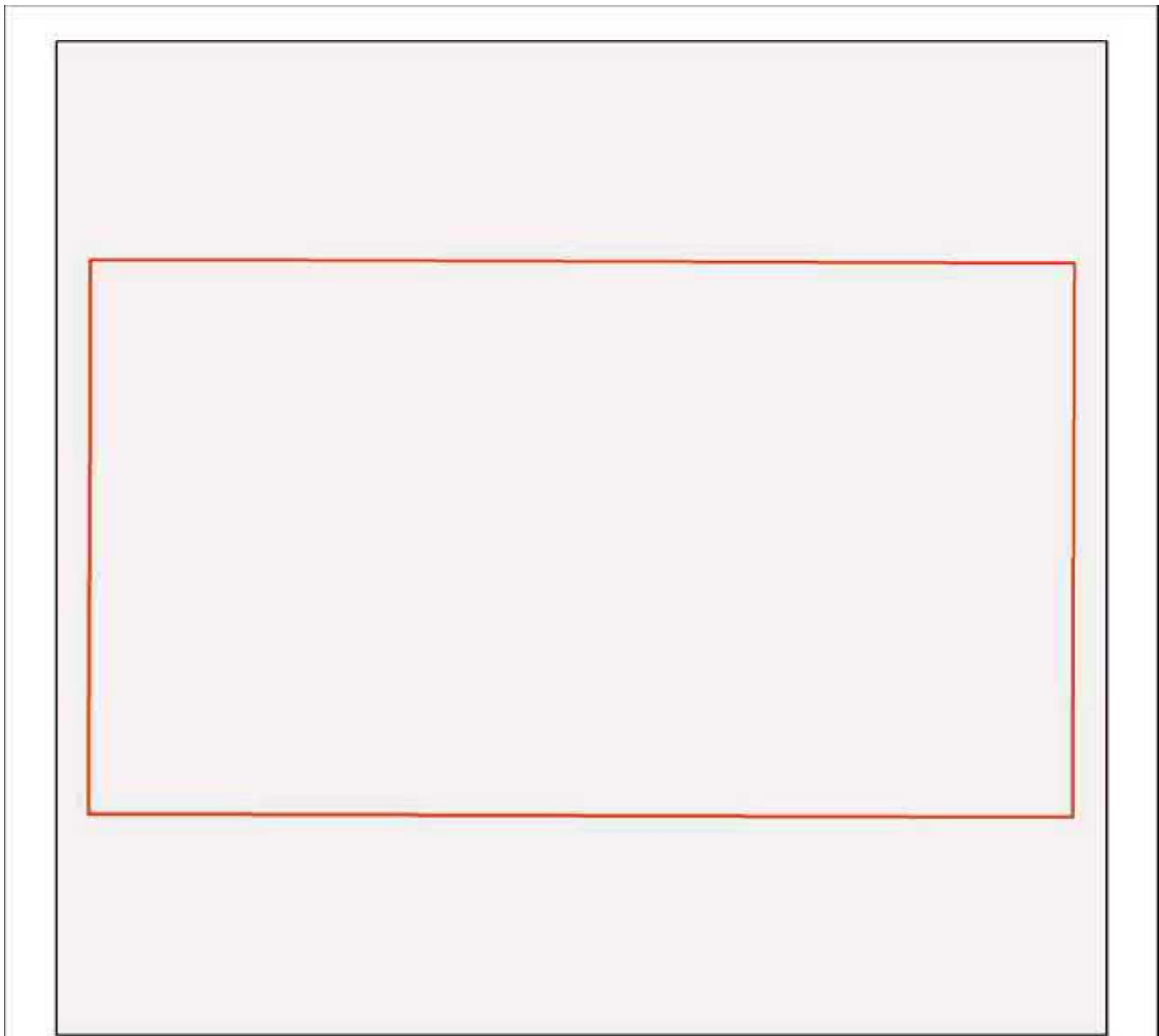
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Map 5 - MSES - Offset Areas



MSES - Offsets

Area of Interest

-  Selected Mining Lease (ML)
-  Towns
-  Freeways/Highways
-  Secondary roads
-  Major rivers/creeks
-  Legally secured offset area (offset register)
-  Legally secured offset area (vegetation offsets)



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Matters of State Environmental Significance

For the selected area of interest
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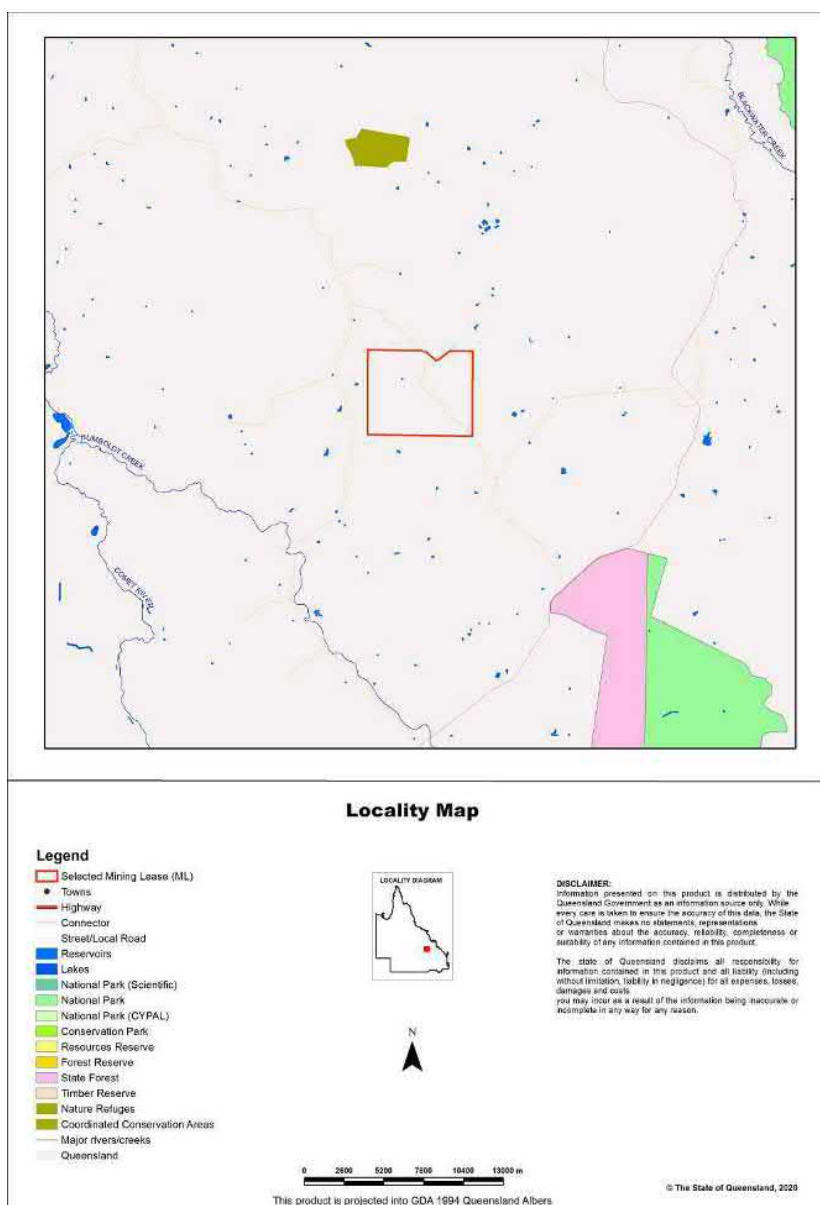
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'The sustainable, long-term conservation of biodiversity is supported. Significant impacts on matters of national or state environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset.'

The MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The SPP defines matters of state environmental significance as:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992* ;
- Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the *Marine Parks Act 2004* ;
- Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;
- Threatened wildlife under the *Nature Conservation Act 1992* and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006;
- Regulated vegetation under the *Vegetation Management Act 1999* that is:
 - Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;
 - Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;
 - Category R areas on the regulated vegetation management map;
 - Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse and drainage feature map;
 - Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;
- Strategic Environmental Areas under the *Regional Planning Interests Act 2014* ;
- Wetlands 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 defined in the Environmental Protection (Water) Policy 2009, schedule 2;
- Legally secured offset areas.

MSES Values Present

The MSES values that are present in the area of interest are summarised in the table below:

Table 2: Summary of MSES present within the AOI

1a Protected Areas- estates	0.0 ha	0.0 %
1b Protected Areas- nature refuges	0.0 ha	0.0 %
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	8.14 ha	0.2%
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways **	0.0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	11.34 ha	0.3%
7b Special least concern animals	0.0 ha	0.0 %
7c i Koala habitat area - core (SEQ)	0.0 ha	0.0 %
7c ii Koala habitat area - locally refined (SEQ)	0.0 ha	0.0 %
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	58.38 ha	1.6%
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	0.0 ha	0.0%
8c Regulated Vegetation - Category R (GBR riverine regrowth)	0.79 ha	0.0%
8d Regulated Vegetation - Essential habitat	11.34 ha	0.3%
8e Regulated Vegetation - intersecting a watercourse **	20.3 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	11.34 ha	0.3%
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(no results)

1b. Protected Areas - nature refuges

(no results)

2. State Marine Parks - highly protected zones

(no results)

3. Fish habitat areas (A and B areas)

(no results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

MSES - Wetlands and Waterways

4. Strategic Environmental Areas (SEA)

(no results)

5. High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values

Natural wetlands that are 'High Ecological Significance' (HES) on the Map of Queensland Wetland Environmental Values are present.

6a. Wetlands in High Ecological Value (HEV) waters

(no results)

6b. Waterways in High Ecological Value (HEV) waters

(no results)

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

MSES - Species

7a. Threatened (endangered or vulnerable) wildlife

Values are present

7b. Special least concern animals

Not applicable

7c i. Koala habitat area - core (SEQ)

Not applicable

7c ii. Koala habitat area - locally refined (SEQ)

Not applicable

Threatened (endangered or vulnerable) wildlife habitat suitability models

Species	Common name	NCA status	Presence
<i>Boronia keysii</i>		V	None
<i>Calyptorhynchus lathami</i>	Glossy black cockatoo	V	None
<i>Casuarius casuaris johnsonii</i>	Sthn population cassowary	E	None
<i>Crinia tinnula</i>	Wallum froglet	V	None
<i>Denisonia maculata</i>	Ornamental snake	V	Core
<i>Litoria freycineti</i>	Wallum rocketfrog	V	None
<i>Litoria olongburensis</i>	Wallum sedgefrog	V	None
<i>Melaleuca irbyana</i>		E	None
<i>Petaurus gracilis</i>	Mahogany Glider	E	None
<i>Petrogale persephone</i>	Proserpine rock-wallaby	E	None
<i>Phascolarctos cinereus</i>	Koala - outside SEQ*	V	None
<i>Pezoporus wallicus wallicus</i>	Eastern ground parrot	V	None
<i>Taudactylus Pleione</i>	Kroombit tinkerfrog	E	None
<i>Xeromys myoides</i>	Water Mouse	V	None

*For koala model, this includes areas outside SEQ. Check 7c SEQ koala habitat for presence/absence.

Threatened (endangered or vulnerable) wildlife species records

(no results)

Special least concern animal species records

(no results)

*Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL).
Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)

Migratory status (M) - China and Australia Migratory Bird Agreement (C), Japan and Australia Migratory Bird Agreement (J), Republic of Korea and Australia Migratory Bird Agreement (R), Bonn Migratory Convention (B), Eastern Flyway (E)

To request a species list for an area, or search for a species profile, access Wildlife Online at:

<https://www.qld.gov.au/environment/plants-animals/species-list/>

Refer to **Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals** and **Map 3b - MSES - Species - Koala habitat area (SEQ)** for an overview of the relevant MSES.

MSES - Regulated Vegetation

For further information relating to regional ecosystems in general, go to:

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

For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:

<https://environment.ehp.qld.gov.au/regional-ecosystems/>

8a. Regulated Vegetation - Endangered/Of concern in Category B (remnant)

Regional ecosystem	Vegetation management polygon	Vegetation management status
11.3.2/11.3.25	O-dom	rem_oc
11.4.8	E-dom	rem_end

8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)

Regional ecosystem	Vegetation management polygon	Vegetation management status
11.3.2/11.3.25	O-dom	hvr_oc

8c. Regulated Vegetation - Category R (GBR riverine regrowth)

Regulated vegetation map category	Map number	RVM rule
R	8649	4

8d. Regulated Vegetation - Essential habitat

Values are present

8e. Regulated Vegetation - intersecting a watercourse**

A vegetation management watercourse is mapped as present

8f. Regulated Vegetation - within 100m of a Vegetation Management wetland

Regulated vegetation map category	Map number	RVM rule
B	8649	2

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets

9a. Legally secured offset areas - offset register areas

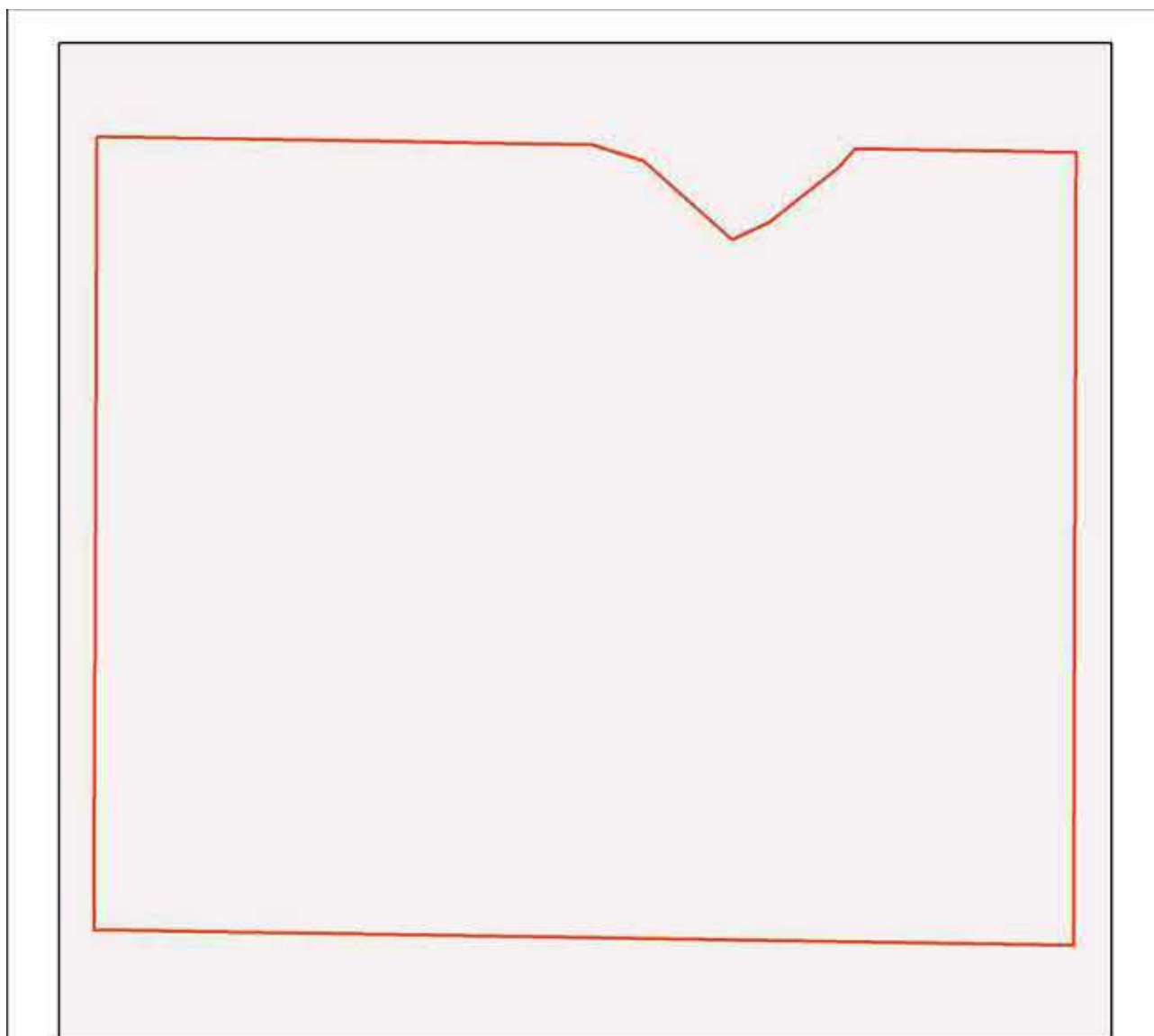
(no results)

9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation

(no results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

Map 1 - MSES - State Conservation Areas



MSES - State Conservation Areas

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Protected area (estates)
- Declared fish habitat area (A and B areas)
- Marine park (highly protected)



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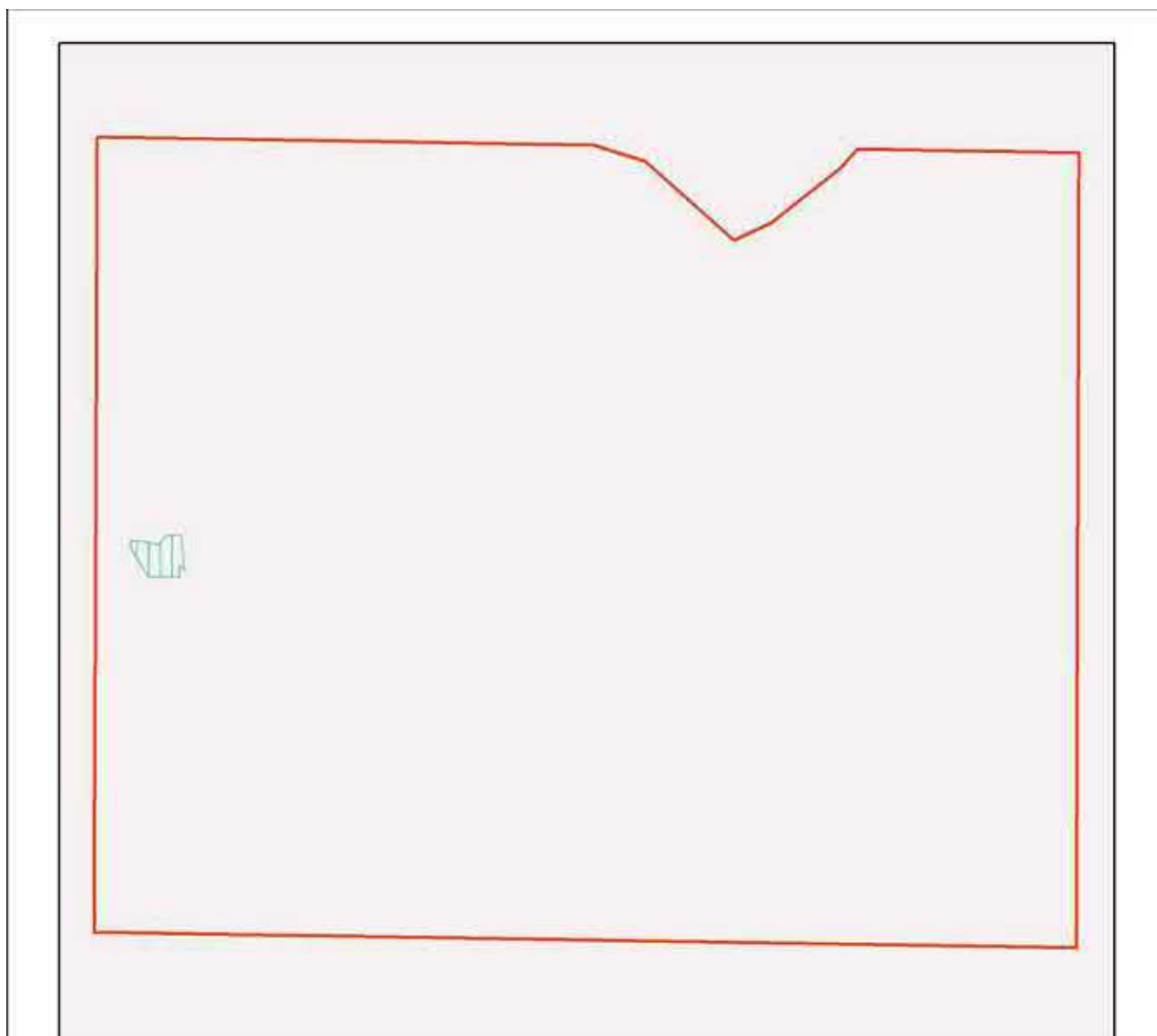
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Map 2 - MSES - Wetlands and Waterways



MSES - Wetlands and Waterways

Area of Interest

-  Selected Mining Lease (ML)
-  Towns
-  Freeways/Highways
-  Secondary roads
-  Major rivers/creeks
-  Declared high ecological value waters (watercourse)
-  Strategic environmental area (designated precinct)
-  Declared high ecological value waters (wetland)
-  High ecological significance wetlands



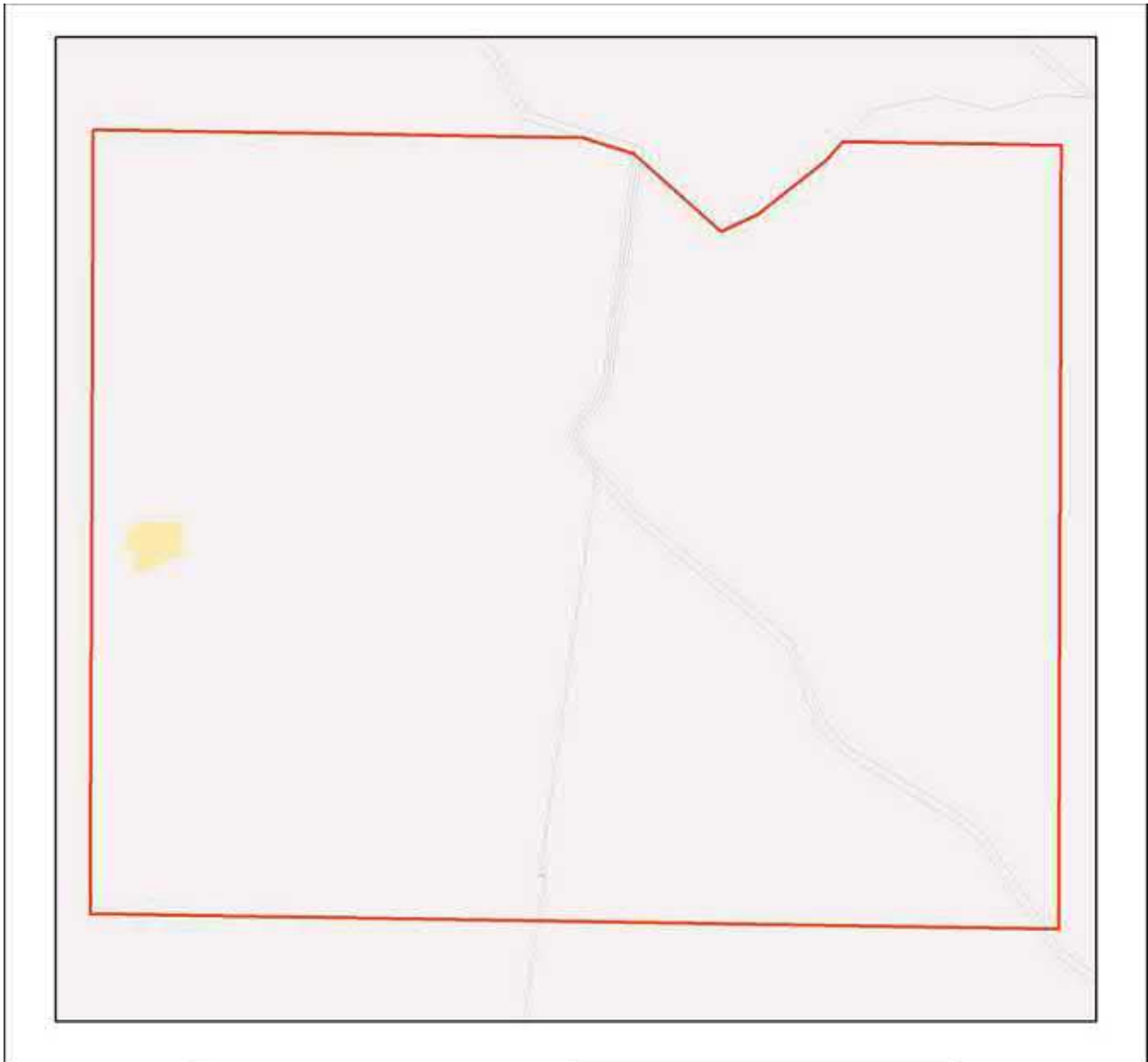
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Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals



MSES - Species Threatened (endangered or vulnerable) wildlife and special least concern animals

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (special least concern)
- Wildlife habitat (endangered or vulnerable)



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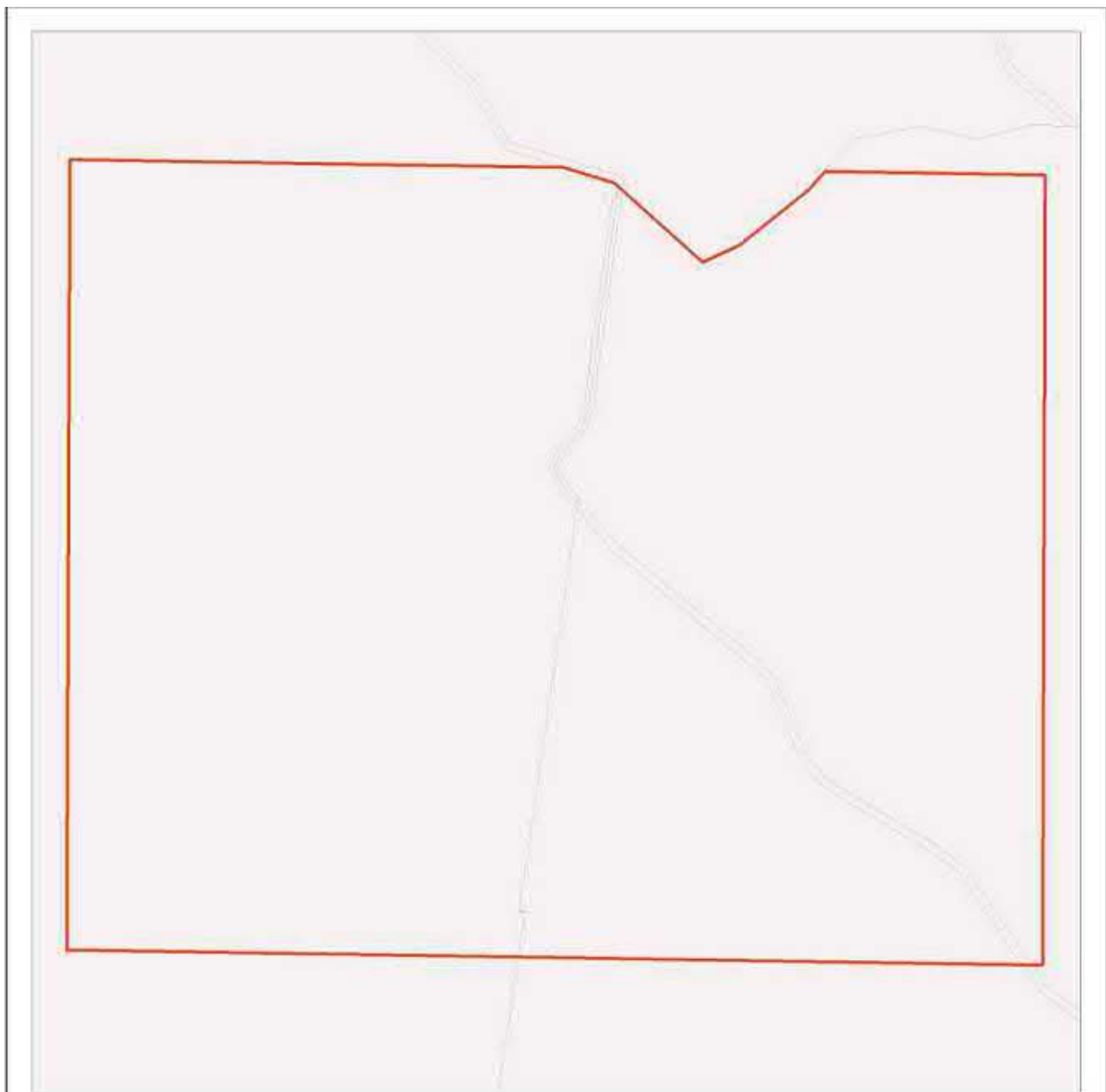
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Map 3b - MSES - Species - Koala habitat area (SEQ)



MSES - Species Koala habitat area (SEQ)

Area of Interest

- Selected Mining Lease (ML)
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Koala habitat area (core)
- Koala habitat area (locally refined)



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The represented layers for SEQ 'koala habitat area-core' and 'koala habitat area-locally refined' in MSES are sourced directly from the regulatory mapping under the Nature Conservation (Koala) Conservation Plan 2017. Whilst every effort is made to ensure the information remains current, there may be delays between updating versions. Please refer to the original mapping for the most recent version. See <https://environment.dea.qld.gov.au/wildlife/animals/living-with/koalas/mapping>

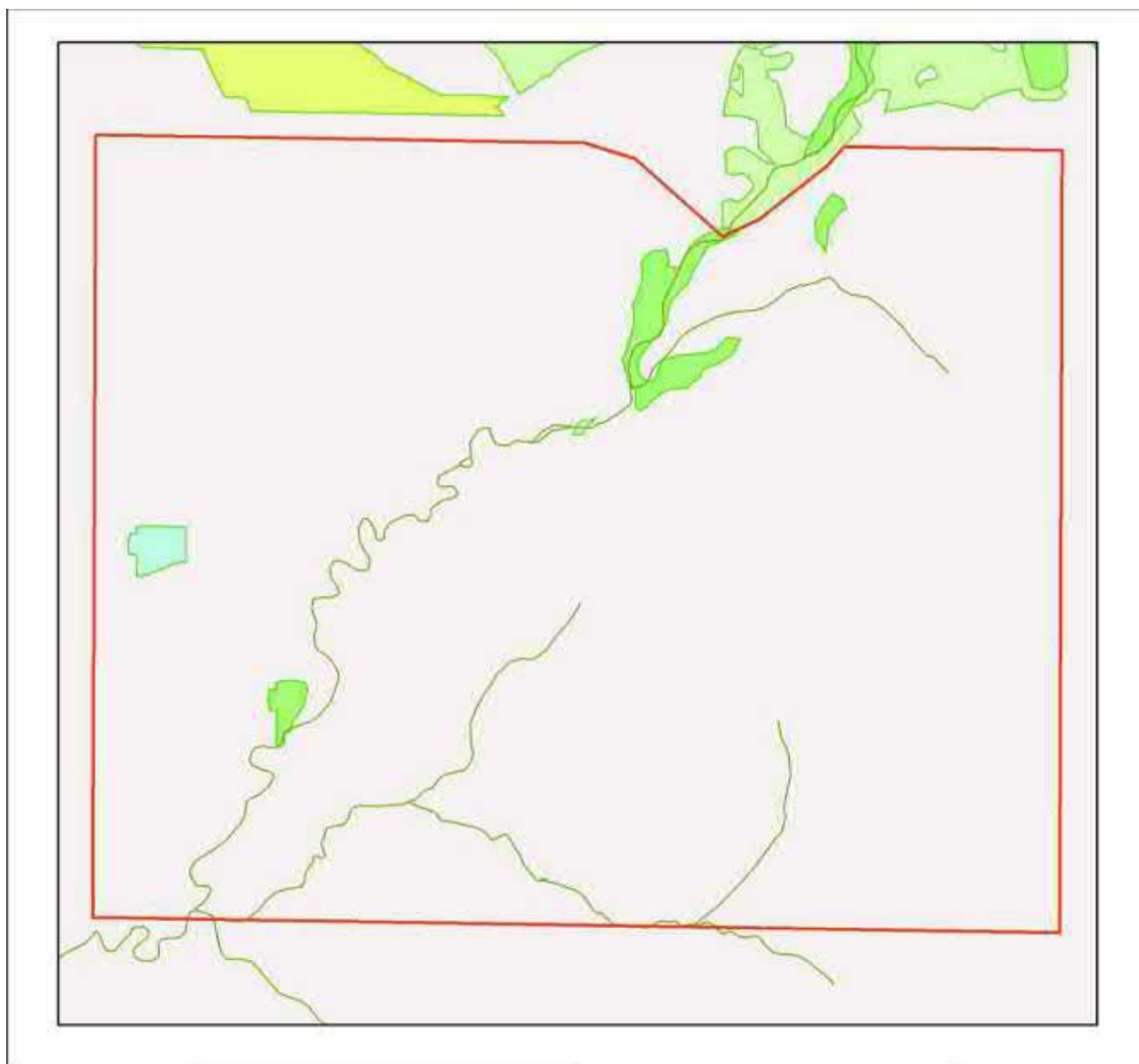
The koala habitat mapping within South East Queensland uses regional ecosystem linework compiled at a scale varying from 1:25,000 to 1:100,000. Linework should be used as a guide only. The positional accuracy of regional ecosystem data mapped at a scale of 1:100,000 is +/- 100 metres.



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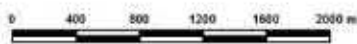
Map 4 - MSES - Regulated Vegetation



MSES - Regulated Vegetation

Area of Interest

- Selected Mining Lease (ML)
- ▲ Towns
- Freeways/highways
- Secondary roads
- Major rivers/creeks
- Regulated vegetation (intersecting a watercourse)
- Regulated vegetation (100m from wetland)
- Regulated vegetation (category B - endangered or of concern)
- Regulated vegetation (category C - endangered or of concern)
- Regulated vegetation (category R - GBR riverine)
- Regulated vegetation (essential habitat)



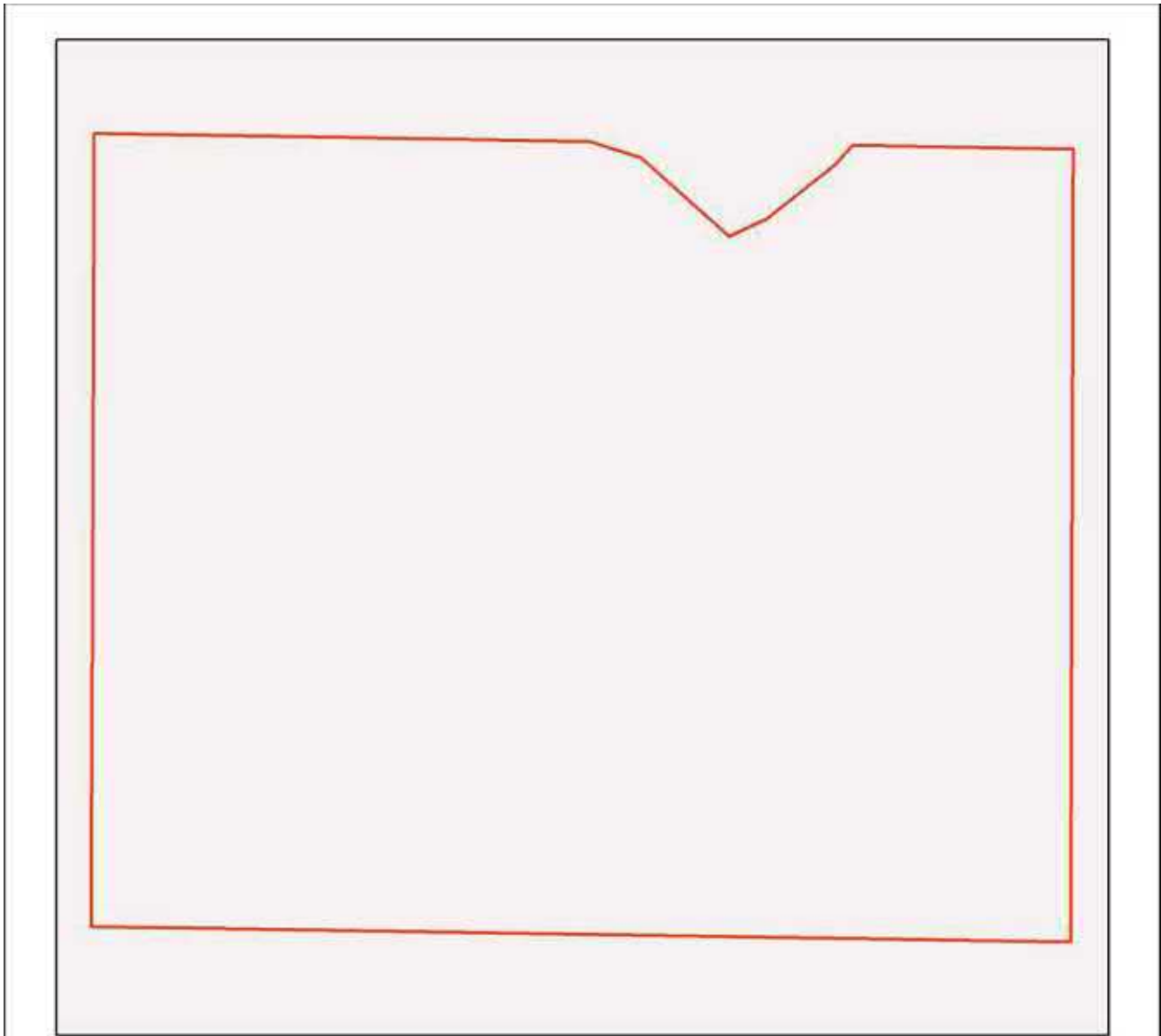
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Map 5 - MSES - Offset Areas



MSES - Offsets

Area of Interest

-  Selected Mining Lease (ML)
-  Towns
-  Freeways/Highways
-  Secondary roads
-  Major rivers/creeks
-  Legally secured offset area (offset register)
-  Legally secured offset area (vegetation offsets)



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Appendices

Appendix 1 - Matters of State Environmental Significance (MSES) methodology

MSES mapping is a regional-scale representation of the definition for MSES under the State Planning Policy (SPP). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" can be downloaded from:

<http://www.ehp.qld.gov.au/land/natural-resource/method-mapping-mses.html> .

Appendix 2 - Source Data

The datasets listed below are available on request from:

<http://qldspatial.information.qld.gov.au/catalogue/custom/index.page>

- Matters of State environmental significance

Note: MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of underlying environment databases and geo-referenced information sources. MSES mapping is a versioned product that is updated generally on a twice-yearly basis to incorporate the changes to underlying data sources. Several components of MSES mapping made for the current version may differ from the current underlying data sources. To ensure accuracy, or proper representation of MSES values, it is strongly recommended that users refer to the underlying data sources and review the current definition of MSES in the State Planning Policy, before applying the MSES mapping.

Individual MSES layers can be attributed to the following source data available at QSpatial:

MSES layers	current QSpatial data (http://qspatial.information.qld.gov.au)
Protected Areas-Estates and Nature Refuges	- Protected areas of Queensland - Nature Refuges - Queensland
Marine Park-Highly Protected Zones	Moreton Bay marine park zoning 2008
Fish Habitat Areas	Queensland fish habitat areas
Strategic Environmental Areas-designated	Regional Planning Interests Act - Strategic Environmental Areas
HES wetlands	Map of Queensland Wetland Environmental Values
Wetlands in HEV waters	HEV waters: - EPP Water (multiple locations) intent for waters Source Wetlands: - Queensland Wetland Mapping (Current version 4, 2015) Source Watercourses: - Vegetation management watercourse and drainage feature map (1:100000 and 1:250000)
Wildlife habitat (threatened and special least concern)	-WildNet database species records - habitat suitability models (various) - SEQ koala habitat areas under the Koala Conservation Plan 2019
VMA regulated regional ecosystems	Vegetation management regional ecosystem and remnant map
VMA Essential Habitat	Vegetation management - essential habitat map
VMA Wetlands	Vegetation management wetlands map
Legally secured offsets	Vegetation Management Act property maps of assessable vegetation. For offset register data-contact DES
Regulated Vegetation Map	Vegetation management - regulated vegetation management map

A.4 Regional Ecosystem Report search results



Department of Environment and Science

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
ml: 70167

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

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government 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 the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.



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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: ml: 70167

Size (ha)	3,752.5
Local Government(s)	Central Highlands 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	11.34	0.3
Of concern	47.04	1.25
No concern at present	98.4	2.62
Total remnant vegetation	156.78	4.18

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
11.3.2	Eucalyptus populnea woodland on alluvial plains	Of concern	39.99	1.07
11.3.25	Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines	Of concern	7.06	0.19
11.4.8	Eucalyptus cambageana woodland to open forest with Acacia harpophylla or A. argyrodendron on Cainozoic clay plains	Endangered	11.34	0.3
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	98.4	2.62
non-rem	None	None	3,595.72	95.82

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
11.3.2	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
11.4.8	Pre-clearing 724000 ha; Remnant 2017 67000 ha	25a	Contains palustrine wetland (e.g. in swales).	Low
11.5.9b	Pre-clearing 365000 ha; Remnant 2017 238000 ha	18b	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
11.3.2	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.
11.4.8	Larger gilgai may provide ephemeral wetland habitat.
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>
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	3,595.72	95.82
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)	7.06	0.19
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)	39.99	1.07
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)	98.4	2.62

BVG (1 Million)	Description	Area (Ha)	% of AOI
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])	11.34	0.3

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/>

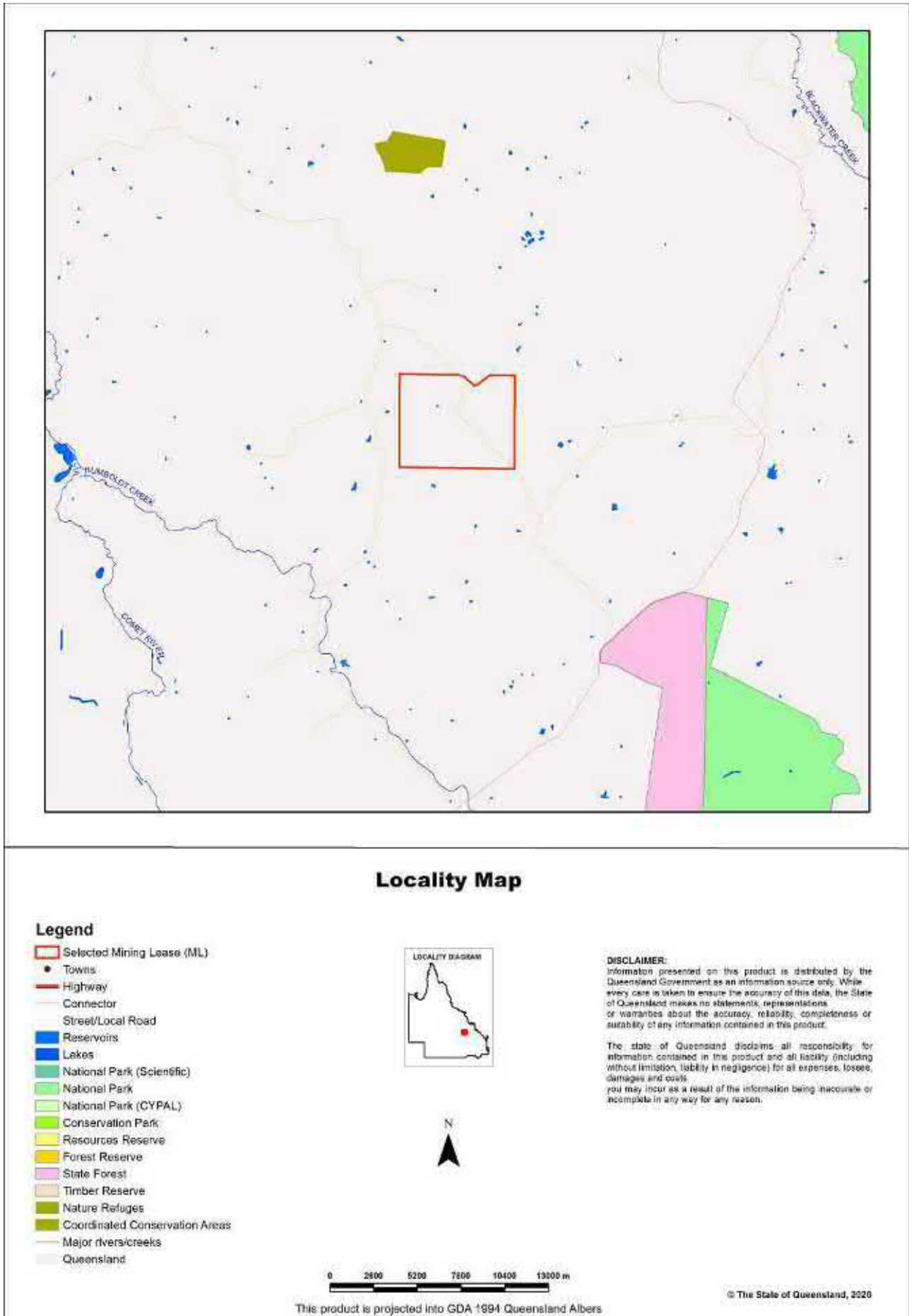
Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance 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
11.3.2	Available	Not currently available
11.3.25	Available	Not currently available
11.4.8	Available	Not currently available
11.5.9b	Available	Not currently available
non-rem	Not currently available	Not currently available

Maps

Map 1 - Location



Map 2 - Remnant 2017 regional ecosystems



Remnant 2017 Regional Ecosystems

Biodiversity Status

- Selected Mining Lease (ML)
- 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 Abers

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.

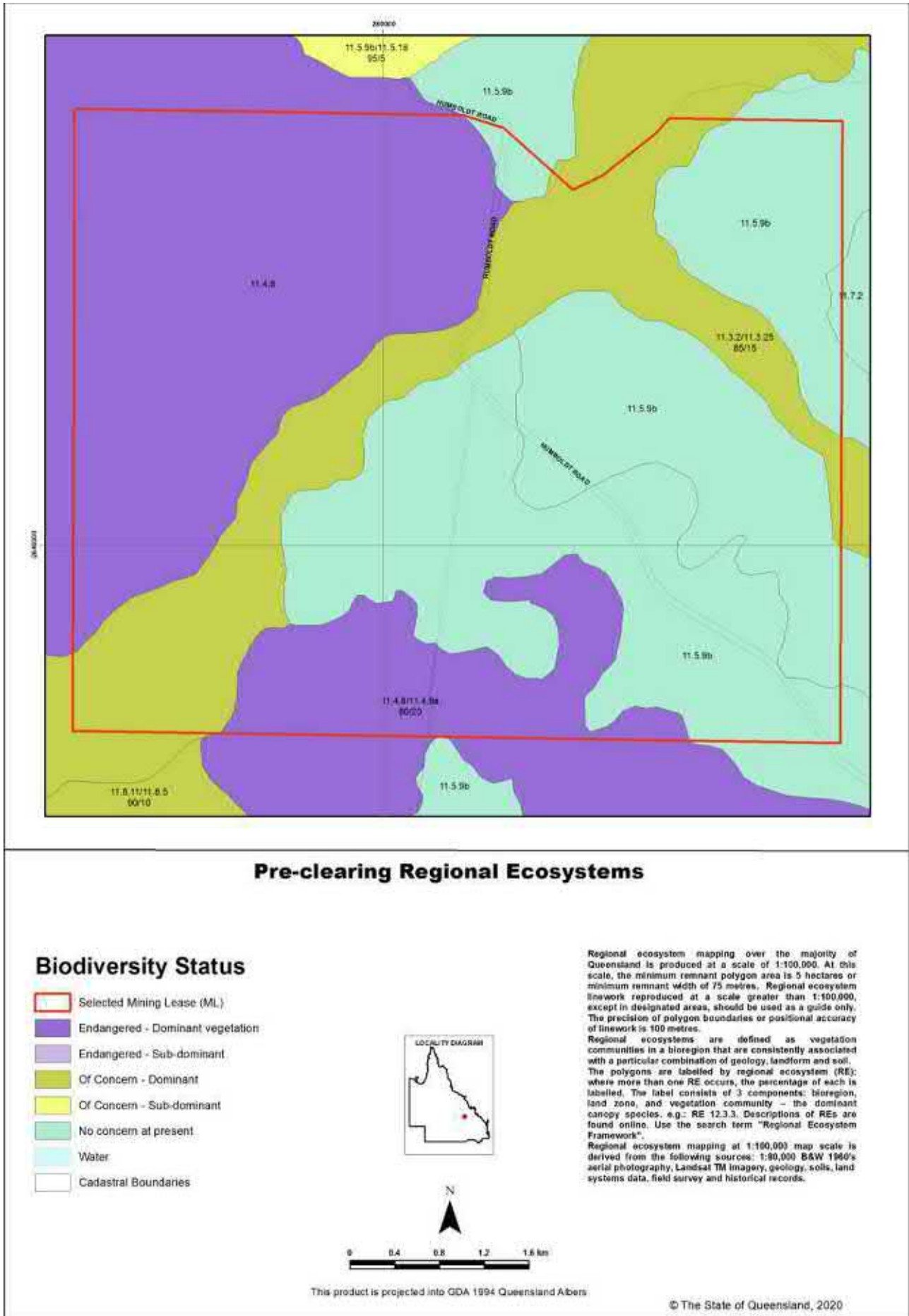
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The polygons are labelled by regional ecosystem (RE), where more than one RE occurs, the percentage of each is labelled. The label consists 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.

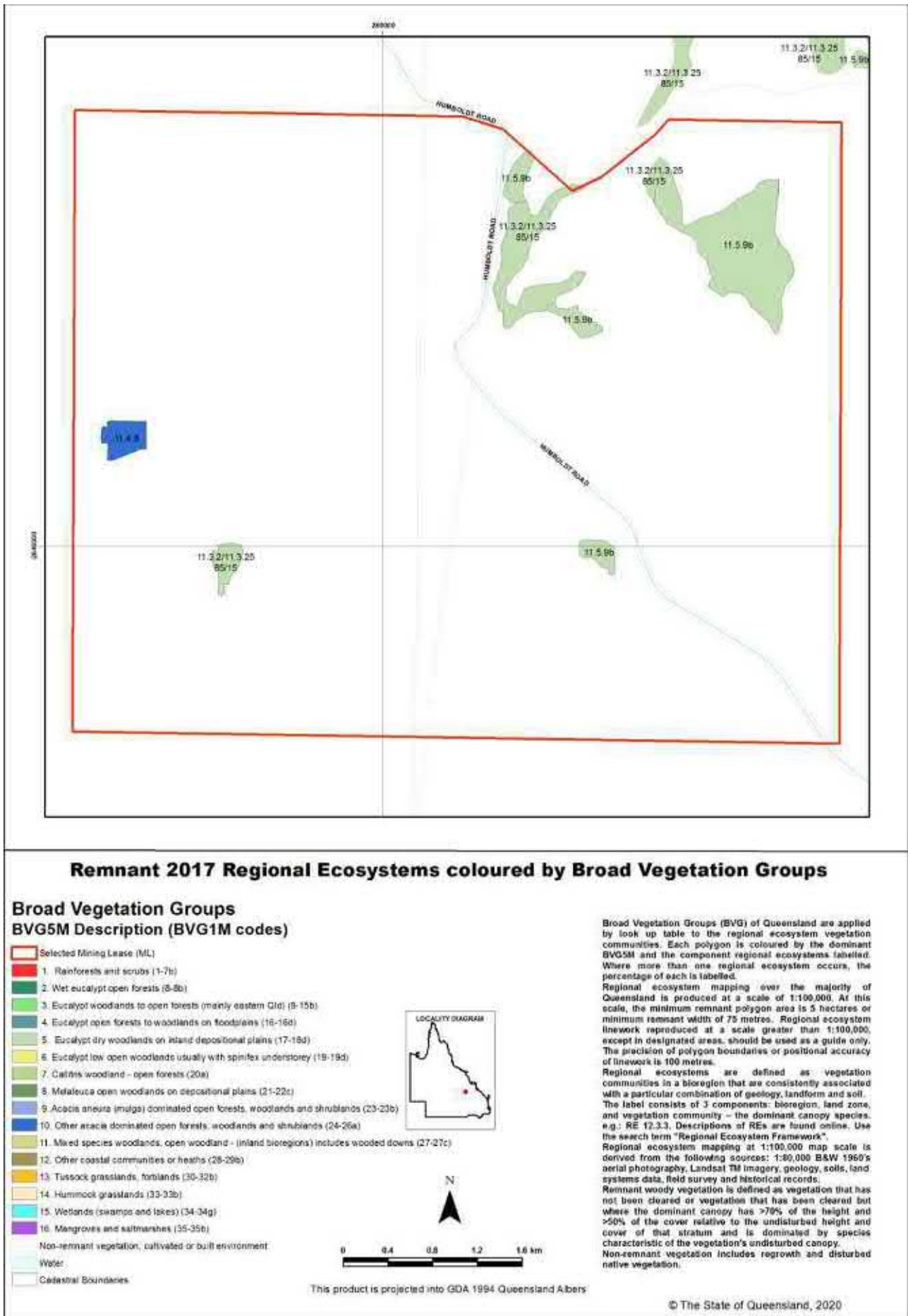
Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's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

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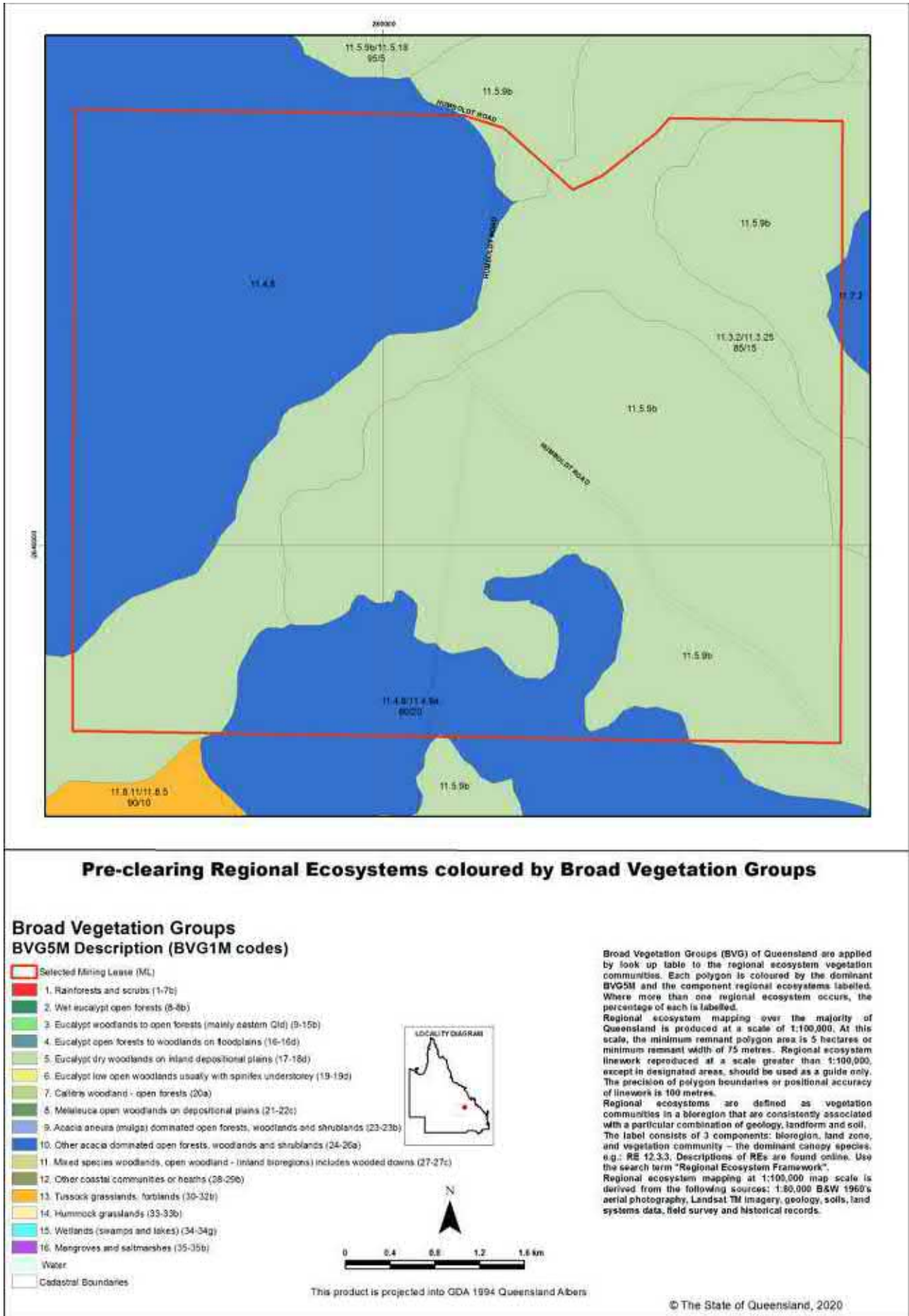
Map 3 - Pre-clearing regional ecosystems



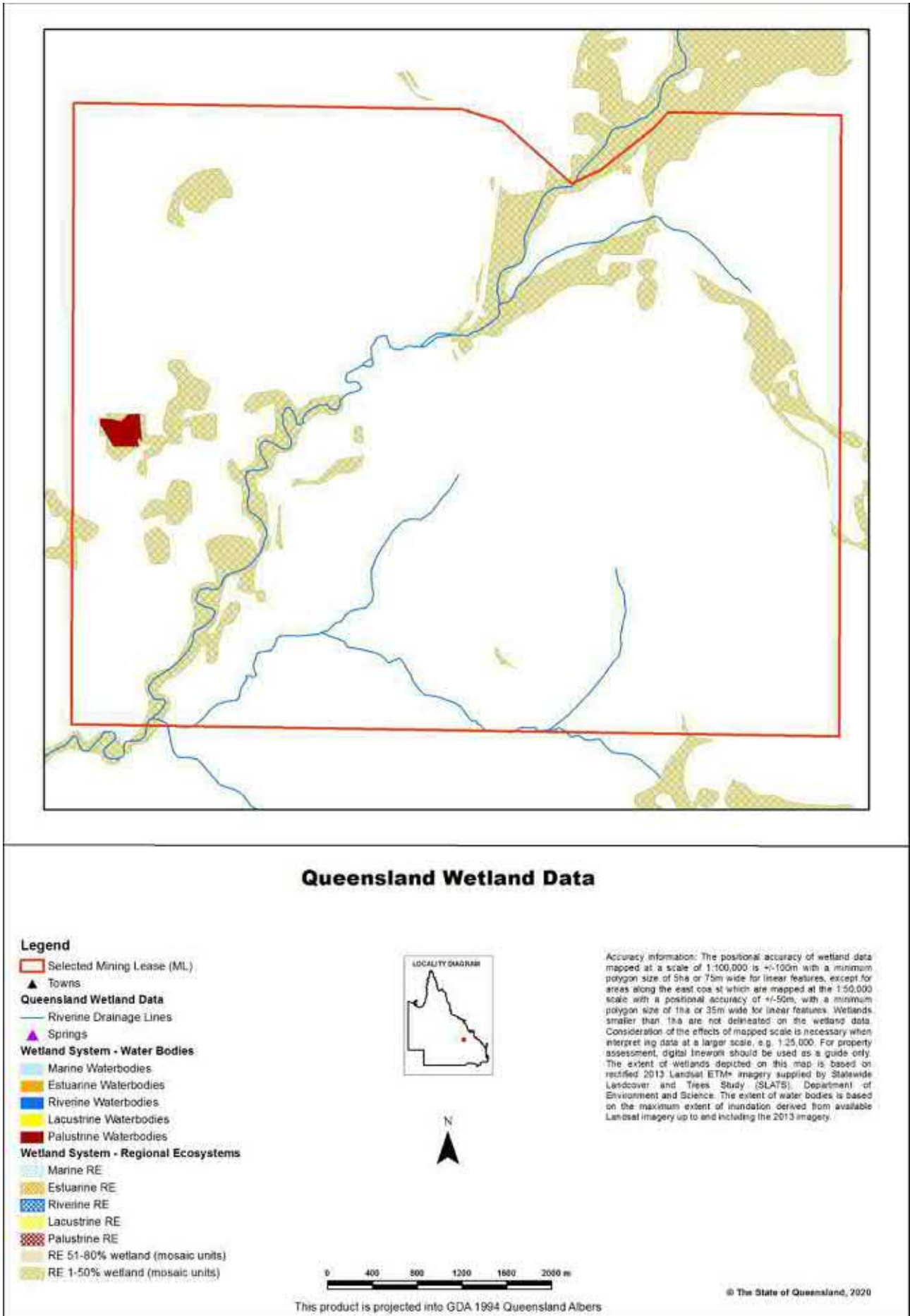
Map 4 - Remnant 2017 regional ecosystems by BVG (5M)



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



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>



Queensland Government

Department of Environment and Science

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
ml: 70139

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

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government 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 the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.



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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: ml: 70139

Size (ha)	946.54
Local Government(s)	Central Highlands 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	6.94	0.73
Of concern	53.01	5.6
No concern at present	142.36	15.04
Total remnant vegetation	202.3	21.37

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
11.3.2	Eucalyptus populnea woodland on alluvial plains	Of concern	45.06	4.76
11.3.25	Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines	Of concern	7.95	0.84
11.4.8	Eucalyptus cambageana woodland to open forest with Acacia harpophylla or A. argyrodendron on Cainozoic clay plains	Endangered	5.55	0.59
11.4.9a	Acacia harpophylla shrubby woodland with Terminalia oblongata on Cainozoic clay plains	Endangered	1.39	0.15
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	84.42	8.92
11.7.2	Acacia spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	No concern at present	57.93	6.12
non-rem	None	None	744.23	78.63

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
11.3.2	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
11.4.8	Pre-clearing 724000 ha; Remnant 2017 67000 ha	25a	Contains palustrine wetland (e.g. in swales).	Low
11.4.9a	Pre-clearing 999000 ha; Remnant 2017 90000 ha	25a	None	Low

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
11.5.9b	Pre-clearing 365000 ha; Remnant 2017 238000 ha	18b	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
11.3.2	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.
11.4.8	Larger gilgai may provide ephemeral wetland habitat.
11.4.9a	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>
11.5.9b	Potential habitat for NCA listed species: <i>Cerbera dumicola</i> , <i>Cossinia australiana</i> , <i>Cycas ophiolitica</i> , <i>Solanum elachophyllum</i>
11.7.2	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	744.23	78.63

BVG (1 Million)	Description	Area (Ha)	% of AOI
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)	7.95	0.84
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)	45.06	4.76
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)	84.42	8.92
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])	57.93	6.12
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])	6.94	0.73

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/>

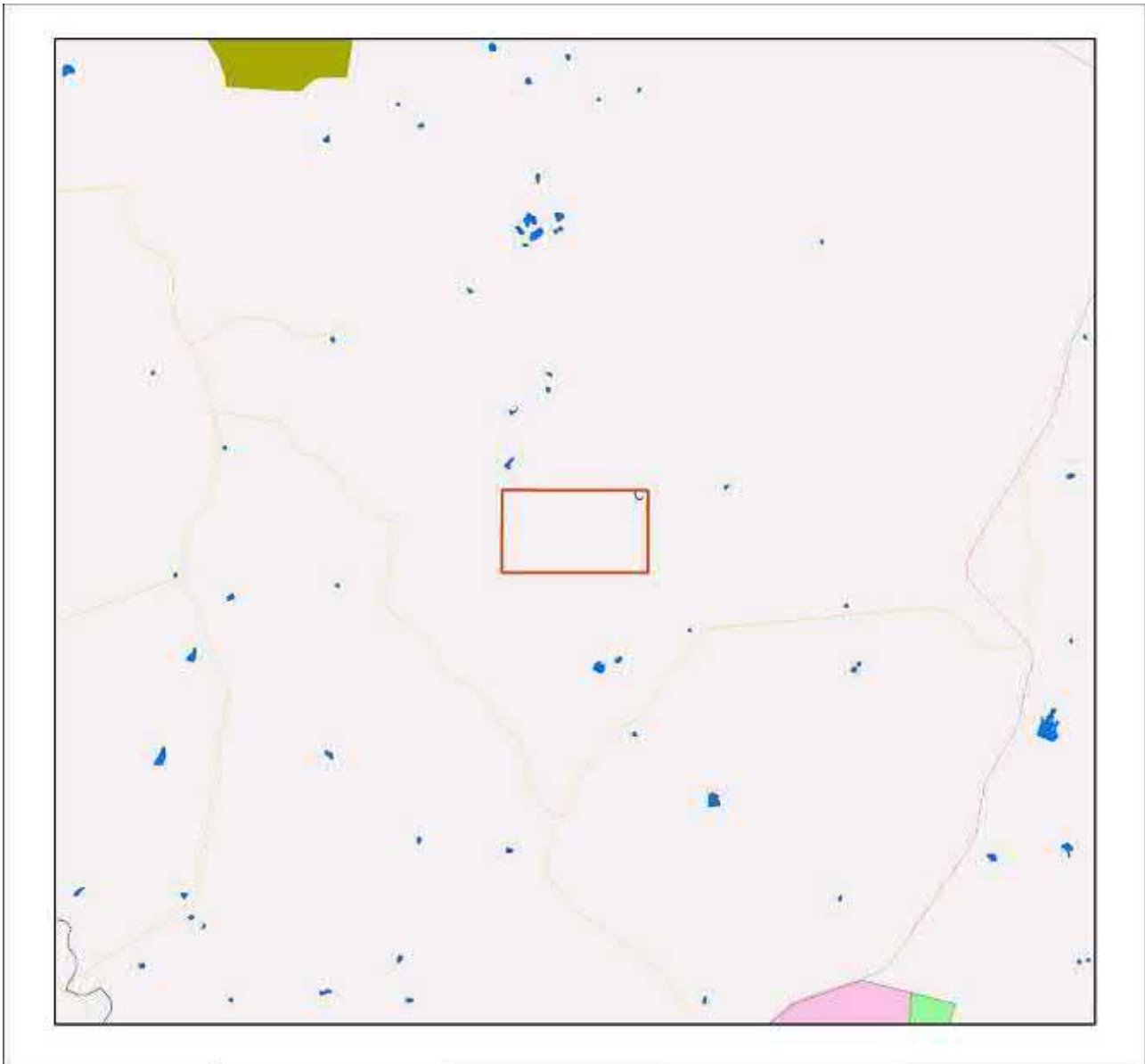
Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance 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
11.3.2	Available	Not currently available
11.3.25	Available	Not currently available
11.4.8	Available	Not currently available
11.4.9a	Available	Not currently available
11.5.9b	Available	Not currently available
11.7.2	Available	Not currently available
non-rem	Not currently available	Not currently available

Maps

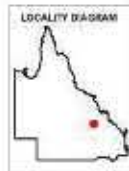
Map 1 - Location



Locality Map

Legend

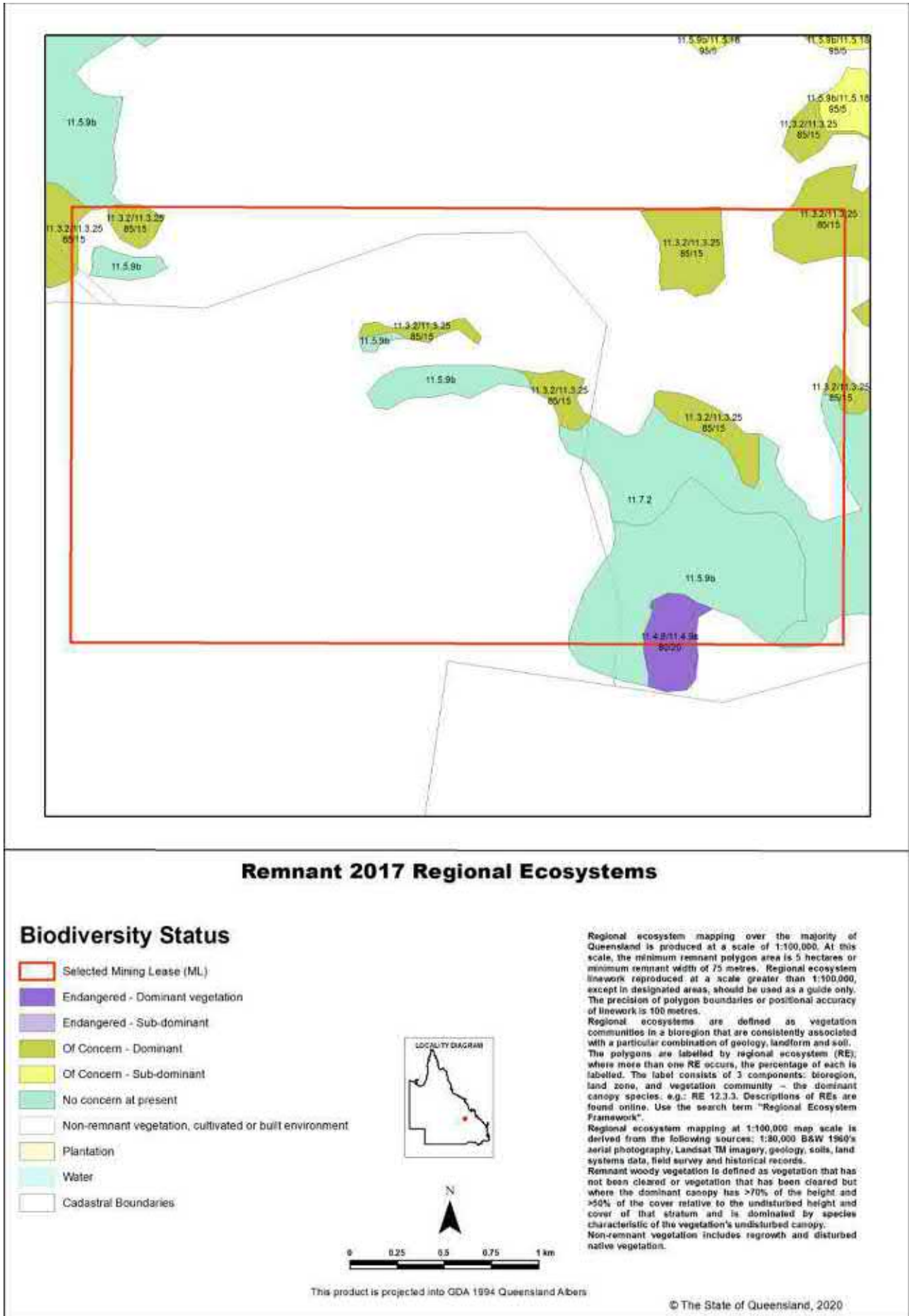
- Selected Mining Lease (ML)
- Towns
- Highway
- Connector
- Street/Local Road
- Reservoirs
- Lakes
- National Park (Scientific)
- National Park
- National Park (CYPAL)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation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



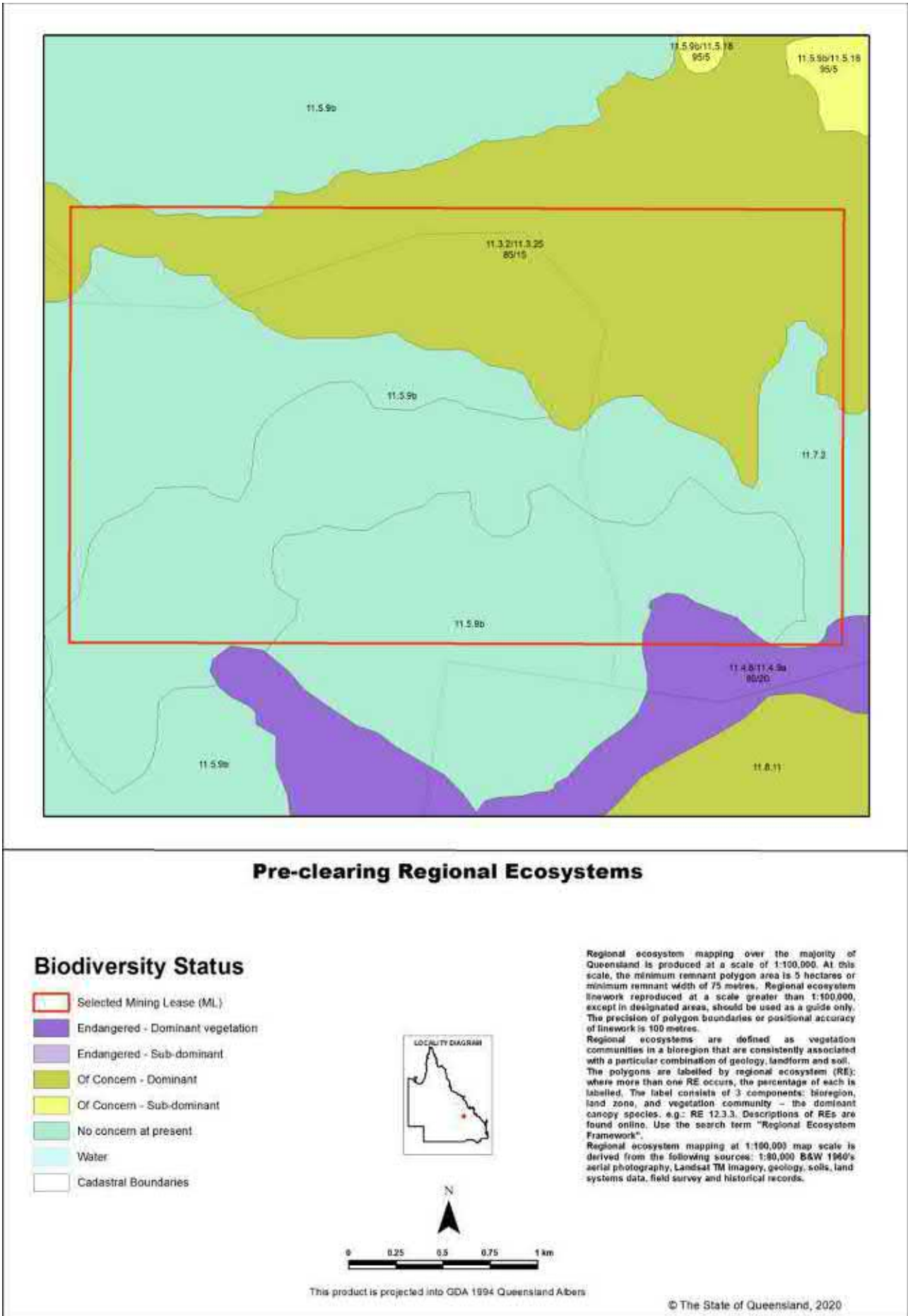
DISCLAIMER:
 Information presented on this product is distributed by the Queensland Government as an information source only. While every care is taken to ensure the accuracy of this data, the State of Queensland makes no statements, representations, or warranties about the accuracy, reliability, completeness or suitability of any information contained in this product.

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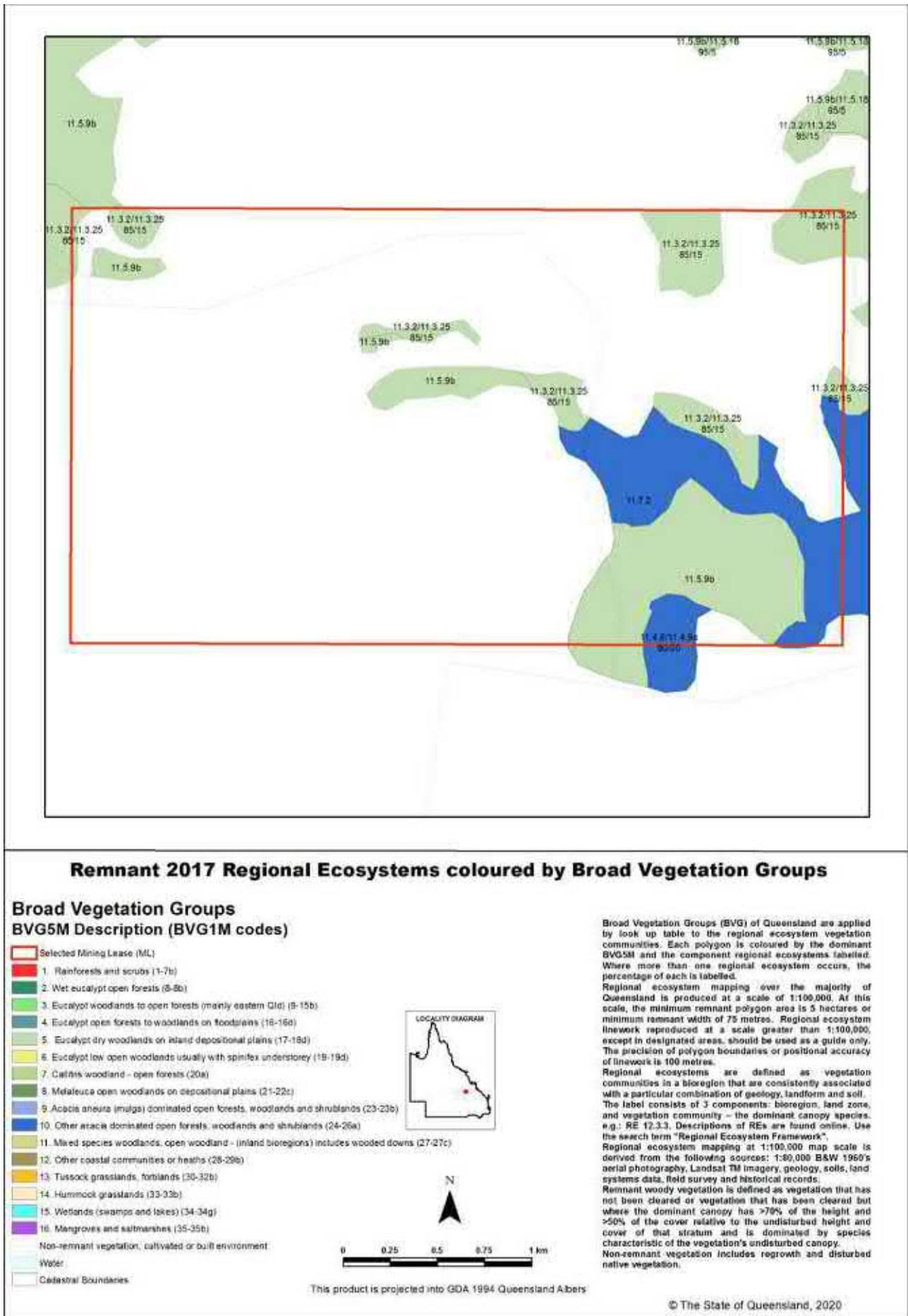
Map 2 - Remnant 2017 regional ecosystems



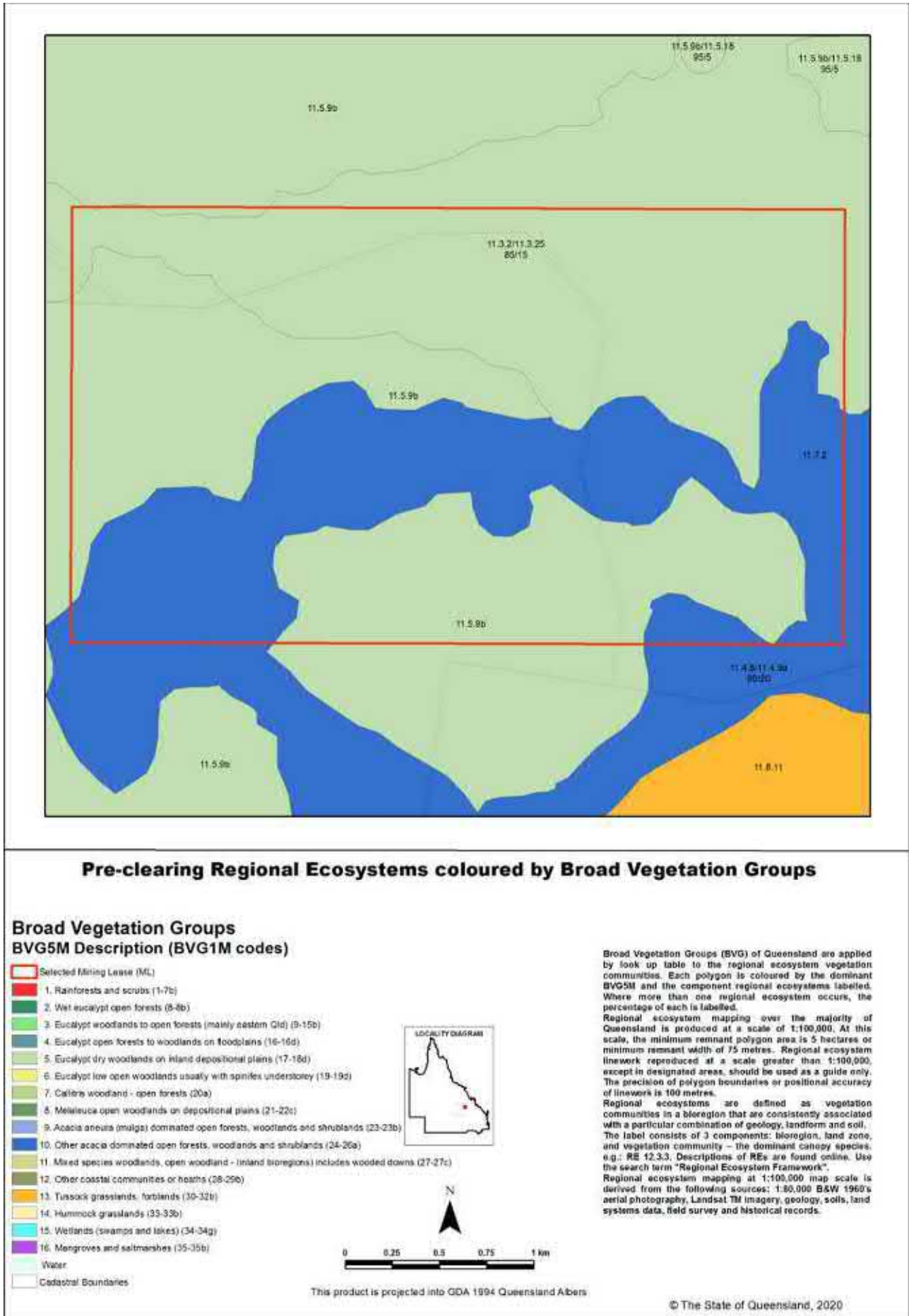
Map 3 - Pre-clearing regional ecosystems



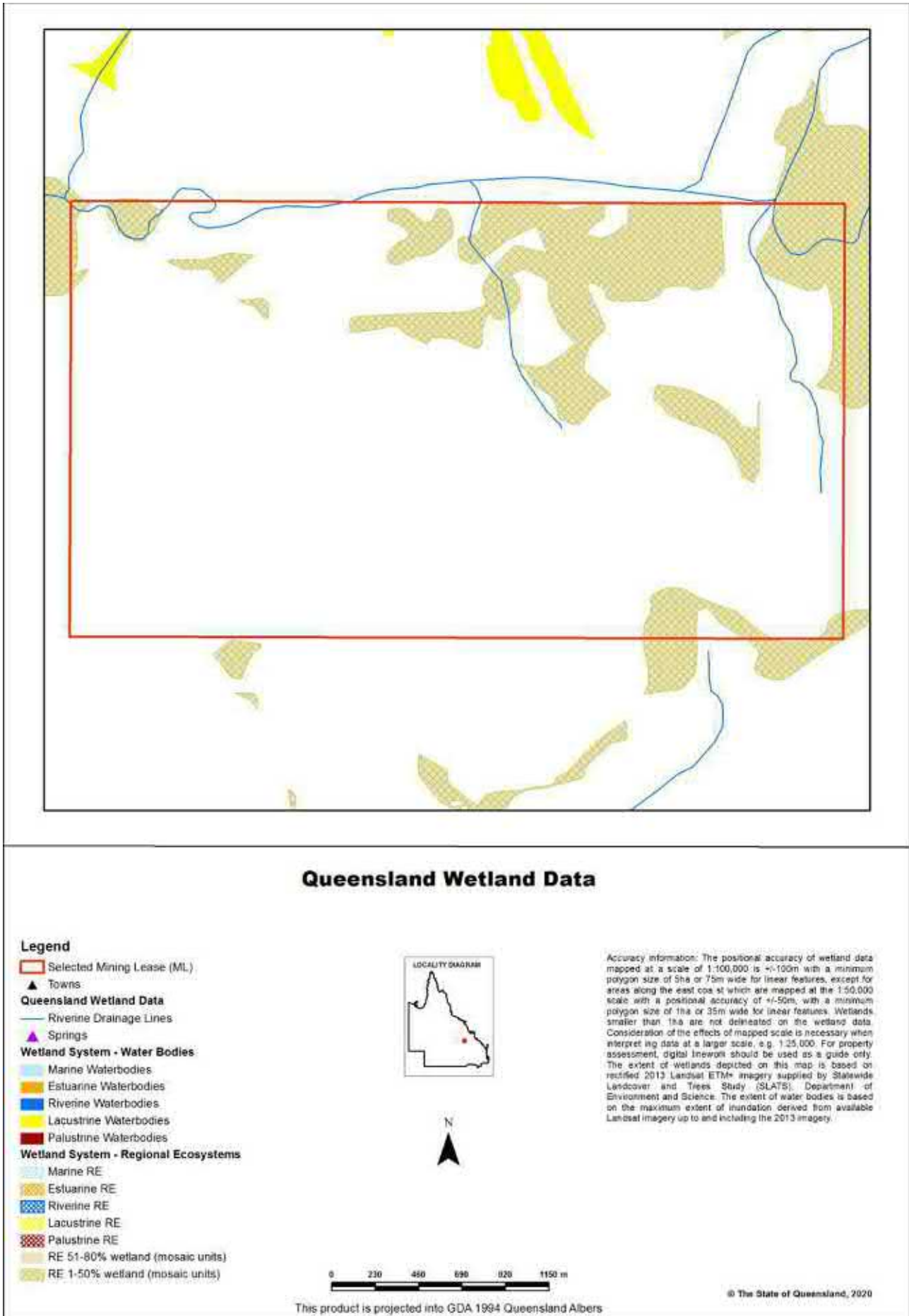
Map 4 - Remnant 2017 regional ecosystems by BVG (5M)



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



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>



Queensland Government

Department of Environment and Science

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
mdl: 155

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

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government 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 the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.



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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: mdl: 155

Size (ha)	8,608.64
Local Government(s)	Central Highlands 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	222.03	2.58
Of concern	48.45	0.56
No concern at present	1,576.44	18.31
Total remnant vegetation	1,846.92	21.45

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
11.3.2	Eucalyptus populnea woodland on alluvial plains	Of concern	40.77	0.47
11.3.25	Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines	Of concern	7.19	0.08
11.4.8	Eucalyptus cambageana woodland to open forest with Acacia harpophylla or A. argyrodendron on Cainozoic clay plains	Endangered	132.15	1.54
11.4.9a	Acacia harpophylla shrubby woodland with Terminalia oblongata on Cainozoic clay plains	Endangered	4.28	0.05
11.5.16	Acacia harpophylla and/or Casuarina cristata open forest in depressions on Cainozoic sand plains and remnant surfaces	Endangered	85.6	0.99
11.5.18	Micromyrtus capricornia open shrubland on Cainozoic sand plains and/or remnant surfaces	Of concern	0.49	0.01
11.5.3	Eucalyptus populnea +/- E. melanophloia +/- Corymbia clarksoniana woodland on Cainozoic sand plains and/or remnant surfaces	No concern at present	1,435.91	16.68
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	15.83	0.18
11.7.2	Acacia spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	No concern at present	120.65	1.4
11.8.4	Eucalyptus melanophloia open woodland on Cainozoic igneous rocks.	No concern at present	4.05	0.05
non-rem	None	None	6,761.53	78.54

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
11.3.2	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
11.4.8	Pre-clearing 724000 ha; Remnant 2017 67000 ha	25a	Contains palustrine wetland (e.g. in swales).	Low
11.4.9a	Pre-clearing 999000 ha; Remnant 2017 90000 ha	25a	None	Low
11.5.16	Pre-clearing 15000 ha; Remnant 2017 4000 ha	25a	Palustrine wetland (e.g. vegetated swamp).	Low
11.5.18	Pre-clearing 7000 ha; Remnant 2017 4000 ha	29b	None	Medium
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
11.7.2	Pre-clearing 565000 ha; Remnant 2017 366000 ha	24a	None	Low
11.8.4	Pre-clearing 217000 ha; Remnant 2017 151000 ha	11a	None	High
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
11.3.2	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.
11.4.8	Larger gilgai may provide ephemeral wetland habitat.
11.4.9a	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>
11.5.16	Potential habitat for NCA listed species: <i>Solanum elachophyllum</i>
11.5.18	None
11.5.3	Potential habitat for NCA listed species: <i>Sannantha brachypoda</i>
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>
11.7.2	Habitat for threatened plant species including <i>Acacia wardellii</i> .

Regional Ecosystem	Special Values
11.8.4	Potential habitat for NCA listed species: <i>Acacia arbiana</i> , <i>Acacia islana</i> , <i>Bertya pedicellata</i> , <i>Grevillea hockingsii</i> , <i>Haloragis exalata</i> subsp. <i>velutina</i> , <i>Marsdenia brevifolia</i> , <i>Sannantha brachypoda</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	6,761.53	78.54
11a	Moist to dry open forests to woodlands dominated by <i>Eucalyptus orgadophila</i> (mountain coolibah). Some areas dominated by <i>E. tereticornis</i> (blue gum), <i>E. melliodora</i> (yellow box), <i>E. albens</i> (white box), <i>E. crebra</i> (narrow-leaved red ironbark) or <i>E. melanophloia</i> (silver-leaved ironbark). (land zones 8, 11, 4, [3]) (BRB, SEQ, EIU)	4.05	0.05
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)	7.19	0.08
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)	1,476.68	17.15
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)	15.83	0.18
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])	120.65	1.4

BVG (1 Million)	Description	Area (Ha)	% of AOI
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])	222.03	2.58
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])	0.49	0.01

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.

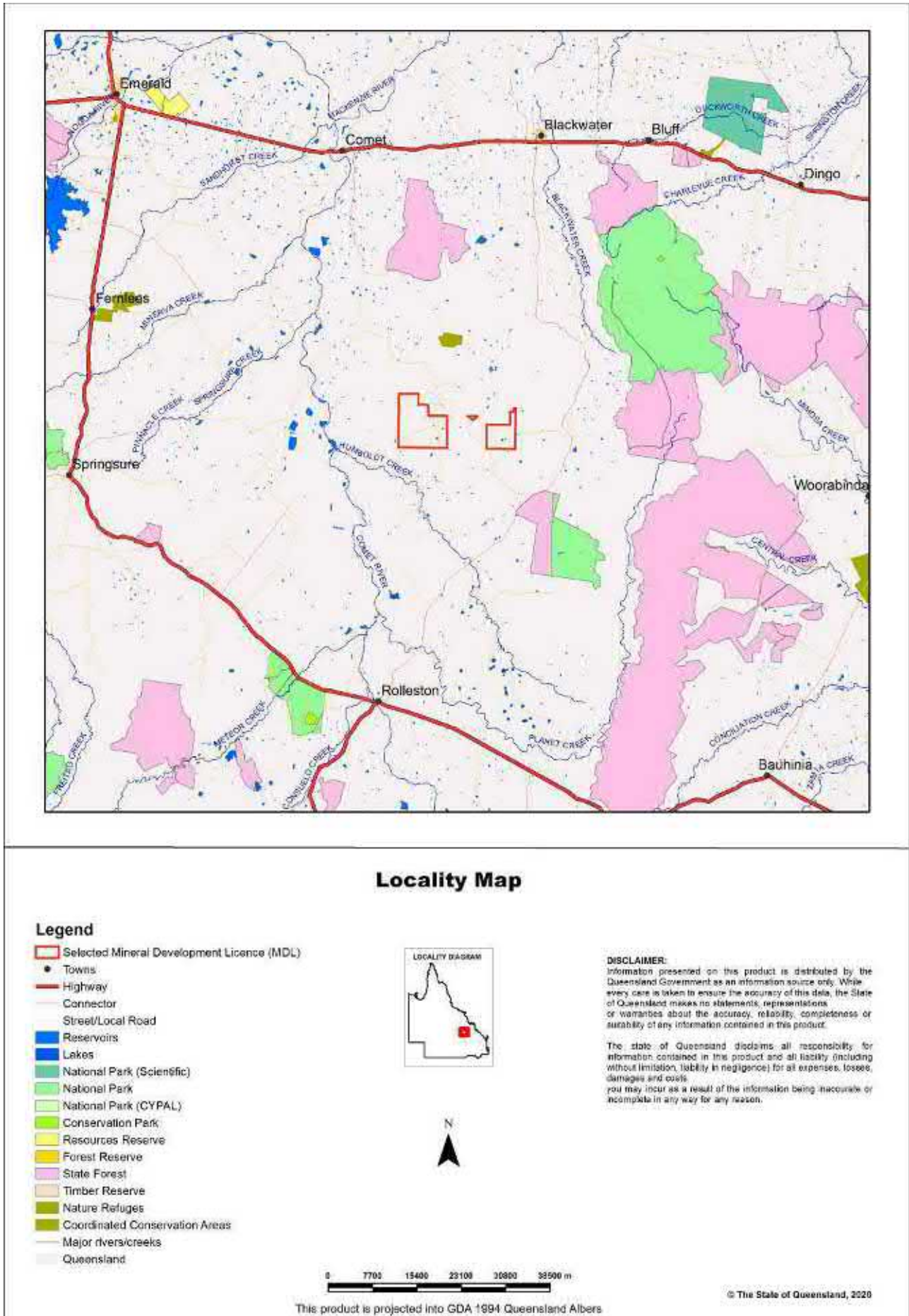
Table 7: List of remnant regional ecosystems within the AOI for which technical and biocondition benchmark descriptions are available

Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
11.3.2	Available	Not currently available
11.3.25	Available	Not currently available
11.4.8	Available	Not currently available
11.4.9a	Available	Not currently available
11.5.16	Available	Not currently available
11.5.18	Available	Not currently available
11.5.3	Available	Not currently available

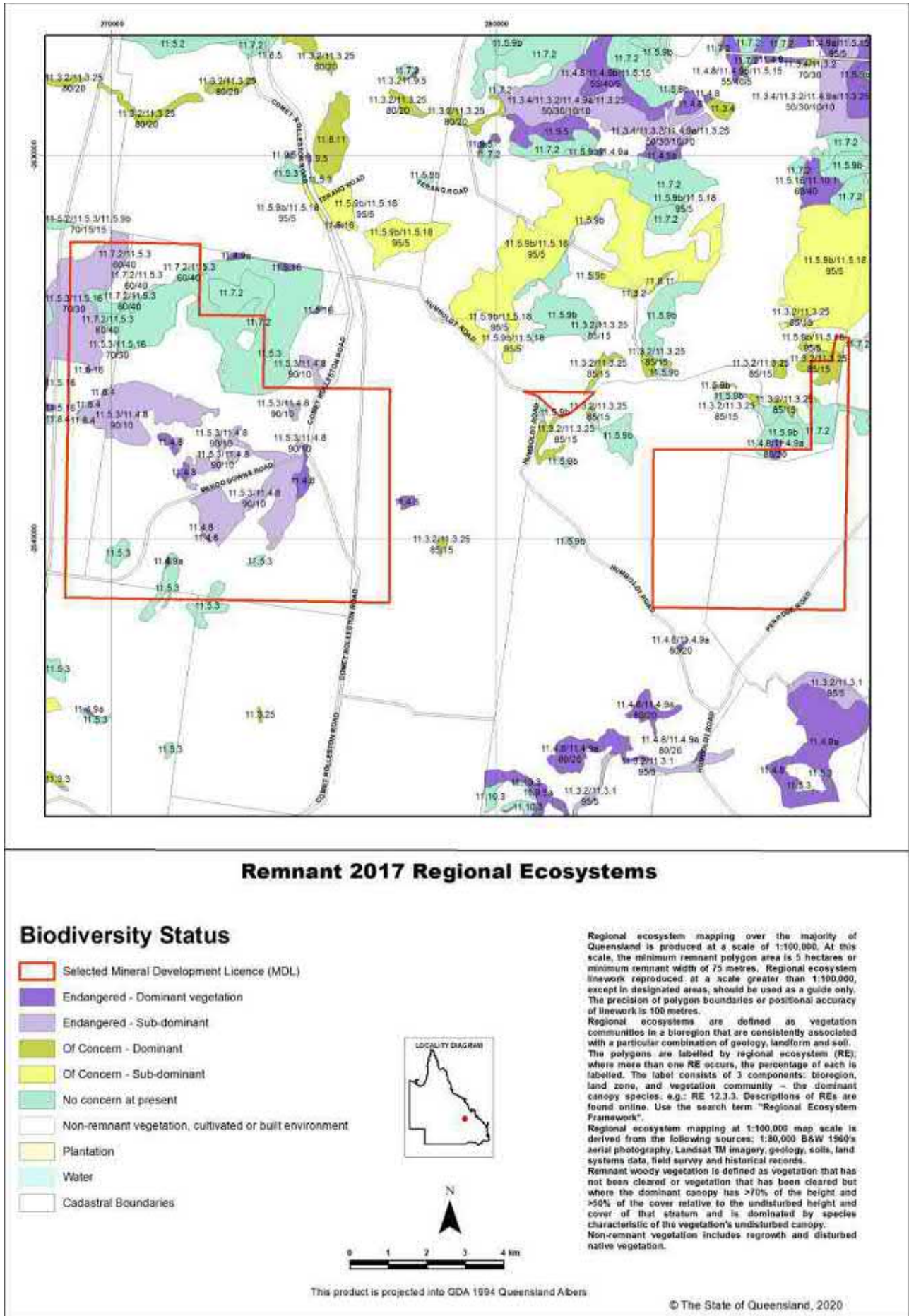
Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
11.5.9b	Available	Not currently available
11.7.2	Available	Not currently available
11.8.4	Available	Not currently available
non-rem	Not currently available	Not currently available

Maps

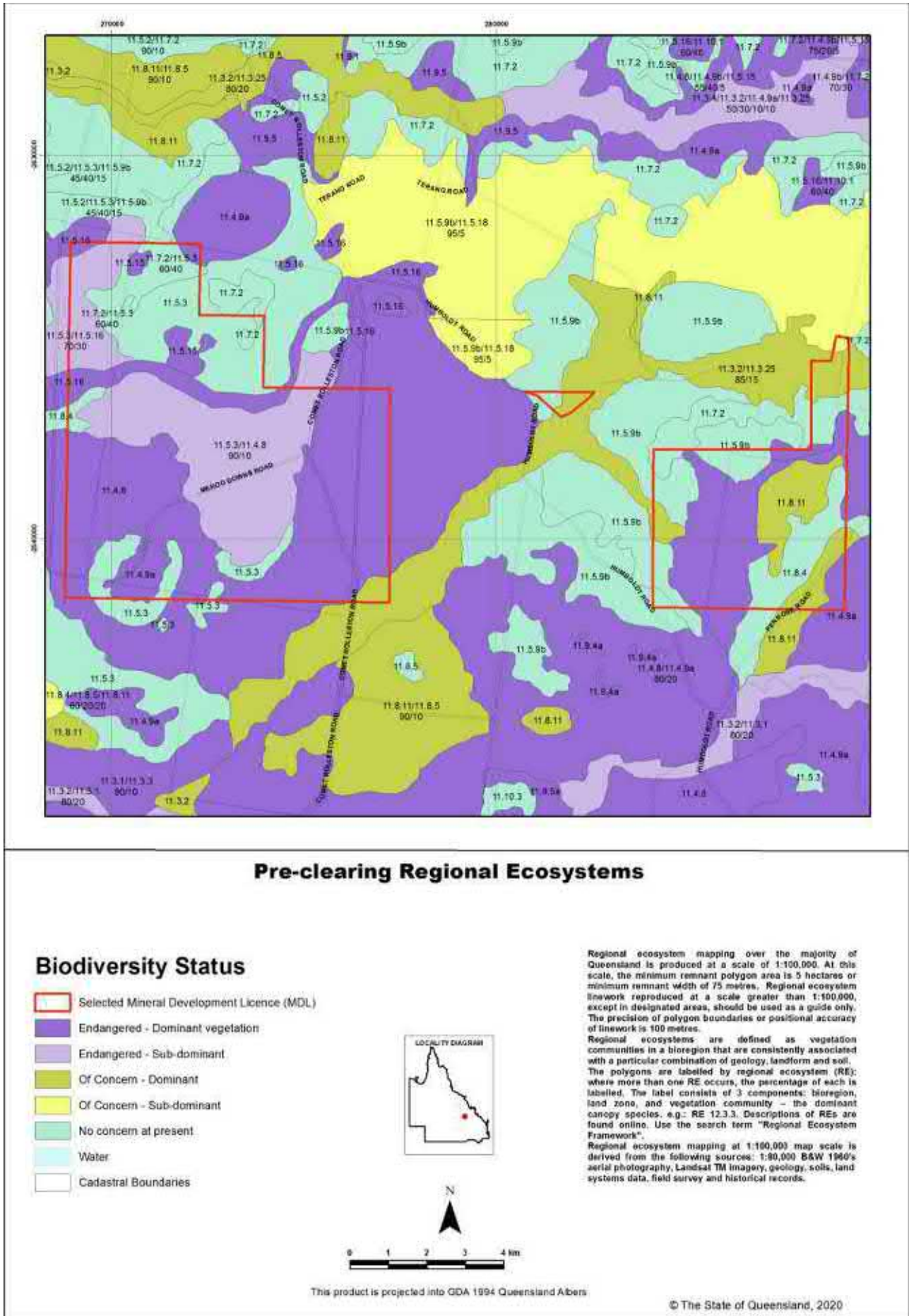
Map 1 - Location



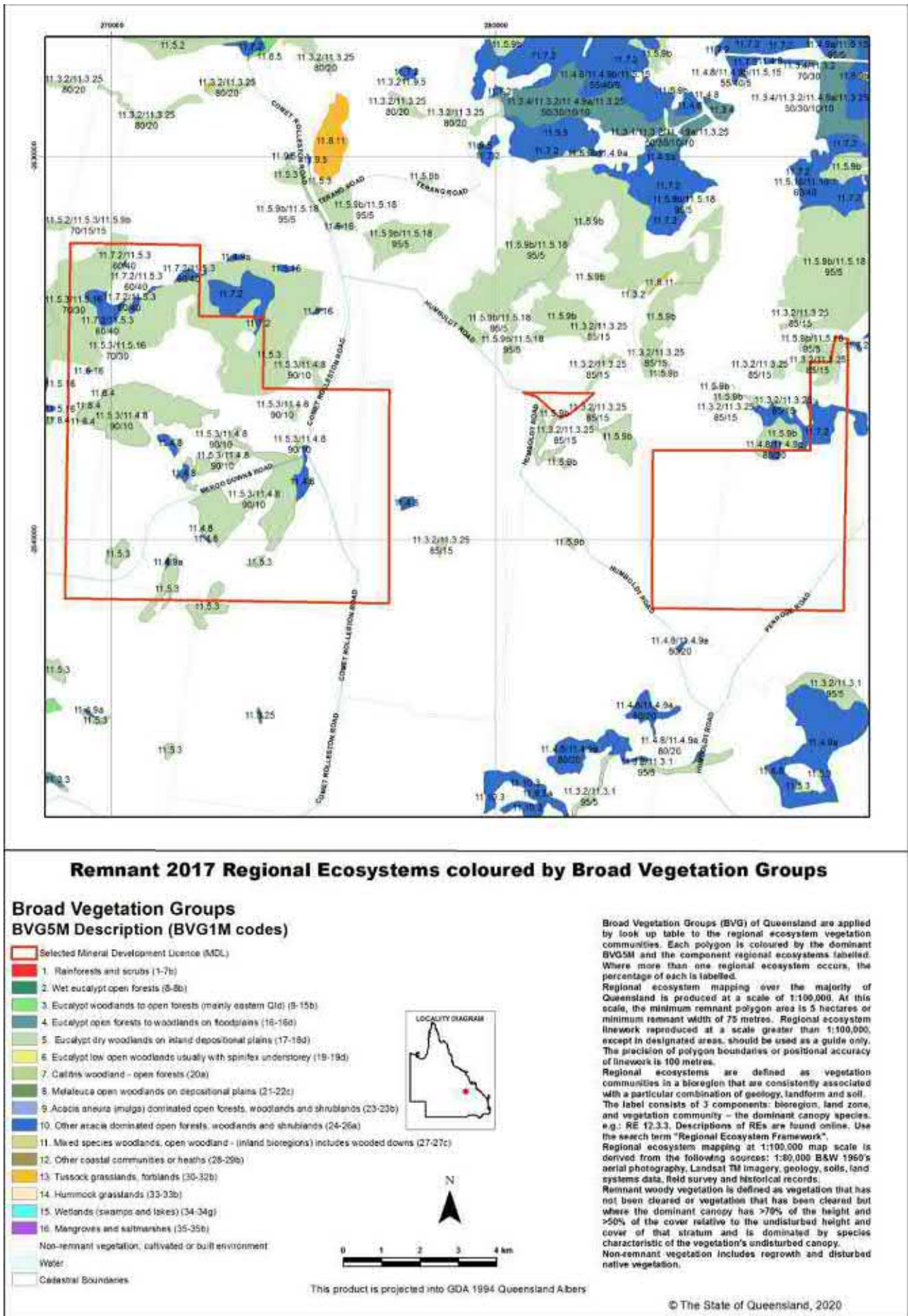
Map 2 - Remnant 2017 regional ecosystems



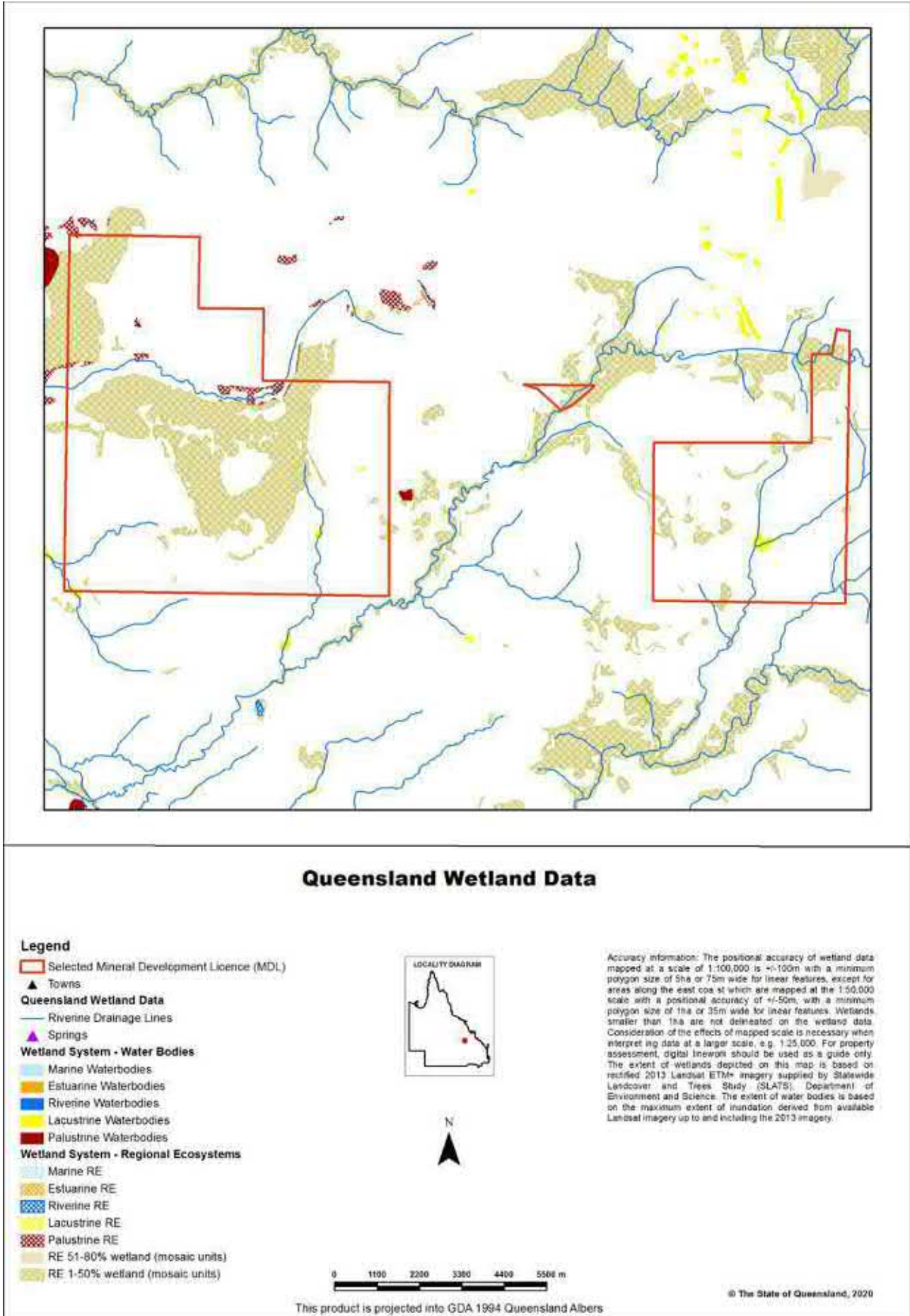
Map 3 - Pre-clearing regional ecosystems



Map 4 - Remnant 2017 regional ecosystems by BVG (5M)



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>



Queensland Government

Department of Environment and Science

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
mdl: 189

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

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government 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 the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.



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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: mdl: 189

Size (ha)	6,881.38
Local Government(s)	Central Highlands 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	283.83	4.12
Of concern	59.07	0.86
No concern at present	49.32	0.72
Total remnant vegetation	392.23	5.7

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
11.10.3	Acacia catenulata or A. shirleyi open forest on coarse-grained sedimentary rocks. Crests and scarps	No concern at present	49.32	0.72
11.3.1	Acacia harpophylla and/or Casuarina cristata open forest on alluvial plains	Endangered	3.11	0.05
11.3.2	Eucalyptus populnea woodland on alluvial plains	Of concern	59.07	0.86
11.4.8	Eucalyptus cambageana woodland to open forest with Acacia harpophylla or A. argyrodendron on Cainozoic clay plains	Endangered	150.03	2.18
11.4.9a	Acacia harpophylla shrubby woodland with Terminalia oblongata on Cainozoic clay plains	Endangered	37.51	0.55
11.9.5a	Acacia harpophylla and/or Casuarina cristata open forest on fine-grained sedimentary rocks	Endangered	93.19	1.35
non-rem	None	None	6,489.05	94.3

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
11.10.3	Pre-clearing 378000 ha; Remnant 2017 331000 ha	24a	None	Medium
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
11.4.8	Pre-clearing 724000 ha; Remnant 2017 67000 ha	25a	Contains palustrine wetland (e.g. in swales).	Low

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
11.4.9a	Pre-clearing 999000 ha; Remnant 2017 90000 ha	25a	None	Low
11.9.5a	Pre-clearing 2272000 ha; Remnant 2017 163000 ha	25a	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
11.10.3	Habitat for threatened flora species including <i>Acacia deuteroneura</i> , <i>A. wardellii</i> and <i>Bertya calycina</i> .
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> .
11.4.8	Larger gilgai may provide ephemeral wetland habitat.
11.4.9a	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>
11.9.5a	Habitat for threatened fauna species including <i>Jalmenus eubulus</i> , pale imperial hairstreak butterfly (Eastwood et al. 2008)
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	6,489.05	94.3
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)	59.07	0.86

BVG (1 Million)	Description	Area (Ha)	% of AOI
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])	49.32	0.72
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])	283.83	4.12

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.

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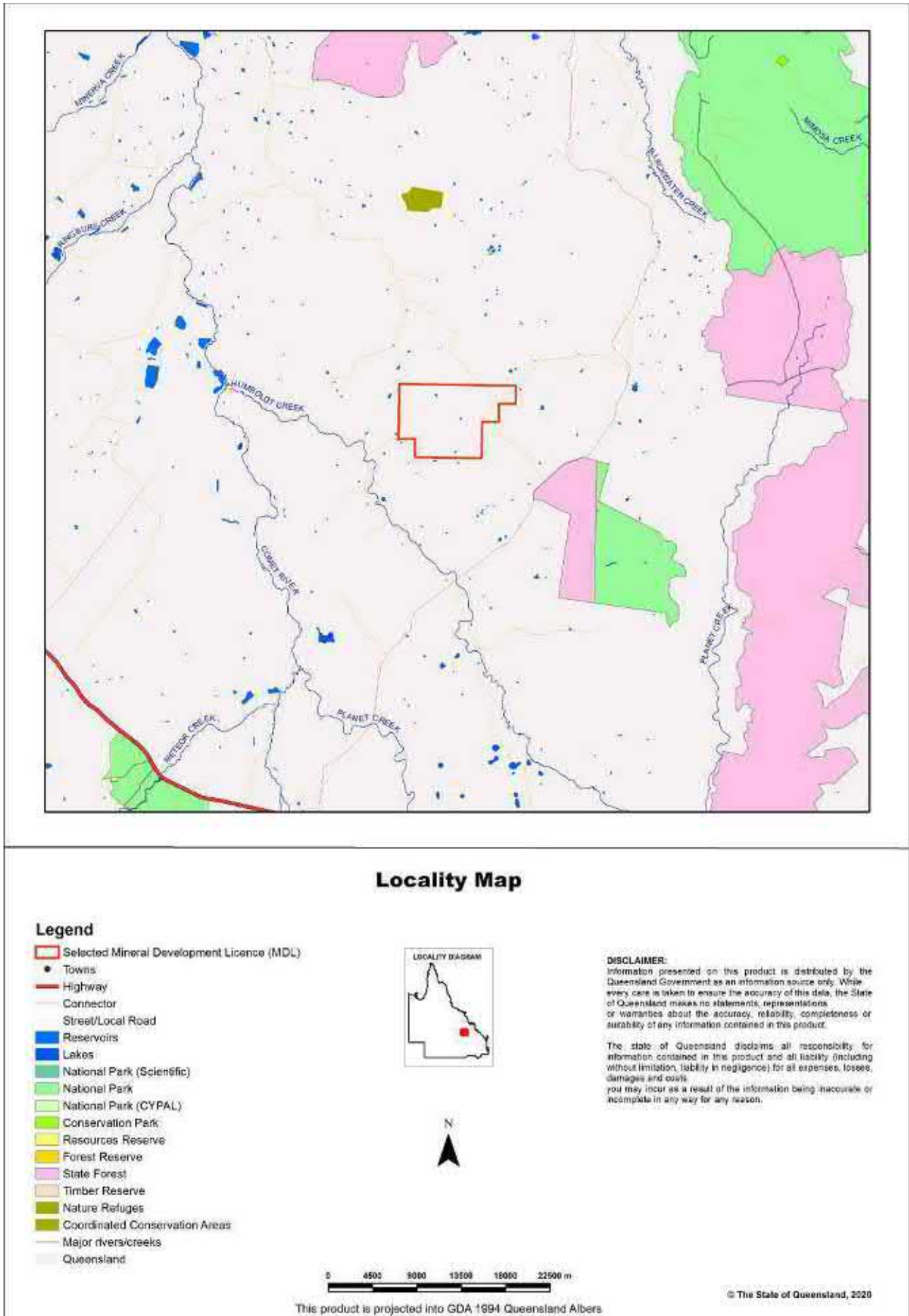
Table 7: List of remnant regional ecosystems within the AOI for which technical and biocondition benchmark descriptions are available

Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
11.10.3	Available	Not currently available
11.3.1	Available	Not currently available
11.3.2	Available	Not currently available
11.4.8	Available	Not currently available
11.4.9a	Available	Not currently available

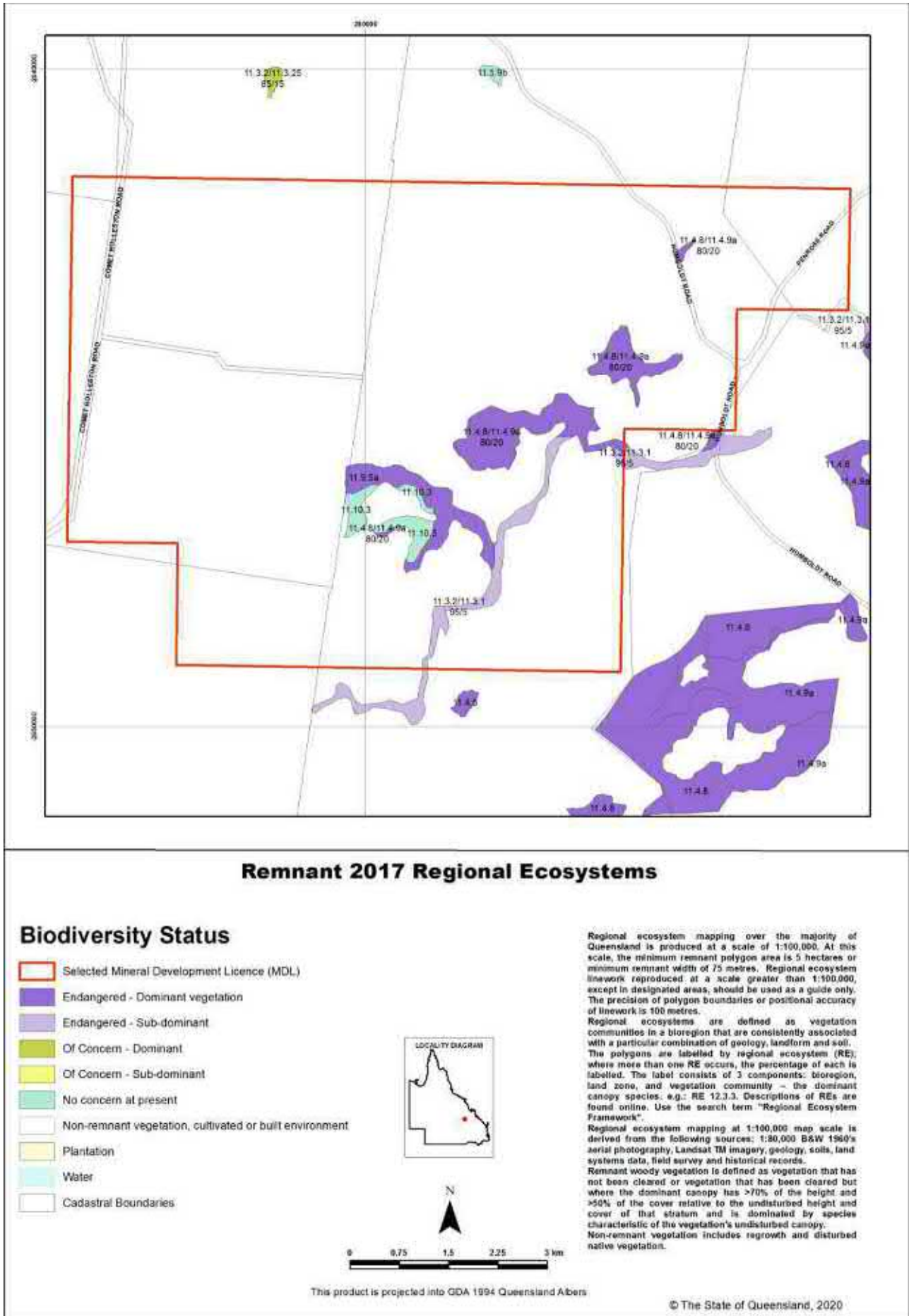
Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
11.9.5a	Available	Not currently available
non-rem	Not currently available	Not currently available

Maps

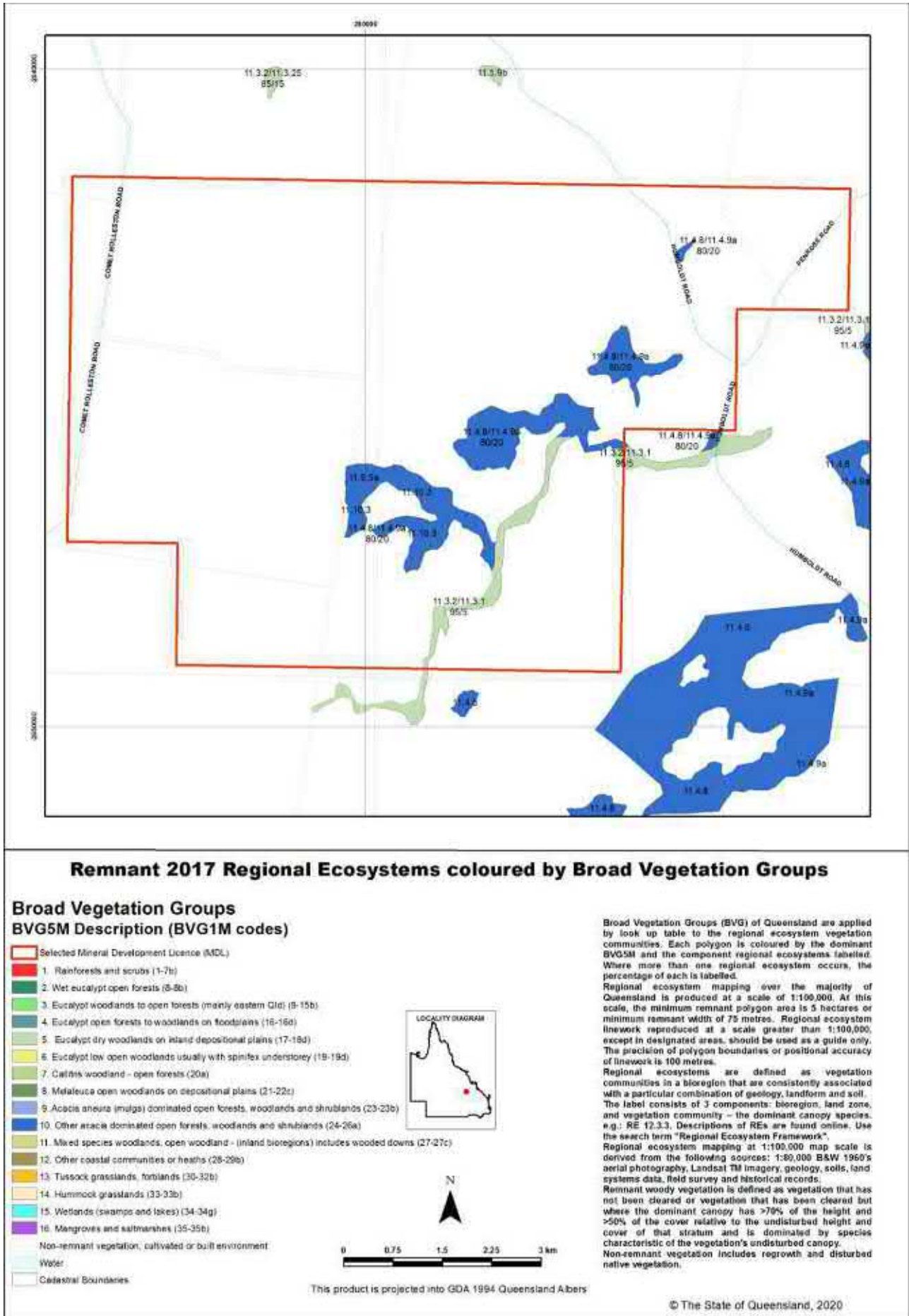
Map 1 - Location



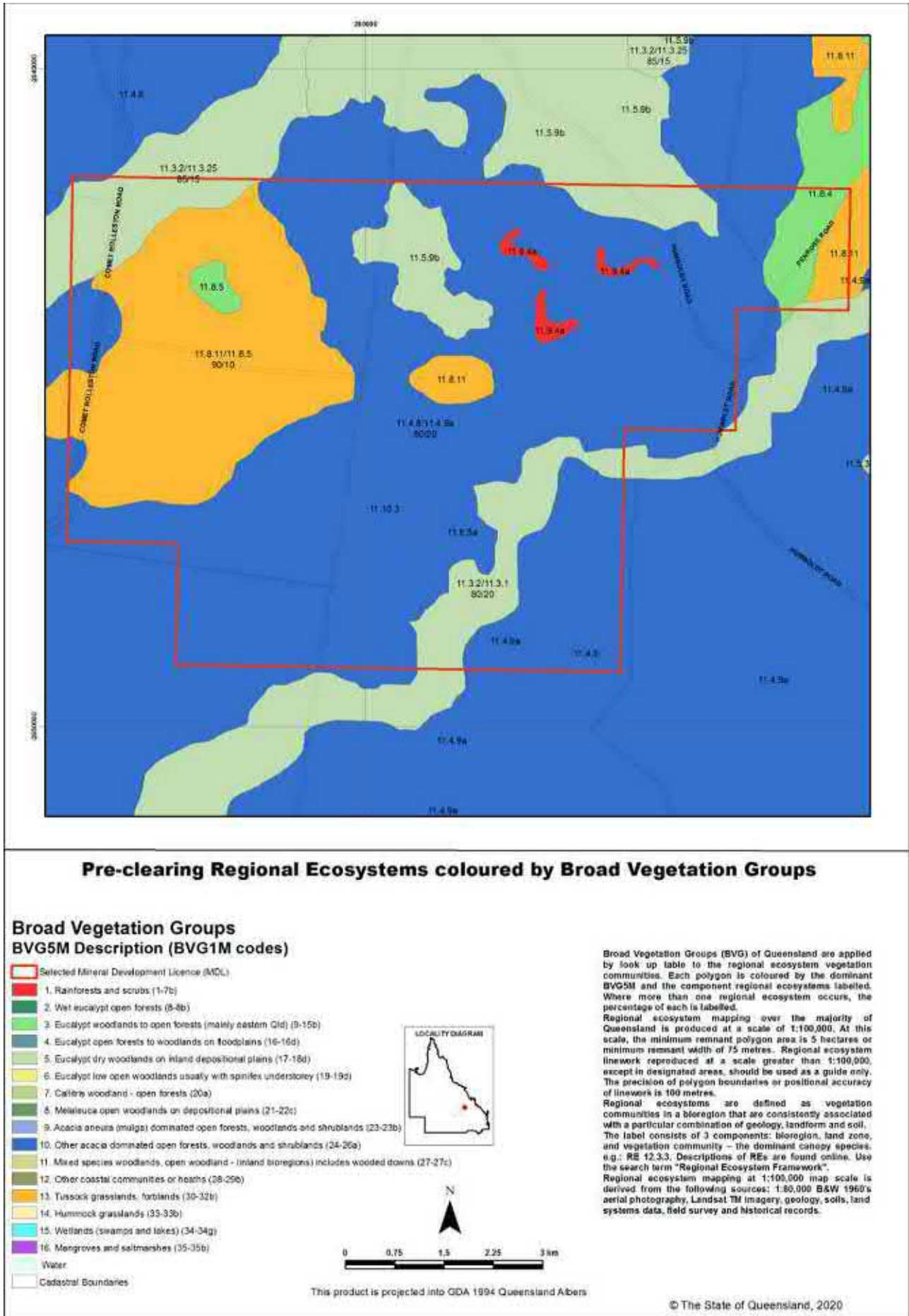
Map 2 - Remnant 2017 regional ecosystems



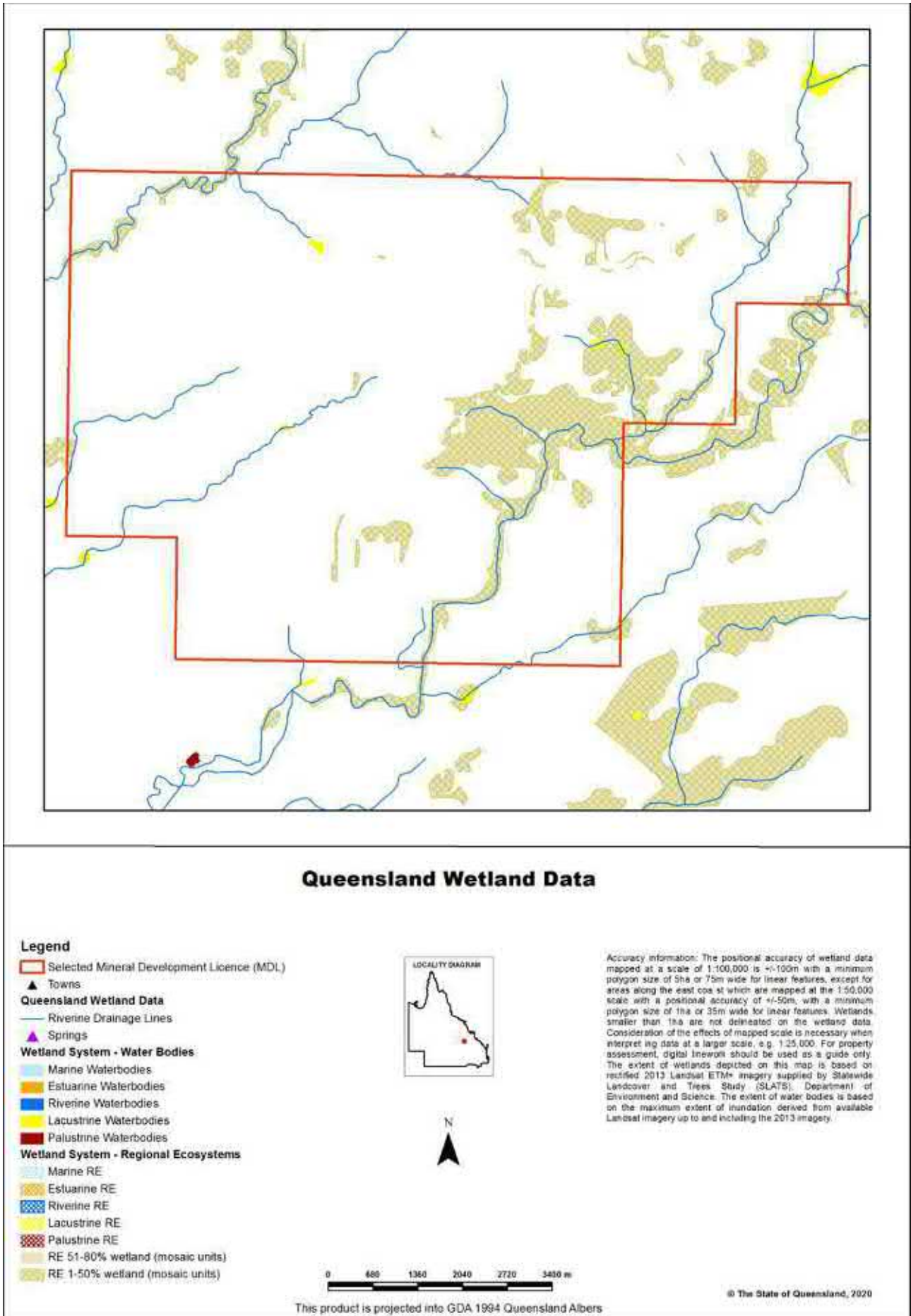
Map 4 - Remnant 2017 regional ecosystems by BVG (5M)



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



Map 6 - Wetlands and waterways



Links and Other Information Sources

The Department of Environment and Science's Website -

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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,

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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.

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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>

Appendix B

General habitat assessment results

B.1 General habitat assessment results – part one of form

Site ID	Validated RE Condition ¹	Validated RE Code	Landform Pattern	Landform Element ²	Soil Texture ³	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decortivating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
1	REM	11.5.9a	Gently undulating plain	PLA	F	5	0	5	Absent	<i>Corymbia clarksoniana</i>	Absent	Absent	0
2	NR	NA	Gently undulating plain	PLA	E	40	0	0	Absent	Absent	Absent	Absent	0
3	REM	11.5.9a	Gently undulating plain	PLA	E	70	0	20	Absent	<i>Eucalyptus populnea</i> , <i>E. melanophloia</i> , <i>E. dallachiana</i>	Absent	Absent	0
4	REM	11.5.9a	Gently undulating plain	PLA	F	50	0	20	Absent	<i>E.s populnea</i> , <i>E. melanophloia</i>	Rare	Absent	0
5	REM	11.5.3	Gently undulating plain	PLA	I	30	0	30	Absent	<i>E. populnea</i> , <i>E. melanophloia</i>	Occasional	Absent	0
6	REM	11.5.9	Gently undulating plain	PLA	F	70	0	100	Absent	<i>C. clarksoniana</i>	Absent	Absent	0
7	REM	11.5.9a	Gently undulating plain	PLA	I	65	0	30	Absent	<i>E. populnea</i> , <i>E. melanophloia</i>	Rare	<i>E.melanophloia</i>	0
8	REM	11.5.3	Gently undulating plain	PLA	I	50	0	35	Absent	<i>E. populnea</i>	Rare	Absent	0
9	NR	NA	Gently undulating plain	PLA	E	50	30	0	Absent	Absent	Rare	Absent	0
10	REM	11.7.2	Gently undulating plain	PLA	B	50	0	60	Absent	Absent	Rare	None	0

Site ID	Validated RE Condition ¹	Validated RE Code	Landform Pattern	Landform Element ²	Soil Texture ³	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
11	REM	11.5.9a	Gently undulating plain	PLA	F	60	55	40	Absent	<i>E. melanophloia</i> , <i>C. clarksoniana</i>	Rare	<i>E. melanophloia</i> , <i>C. clarksoniana</i>	10
12	REM	11.5.3	Undulating plain	PLA	E	80	80	30	Absent	<i>C. tessellaris</i> , <i>E. populnea</i> , <i>E. melanophloia</i>	Absent	<i>E. populnea</i> , <i>E. melanophloia</i>	10
13	REM	11.5.9a	Gently undulating plain	PLA	I	50	20	20	Absent	<i>E. populnea</i> , <i>E. melanophloia</i>	Absent	<i>E. populnea</i> , <i>E. melanophloia</i>	8
14	REM	11.5.3	Gently undulating rises	HCR	I	60	50	20	Absent	<i>E. melanophloia</i> , <i>C. clarksoniana</i> , <i>E. populnea</i>	Rare	<i>E. melanophloia</i> , <i>C. clarksoniana</i> , <i>E. populnea</i>	30
15	REM	11.4.8	Gently undulating plain	PLA	I	30	10	35	Absent	<i>E. cambageana</i>	Rare	<i>E. cambageana</i>	15
16	REM	11.5.3	Undulating plain	PLA	I	20	0	30	Absent	<i>E. populnea</i>	Occasional	<i>E. populnea</i>	10
17	REM	11.5.9a	Undulating plain	PLA	F	60	0	20	Absent	<i>C. clarksoniana</i> , <i>E. populnea</i>	Absent	<i>C. clarksoniana</i>	5
18	REM	11.7.2	Gently undulating plain	PLA	E	65	5	40	Absent	Absent	Occasional	Absent	0
19	REM	11.7.2	Gently undulating plain	PLA	E	60	40	45	Absent	Absent	Common	Absent	0
20	REM	11.7.2	Gently undulating plain	PLA	E	70	0	40	Absent	Absent	Common	Absent	0
21	REM	11.4.8	Gently undulating plain	DDE	A	30	5	50	Absent	<i>E. cambageana</i>	Occasional	<i>E. cambageana</i>	10

Site ID	Validated RE Condition ¹	Validated RE Code	Landform Pattern	Landform Element ²	Soil Texture ³	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
22	REM	11.5.9a	Undulating plain	PLA	E	60	20	35	Absent	<i>E. melanophloia</i> , <i>C. clarksoniana</i>	Common	<i>E. melanophloia</i>	8
23	REM	11.3.2	Gently undulating plain	STC	A	50	80	35	Absent	<i>E. melanophloia</i> , <i>E. camaldulensis</i> , <i>E. populnea</i>	Occasional	<i>Eucalyptus camaldulensis</i> , <i>E. melanophloia</i>	30
24	REM	11.4.3a	Gently undulating plain	DDE	A	10	0	55	Absent	Absent	Absent	Absent	0
25	RGW	11.4.8	Gently undulating plain	PLA	A	40	90	45	Absent	<i>E. cambageana</i>	Absent	Absent	0
26	REM	11.7.2	Undulating low hills	HCR	D	40	0	45	Absent	<i>E. thozetiana</i> , <i>E. cambageana</i>	Occasional	<i>E. thozetiana</i> , <i>E. cambageana</i> , <i>Acacia catenulata</i>	10
38	REM	11.3.2	Gently undulating plain	STC	E	60	90	30	Absent	<i>E. populnea</i> , <i>E. camaldulensis</i> , <i>E. melanophloia</i>	Absent	<i>E. populnea</i>	20
39	REM	11.3.1	Undulating plain	STC	E	40	90	40	Absent	<i>E. cambageana</i> , <i>E. camaldulensis</i>	Absent	<i>E. cambageana</i> , <i>E. camaldulensis</i>	20
40	REM	11.7.2	Gently undulating rises	PLA	D	20	80	50	Absent	<i>E. cambageana</i>	Occasional	<i>E. cambageana</i>	8
41	RGW	11.7.1	Undulating rises	HSL	A	30	90	45	Absent	<i>E. thozetiana</i>	Absent	Absent	0
42	REM	11.7.2	Undulating rises	HCR	D	70	80	45	Absent	<i>C. tessellaris</i>	Rare	<i>C. tessellaris</i>	8

Site ID	Validated RE Condition ¹	Validated RE Code	Landform Pattern	Landform Element ²	Soil Texture ³	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
43	REM	11.7.1	Undulating rises	DDE	B	30	0	30	Absent	<i>E. thozetiana</i>	Absent	<i>Eucalyptus thozetiana</i>	10
44	RGW	11.7.2	Rolling rises	HSL	D	20	0	60	Absent	<i>E. cambageana</i>	Absent	Absent	0
45	REM	11.7.1	Undulating rises	HSL	B	60	50	35	Absent	<i>E. thozetiana</i> , <i>E. cambageana</i>	Absent	<i>E. thozetiana</i> , <i>E. cambageana</i>	20
46	REM	11.7.1	Undulating rises	HSL	D	50	35	40	Absent	<i>E. cambageana</i>	Occasional	<i>E. cambageana</i>	20
47	REM	11.7.2	Undulating rises	PLA	D	40	0	60	Absent	Absent	Absent	Absent	0
48	REM	11.5.3	Undulating plain	PLA	E	60	90	35	Absent	<i>E. chloroclada</i> , <i>E. populnea</i>	Rare	<i>E. populnea</i>	10
49	NR	NA	Undulating plain	PLA	F	50	80	30	Absent	<i>E. melanophloia</i>	Absent	Absent	0
50	RGW	11.7.2	Gently undulating rises	HSL	D	15	0	60	Absent	Absent	Absent	Absent	0
51	RGW	11.7.2	Undulating rises	HSL	D	25	50	45	Absent	Absent	Absent	Absent	0
52	REM	11.7.2	Gently undulating rises	PLA	D	50	75	35	Absent	<i>E. thozetiana</i> , <i>E. crebra</i>	Occasional	<i>E. crebra</i>	20
53	REM	11.3.2	Gently undulating plain	STC	B	70	80	30	Absent	<i>E. melanophloia</i> , <i>C. tessellaris</i> , <i>E. populnea</i>	Occasional	<i>E. melanophloia</i> , <i>C. tessellaris</i> , <i>E. populnea</i>	30

Site ID	Validated RE Condition ¹	Validated RE Code	Landform Pattern	Landform Element ²	Soil Texture ³	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
54	REM	11.5.3	Undulating rises	PLA	I	30	50	35	Absent	<i>E. populnea</i> , <i>E. melanophloia</i>	Occasional	<i>E. populnea</i> , <i>E. melanophloia</i>	0
55	REM	11.7.2	Undulating rises	PLA	D	30	0	70	Absent	Absent	Occasional	None	0
56	REM	11.5.3	Gently undulating plain	PLA	D	35	80	20	Absent	<i>E. populnea</i>	Absent	Absent	20
57	REM	11.5.3	Gently undulating plain	PLA	D	70	90	5	Absent	<i>E. populnea</i> , <i>E. orgadophila</i> , <i>C. erythrophloia</i>	Absent	<i>E. populnea</i> , <i>E. orgadophila</i>	15
58	REM	11.7.4	Undulating rises	PLA	D	50	20	20	Absent	<i>C. clarksoniana</i> , <i>E. crebra</i> , <i>E. melanophloia</i>	Occasional	<i>E. crebra</i> , <i>E. melanophloia</i>	20
59	RGW	11.5.9a	Gently undulating plain	PLA	I	75	50	25	Absent	<i>E. melanophloia</i> , <i>E. populnea</i>	Occasional	<i>E. melanophloia</i>	15
60	REM	11.7.2	Rolling rises	HSL	D	50	50	30	Absent	<i>E. populnea</i> , <i>E. melanophloia</i>	Occasional	<i>E. Melanophloia</i>	10
61	RGW	11.5.9a	Undulating plain	PLA	F	80	0	30	Absent	<i>E. melanophloia</i>	Common	<i>E. melanophloia</i>	10
62	REM	11.3.1	Undulating plain	PLA	A	20	2	18	Absent	<i>E. populnea</i>	Absent	<i>E. populnea</i>	4
63	REM	11.3.2	Undulating plain	CBE	E	20	20	0	Absent	<i>E. populnea</i> , <i>E. melanophloia</i>	Rare	<i>E. populnea</i> , <i>Eucalyptus melanophloia</i>	4
64	REM	11.7.2	Undulating rises	HSL	B	10	2	8	Absent	<i>E. populnea</i>	Occasional	<i>E. populnea</i>	6

Site ID	Validated RE Condition ¹	Validated RE Code	Landform Pattern	Landform Element ²	Soil Texture ³	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
65	REM	11.7.2	Undulating rises	HSL	B	15	0	15	Absent	<i>E. crebra</i>	Occasional	<i>E. populnea</i>	6
66	REM	11.8.5	Gently undulating rises	HSL	A	50	20	30	Absent	<i>E. orgadophila</i>	Absent	<i>E. orgadophila</i>	6
67	REM	11.4.9	Gently undulating rises	HSL	A	25	20	5	Absent	Absent	Occasional	Absent	0
68	REM	11.7.2	Undulating rises	HSL	D	5	0	5	Absent	<i>E. melanophloia</i>	Occasional	<i>E. melanophloia</i>	1
69	REM	11.7.2	Undulating rises	HSL	B	50	5	45	Absent	<i>E. melanophloia</i>	Occasional	<i>E. melanophloia</i>	4
111	REM	11.5.3	Undulating plain	PLA	E	40	20	80	Absent	<i>E. populnea</i>	Occasional	Absent	0
112	REM	11.3.25/1 1.3.2	Undulating plain	BAN	H	50	40	60	Absent	<i>E. camaldulensis</i> , <i>E. melanophloia</i> , <i>E. populnea</i> , <i>C. tessellaris</i>	Occasional	<i>E. melanophloia</i> , <i>E. camaldulensis</i>	20
113	REM	11.5.9	Undulating plain	PLA	E	75	25	75	Absent	<i>E. populnea</i> , <i>E. melanophloia</i> , <i>C. clarksoniana</i>	Occasional	<i>Eucalyptus melanophloia</i>	5
114	REM	11.5.9	Rolling low hills	PLA	I	80	60	30	Absent	<i>E. melanophloia</i> , <i>E. crebra</i> , <i>C. clarksoniana</i>	Occasional	<i>E. melanophloia</i> , <i>E. crebra</i> , <i>C. clarksoniana</i>	20
115	REM	11.9.5	Undulating plain	PLA	A	60	5	85	Absent	Absent	Occasional	Absent	0

Site ID	Validated RE Condition ¹	Validated RE Code	Landform Pattern	Landform Element ²	Soil Texture ³	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
116	NR	11.5.3	Gently undulating plain	PLA	L	70	20	50	Absent	<i>E. populnea</i> , <i>E. melanophloia</i>	Occasional	Absent	0
117	REM	11.4.8	Gently undulating plain	PLA	A	65	15	35	Absent	<i>E. cambageana</i>	Occasional	<i>E. cambageana</i>	15
118	NR	11.3.2	Undulating plain	PLA	F	65	50	50	Absent	<i>E. populnea</i> , <i>E. melanophloia</i>	Occasional	Absent	0
119	REM	11.5.3	Undulating plain	PLA	E	30	30	60	Absent	<i>E. populnea</i> , <i>E. cambageana</i>	Occasional	<i>E. populnea</i>	10
120	RGW	11.5.9a	Undulating plain	PLA	E	60	60	20	Absent	<i>E. melanophloia</i>	Absent	Absent	0
121	REM	11.5.9/11.4.8	Undulating plain	PLA	I	50	50	30	Absent	<i>E. melanophloia</i> , <i>E. crebra</i> , <i>E. cambageana</i> , <i>E. populnea</i>	Occasional	<i>E. melanophloia</i> , <i>E. crebra</i>	10
122	RGW	11.3.2	Undulating plain	PLA	F	50	30	30	Absent	<i>E. melanophloia</i> , <i>E. cambageana</i> , <i>E. populnea</i>	Occasional	<i>E. melanophloia</i>	5
123	REM	11.3.1	Undulating plain	BAN	A	50	30	30	Absent	<i>E. populnea</i>	Occasional	Absent	0
124	RGW	11.3.2	Undulating plain	PLA	B	40	30	30	Absent	<i>E. populnea</i>	Occasional	Absent	0
125	REM	11.5.9a	Undulating plain	PLA	F	75	50	30	Absent	<i>E. melanophloia</i>	Occasional	<i>E. melanophloia</i>	10
126	RGW	11.4.9	Undulating plain	PLA	A	40	30	60	Absent	<i>E. populnea</i>	Occasional	Absent	0

Site ID	Validated RE Condition ¹	Validated RE Code	Landform Pattern	Landform Element ²	Soil Texture ³	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
127	REM	11.3.2/.11.3.1	Gently undulating plain	BAN	H	40	50	40	Absent	<i>E. camaldulensis</i> , <i>E. melanophloia</i> , <i>E. populnea</i>	Occasional	<i>E. camaldulensis</i> , <i>E. melanophloia</i>	15
128	RGW	11.3.1	Gently undulating plain	BAN	B	40	75	20	Absent	Absent	Occasional	Absent	0
129	NR	NA	Gently undulating plain	PLA	B	90	75	20	Absent	Absent	Absent	Absent	0
130	REM	11.7.2	Level plain	RFL	D	80	10	70	Absent	<i>Eucalyptus exserta</i>	Occasional	Absent	0
131	REM	11.5.3	Gently undulating plain	PLA	F	80	80	30	Absent	<i>Eucalyptus populnea</i> , <i>E. melanophloia</i>	Occasional	<i>Eucalyptus populnea</i> , <i>E. melanophloia</i>	10
132	RGW	11.4.9	Gently undulating plain	PLA	I	80	80	20	Absent	Absent	Occasional	Absent	0
133	NR	NA	Gently undulating plain	PLA	C	60	70	20	Absent	<i>Eucalyptus populnea</i>	Absent	Absent	0
134	RGW	11.7.2	Gently undulating plain	PLA	F	60	70	30	Absent	<i>E. crebra</i> , <i>Corymbia clarksoniana</i> , <i>C. tessellaris</i>	Absent	Absent	0
135	REM	11.7.2	Gently undulating plain	PLA	E	70	80	20	Absent	<i>Eucalyptus crebra</i>	Absent	Absent	0
136	REM	11.4.8	Gently undulating plain	PLA	B	70	50	30	Absent	<i>Eucalyptus cambadgeana</i>	Occasional	Absent	0
137	RGW	11.4.8	Gently undulating plain	PLA	B	60	70	10	Absent	<i>Eucalyptus cambadgeana</i>	Absent	Absent	0

Site ID	Validated RE Condition ¹	Validated RE Code	Landform Pattern	Landform Element ²	Soil Texture ³	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
138	RGW	11.5.9a	Gently undulating plain	PLA	C	60	40	30	Absent	<i>Eucalyptus melanophloia</i> , <i>Corymbia clarksoniana</i>	Occasional	<i>Eucalyptus melanophloia</i>	5
139	RGW	11.5.9a	Gently undulating plain	PLA	E	90	50	40	Absent	<i>Eucalyptus melanophloia</i> , <i>E. clarksoniana</i>	Occasional	Absent	0
140	REM	11.3.1/11.3.2/11.3.4/11.3.25	Gently undulating plain	BAN	D	90	80	20	Absent	<i>E. tereticornis</i> , <i>E. populnea</i> , <i>C. tessellaris</i>	Absent	<i>Eucalyptus tereticornis</i>	10
141	REM	11.8.5	Very steep low hills	HCR	D	80	50	40	Absent	<i>Eucalyptus orgadophila</i> , <i>Corymbia erythrophloia</i>		Absent	0
142	RGW	11.4.9	Gently undulating plain	PLA	B	90	80	10	Absent	<i>Eucalyptus clarksoniana</i> , <i>Corymbia erythrophloia</i>	Absent	Absent	0
143	RGW	11.8.5	Gently undulating rises	PLA	A	99	70	20	Absent	<i>Eucalyptus orgadophila</i>	Absent	Absent	0
144	REM	11.7.1	Very steep hills	SCA	G	40	5	75	Absent	<i>Eucalyptus thozetiana</i>	Occasional	Absent	0
145	REM	11.3.25/11.3.2/11.3.1	Gently undulating plain	BAN	E	80	70	20	Absent	<i>Eucalyptus tereticornis</i> , <i>E. populnea</i>	Absent	<i>Eucalyptus tereticornis</i>	5
146	REM	11.7.2	Gently undulating plain	PLA	E	50	50	30	Absent	<i>Eucalyptus exserta</i>	Occasional	Absent	0
147	RGW	11.5.16/11.5.3	Gently undulating plain	PLA	E	75	70	20	Absent	<i>Eucalyptus melanophloia</i> , <i>populnea</i>	Rare	Absent	0
148	REM	11.4.8	Gently undulating plain	PLA	A	80	90	10	Absent	<i>Eucalyptus cambadgeana</i> , <i>E. populnea</i>	Absent	Absent	0

Site ID	Validated RE Condition ¹	Validated RE Code	Landform Pattern	Landform Element ²	Soil Texture ³	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
149	RGW	11.4.8	Gently undulating plain	PLA	A	90	90	10	Absent	Absent	Absent	Absent	0
150	REM	11.4.9	Gently undulating plain	PLA	A	90	90	10	Absent	Absent	Absent	Absent	0
151	REM	11.7.1	Gently undulating plain	SCA	C	20	5	40	Absent	<i>Eucalyptus cambageana</i> , <i>Eucalyptus thozetiana</i>	Absent	<i>Eucalyptus cambageana</i>	10
152	REM	11.7.2	Gently undulating plain	PLA	C	40	10	50	Absent	<i>Eucalyptus populnea</i>	Occasional	Absent	0
153	REM	11.3.25f	Gently undulating plain	STC	B	50	20	60	Absent	<i>Eucalyptus tereticornis</i>	Absent	<i>Eucalyptus tereticornis</i>	5

1. Validated RE Condition: REM – remnant, RGW – regrowth, NR – non-remnant

2. CORVEG landform element codes: BAN – bank (stream bank), CBE – channel bench, DDE – drainage depression, DUC – dune crest, HCR – hill crest, HSL – hill slope, PLA - plain, RFL – rock flat, STC – stream channel

3. CORVEG soil texture codes: A – clay, B – clay loam, C – silty loam, D – loam, E – sandy loam, F – sand, G – stony, H – silty clay, I – sandy clay, J – silty clay loam, K – sandy clay loam, L – loam sand

B.2 General habitat assessment results – part two of form

Site	Hollow Tree Size (cm)	Soil Crack Presence	Soil Crack Abundance	Gilgai Presence	Gilgai Abundance	Fallen Woody Debris Abundance	Leaf Litter Cover (%) and Depth (mm)	Proximity to Water (km)	Water Type	Koala Food Trees	Connectivity	Presence of Threat	Comments
1	0	Absent	Absent	Absent	Absent	Common	80%, 25mm	>3	Unknown	<i>C. clarksoniana</i>	Isolated fragment	Broadscale clearing	
2	0	Absent	Absent	Absent	Absent	Occasional	30%, 10mm	>3	Unknown	None	Isolated fragment		Recently cleared.
3	0	Shallow	Occasional	Absent	Absent	Occasional	30%, 20mm	>3	Unknown	<i>E. populnea</i> , <i>E. melanophloia</i> , <i>E. dallachiana</i>	Isolated fragment	Broadscale clearing	Remnant habitat with dense ground layer dominated by Kangaroo grass.
4	0	Shallow	Rare	Absent	Absent	Occasional	40%, 30mm	>3	Unknown	<i>E. populnea</i> , <i>E. melanophloia</i>	Isolated fragment	Broadscale clearing	
5	0	Absent	Absent	Absent	Absent	Occasional	40%, 30mm	>3	Unknown	<i>E. populnea</i> , <i>E. melanophloia</i>	Isolated fragment	Broadscale clearing	
6	0	Absent	Absent	Absent	Absent	Occasional	40%, 20mm	>3	Unknown	<i>absent</i>	Isolated fragment	Broadscale clearing	
7	0	Shallow	Rare	Absent	Absent	Common	20%, 20mm	>3	Unknown	<i>E. populnea</i> , <i>E. melanophloia</i>	Isolated fragment	Broadscale clearing	
8	0	Absent	Absent	Absent	Absent	Occasional	25	>3	Unknown	<i>E. populnea</i>	Isolated fragment	Broadscale clearing	
9	0	Absent	Absent	Absent	Absent	Occasional	15%, 10mm	>3	Unknown	None	Isolated fragment		Recently cleared.
10	0	Absent	Absent	Absent	Absent	Common	30%, 20mm	>3	Unknown	None	Isolated fragment	Broadscale clearing	Site dominated by Lancewood.
11	Large (>20 cm)	Absent	Absent	Absent	Absent	Occasional	30%, 30mm	>3	Unknown	<i>E. melanophloia</i> , <i>C. clarksoniana</i>	Isolated fragment	Broadscale clearing	

Site	Hollow Tree Size (cm)	Soil Crack Presence	Soil Crack Abundance	Gilgai Presence	Gilgai Abundance	Fallen Woody Debris Abundance	Leaf Litter Cover (%) and Depth (mm)	Proximity to Water (km)	Water Type	Koala Food Trees	Connectivity	Presence of Threat	Comments
12	Large (>20 cm)	Absent	Absent	Absent	Absent	Rare	10%, 20mm	>3	Unknown	<i>E. populnea</i> , <i>E. melanophloia</i> , <i>C. tessellaris</i>	Isolated fragment	Broadscale clearing	
13	Large (>20 cm)	Shallow	Rare	Absent	Absent	Occasional	20%, 20mm	>3	Unknown	<i>E. melanophloia</i> , <i>E. populnea</i>	Isolated fragment	Broadscale clearing	
14	Large (>20 cm)	Shallow	Occasional	Absent	Absent	Occasional	10%, 20mm	>3	Unknown	<i>E. melanophloia</i> , <i>C. clarksoniana</i> , <i>E. populnea</i>	Isolated fragment	Broadscale clearing	
15	Large (>20 cm)	Absent	Occasional	Shallow	Occasional	Abundant	30%, 40mm	>3	Unknown	<i>E. cambageana</i>	Narrow linear patch	Broadscale clearing	Possible TEC
16	Large (>20 cm)	Absent	Absent	Absent	Absent	Abundant	40%, 25mm	>3	Unknown	<i>E. populnea</i>	Isolated fragment	Broadscale clearing	
17	Large (>20 cm)	Absent	Absent	Absent	Absent	Rare	10%, 15mm	>3	Unknown	<i>C. clarksoniana</i>	Isolated fragment	Broadscale clearing	Additional site survey justified by obvious RE change.
18	0	Absent	Absent	Absent	Absent	Common	15%, 20mm	>3	Unknown	None	Isolated fragment	Broadscale clearing	Lancewood dominated ecosystem.
19	0	Absent	Absent	Absent	Absent	Common	15%, 20mm	>3	Unknown	None	Isolated fragment	Broadscale clearing	Lancewood dominated ecosystem.
20	0	Absent	Absent	Absent	Absent	Occasional	20%, 20mm	>3	Unknown	None	Isolated fragment	Broadscale clearing	Lancewood dominated ecosystem.
21	Large (>20 cm)	Absent	Absent	Absent	Absent	Abundant	50%, 35mm	>3	Unknown	<i>E. cambageana</i>	Narrow linear patch	Broadscale clearing	Possible Brigalow TEC

Site	Hollow Tree Size (cm)	Soil Crack Presence	Soil Crack Abundance	Gilgai Presence	Gilgai Abundance	Fallen Woody Debris Abundance	Leaf Litter Cover (%) and Depth (mm)	Proximity to Water (km)	Water Type	Koala Food Trees	Connectivity	Presence of Threat	Comments
22	Large (>20 cm)	Absent	Absent	Absent	Absent	Common	20%, 30mm	>3	Unknown	<i>E. melanophloia</i> , <i>C. clarksoniana</i>	Isolated fragment	Broadscale clearing	
23	Large (>20 cm)	Diverse	Abundant	Absent	Absent	Common	30%, 50mm	<1	Ephemeral	<i>E. camaldulensis</i> , <i>E. melanophloia</i> , <i>E. populnea</i>	Narrow linear patch	Broadscale clearing	
24	0	Diverse	Abundant	Diverse	Common	Occasional	5%, 10mm	>3	Unknown	Absent	Isolated fragment	Broadscale clearing	Good quality gilgai with deep cracks in clay.
25	0	Diverse	Common	Diverse	Common	Occasional	20%, 30mm	1 - 3	Permanent	<i>E. cambageana</i>	Isolated fragment	Broadscale clearing	Brigalow regrowth.
26	Large (>20 cm)	Absent	Absent	Absent	Absent	Abundant	40%, 50mm	>3	Unknown	<i>E. thozetiana</i> , <i>E. cambageana</i>	Isolated fragment	Broadscale clearing	Elevated site on rocky outcrop - large rocks, overhangs and small caves surrounding site.
38	Large (>20 cm)	Absent	Absent	Absent	Absent	Occasional	20%, 30mm	<1	Permanent	<i>E. melanophloia</i> , <i>E. camaldulensis</i> , <i>E. populnea</i>	Isolated fragment	Grazing	
39	Large (>20 cm)	Absent	Absent	Absent	Absent	Common	30%, 30mm	1 - 3	Permanent	<i>E. cambageana</i> , <i>E. camaldulensis</i>	Isolated fragment	Grazing	
40	Large (>20 cm)	Absent	Absent	Absent	Absent	Common	30%, 30mm	1 - 3	Permanent	<i>E. cambageana</i>	Isolated fragment	Broadscale clearing	
41	0	Shallow	Common	Absent	Absent	Common	40%, 40mm	<1	Permanent	<i>E. thozetiana</i>	Isolated fragment	Broadscale clearing	

Site	Hollow Tree Size (cm)	Soil Crack Presence	Soil Crack Abundance	Gilgai Presence	Gilgai Abundance	Fallen Woody Debris Abundance	Leaf Litter Cover (%) and Depth (mm)	Proximity to Water (km)	Water Type	Koala Food Trees	Connectivity	Presence of Threat	Comments
42	Large (>20 cm)	Absent	Absent	Absent	Absent	Common	20%, 30mm	1 - 3	Permanent	<i>C. tessellaris</i>	Isolated fragment	Broadscale clearing	
43	Large (>20 cm)	Shallow	Common	Absent	Absent	Abundant	25%, 30mm	>3	Permanent	<i>E. thozetiana</i>	Isolated fragment	Broadscale clearing	
44	0	Absent	Absent	Absent	Absent	Abundant	30%, 35mm	>3	Permanent	<i>E. cambageana</i>	Isolated fragment	Broadscale clearing	
45	Large (>20 cm)	Shallow	Common	Shallow	Occasional	Abundant	30%, 30mm	>3	Permanent	<i>E. cambageana</i> , <i>E. thozetiana</i>	Narrow linear patch	Broadscale clearing	
46	Large (>20 cm)	Absent	Absent	Absent	Absent	Common	30%, 40mm	>3	Permanent	<i>E. cambageana</i>	Narrow linear patch	Broadscale clearing	
47	NA	Absent	Absent	Absent	Absent	Abundant	40%, 20mm	>3	Permanent	None	Isolated fragment	Broadscale clearing	
48	Large (>20 cm)	Absent	Absent	Absent	Absent	Occasional	20%, 40mm	>3	Permanent	<i>E. populnea</i> , <i>E. chloroclada</i>	Isolated fragment	Broadscale clearing	
49	0	Absent	Absent	Absent	Absent	Occasional	20%, 20mm	>3	Permanent	<i>E. melanophloia</i>	Isolated fragment		
50	NA	Absent	Absent	Absent	Absent	Abundant	75%, 20mm	>3	Permanent	None	Isolated fragment	Broadscale clearing	
51	0	Absent	Absent	Absent	Absent	Common	70%, 20mm	>3	Permanent	None	Isolated fragment	Broadscale clearing	

Site	Hollow Tree Size (cm)	Soil Crack Presence	Soil Crack Abundance	Gilgai Presence	Gilgai Abundance	Fallen Woody Debris Abundance	Leaf Litter Cover (%) and Depth (mm)	Proximity to Water (km)	Water Type	Koala Food Trees	Connectivity	Presence of Threat	Comments
52	Large (>20 cm)	Absent	Absent	Absent	Absent	Common	20%, 40mm	>3	Permanent	<i>E. thozetiana</i> , <i>E. crebra</i>	Isolated fragment	Broadscale clearing	
53	Large (>20 cm)	Shallow	Common	Absent	Absent	Occasional	15%, 20mm	>3	Permanent	<i>E. melanophloia</i> , <i>C. tessellaris</i> , <i>E. populnea</i>	Narrow linear patch	Broadscale clearing	
54	Medium (11-20 cm)	Shallow	Occasional	Absent	Absent	Abundant	20%, 30mm	>3	Permanent	<i>E. populnea</i> , <i>E. melanophloia</i>	Isolated fragment	Broadscale clearing	
55	absent	Absent	Absent	Absent	Absent	Abundant	50%, 40mm	>3	Unknown	None	Isolated fragment	Broadscale clearing	
56	Large (>20 cm)	Shallow	Occasional	Absent	Absent	Occasional	10%, 30mm	>3	Unknown	<i>E. populnea</i>	Isolated fragment	Broadscale clearing	
57	Large (>20 cm)	Shallow	Common	Absent	Absent	Occasional	10%, 10mm	>3	Unknown	<i>E. populnea</i> , <i>E. orgadophila</i> , <i>C. erythrophloia</i>	Isolated fragment	Broadscale clearing	
58	Large (>20 cm)	Absent	Absent	Absent	Absent	Occasional	15%, 20mm	>3	Unknown	<i>C. clarksoniana</i> , <i>E. crebra</i> , <i>E. melanophloia</i>	Isolated fragment	Broadscale clearing	
59	Large (>20 cm)	Shallow	Common	Absent	Absent	Common	25%, 20mm	>3	Unknown	<i>E. melanophloia</i> , <i>E. populnea</i>	Isolated fragment	Broadscale clearing	
60	Large (>20 cm)	Shallow	Occasional	Absent	Absent	Common	25%, 40mm	>3	Unknown	<i>E. populnea</i> ,	Isolated fragment	Broadscale clearing	
61	Large (>20 cm)	Absent	Absent	Absent	Absent	Common	10%, 20mm	>3	Unknown	<i>E. melanophloia</i>	Isolated fragment	Broadscale clearing	

Site	Hollow Tree Size (cm)	Soil Crack Presence	Soil Crack Abundance	Gilgai Presence	Gilgai Abundance	Fallen Woody Debris Abundance	Leaf Litter Cover (%) and Depth (mm)	Proximity to Water (km)	Water Type	Koala Food Trees	Connectivity	Presence of Threat	Comments
62	Medium (11-20 cm)	Shallow	Occasional	Shallow	Occasional	Common	30%, 30mm	<1	Permanent	<i>E. populnea</i>	Contiguous area (>100 ha)	Grazing	
63	Medium (11-20 cm)	Absent	NA	Absent	NA	Occasional	60%, 20mm	<1	Permanent	<i>E. populnea</i>	Contiguous area (>100 ha)	Grazing	
64	Medium (11-20 cm)	Absent	NA	Absent	NA	Abundant	30%, 20mm	1 - 3	Permanent	<i>E. populnea</i>	Contiguous area (>100 ha)		
65	Medium (11-20 cm)	Absent	NA	Absent	NA	Abundant	30%, 20mm	1 - 3	Permanent	<i>E. crebra</i>	Contiguous area (>100 ha)		
66	Small (5-10 cm)	Shallow	Occasional	Absent	NA	Rare	0/0	1 - 3	Permanent	Absent	Contiguous area (>100 ha)	Grazing	
67	0	Shallow	Occasional	Absent	NA	Common	0/0	1 - 3	Permanent	Absent	Contiguous area >100 ha	Grazing	
68	Medium (11-20 cm)	Absent	Absent	Absent	Absent	Abundant	30%, 20mm	1 - 3	Permanent	<i>E. melanophloia</i>	Contiguous area (>100 ha)	Broadscale clearing	
69	Medium (11-20 cm)	Absent	NA	Absent	NA	Rare	30%, 20mm	1 - 3	Permanent	Absent	Contiguous area (>100 ha)		
111		Absent	Absent	Absent	Absent	Common	15%, 20mm	<1	Ephemeral	<i>E. populnea</i>	Isolated fragment	Broadscale clearing	
112	Large (>20 cm)	Shallow	Occasional	Absent	Absent	Occasional	10%, 10mm	<1	Ephemeral	<i>E. camaldulensis</i> , <i>E. melanophloia</i> , <i>E. populnea</i> , <i>C. tessellaris</i>	Narrow linear patch	Fragmentation	

Site	Hollow Tree Size (cm)	Soil Crack Presence	Soil Crack Abundance	Gilgai Presence	Gilgai Abundance	Fallen Woody Debris Abundance	Leaf Litter Cover (%) and Depth (mm)	Proximity to Water (km)	Water Type	Koala Food Trees	Connectivity	Presence of Threat	Comments
113	Large (>20 cm)	Absent	Absent	Absent	Absent	Common	15%, 20mm	<1	Ephemeral	<i>E. populnea</i> , <i>E. melanophloia</i> , <i>C. clarksoniana</i>	Isolated fragment	Broadscale clearing	
114	Large (>20 cm)	Absent	Absent	Absent	Absent	Occasional	20%, 20mm	1 - 3	Ephemeral	<i>E. melanophloia</i> , <i>E. crebra</i> , <i>C. clarksoniana</i>	Isolated fragment	Grazing	
115		Shallow	Common	Absent	Absent	Abundant	20%, 20mm	1 - 3	Ephemeral	None	Isolated fragment	Broadscale clearing	
116		Absent	Absent	Absent	Absent	Occasional	20%, 20mm	>3	Unknown	<i>E. populnea</i> , <i>E. melanophloia</i>	Isolated fragment	Broadscale clearing	
117	Large (>20 cm)	Shallow	Rare	Absent	Absent	Common	30%, 30mm	>3	Unknown	<i>E. cambageana</i>	Isolated fragment	Broadscale clearing	
118		Absent	Absent	Absent	Absent	Occasional	10%, 20mm	<1	Ephemeral	<i>E. populnea</i> , <i>E. melanophloia</i>	Isolated fragment	Broadscale clearing	
119	Large (>20 cm)	Absent	Absent	Absent	Absent	Common	20%, 15mm	<1	Ephemeral	<i>E. populnea</i> , <i>E. cambageana</i>	Narrow linear patch	Broadscale clearing	
120			Absent	Absent	Absent	Common	20%, 15mm	<1	Ephemeral	<i>E. melanophloia</i>	Narrow linear patch	Broadscale clearing	
121	Large (>20 cm)	Shallow	Occasional	Absent	Absent	Common	20%, 20mm	<1	Ephemeral	<i>E. melanophloia</i> , <i>E. crebra</i> , <i>E. cambageana</i> , <i>E. populnea</i>	Isolated fragment	Broadscale clearing	
122	Large (>20 cm)	Absent	Absent	Absent	Absent	Common	15%, 20mm	<1	Ephemeral	<i>E. melanophloia</i> , <i>E. cambageana</i> , <i>E. populnea</i>	Isolated fragment	Broadscale clearing	

Site	Hollow Tree Size (cm)	Soil Crack Presence	Soil Crack Abundance	Gilgai Presence	Gilgai Abundance	Fallen Woody Debris Abundance	Leaf Litter Cover (%) and Depth (mm)	Proximity to Water (km)	Water Type	Koala Food Trees	Connectivity	Presence of Threat	Comments
123		Shallow	Common	Absent	Absent	Common	20%, 20mm	<1	Ephemeral	<i>E. populnea</i>	Isolated fragment	Broadscale clearing	
124		Shallow	Common	Absent	Absent	Common	30%, 20mm	<1	Ephemeral	<i>E. populnea</i>	Isolated fragment	Broadscale clearing	
125	Large (>20 cm)	Shallow	Absent	Absent	Absent	Common	20%, 20mm	1 - 3	Ephemeral	<i>E. melanophloia</i>	Isolated fragment	Broadscale clearing	
126		Diverse	Abundant	Deep	Common	Abundant	35%, 30mm	<1	Ephemeral	<i>E. populnea</i>	Isolated fragment	Broadscale clearing	
127	Large (>20 cm)	Shallow	Occasional	Absent	Absent	Common	20%, 20mm	<1	Ephemeral	<i>E. camaldulensis</i> , <i>E. melanophloia</i> , <i>E. populnea</i>	Isolated fragment	Broadscale clearing	
128	Large (>20 cm)	Shallow	Occasional	Absent	Absent	Common	20%, 20mm	<1	Ephemeral	<i>E. camaldulensis</i> , <i>E. melanophloia</i> , <i>E. populnea</i>	Isolated fragment	Broadscale clearing	
129		Absent	Absent	Absent	Absent	Occasional	5%, 10mm	<1	Permanent	None	Isolated fragment	Broadscale clearing	
130		Diverse	Occasional	Diverse	Occasional	Rare	0%, 0mm	<1	Permanent	None	Contiguous area (>100 ha)	Broadscale clearing	Ornamental snake habitat gilgais
131		Absent	Absent	Absent	Absent	Common	10%, 10mm	1 - 3	Permanent	<i>E. exserta</i>	Isolated fragment	Broadscale clearing	Koala habitat <i>Eucalyptus exserta</i> patches in <i>Acacia shirleyi</i>
132		Shallow	Occasional	Shallow	Rare	Common	20%, 10mm	<1	Permanent	None	Isolated fragment	Broadscale clearing	Brigalow. Potential OS habitat

Site	Hollow Tree Size (cm)	Soil Crack Presence	Soil Crack Abundance	Gilgai Presence	Gilgai Abundance	Fallen Woody Debris Abundance	Leaf Litter Cover (%) and Depth (mm)	Proximity to Water (km)	Water Type	Koala Food Trees	Connectivity	Presence of Threat	Comments
133		Absent	Absent	Absent	Absent	Rare	5%, 10mm	1 - 3	Ephemeral	<i>E. populnea</i>	Isolated fragment	Weeds	Regrowth <i>Eucalyptus populnea</i>
134		Absent	Absent	Absent	Absent	Occasional	5%, 10mm	1 - 3	Ephemeral	<i>E. crebra</i> , <i>C. clarksoniana</i> , <i>C. tessellaris</i>	Isolated fragment	Broadscale clearing	Regrowth <i>Eucalyptus crebra</i> , <i>E. clarksoniana</i> and <i>Acacia shirleyi</i> , <i>A. catenulata</i>
135		Absent	Absent	Absent	Absent	Absent	10%, 10mm	<1	Permanent	<i>E. crebra</i>	Isolated fragment	Broadscale clearing	<i>Acacia catenulata</i> , <i>Brachychiton populnea</i> , <i>Eucalyptus crebra</i>
136		Shallow	Rare	Absent	Absent	Common	20%, 20mm	1 - 3	Permanent	<i>E. cambadgeana</i>	Isolated fragment	Broadscale clearing	<i>Eucalyptus cambadgeana</i> scattered throughout
137		Shallow	Occasional	Shallow	Occasional	Common	10%, 20mm	1 - 3	Ephemeral	<i>E. cambadgeana</i>	Isolated fragment	Broadscale clearing	Minimal gilgai. <i>Eucalyptus cambadgeana</i> , <i>Acacia harpophylla</i> woodland
138	Large (>20 cm)	Absent	Absent	Absent	Absent	Rare	15%, 20mm	1 - 3	Permanent	<i>E. melanophloia</i>	Isolated fragment	Broadscale clearing	Potential trap site in spinifex grassland
139		Absent	Absent	Absent	Absent	Occasional	5%, 10mm	1 - 3	Permanent	<i>E. melanophloia</i>	Isolated fragment	Broadscale clearing	

Site	Hollow Tree Size (cm)	Soil Crack Presence	Soil Crack Abundance	Gilgai Presence	Gilgai Abundance	Fallen Woody Debris Abundance	Leaf Litter Cover (%) and Depth (mm)	Proximity to Water (km)	Water Type	Koala Food Trees	Connectivity	Presence of Threat	Comments
140	Large (>20 cm)	Absent	Absent	Absent	Absent	Occasional	5%, 10mm	<1	Ephemeral	<i>E. tereticornis</i> , <i>E. populnea</i>	Narrow linear patch	Weeds	Koala habitat
141		Absent	Absent	Absent	Absent	Rare	5%, 10mm	1 - 3	Ephemeral	<i>E. orgadophila</i>	Isolated fragment	Weeds	Rock-wallaby and Wallaroo habitat. Reptiles habitat. Southern slope rocky vine scrub community.
142		Shallow	Occasional	Absent	Absent	Rare	5%, 10mm	1 - 3	Ephemeral	None	Isolated fragment	Weeds	Eucalyptus dieback with Brigalow
143		Shallow	Occasional	Absent	Absent	Absent	1%, 10mm	1 - 3	Permanent	<i>E. orgadophila</i>	Narrow linear patch	Weeds	
144		Absent	Absent	Absent	Abundant	Abundant	20%, 20mm	<1	Permanent	<i>E. thozetiana</i>	Isolated fragment	Broadscale clearing	Active search site. Abundant fallen debris. Rocky slope
145	Large (>20 cm)	Absent	Absent	Absent	Absent	Occasional	10%, 10mm	<1	Ephemeral	<i>E. tereticornis</i> , <i>E. populnea</i>	Narrow linear patch	Weeds	Koala habitat
146		Absent	Absent	Absent	Absent	Common	10%, 10mm	<1	Permanent	<i>E. exserta</i>	Isolated fragment	Broadscale clearing	
147		Absent	Absent	Absent	Absent	Occasional	10%, 10mm	<1	Ephemeral	<i>E. melanophloia</i> , <i>E. populnea</i>	Isolated fragment	Broadscale clearing	Regrowth but still koala habitat - <i>Eucalyptus melanophloia</i>

Site	Hollow Tree Size (cm)	Soil Crack Presence	Soil Crack Abundance	Gilgai Presence	Gilgai Abundance	Fallen Woody Debris Abundance	Leaf Litter Cover (%) and Depth (mm)	Proximity to Water (km)	Water Type	Koala Food Trees	Connectivity	Presence of Threat	Comments with scattered <i>E. populnea</i>
148		Shallow	Common	Shallow	Common	Occasional	5%, 10mm	<1	Permanent	<i>E. populnea</i>	Isolated fragment	Broadscale clearing	
149		Shallow	Common	Shallow	Common	Rare	5%, 10mm	<1	Ephemeral	None	Isolated fragment	Broadscale clearing	
150		Shallow	Common	Shallow	Common	Occasional	10%, 10mm	<1	Ephemeral	None	Isolated fragment	Broadscale clearing	
151	Small (5-10 cm)	Absent	Absent	Absent	Absent	Common	20%, 20mm	<1	Permanent	<i>E. cambageana, E. thozetiana</i>	Isolated fragment	Broadscale clearing	Woody debris for active search
152		Absent	Absent	Absent	Absent	Abundant	20%, 20mm	1 - 3	Permanent	<i>E. populnea</i>	Isolated fragment	Broadscale clearing	
153	Large (>20 cm)	Absent	Absent	Absent	Absent	Occasional	10%, 10mm	<1	Permanent	<i>E. tereticornis</i>	Isolated fragment	Broadscale clearing	

Appendix C

Consolidated fauna species list

Class	Scientific name	Common name
Amphibia	<i>Cyclorana alboguttata</i>	Striped Burrowing Frog
	<i>Cyclorana platycephala</i>	Water-holding Frog
	<i>Limnodynastes salmini</i>	Salmon-striped Frog
	<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog
	<i>Litoria caerulea</i>	Green Tree Frog
	<i>Litoria fallax</i>	Eastern Sedge Frog
	<i>Litoria latopalmata</i>	Broad-palmed Rocket Frog
	<i>Platyplectrum ornatum</i>	Ornate Burrowing Frog
	<i>Ranoidea novaehollandiae</i>	New Holland Frog
	<i>Rhinella marina*</i>	Cane Toad*
Aves	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater
	<i>Acanthiza apicalis</i>	Inland Thornbill
	<i>Acanthiza reguloides</i>	Buff-rumped Thornbill
	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk
	<i>Accipiter fasciatus</i>	Brown Goshawk
	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar
	<i>Anas gracilis</i>	Grey Teal
	<i>Anas superciliosa</i>	Pacific Black Duck
	<i>Anhinga novaehollandiae</i>	Australasian Darter
	<i>Anthus novaeseelandiae</i>	Australasian Pipit
	<i>Aprosmictus erythropterus</i>	Red-winged Parrot
	<i>Aquila audax</i>	Wedge-tailed Eagle
	<i>Ardea intermedia</i>	Intermediate Egret
	<i>Ardea modesta</i>	Eastern Great Egret
	<i>Ardea pacifica</i>	White-necked Heron
	<i>Ardeotis australis</i>	Australian Bustard
	<i>Artamus cinereus</i>	Black-faced Woodswallow
	<i>Artamus minor</i>	Little Woodswallow
	<i>Aviceda subcristata</i>	Pacific Baza
	<i>Aythya australis</i>	Hardhead
	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo
	<i>Cacomantis pallidus</i>	Pallid Cuckoo
	<i>Centropus phasianinus</i>	Pheasant Coucal
	<i>Chalcites lucidus</i>	Shining Bronze Cuckoo
	<i>Chalcites minutillus</i>	Little Bronze-Cuckoo
	<i>Chalcites osculans</i>	Black-eared Cuckoo
	<i>Chenonetta jubata</i>	Maned Duck
	<i>Chlamydera maculata</i>	Spotted Bowerbird
	<i>Cincloramphus cruralis</i>	Brown Songlark
	<i>Colluricincla harmonica</i>	Grey Shrikethrush
<i>Coracina maxima</i>	Ground Cuckooshrike	

Class	Scientific name	Common name
	<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike
	<i>Coracina papuensis</i>	White-bellied Cuckooshrike
	<i>Coracina tenuirostris</i>	Cicadabird
	<i>Corcorax melanorhamphos</i>	White-winged Chough
	<i>Corvus coronoides</i>	Australian Raven
	<i>Corvus orru</i>	Torresian Crow
	<i>Coturnix pectoralis</i>	Stubble Quail
	<i>Cracticus nigrogularis</i>	Pied Butcherbird
	<i>Cracticus tibicen</i>	Australian Magpie
	<i>Cracticus torquatus</i>	Grey Butcherbird
	<i>Cygnus atratus</i>	Black Swan
	<i>Dacelo novaeguineae</i>	Laughing Kookaburra
	<i>Dendrocygna eytonii</i>	Plumed Whistling Duck
	<i>Dicaeum hirundinaceum</i>	Mistletoebird
	<i>Dicrurus bracteatus</i>	Spangled Drongo
	<i>Dromaius novaehollandiae</i>	Emu
	<i>Edolisoma tenuirostre</i>	Common Cicadabird
	<i>Egretta novaehollandiae</i>	White-faced Heron
	<i>Egretta sacra</i>	Eastern Reef Egret
	<i>Elanus axillaris</i>	Black-shouldered Kite
	<i>Elseyornis melanops</i>	Black-fronted Dotterel
	<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater
	<i>Eolophus roseicapilla</i>	Galah
	<i>Eopsaltria australis</i>	Eastern Yellow Robin
	<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork
	<i>Eudynamis orientalis</i>	Eastern Koel
	<i>Eurostopodus mystacalis</i>	White-throated Nightjar
	<i>Eurystomus orientalis</i>	Dollarbird
	<i>Falco berigora</i>	Brown Falcon
	<i>Falco cenchroides</i>	Nankeen Kestrel
	<i>Falco subniger</i>	Black Falcon
	<i>Fulica atra</i>	Eurasian Coot
	<i>Galinago hardwickii</i>	Latham's Snipe
	<i>Gallinula tenebrosa</i>	Dusky Moorhen
	<i>Geopelia cuneata</i>	Diamond Dove
	<i>Geopelia humeralis</i>	Bar-shouldered Dove
	<i>Geopelia placida</i>	Peaceful Dove
	<i>Gerygone albogularis</i>	White-throated Gerygone
	<i>Grallina cyanoleuca</i>	Magpie-lark
	<i>Grus rubicunda</i>	Brolga
	<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle

Class	Scientific name	Common name
	<i>Haliastur sphenurus</i>	Whistling Kite
	<i>Himantopus leucocephalus</i>	Pied Stilt
	<i>Hirundapus caudacutus</i>	White-throated Needletail
	<i>Hirundo neoxena</i>	Welcome Swallow
	<i>Lalage tricolor</i>	White-winged Triller
	<i>Lichenostomus virescens</i>	Singing Honeyeater
	<i>Lichmera indistincta</i>	Brown Honeyeater
	<i>Malurus cyaneus</i>	Superb Fairywren
	<i>Malurus lamberti</i>	Variegated Fairy-wren
	<i>Malurus melanocephalus</i>	Red-backed Fairywren
	<i>Manorina flavigula</i>	Yellow-throated Miner
	<i>Manorina melanocephala</i>	Noisy Miner
	<i>Megalurus mathewsi</i>	Rufous Songlark
	<i>Meliphaga lewinii</i>	Lewin's Honeyeater
	<i>Melithreptus albogularis</i>	White-throated Honeyeater
	<i>Melopsittacus undulatus</i>	Budgerigar
	<i>Merops ornatus</i>	Rainbow Bee-eater
	<i>Microcarbo melanoleucos</i>	Little Pied Cormorant
	<i>Milvus migrans</i>	Black Kite
	<i>Mirafra javanica</i>	Horsfield's Bushlark
	<i>Myiagra inquieta</i>	Restless Flycatcher
	<i>Myiagra rubecula</i>	Leaden Flycatcher
	<i>Neochmia modesta</i>	Plum-headed Finch
	<i>Nycticorax caledonicus</i>	Nankeen Night Heron
	<i>Nymphicus hollandicus</i>	Cockatiel
	<i>Ocyphaps lophotes</i>	Crested Pigeon
	<i>Oriolus sagittatus</i>	Olive-backed Oriole
	<i>Pachycephala rufiventris</i>	Rufous Whistler
	<i>Pardalotus striatus</i>	Striated Pardalote
	<i>Petrochelidon nigricans</i>	Tree Martin
	<i>Phalacrocorax carbo</i>	Great Cormorant
	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant
	<i>Phaps chalcoptera</i>	Common Bronzewing
	<i>Philemon citreogularis</i>	Little Friarbird
	<i>Philemon corniculatus</i>	Noisy Friarbird
	<i>Platycercus adscitus</i>	Pale-headed Rosella
	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater
	<i>Plegadis falcinellus</i>	Glossy Ibis
	<i>Podargus strigoides</i>	Tawny Frogmouth
	<i>Podiceps cristatus</i>	Great-crested Grebe
	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe

Class	Scientific name	Common name
	<i>Pomatostomus temporalis</i>	Grey-crowned Babbler
	<i>Ptilonorhynchus maculatus</i>	Spotted Bowerbird
	<i>Rhipidura albiscapa</i>	Grey Fantail
	<i>Rhipidura leucophrys</i>	Willie Wagtail
	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo
	<i>Smicrornis brevirostris</i>	Weebill
	<i>Strepera graculina</i>	Pied Currawong
	<i>Struthidea cinerea</i>	Apostlebird
	<i>Sturnus tristis*</i>	Common Myna*
	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe
	<i>Taeniopygia bichenovii</i>	Double-barred Finch
	<i>Taeniopygia guttata</i>	Zebra Finch
	<i>Threskiornis moluccus</i>	Australian White Ibis
	<i>Threskiornis spinicollis</i>	Straw-necked Ibis
	<i>Todiramphus macleayii</i>	Forest Kingfisher
	<i>Todiramphus sanctus</i>	Sacred Kingfisher
	<i>Trichoglossus moluccanus</i>	Rainbow Lorikeet
	<i>Turnix pyrrhothorax</i>	Red-chested Buttonquail
	<i>Turnix varius</i>	Painted Buttonquail
	<i>Turnix velox</i>	Little Buttonquail
	<i>Tyto javanica</i>	Eastern Barn Owl
	<i>Vanellus miles</i>	Masked Lapwing
	<i>Zosterops lateralis</i>	Silvereye
Non-volant mammals	<i>Aepyprymnus rufescens</i>	Rufous Bettong
	<i>Canis lupus</i>	Dingo, Domestic Dog
	<i>Hydromys chrysogaster</i>	Water-rat
	<i>Lepus europaeus</i>	Brown Hare*
	<i>Macropus giganteus</i>	Eastern Grey Kangaroo
	<i>Mus musculus</i>	House Mouse*
	<i>Oryctolagus cuniculus</i>	Rabbit*
	<i>Petaurus breviceps</i>	Sugar Glider
	<i>Petrogale herberti</i>	Herbert's Rock Wallaby
	<i>Phascolarctos cinereus</i>	Koala
	<i>Pseudomys delicatulus</i>	Delicate Mouse
	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna
	<i>Trichosurus vulpecula</i>	Common Brushtail Possum
	<i>Wallabia bicolor</i>	Swamp Wallaby
Reptilia	<i>Antaresia maculosa</i>	Spotted Python
	<i>Boiga irregularis</i>	Brown Tree Snake
	<i>Carlia pectoralis</i>	Open-litter Rainbow-skink
	<i>Carlia schmeltzii</i>	Robust Rainbow-skink

Class	Scientific name	Common name
	<i>Cryptoblepharus pulcher</i>	Elegant Snake-eyed Skink
	<i>Cryptophis boschmai</i>	Carpentaria Snake
	<i>Ctenotus pantherinus</i>	Leopard Skink
	<i>Ctenotus robustus</i>	Eastern Striped Skink
	<i>Ctenotus taeniolatus</i>	Copper-tailed Skink
	<i>Demansia psammophis</i>	Yellow-faced Whipsnake
	<i>Denisonia maculata</i>	Ornamental Snake
	<i>Diplodactylus platyurus</i>	Eastern Fat-tailed Gecko
	<i>Diplodactylus vittatus</i>	Eastern Stone Gecko
	<i>Diprophora australis</i>	Tommy Roundhead
	<i>Gehyra catenata</i>	Chain-backed Dtella
	<i>Gehyra dubia</i>	Dubious Dtella
	<i>Heteronotia binoei</i>	Bynoe's Gecko
	<i>Lerista fragilis</i>	Eastern Mulch-slider
	<i>Lerista punctatovittata</i>	Eastern Robust Slider
	<i>Lialis burtonis</i>	Burton's Legless Lizard
	<i>Lucasium steindachneri</i>	Box-patterned Gecko
	<i>Morethia boulengeri</i>	South-eastern Morethia Skink
	<i>Nephurus asper</i>	Prickly Knob-tailed Gecko
	<i>Oedura monilis</i>	Ocellated Velvet Gecko
	<i>Strophurus taenicauda</i>	Golden-tailed Gecko
	<i>Suta suta</i>	Curl Snake
	<i>Tropidonophis mairii</i>	Keelback
	<i>Varanus tristis</i>	Black-headed monitor
	<i>Vermicella annulata</i>	Bandy Bandy
Bats	<i>Chaerephon jobensis</i>	Northern Freetail Bat
	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat
	<i>Chalinolobus morio</i>	Chocolate Wattled Bat
	<i>Chalinolobus picatus</i>	Little Pied Bat
	<i>Miniopterus orianae oceanensis</i>	Southern Bent-wing Bat
	<i>Nyctophilus sp.</i>	Long-eared Bat species
	<i>Ozimops lumsdenae</i>	Northern Free-tailed Bat
	<i>Ozimops ridei</i>	Eastern Free-tailed Bat
	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail Bat
	<i>Scotorepens balstoni</i>	Western Broad-nosed Bat
	<i>Scotorepens greyii</i>	Little Broad-nosed Bat
	<i>Vespadelus baverstocki</i>	Inland Forest Bat
	<i>Vespadelus troughtoni</i>	Eastern Cave Bat

* - pest fauna species

Appendix D

Refined likelihood of occurrence

D.1 Threatened fauna with potential to occur

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
<i>Calidris ferruginea</i>	Curlew Sandpiper	✓	×	CE, Mi	E	The Curlew Sandpiper is a migratory shorebird species that spends its non-breeding season in coastal parts of Australia. The species has been recorded in various inland regions as it migrates to southern parts of the Australian coastline. Near the coast it inhabits intertidal mudflats in sheltered areas and inland they utilise ephemeral and permanent lakes, lagoons, ponds, dams with bare edges of mud. The species does not breed in Australia (DAWE 2020n).	Unlikely	The desktop reviews confirmed no records of this species within the survey area. There is potential for this species to occur during migration but it is not considered likely, and suitable habitat such as large inland waterbodies are not present (with farm dams being small and typically steep sided).
<i>Calyptorhynchus lathami erebus</i>	Glossy Black-Cockatoo (northern)	×	×	-	V	The Glossy Black-cockatoo favours woodland areas dominated by <i>Allocasuarina sp.</i> , or open sclerophyll forests and woodland with a distinct stratum of <i>Allocasuarina sp.</i> They have also been observed in mixed woodland consisting of <i>Allocasuarina</i> , <i>Callitris</i> and Brigalow in the Brigalow Belt region (Hourigan 2012).	Potential	There are records of the species in the Blackdown Tableland National Park to the northeast however no records of the species were observed during historic surveys. There are limited <i>Allocasuarina</i> food trees in the survey area for the Glossy-black Cockatoo. Where there are suitable food tree species, signs of species presence (e.g. chewed <i>Allocasuarina</i> cones) are easily found. These signs were not observed in areas of Belah (<i>Casuarina cristata</i>) in the survey area. Due to the absence of preferred foraging resources and the lack of tree hollows, the likelihood of the species in the survey area is greatly reduced and it is considered only to have potential to occur on an intermittent basis.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	✓	×	V	V	The Large-eared Pied Bat typically roosts in caves and other crevices with preferred foraging habitat consisting of fertile eucalypt woodlands or dense riparian corridors (DAWE 2020o).	Unlikely	The desktop review confirmed records of the species in the Blackdown Tableland National Park to the east however no records of the species have been confirmed within the survey area. Most records for the species are within several kilometres of cliff lines or rocky terrain (preferred roosting habitat). The survey area contains limited potential roosting habitat on rocky escarpments, however this area is limited and isolated from foraging habitat. Preferred foraging habitat comprises open forests and woodlands including riparian zones, foot-slopes and valley

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
								<p>floors, within 2.5 km of preferred roosting habitat (Kerswell et al. 2020).</p> <p>The Large-eared Pied Bat requires a combination of sandstone cliffs and fertile woodland valley within close proximity of each other (DAWE 2020o).</p> <p>Ultimately, the long distance from preferred roosting habitat and the disjunct and limited foraging habitat within the survey area, the species is considered unlikely to occur. Extensive survey effort (see Section 5.2.1) failed to record this species.</p>
<i>Dasyurus hallucatus</i>	Northern Quoll	✓	×	E	-	This species can utilise a range of habitats and shows preference for eucalypt woodlands, riparian vegetation, and vine thickets. They are recorded in higher densities where these areas remain in proximity to suitable denning habitat which typically consists of steep rocky terrain with crevices and other sheltering microhabitats (TSSC 2005).	Unlikely	<p>The desktop review confirmed records of the species in the Blackdown Tableland National Park to the northeast however no records of the species have been confirmed within the survey area. Habitat critical to the survival of the Northern Quoll is defined in (DoE 2016) as:</p> <ul style="list-style-type: none"> • Rocky habitats such as ranges, escarpments, mesas, gorges, breakaways, boulder fields, major drainage lines or treed creek lines; and/or • Structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs. <p>Foraging or dispersal habitat is recognised to be any land comprising predominantly native vegetation in the immediate area (ie within 1 km) of shelter habitat. The Survey area is unsuitable habitat, with small lateritic jump-ups being isolated in farmland.</p>
<i>Delma torquata</i>	Collared Delma	✓	×	V	V	The Collared Delma is an endemic species to Queensland It inhabits eucalypt-dominated woodlands and open forests in land zones 3, 9 and 10. The presence of rocks, logs, bark and other woody coarse debris, and mats of leaf litter are essential microhabitat features (DoE 2019e).	Unlikely	<p>The desktop review identified records of the species in the Blackdown Tableland National Park to the east however no records have been confirmed within the survey area. Limited information is known about its full distribution in Queensland; however, it has been recorded in isolated populations where microhabitat occurs.</p> <p>The majority of the survey area is land zone 4 and/or cleared of vegetation, or does not have suitable habitat factors (well developed leaf litter, rocky areas or woody debris). The survey area includes some areas of eucalypt dominated woodlands on</p>

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
								<p>land zone 3 but these are typically limited to riparian corridors without extensive rocky areas or well developed leaf litter.</p> <p>Some patches of land zone 9 occur on the margins of rocky jump ups in the centre of the survey area, but these are isolated and limited in extent. While loose surface rock and scattered outcrops occur, it does not occur extensively in the survey area. The majority of records are from woodland sites, with an understorey of grasses and Creeping Lantana (<i>Lantana montevidensis</i>) on stony soils or rocky ridges (Porter 1998). There is suggestion (DSEWPC 2011a) that the species may be grazing-sensitive, as all Brigalow Belt records are from ungrazed or rarely grazed areas (DERM unpubl. data). The survey area is extensively grazed throughout.</p> <p>Therefore the species is considered unlikely to occur and its presence in the region is likely to be limited to Blackdown Tableland National Park.</p>
<i>Denisonia maculata</i>	Ornamental Snake	✓	×	V	V	The Ornamental Snake is a nocturnal, relatively small snake species known only from the Brigalow Belt North and the Brigalow Belt South biogeographical regions. Its preferred habitat includes woodlands (acacia and eucalypt) and open forests associated with moist areas and cracking clays. It has been recorded from multiple regional ecosystems including RE11.4.3, 11.4.6, 11.4.8, 11.4.9, 11.3.3, 11.5.16., most regularly from those associated with clay soils (Land zone 4). It shelters within deep soil cracks, under coarse woody debris and amongst deep leaf litter. It feeds almost exclusively on frog species and therefore is most active during wet conditions (DAWE 2020k).	Known	<p>Records of the Ornamental Snake have been confirmed from historical surveys and have been recorded during the recent spring and autumn surveys across the survey area.</p> <p>Suitable habitat in form of gilgai has been confirmed as present and mapped.</p>

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
<i>Egernia rugosa</i>	Yakka Skink	✓	×	V	V	The core habitat of this species is within the Mulga lands and Brigalow Belt South Bioregions. Common woodland and open forest types it inhabits include acacia, casuarina, eucalyptus. It is commonly found in cavities under partly buried rocks, logs or tree stumps (DAWE 2020p).	Unlikely	<p>The desktop review did not identify any records of species within the study area; however, it is known to occur in the wider region.</p> <p>The survey area contains marginally suitable habitat for this species including acacia and eucalypt woodlands with logs, tree stumps and rocky areas. However, these areas are disjunct from other habitats and are minimal in extent. The species has not been identified in the survey area after survey effort conducted over the spring and autumn surveys therefore it is unlikely to occur.</p> <p>The majority of the survey area is land zone 4 and/or cleared of vegetation, or does not have suitable habitat factors (rocky areas or woody debris). The survey area includes some areas of eucalypt dominated woodlands on land zone 3 but these are typically limited to riparian corridors without extensive rocky areas or extensive woody debris.</p> <p>Some patches of land zone 9 occur on the margins of rocky jump ups in the centre of the survey area, but these are isolated and limited in extent. While loose surface rock and scattered outcrops occur, it does not occur extensively in the survey area.</p> <p>Therefore the species is considered unlikely to occur and its presence in the region is likely to be limited to Blackdown Tableland National Park.</p>
<i>Elseya albagula</i>	Southern Snapping Turtle	✓	×	CE	E	The White-throated Snapping Turtle is the largest short-necked freshwater turtle in Australia. The species is only found in Queensland in the Fitzroy, Mary and Burnett Rivers and associated drainages. It is typically found in clear, flowing, well-oxygenated waters (DES 2020o). Most records of the species are from larger river systems. There are records in ALA north of Emerald and east of Duaringa.	Unlikely	The desktop review did not identify any records of species within the study area. No waterways within the survey area are likely to provide suitable habitat to support the species.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
<i>Erythrotriorchis radiatus</i>	Red Goshawk	✓	×	V	E	The Red Goshawk is a large bird-of-prey that primarily feeds on other bird species. The species prefers a mosaic of vegetation types including forest and woodland communities with ample prey populations and permanent water. Prey species include Corvids, Kingfishers and Parrots. Nests are restricted to trees taller than 20 m and within 1 km of a permanent watercourse or wetland (DAWE 2020q).	Unlikely	The desktop review identified three historical records of the species in the Blackdown Tableland National Park, but no records exist from historical surveys within or adjacent to the survey area. The survey area does have the potential to provide foraging habitat for the species but does not contain tall woodlands, large tracts of riverine vegetation and permanent water required for breeding events. The possibility of Red Goshawk (<i>Erythrotriorchis radiatus</i>) is low given the range contraction this species has undergone in recent years. It is understood that this species now no longer occurs south of the Cape York Peninsula.
<i>Furina dunmalli</i>	Dunmall's Snake	✓	×	V	V	Dunmall's Snake is a small elapid that primarily occurs in the Brigalow Belt region and is considered very rare with limited records. It has been recorded in forests and woodland dominated by Brigalow and other Acacia, native Cypress or Bull-oak. It shelters under fallen timber and ground litter and may use cracks in alluvial clay soils. Suitable soils occur on land zone 4 and 10 (DAWE 2020r).	Unlikely	Desktop review did not identify any records of the species within the study area. The modelled distribution of this species suggests that this species does not occur.
<i>Geophaps scripta scripta</i>	Squatter Pigeon (southern)	✓	✓	V	V	The Squatter Pigeon is a medium-sized, highly terrestrial pigeon that occurs from Cape York to southern Queensland (formally to northern New South Wales). Habitat for the species is generally open-forests to sparse open-woodlands and scrub, dominated by eucalyptus, corymbia, acacia or callitris species, within 3km of surface water. Utilised habitat in these areas have low groundlayer cover, typically below 33%. Soils in these areas consist of sandy substrates dissected with low gravely ridges (DAWE 2020s).	Potential	The desktop review indicated that the species has been recorded during historic surveys within the Blackwater mine leases and in 2006 and 2007 in the Terang and South Marshmead areas. Squatter Pigeon generally require open forest or scrub on sandy soils, dominated by native grasses, in close association with permanent water (DAWE 2020s). Where non-alluvial clay soils (land zone 4) occur, the species is less likely to be present unless the ground cover has been thinned to suitable levels (Squatter Pigeon Workshop 2011; DoEE 2018). It often occurs around cattle yards and other disturbed areas, although is unlikely to occur far from wooded areas. This species has broad habitat preferences, although in the survey area this is constrained by the nature of the ground cover (dense Buffel Grass) and soil type (extensive areas of gilgai with a clay substrate). Areas of denser woodland (e.g. patches of RE 11.7.2) are also unsuitable as the species favours more open woodland habitats. Although the species has been recorded

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
								during historical surveys, it has not been recorded during recent ecological surveys comprising of significant effort (Section 3.4.6). Habitats in the survey area predominantly consist of areas of agricultural land, cleared areas of gilgai habitat on clay soils and dense woodland (such as large stands of <i>Acacia shirleyi</i>), none of which are suitable for this species which favours open grassy woodland on sandy soils, a habitat type not particularly abundant in the survey area. Another significant factor is likely the extensive areas of dense Buffel Grass dominating the survey area. Although the species could occur, and there are records from surrounding the study area, the lack of records during extensive survey effort and significant time driving around the site on dirt roads and tracks, suggests the species is not abundant or regular in the survey area, and perhaps limited to sporadic occurrences dispersing from surrounding areas of more suitable open grassy woodland habitat on sandy soils.
<i>Grantiella picta</i>	Painted Honeyeater	✓	×	V	V	The Painted Honeyeater is a nomadic species that occurs in inland areas spanning from central Victoria, through NSW into central QLD and eastern NT. It occupies dry, open forests and woodlands including box, ironbark, yellow gum, <i>Melaleuca</i> , <i>Casuarina</i> , <i>Callitris</i> , and <i>Acacia</i> communities. It feeds primarily on Mistletoe (Loranthaceae) fruits and its movements are highly dependent on fruit availability (DAWE 2020t).	Potential	<p>Desktop review identified records of the Painted Honeyeater within the study area west of Blackdown Tableland National Park (11985 and 2017). However, the species is likely to be an infrequent and scarce visitor to the region, and there are no other records in the region.</p> <p>Although targeted surveys did not record this species, areas of potential habitat exist within the survey. This consists of remnant acacia woodlands and riparian eucalypt vegetation with mistletoe species such as <i>Amyema quandang</i>.</p> <p>It feeds primarily on Mistletoe (Loranthaceae) fruits and its movements are highly dependent on fruit availability. Although potential habitat does occur (with mistletoe host species such as brigalow and belah present) the habitat is limited in extent within the survey area and it is not within the core range of this species. Extensive areas of remnant acacia or eucalypt woodlands do not occur in the Survey area. The species retains a low possibility of occurrence on a sporadic basis.</p>

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
<i>Hirundapus caudacutus</i>	White-throated Needletail	✓	×	V	SLC	A regular summer non-breeding migrant to eastern Australia, the White-throated Needletail is a highly aerial species that can forage in the airspace over any habitat varying from forest ranges to cleared agricultural lands (up to 2000 m asl). However, the species tends to show preference for hilly areas and coastal ranges. Its roosting habits are poorly known but the species has been recorded roosting in woodlands high amongst the foliage of large eucalypt species (DAWE 2020i).	Known	The species was recorded during the spring 2019 surveys.
<i>Macroderma gigas</i>	Ghost Bat	✓	×	V	E	The Ghost Bat is Australia's largest micro-bat (microchiropteran) species at 98-118mm. The species occurs in a wide range of habitat including rainforest, monsoon and vine scrub, to open woodlands in arid areas. Their favoured roosting sites are undisturbed caves or mineshafts. Populations in Queensland are restricted to the central and northern coasts although they were formally more widespread the state (TSSC 2016b).	Unlikely	Desktop review confirmed no previous records of the species within the survey area. Preferred roosting habitat has not been recorded within the survey area.
<i>Neochmia ruficauda ruficauda</i>	Star Finch	✓	×	E	E	The species mainly occurs in damp grasslands and grassy woodlands located close to freshwater bodies. In Qld, the species distribution has largely contracted to eastern Cape York and the Gulf of Carpentaria (DAWE 2020u).	Unlikely	The desktop review did not identify any records of the species within the study area. The survey area is not within its currently known distribution and is therefore unlikely to occur, and the subspecies is potentially extinct.
<i>Ninox strenua</i>	Powerful Owl	×	×	-	V	The Powerful Owl inhabits moist forest of eastern Australia. It has also been found in open areas near forests such as farmland and remnant bushland patches. The species requires large tracts of bushland for sufficient breeding and hunting space (Birdlife 2018). The desktop review did not identify any records of the species within the study area from historic surveys. The species has been recorded in the Blackdown Tableland National Park to the east of the project. The survey area is unlikely to support	Potential	Although the survey area does support potential foraging habitat, there are few large mature trees in the creeklines and the very low density of large hollows present reduces the value of the habitat for Powerful Owl. Limited suitable nesting habitat in tree hollows was recorded along Rockland Creek and Shotover Creek. Therefore the occurrence of this species is likely constrained by the lack of hollow bearing trees. Significant nocturnal survey effort has been undertaken in the south (Section 3.4.6) and if present the species is not difficult to detect therefore the species is unlikely to occur beyond sporadic occurrences.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
						large enough tracts of vegetation but the vegetation on the site is connected to larger areas to the east.		
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat	✓	✗	V	V	Corben's Long-eared Bat's preferred habitat is eucalypt woodland including box/ironbark/cypress pine woodlands, Bull-oak woodlands, Brigalow woodlands, and Belah woodland. It roosts under loose bark or in the crevices and hollows of trees. Overall it is considered a relatively rare species (TSSC 2015).	Unlikely	The desktop review did not identify any record of the species within the survey area. The survey area appears to be beyond the known northern limit of the species distribution and the closest record is approximately 185 km to the south in Expedition National Park.
<i>Petauroides volans volans</i>	Southern Greater Glider	✓	✓	V	V	The Southern Greater Glider favours forests with a diversity of eucalypt species and taller mature trees with abundant hollows. Populations of this species have shown to be particularly sensitive to forest clearance (TSSC 2016c).	Potential	<p>The desktop review identified records of the species in Blackdown Tableland National Park. However, no records exist from historic surveys within the survey area.</p> <p>Although the survey area does support potential foraging habitat, there are few large mature trees in the creeklines and the very low density of large hollows present reduces the value of the habitat for Greater Glider. Limited suitable denning habitat in tree hollows was recorded along Rockland Creek and Shotover Creek.</p> <p>The species is easy to detect and extensive surveys along watercourses where the species had a higher potential of occurring, did not locate the species. Connectivity along these watercourses is limited, with movement to the west limited by the existing Blackwater Mine, and to the east vegetation is sparse in places along these watercourses.</p> <p>Therefore the occurrence of this species is likely constrained by the lack of hollow bearing trees. Significant nocturnal survey effort has been undertaken in the south (Section 3.4.6) and if present the species is not difficult to detect therefore the species is considered a low potential to occur.</p>

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
<i>Phascolarctos cinereus</i>	Koala	✓	✓	V	V	The Koala inhabits a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by <i>Eucalyptus</i> species. It feeds almost exclusively on the foliage of eucalypts and related species including <i>Corymbia</i> , <i>Lophostemon</i> and <i>Melaleuca</i> (DAWE 2020l).	Known	Direct and indirect observations of the species were made during the spring and autumn surveys. Suitable habitat supporting eucalypt woodlands have been confirmed and mapped.
<i>Poephila cincta cincta</i>	Southern Black-throated Finch	✓	×	E	E	The Southern Black-throated Finch prefers grassy woodland dominated by eucalypts (savannah communities) but will also use paperbark or acacia dominated communities with a range of grass species. Vegetative riparian zones are also utilised within highly fragmented and modified environments (DAWE 2020y).	Unlikely	Habitat within the survey is not considered suitable for this species. Majority of the area is highly disturbed and degraded with vast areas of exotic pasture grass completely dominating the ground-layer. A sufficient supply of preferred native grass species therefore does not exist within the survey area. The survey area is outside the known range for this subspecies.
<i>Rheodytes leukops</i>	Fitzroy River Turtle	✓	×	V	V	The Fitzroy River turtle inhabits permanent freshwater riverine reaches and large, isolated permanent waterholes. It is only found in the Fitzroy River and its tributaries (DAWE 2020z).	Unlikely	The desktop review did not identify any records of this species within the survey area. No waterways within the survey area are likely to provide suitable habitat to support the species.
<i>Rostratula australis</i>	Australian Painted Snipe	✓	×	E	V	The Australian Painted Snipe is a crepuscular and nocturnal shorebird species. The species inhabits shallow terrestrial freshwater wetlands, including temporary and permanent lakes, swamps and claypans. It is most common in eastern Australia in shallow wetlands, including both ephemeral and permanent wetlands with ample low vegetative cover (DAWE 2020m).	Likely	This species was recorded by EMM ecologists in the northern lease areas. It was recorded during both dry and wet conditions (in spring and autumn surveys). Two records were of birds utilising constructed dams with shallow marshy edges, with the remaining record from flooded gilgai during wet conditions. The survey area contains similar potential habitat therefore the species is likely to occur.
<i>Strophurus taenicauda</i>	Golden-tailed Gecko	×	×	-	NT	Golden-tailed Gecko are arboreal and inhabit open woodland and open forest areas where they shelter under loose bark and hollow limbs. It is a nocturnal species but can be identified during diurnal surveys by searching under decorticating bark. The species feeds on small insects (DES 2020n).	Known	Three individuals were recorded during autumn 2020 spotlighting surveys within Lancewood (<i>Acacia shirleyi</i>) woodland.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
<i>Turnix melanogaster</i>	Black-breasted Button-quail	✓	×	VU	V	The Black-breasted Button-quail is generally restricted to coastal and near-coastal regions of south-eastern Qld and north-eastern NSW (DEE 2018ac). The species is most commonly associated with vine thicket rainforest with annual rainfall above 800mm, deep leaf litter and closed canopy. They can also occur in softwood scrubs in Brigalow Belt and drier low closed forests and may also be found in low dense acacia thickets. In the Fitzroy catchment, this species has been reported in dry forest comprising of Brigalow, Belah and Bottletree (DAWEaa).	Unlikely	The desktop review did not identify any records of this species within the survey area. The survey area does not support extensive areas of suitable rainforest or vine thicket communities to support this species.

D.2 Threatened flora with potential to occur

Scientific name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
<i>Acacia storyi</i>	×	✓	-	NT	Known only to grow on sandstone substrates within Blackdown Tableland NP (DES 2020a).	Unlikely	The species is restricted to Blackdown Tableland and unlikely to occur within the survey area.
<i>Aristida annua</i>	✓	✓	V	-	This species is restricted to a relatively small area in central Queensland. It is primarily recorded from <i>Eucalyptus orgadophila</i> woodlands on basalt derived black soils. However, other records exist from disturbed environs with exotic grass species such as roadsides (DAWE 2020a).	Potential	Although no records occur within the survey area, regional records do exist. No preferred habitat occurs within the survey area; however, due to records of the species from disturbed sites along with low detection rates, this species is considered potential to occur.
<i>Arthraxon hispidus</i>	✓	×	V	V	A perennial grass recorded from scattered locations in Queensland and northern New South Wales. Found on the edges of rainforest or wet eucalypt forest near creeks and swamps (TSSC, 2008).	Unlikely	No preferred habitat within the survey area, there are records from Blackdown Tableland within the study area.
<i>Baeckea trapeza</i>	×	×	-	V	Known only to grow on sandstone substrates within Blackdown Tableland NP (DES 2020b).	Unlikely	The species is restricted to Blackdown Tableland and unlikely to occur within the survey area.
<i>Bertya opposens</i>	✓	×	V	-	The species occurs in the region primarily on lateritic 'jump-ups' (Land zone 7) in association with Lancewood (<i>Acacia shirleyi</i>) communities (DAWE 2020b).	Known	One patch of <i>Bertya opposens</i> was recorded in the survey area. Fourteen individuals were identified on remnant <i>Acacia</i> woodland within the shrub layer. It occurred in association with <i>Erythroxylum australe</i> , <i>Croton phebalioides</i> and <i>Geijera parviflora</i> . <i>Bertya opposens</i> was also found just outside the survey area in separate surveys by EMM during 2018, in high densities along the periphery of disturbed areas in association with Lancewood dominated communities of RE11.7.2, particularly along vehicle tracks and other forms of ground disturbance. Most populations found consisted of varying age groups ranging from seedlings through to mature plants and in healthy condition.
<i>Bertya pedicellata</i>	×	×	-	NT	The species occurs on 'jump ups' laterite land zone 7 in association with Lancewood. It has been recorded growing on rocky hillsides in eucalypt forest or woodland, <i>Acacia</i> woodland or shrubland and open heathland or vine thicket communities (DES 2020c).	Potential	No records exist within the survey area. Land zone 7 occurs within the survey area, with limited areas of lateritic jump ups, therefore the species has potential to occur.

Scientific name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
<i>Cadellia pentastylis</i>	✓	✓	V	-	Occurs grows in semi-evergreen vine thickets and sclerophyll vegetation on undulating terrain of various geology, including sandstone, conglomerate and claystone. Soils generally have low to medium nutrient content and are normally associated with upper and mid-slopes in the landscape. The altitude is generally 300-460 m above sea level, with some stands known to occur at 600 m asl. The species forms a closed or open canopy, as a dominant or commonly with White Box (<i>Eucalyptus albens</i>) and White Cypress Pine (<i>Callitris glaucophylla</i>) (DAWE 2020c).	Unlikely	This species has multiple confirmed records north of the survey area and suitable habitat exists within the survey area. However, the population to the north is relatively restricted and is disjunct from any vegetation within the survey area. Additionally, this species is distinctive and usually easy to detect and due to no records, is considered unlikely to occur within the survey area.
<i>Cerbera dumicola</i>	×	✓	-	NT	Occurs in the region primarily on lateritic 'jump-ups' (Land zone 7) in association with Lancewood (<i>Acacia shirleyi</i>) or vine thicket communities (DES 2020d).	Potential	No records exist within the survey area. Land zone 7 occurs within the survey area, with limited areas of lateritic jump ups, therefore the species has potential to occur.
<i>Daviesia discolor</i>	✓	×	V	V	On the Blackdown Tableland, <i>Daviesia discolor</i> occurs on sandy soil derived from sandstone and on lateritic clay, at altitudes of 600 to 900 m, in open eucalypt forest dominated by species such as Blackdown Stringybark (<i>Eucalyptus sphaerocarpa</i>) and Black Stringybark (<i>E. nigra</i>) (DoE 2008a).	Unlikely	Suitable habitat does not exist in the survey area as the elevation is too low therefore the species is unlikely to occur.
<i>Dichanthium queenslandicum</i>	✓	✓	E	-	Primarily grows on black cracking soil in natural native grassland (DoE 2013).	Potential	A record of this species exists just beyond the south-western boundary of the northern lease and it has also been recorded from other areas in the region. However, due to a lack of suitable native grasslands and extensive area of Buffel Grass along with cattle grazing, the species is only considered potential to occur. This is a conservative approach due to the difficulties in detecting this species.
<i>Dichanthium setosum</i>	✓	×	V	-	The species grows in woodlands associated with rich, high nutrient soils. It is difficult to identify in the field and extremely similar to <i>D. sericeum</i> and <i>D. fecundum</i> (DAWE 2020d).	Potential	Suitable habitat for this species does not occur on the survey area. However, due to the difficulties in the detection and identification of this species, it is considered potential to occur.
<i>Eucalyptus raveretiana</i>	×	×	V	-	Black Ironbox usually grows along watercourses, and sometimes on river flats or open woodland. It occurs in coastal and subcoastal areas of Queensland	Unlikely	The species is restricted to coastal and subcoastal areas of Queensland and the survey area is outside the range of the species.

Scientific name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
<i>Homoranthus decumbens</i>	✓	×	E	-	<i>Homoranthus decumbens</i> is restricted to Barakula State Forest near Chinchilla with a population of approximately 50 plants, and Blackdown Tableland national Park. The species is found in tall shrubland or heath up to 800 m in altitude. It occurs on the edges of sandstone cliffs or in shallow sandy soil containing lateritic pebbles, and is often associated with species such as <i>Goodenia racemosa</i> , <i>Petrophile</i> spp. (cone bush), <i>Xanthorrhoea</i> spp. (grasstree) and <i>Banksia oblongifolia</i> (DAWE 2020f).	Unlikely	The species is restricted to Blackdown Tableland National Park and unlikely to occur within the survey area.
<i>Macrozamia platyrhachis</i>	✓	×	E	-	The species is known only from higher altitudes on the Blackdown Tableland National Park and occurs in eucalypt woodland or open forest on sandy soil (Queensland Herbarium 2007).	Unlikely	The species is restricted to Blackdown Tableland National Park and unlikely to occur within the survey area.
<i>Marsdenia brevifolia</i>	✓	×	V	V	An endemic species to Queensland, records exist from multiple disjunct populations. These occur from the Townsville region, Rockhampton region and a small area south of Emerald. Habitat preferences of this species are different for each population however they are generally found in eucalypt woodlands with grassy understoreys (DAWE 2020g).	Unlikely	No records exist within the survey area. While eucalypt woodlands are present in the survey area, they are infested with weeds and therefore does not appear to support suitable habitat for this species.
<i>Ochrosperma obovatum</i>	×	×	-	V	Known only from Brovinia south-eastern Queensland and Planet Downs near Rolleston. It is found within heathland habitats associated with sandstones (DES 2020j).	Unlikely	No records exist within survey area and survey area does not support suitable habitat for this species.
<i>Polianthion minutiflorum</i>	✓	✓	V	-	The species is primarily restricted to coastal <i>Melaleuca</i> swamps with an outlier record from an artesian spring near Blackdown Tableland (DoE 2008b).	Unlikely	Suitable habitat not available within survey area.
<i>Sannantha brachypoda</i>	×	✓	-	NT	There are records from near Springsure and Humboldt State Forest. Favours woodland habitat on sandstone ridges.	Potential	The species has a distinctive habit, and is easily identifiable. Preferred habitats of sandstone do not occur.

Scientific name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
<i>Solanum adenophorum</i>	x	x	-	E	This species is known only from the Dingo-Nebo-Clermont area. It grows primarily on gentle sloping landscapes within Brigalow communities with other records from gidgee scrub on deep cracking clays (DES 2020l).	Unlikely	Although suitable habitat exists the survey area is outside the known geographical range for this species.
<i>Solanum dissectum</i>	✓	✓	E	E	A range restricted species known only from the Biloela-Banana-Baralaba area. It occurs on heavy cracking soils in association with Brigalow and <i>Eucalyptus thozetiana</i> communities (TSSC 2016a).	Potential	The species has been recorded by EMM just north of the survey area. Suitable Brigalow dominated communities occur within the survey area therefore the species has potential to occur.
<i>Solanum elachophyllum</i>	x	✓	-	E	A range restricted species known only from the Leichardt district. It has been recorded growing on cracking clay soils associated with Brigalow, Belah, <i>Macropteranthes</i> or Dawson Gum (DES 2020m).	Known	A substantial population from multiple locations was recorded within the survey area.

D.3 Migratory species with potential to occur

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
Migratory terrestrial birds								
<i>Cuculus optatus</i>	Oriental Cuckoo	✓	×	Mi	SLC (Mi)	This species is a summer visitor to Australia. It inhabits a wide range of habitats, including dense to open woodlands and forests, vine thickets monsoonal rainforest and wet sclerophyll forest. It particularly prefers the edges of riparian forests (Menkhorst et al. 2017).	Unlikely	The desktop review did not identify records of this species within the Survey area. The Survey area contains woodlands as potential habitat and the species is widespread albeit never common in eastern Queensland. As such, this species is considered to have low potential to occur.
<i>Hirundapus caudacutus</i>	White-throated Needletail	✓	✓	V, Mi	V, SLC (Mi)	This species is almost exclusively aerial in Australia. The species is usually seen in foraging flocks over many habitat types including open forest and rainforest, cleared areas and heathland. They also prefer areas with updrafts (eg hills and coastal cliffs) (Menkhorst et al. 2017, DAWE 2021).	Known	The species was recorded during the spring 2019 surveys.
<i>Monarcha melanopsis</i>	Black-faced Monarch	✓	×	Mi	SLC (Mi)	This species is widespread in eastern Australia. It mainly inhabits rainforest systems, including vine thickets, warm temperate rainforests and dry rainforest. The species can also be found in gullies in open eucalypt forests and coastal foothills (DAWE 2021).	Unlikely	The Survey area does not contain potential habitat in vine thicket and gullies. As such, this species is considered to be unlikely to occur.
<i>Symposiachrus trivirgatus</i>	Spectacled Monarch	✓	×	Mi	SLC (Mi)	This species occurs in rainforest, dense waterside vegetation and mangrove ecosystems (Menkhorst et al. 2017).	Potential	The Survey area does not contain potential habitat in vine thicket and gullies. The species occasionally occurs in riparian woodland on migration and as such as limited potential to occur on an occasional basis.
<i>Motacilla flava</i>	Yellow Wagtail	✓	×	Mi	SLC (Mi)	This species inhabits wet meadows, marshlands and grassy and muddy lakeshores (eBird 2020).	Unlikely	The species is a vagrant to the region. Therefore, it is considered unlikely to occur.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	✓	×	Mi	SLC (Mi)	This species is widespread in eastern Australia. It occurs in heavily vegetated gullies in eucalypt dominated forests and woodlands. Specifically, they occur near watercourses or wetlands and occur mostly in the canopy (DAWE 2021, Menkhorst et al. 2017).	Unlikely	The desktop review did not identify records of this species within the Survey area. The Survey area does not contain potential suitable habitat in eucalypt woodlands and it is a scarce passage migrant in eastern Queensland. As such, this species is considered to be unlikely to occur.
<i>Rhipidura rufifrons</i>	Rufous Fantail	✓	✓	Mi	SLC (Mi)	This species prefers moist habitats such as wet sclerophyll forests, vine thickets and mangroves. It usually occurs in eucalypt dominated gullies with a dense shrubby understorey. It can also occur in drier woodlands along watercourses (DAWE 2021, Menkhorst et al. 2017).	Potential	The Survey area does not contain potential habitat in vine thicket and gullies. The species occasionally occurs in riparian woodland on migration and as such as limited potential to occur on an occasional basis.
Migratory wetland birds								
<i>Actitis hypoleucos</i>	Common Sandpiper	✓	×	Mi	SLC (Mi)	This species prefers coastal wetlands and are found around muddy margins or rocky shores. It occurs in some inland wetlands (DAWE 2021).	Unlikely	Suitable coastal or inland waters habitat for this species does not occur within the Survey area. Therefore, it is considered unlikely to occur.
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	✓	×	Mi	SLC (Mi)	This species spends its non-breeding season in Australia along muddy edges of shallow fresh or brackish wetlands. Wetlands they occupy include lagoons, swamps, lakes and dams (DAWE 2021).	Unlikely	Suitable wetland habitat for this species does not occur within the Survey area. Therefore, it is considered unlikely to occur.
<i>Calidris ferruginea</i>	Curlew Sandpiper	✓	×	CE, Mi	CE	This migratory shorebird species spends its non-breeding season in coastal parts of Australia. The species has been recorded in various inland regions as it migrates to southern parts of the Australian coastline (Pizzey et al. 2012). Near the coast it inhabits intertidal mudflats in sheltered areas and inland they utilise ephemeral and permanent lakes, lagoons, ponds, dams with bare edges of mud. The species does not breed in Australia (DAWE 2021).	Unlikely	Suitable coastal or inland waters habitat for this species does not occur within the Survey area. Therefore, it is considered unlikely to occur.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status ¹	NC Act status ²	Habitat and ecology	Refined likelihood of occurrence	Rationale
<i>Calidris melanotos</i>	Pectoral Sandpiper	✓	×	Mi	SLC (Mi)	This species mainly occurs in coastal habitats at lagoons, estuaries, swamps and lakes. It can occasionally be found inland. It prefers open fringing mudflats on wetlands (DAWE 2021).	Unlikely	Suitable coastal or inland waters habitat for this species does not occur within the Survey area. Therefore, it is considered unlikely to occur.
<i>Gallinago hardwickii</i>	Latham's Snipe	✓	×	Mi	SLC (Mi)	This species is a non-breeding visitor to eastern Australia. It mainly occurs in permanent and ephemeral freshwater wetlands with low, dense vegetation but can also occur in saline or brackish wetlands that are artificial or modified (DAWE 2021).	Known	The desktop review did not identify records of this species within the survey area. This species favours permanent and ephemeral freshwater wetlands with low, dense vegetation. This species was recorded in the field surveys.
<i>Pandion haliaetus</i>	Eastern Osprey	✓	×	Mi	SLC (Mi)	This species mainly occurs in coastal areas but occasionally occur inland along major river systems. They inhabit wetland habitats such as bays, beaches, mangrove swamps and large lakes. They require brackish or saline water for foraging (DAWE 2021).	Unlikely	Suitable wetland habitat for this species does not occur within the survey area. Therefore, it is considered unlikely to occur.
Migratory marine birds								
<i>Apus pacificus</i>	Fork-tailed Swift	✓	✓	Mi	SLC (Mi)	This species is almost exclusively aerial and occurs mainly over inland plains. Habitats include riparian woodland, heathland and low scrub areas. They also occur in coastal areas over cliffs and beaches (DAWE 2021).	Likely	Although this species was not recorded during field surveys, it has been recorded adjacent to the Survey area. This species is likely to occur in airspace over the site sporadically during summer months.

D.4 TECs with potential to occur

TECs	EPBC Act status	Associated ground-truthed regional ecosystems	Refined likelihood of occurrence	Rationale
Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	Endangered	11.3.1, 11.3.3, 11.4.3a, 11.4.7, 11.4.8, 11.4.8a, 11.4.9, 11.5.16, 11.9.1, 11.9.5	Known	Brigalow TEC was the most dominant TEC, with 104.8 ha mapped within the survey area (Photograph 5.19). Patches mainly consisted of open forest on fine-grained sedimentary rocks with Belah (<i>Casuarina cristata</i>) and/or Poplar Box (<i>Eucalyptus populnea</i>).
Coolibah – Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	11.3.3	Does not occur	This community does not occur in the survey area.
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	11.8.11	Does not occur	One patch of natural grassland was recorded totalling to 2.78 ha. It did not meet the criteria for the TEC.
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	11.5.15, 11.8.13	Known	Two patches of SEVT TEC were recorded, totalling to 8.06 ha.
Weeping Myall woodlands	Endangered	11.3.2	Does not occur	This community does not occur in the survey area.
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	11.3.2	Does not occur	Several areas of ground-truthed RE11.3.2 were recorded in the survey area. All areas failed to meet Poplar Box TEC thresholds through excessive weed cover.

Appendix E

Anabat results



Microbat Call Interpretation Report

Prepared for (“Client”):	EMM Consulting
Survey location/project name:	Blackwater (South)
Survey dates:	29 October – 2 November 2019
Client project reference:	
Job no.:	EMM-1902B
Report date:	16 December 2019

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Methods

Data received

Balance! Environmental received 12 ZCA data files and associated LOG files, recorded using three Anabat Express detectors (Titley Scientific, Brisbane) between 29th October and 2nd November 2019.

Post-processing

Zero-crossing analysis format bat-call sequence files (ZC files) were extracted from the raw ZCA files using *Anabat Insight* (Titley Scientific, Brisbane). Noise-only files were filtered, by default, from the data set during the extraction process.

Call identification

Call analysis and identification was performed with *Anabat Insight*, with all ZC files scanned, classified according to (mainly frequency-based) zero-crossing parameters, and assigned a tentative species-label using the Decision Tree analysis process. Classified calls were then reviewed manually in spectrogram view and species identities confirmed or adjusted following comparison of the spectrograms and derived call metrics with those from reference calls recorded in northern and central Queensland and/or with published call descriptions (e.g. Reinhold et al. 2001). 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>).

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).

Technical terms used in the report are explained in the Glossary.

Results & Discussion

Data conversion and noise filtering yielded an analysis dataset of 5368 ZC files, which contained a total of 5481 identifiable bat-calls.

At least 12 and possibly 14 bat species were recorded during the September-October 2019 surveys at Blackwater (see **Table 1**). Eleven call types were reliably identified to individual species and one call type was attributed to the *Nyctophilus* genus, within which species' calls cannot be reliably differentiated. Two *Nyctophilus* species probably occur in the study area: *N. geoffroyi* and *N. gouldi*.

Appendix 1 provides a breakdown of the numbers of calls attributed to each species or unresolved pair per detector-night.

Positive identification was achieved for 2993 (54.6%) of the recognised calls. The remainder had mixed or intermediate call characteristics and potentially belonged to two or more species. These 'unresolved' calls were assigned to one of several multi-species groups (see **Appendix 1**). One unresolved species group included a species that was not otherwise identified in the dataset (*Vespadelus baverstocki*), but all other groups contained species that were also positively identified from more typical calls. Where 'unresolved' calls were identified for a given detector-night, all members of the relevant group are listed as "possible" in **Table 1**, unless more diagnostic calls from one or more members were reliably identified.

Chalinolobus gouldii contributed almost one-third (31.1%) of the identified calls and was probably responsible for another 30% but those additional calls were not reliably identified and may also have represented another two species (*Ozimops ridei* and *Scotorepens balstoni*). Two other species (*Chaerephon jobensis* and *Saccolaimus flaviventris*) together contributed another 17.9% of the total call-count; and a further 14.2% were from *Chalinolobus picatus* and/or *Scotorepens greyii*.

Sample spectrograms of call types recorded during the survey are displayed in **Appendix 2**.

References

- Churchill, S. (2008). *Australian Bats*. Jacana Books, Allen & Unwin; Sydney.
- Jackson, S. and Groves, C. (2015). *Taxonomy of Australian Mammals*. CSIRO Publishing, Melbourne.
- Reardon, T. (2003). Standards in bat detector based surveys. *Australasian Bat Society Newsletter* **20**, 41-43.
- Reinhold, L., Law, B., Ford, G. and Pennay, M. (2001). *Key to the bat calls of south-east Queensland and north-east New South Wales*. Department of Natural Resources and Mines, Brisbane.
- van Dyck, S., Gynther, I. and Baker, A. (ed.) (2013). *Field Companion to the Mammals of Australia*. New Holland; Sydney.

Table 1 Microbat species detected at Blackwater South, 29 October – 2 November 2019.

◆ = 'definite' - at least one call was attributed unequivocally to the species

□ = 'possible' - calls similar to those of the species were recorded, but were not reliably identified

Detector name-Serial No.:	DPM SN395665				EcoSmart SN304010					GLE SN324708			
	Date:	29-Oct	30-Oct	1-Nov	2-Nov	29-Oct	30-Oct	31-Oct	1-Nov	2-Nov	29-Oct	30-Oct	31-Oct
<i>Chalinolobus gouldii</i>	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
<i>Chalinolobus morio</i>			□		◆	◆	◆	□	□				◆
<i>Chalinolobus picatus</i>	□		◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
<i>Nyctophilus sp.</i>						◆	◆				◆		◆
<i>Scotorepens balstoni</i>	□		◆	◆		□	◆	◆	◆	◆	◆	◆	◆
<i>Scotorepens greyii</i>	□		◆	◆	◆	◆	◆	□	◆	◆	◆	◆	◆
<i>Vespadelus baverstocki</i>				□	□					□	□		□
<i>Vespadelus troughtoni</i>			◆		□		□	□	□	□			◆
<i>Miniopterus orianae oceanensis</i>			◆	◆					◆	□		◆	◆
<i>Chaerephon jobensis</i>	◆	□	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
<i>Ozimops lumsdenae</i>	◆			◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
<i>Ozimops ridei</i>	□	□	□	◆	◆	◆	◆	◆	◆	◆	◆	□	◆
<i>Saccolaimus flaviventris</i>	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆

Glossary

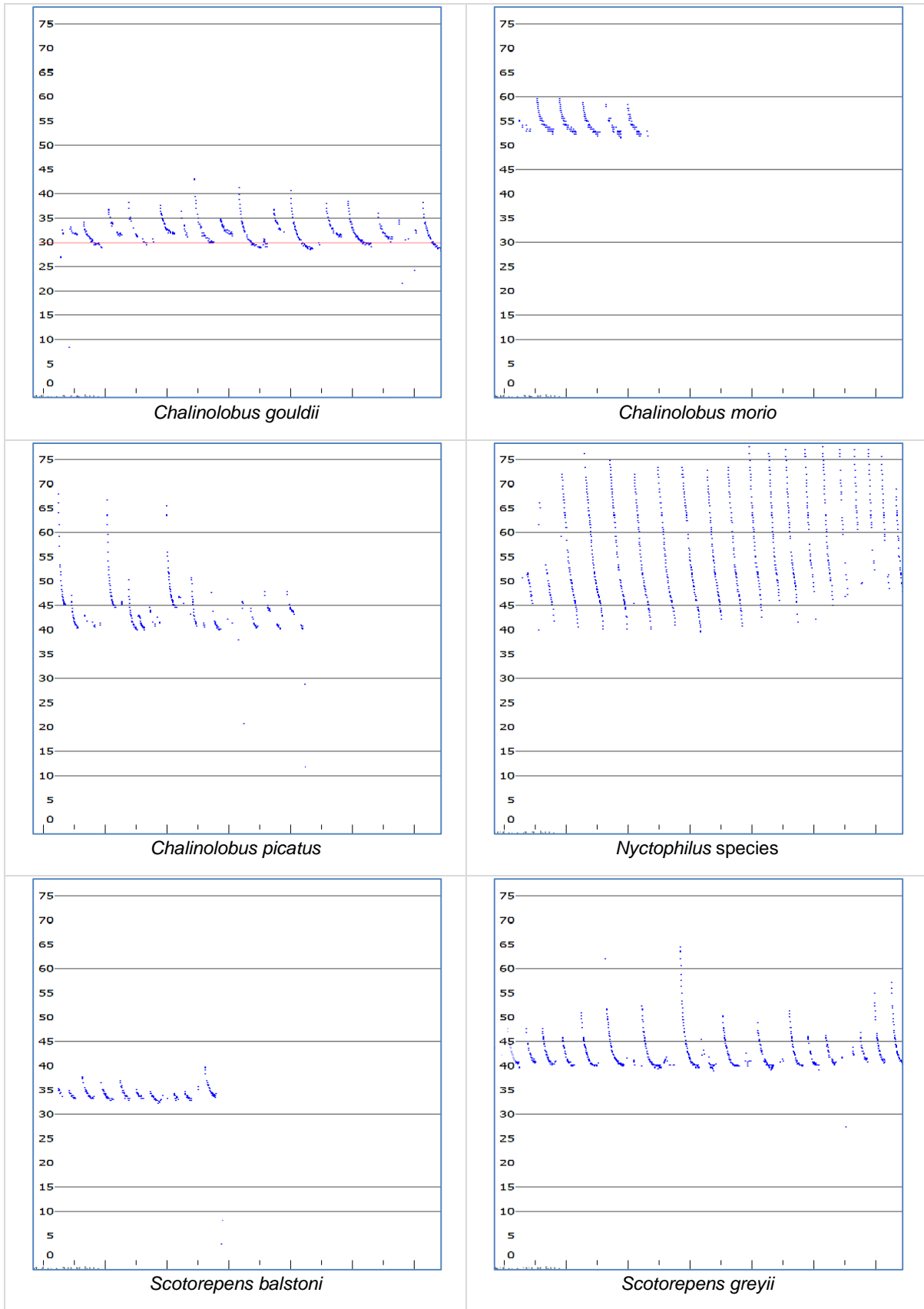
Technical terms used in this report are described in the following table.

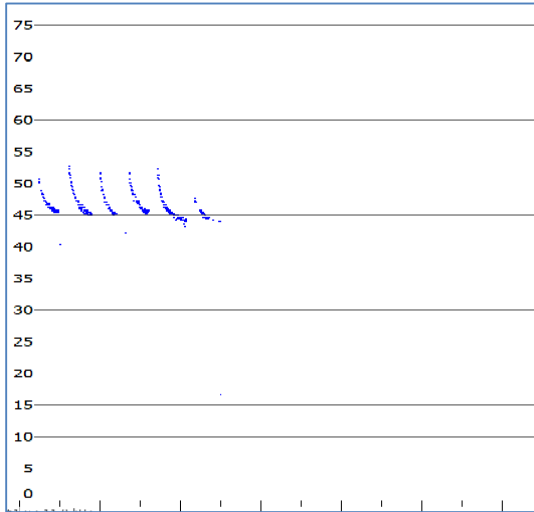
Approach phase	The part of a bat <i>call</i> emitted as the bat starts to home in on a detected prey item; a transitional series of <i>pulses</i> between the <i>search phase</i> and <i>feeding buzz</i> , that become progressively steeper and shorter in duration.
Call	Refers to a single bat call, made up of a series of individual sound <i>pulses</i> in one or more <i>phases</i> (<i>search, approach, feeding buzz</i>).
CF (=Constant Frequency)	A type of <i>pulse</i> in which the dominant component consists of a more-or-less 'pure tone' of sound at a Constant Frequency; with <i>shape</i> appearing flat on the sonogram. Often also contains a brief <i>FM</i> component at the beginning and/or end of the CF component (<i>viz.</i> FM-CF-FM).
Characteristic frequency (Fc)	The frequency of the flattest part of a <i>pulse</i> ; usually the lowest frequency reached in the <i>qCF</i> component of a pulse. This is often the primary diagnostic feature for species identification.
Duration	The time period from the beginning of a <i>pulse</i> to the end of the pulse.
Feeding buzz	The terminal part of a <i>call</i> , following the <i>approach phase</i> , emitted as the bat catches a prey item; a distinctive, rapid series of very steep, very short-duration pulses.
FM (=Frequency Modulated)	A type of <i>pulse</i> in which there is substantial change in frequency from beginning to end; <i>shape</i> ranges from almost vertical and linear through varying degrees of curvature.
FC range	Refers to the range of frequencies occupied by the <i>characteristic frequency</i> section of <i>pulses</i> within a call or set of calls.
Frequency sweep or "band-width"	The range of frequencies through which a <i>pulse</i> sweeps from beginning to end; Maximum frequency (Fmax) – minimum frequency (Fmin).
Knee	The transitional part of a <i>pulse</i> between the initial (usually steeper) frequency sweep and the <i>characteristic frequency</i> section (usually flatter); time to knee (Tk) and frequency of knee (Fk) can be diagnostic for some species.
Pulse	An individual pulse of sound within a bat <i>call</i> ; the <i>shape, duration</i> and <i>characteristic frequency</i> of a pulse are the key diagnostic features used to differentiate species.
Pulse body	The part of the <i>pulse</i> between the <i>knee</i> and <i>tail</i> and containing the <i>characteristic frequency</i> section.
Pulse shape	The general appearance of a <i>pulse</i> on the sonogram, described using relative terms related to features such as slope and degree of curvature. See also <i>CF, qCF</i> and <i>FM</i> .
qCF (=quasi Constant Frequency)	A type of <i>pulse</i> in which there is very little change in frequency from beginning to end; <i>shape</i> appears to be almost flat. Some pulses also contain an <i>FM</i> component at the beginning and/or end of the qCF component (<i>viz.</i> FM-qCF).
Search phase	The part of a bat <i>call</i> generally required for reliable species diagnosis. A consistent series of <i>pulses</i> emitted by a bat that is searching for prey or and/or navigating through its habitat. Search phase pulses generally have longer duration, flatter slope and more consistent shape than <i>approach phase</i> and <i>feeding buzz</i> pulses.
Sequence	Literally, a sequence of <i>pulses</i> that may be from one or more bats; but generally refers to a <i>call</i> or part (e.g. <i>phase</i>) of a call.
Tail	The final component of a <i>pulse</i> , following the <i>characteristic frequency</i> section; may consist of a short or long sweep of frequencies either upward or downward from the Fc; or may be absent.

Appendix1 Call-detection rates for bat species recorded at Blackwater South, 29 October – 2 November 2019.

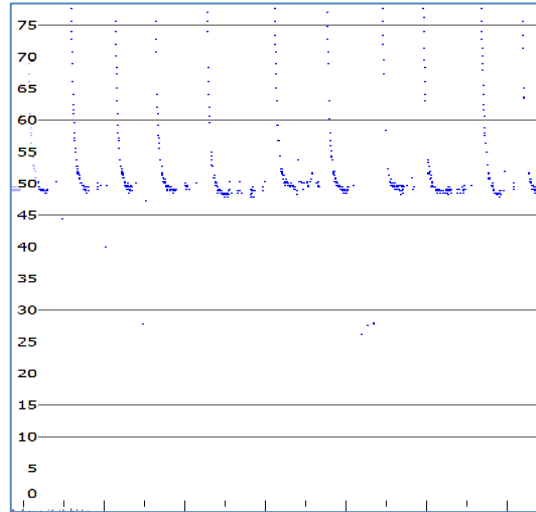
Detector name-Serial No.:	DPM SN395665				EcoSmart SN304010					GLE SN324708			Species Total
	Date:	29-Oct	30-Oct	1-Nov	2-Nov	29-Oct	30-Oct	31-Oct	1-Nov	2-Nov	29-Oct	30-Oct	
Positively identified calls													
<i>Chalinolobus gouldii</i>	8	1	528	743	21	67	95	72	42	28	22	76	1703
<i>Chalinolobus morio</i>					2	6	9					1	18
<i>Chalinolobus picatus</i>			152	24	6	3	2	24	31	9	4	28	283
<i>Nyctophilus sp.</i>						1	1			1		3	6
<i>Scotorepens balstoni</i>			5	4			1	3	7	9	26	2	57
<i>Scotorepens greyii</i>			18	14	5	10	2		8	9	4	17	87
<i>Vespadelus troughtoni</i>			2									37	39
<i>Miniopterus orianae oceanensis</i>			8	9				1			1	1	20
<i>Chaerephon jobensis</i>	23		10	47	45	18	45	22	40	25	8	129	412
<i>Ozimops lumsdenae</i>	2			4	3	3	19	6	5	3	3	65	113
<i>Ozimops ridei</i>				3	1	4	3	24	3	4		8	50
<i>Saccolaimus flaviventris</i>	14	3	7	24	4	86	3	1	46	7	3	7	205
Unresolved calls													
<i>C. gouldii</i> / <i>O. ridei</i>	41	3	118	354	24	125	33	224	83	39	46	22	1112
<i>C. gouldii</i> / <i>S. balstoni</i>	1		217	244		2	11	9	32	4	2	2	524
<i>C. morio</i> / <i>V. troughtoni</i>			6		1		1	1	2			2	13
<i>C. picatus</i> / <i>S. greyii</i>	10		112	90	7	8	7	4	13	10	36	112	409
<i>C. picatus</i> / <i>V. baverstocki</i>				56	1					1		3	61
<i>V. baverstocki</i> / <i>M. o. oceanensis</i>				6					1				7
<i>S. flaviventris</i> / <i>C. jobensis</i>	56	4	7	9	7	12	43	31	60	16	5	112	362
Detector-night Total	155	11	1190	1631	127	345	275	422	373	165	160	627	5481

Appendix 2 Representative call sequences from the Blackwater South surveys, spring 2019.
 (Scale: 10 msec per tick; time between pulses removed)

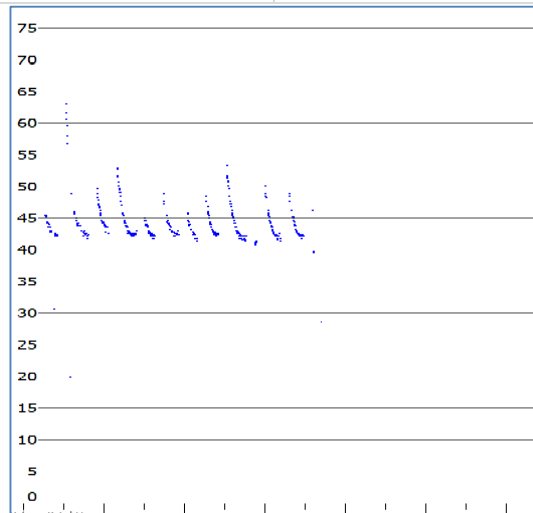




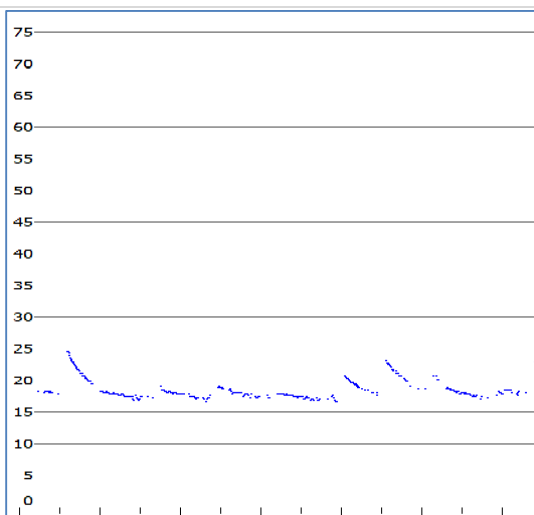
Miniopterus orianae oceanensis



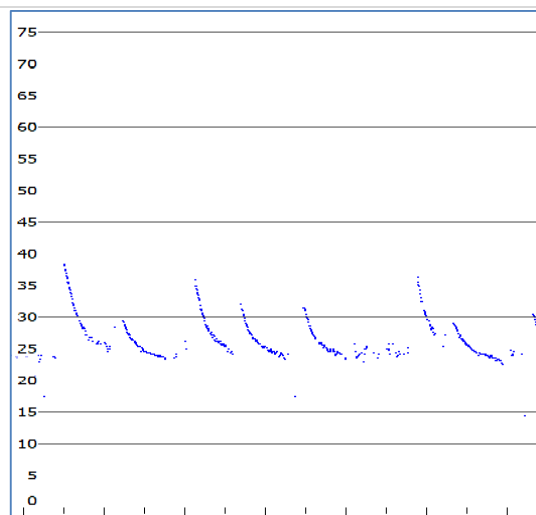
Vespadelus trougtoni



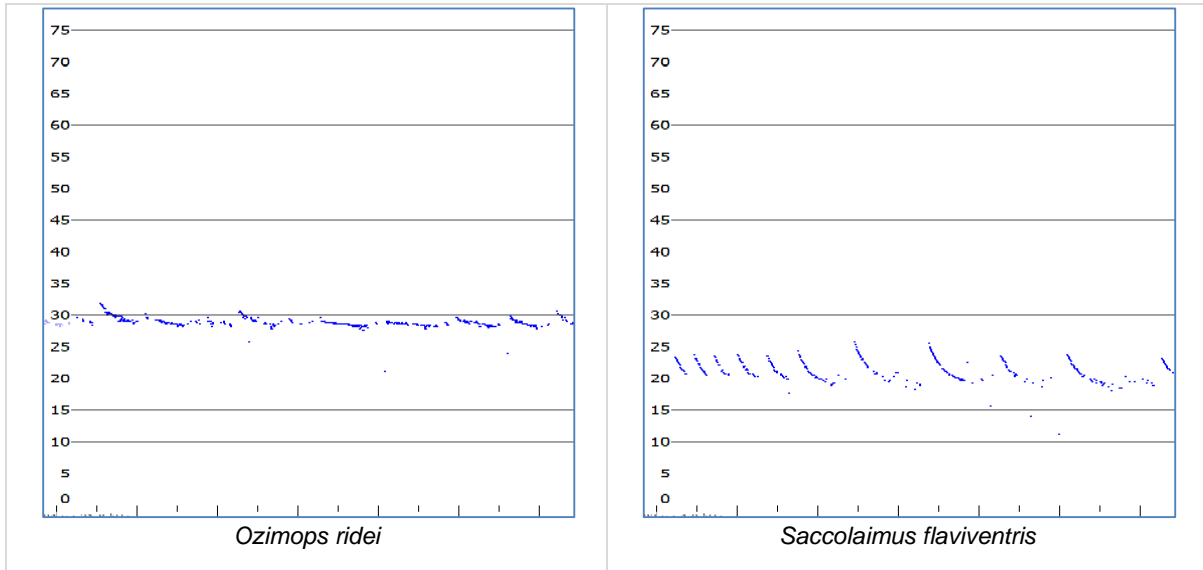
Vespadelus baverstocki or *C. picatus*



Chaerephon jobensis



Ozimops lumsdenae





Microbat Call Identification Report

Prepared for (“Client”):	EMM Consulting
Survey location/project name:	Humboldt area (south of Blackwater)
Survey dates:	21-25 April 2020
Client project reference:	
Job no.:	EMM-2004
Report date:	10 June 2020

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Methods

Data received

Balance! Environmental received 9 raw ZCA files, recorded on two Anabat Express detectors (“GLE 1” & “GLE 2”) over four nights (21st – 24th April 2020). Detector log data indicate that seven separate sites were sampled (see **Figure 1**), with six sites sampled for one night each and one site sampled for two consecutive nights (22nd & 23rd April). Site numbers were assigned chronologically to each detector, viz. GLE1-1 (21/4), GLE1-2 (22/4 & 23/4), GLE1-3 (24/4), GLE2-1 (21/4), GLE2-2 (22/4), GLE2-3 (23/4) and GLE2-4 (24/4).

Detector “GLE 2” had clock setting at GMT+0:00 hrs, hence the default per-night data-saving process generated five ZCA files instead of four for that unit. The other units (“GLE 1”) was running correctly on GMT+10:00 hrs, so the default data-save process generated four ZCA files, correctly aligned to each recording night.

Call analysis and identification

The data were processed in four steps using *Anabat Insight* (Version 1.9.3; Titley Scientific, Brisbane):

1. All ZCA files were converted to bat-call sequence files (ZC files) and the date-misaligned file output for “Anabat 2” was sorted to reflect correct recording nights/sites.
2. All ZC files output by the conversion process were automatically scanned with a generic noise filter to separate files containing only non-bat background noise from those with potentially identifiable bat calls.
3. ZC files that passed the noise filter (*i.e.* contained bat calls) were then processed through a Decision Tree analysis to group calls with similar pulse characteristics (e.g. characteristic frequency, slope, duration) and apply tentative species labels.
4. Each “species” group was reviewed manually to verify and/or correct species labels by comparing call spectrograms and derived metrics with those of regionally relevant reference calls and published call descriptions (Reinhold *et al.* 2001; Pennay *et al.* 2004).

Species attribution was also guided by considering probability of occurrence based on published distributional information (Churchill 2008; van Dyck *et al.* 2013) and/or records held in Atlas of Living Australia (<http://www.ala.org.au>).

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).



Figure 1 Bat detector deployment locations during the April 2020 survey at Humboldt. Site codes (GLE X - Y) represent detector X (*i.e.* “GLE1” & “GLE2”) and site number Y assigned (chronologically) for the purpose of this analysis.

Results

The ZCA conversion process yielded 9448 ZC files; however, 7103 of those files were excluded from further analysis by the noise filtration process. A total of 2584 bat calls were identified in the remaining 2345 ZC files.

Table 1 provides an overview of the species detected by each detector for each night of the survey, while **Table 2** gives a full breakdown of the numbers of calls recorded per species per detector-night. Example spectrograms for each identified species (or unresolved species groups) were extracted from the dataset and appear in **Appendix 1**.

At least 13 and up to 14 species were detected during the Humboldt survey (see **Table 1**). More than 90% (2338) of the calls were reliably attributed to 12 unique species or the undifferentiated *Nyctophilus* genus. Two species of *Nyctophilus* (*N. geoffroyi* and *N. gouldii*) probably occur in the study area.

The other 246 calls could not be reliably identified due to similarities in call characteristics shared between some species. These calls were assigned to five multi-species groups (see lower portion of **Table 2**), all of which represented species that were also positively identified from other, more “typical” calls. Where unresolved calls were identified, all group members are shown as “possible” in **Table 1** unless positive identification was achieved from more definitive calls recorded at the same site.

Table 1 Bats recorded during the Humboldt area, 21-25 April 2020.

- ◆ = ‘definite’ - at least one call was attributed unequivocally to the species at the site
- = ‘possible’ - calls like those of the species were recorded, but were not reliably identified

Site:	GLE1-1	GLE1-2	GLE1-3	GLE2-1	GLE2-2	GLE2-3	GLE2-4
<i>Chalinolobus gouldii</i>	◆	◆	◆	◆	◆	◆	◆
<i>Chalinolobus morio</i>	◆		◆		◆	◆	◆
<i>Chalinolobus picatus</i>	◆	◆	◆	◆	◆	◆	◆
<i>Nyctophilus sp.</i>		◆			◆	◆	◆
<i>Scotorepens balstoni</i>				◆			◆
<i>Scotorepens greyii</i>		◆	◆	◆	◆	◆	◆
<i>Vespadelus troughtoni</i>		◆	◆			◆	
<i>Miniopterus orianae oceanensis</i>	◆	◆	◆	◆	◆	◆	◆
<i>Austronomus australis</i>		◆	◆				
<i>Chaerephon jobensis</i>	◆	◆	◆	◆	◆	◆	◆
<i>Ozimops lumsdenae</i>		◆	◆	◆		◆	◆
<i>Ozimops ridei</i>	◆	□	◆	◆	◆	□	◆
<i>Saccolaimus flaviventris</i>	◆	◆	◆	◆	◆	◆	◆

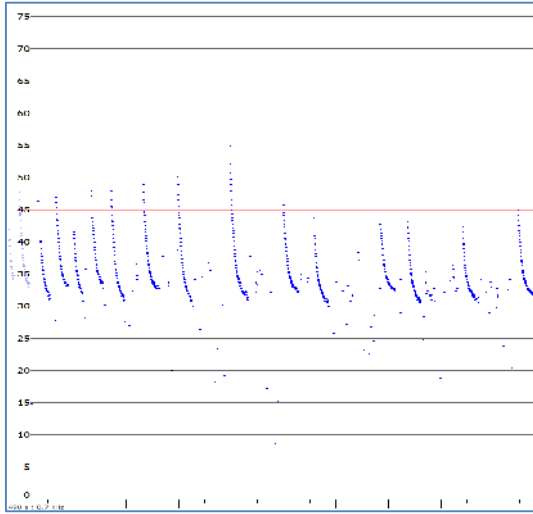
References

- Churchill, S. (2008). *Australian Bats*. Jacana Books, Allen & Unwin; Sydney.
- Jackson, S. and Groves, C. (2015). *Taxonomy of Australian Mammals*. CSIRO Publishing, Melbourne.
- Pennay, M., Law, B. and Reinhold, L. (2004). *Bat Calls of New South Wales*. Department of Environment and Conservation, Hurstville.
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- Reinhold, L., Law, B., Ford, G. and Pennay, M. (2001). *Key to the bat calls of south-east Queensland and north-east New South Wales*. Department of Natural Resources and Mines, Brisbane.
- van Dyck, S., Gynther, I. and Baker, A. (ed.) (2013). *Field Companion to the Mammals of Australia*. New Holland; Sydney.

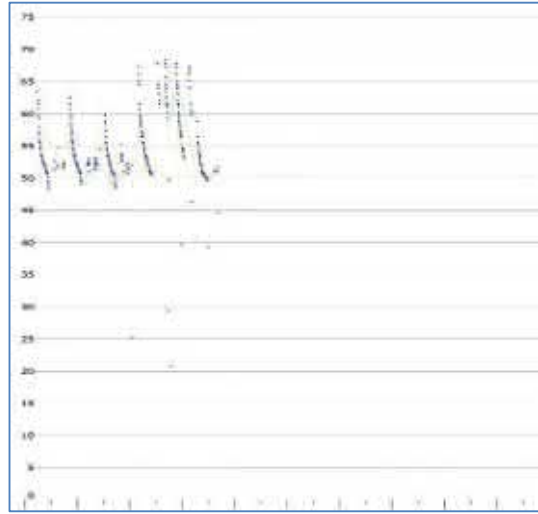
Table 2 Bats recorded during the Humboldt area, 21-25 April 2020.
 Number of calls per detector-night per species or unresolved species group.

Site:	GLE1-1	GLE1-2	GLE1-3	GLE2-1	GLE2-2	GLE2-3	GLE2-4	Species Total
Positively identified calls								
<i>Chalinolobus gouldii</i>	4	55	15	147	3	7	75	306
<i>Chalinolobus morio</i>	1		2		7	2	11	23
<i>Chalinolobus picatus</i>	2	45	6	18	21	17	5	114
<i>Nyctophilus</i> sp.		2			5	1	9	17
<i>Scotorepens balstoni</i>				5			5	10
<i>Scotorepens greyii</i>		2	1	24	2	3	7	39
<i>Vespadelus trouhtoni</i>		1	2			1		4
<i>Miniopterus oriana oceanensis</i>	3	1	3	403	44	13	6	473
<i>Austronomus australis</i>		2	1					3
<i>Chaerephon jobensis</i>	10	113	170	40	4	3	422	762
<i>Ozimops lumsdenae</i>		11	13	16		1	39	80
<i>Ozimops ridei</i>	2		2	4	3		9	20
<i>Saccolaimus flaviventris</i>	8	55	42	350	17	5	10	487
Unresolved calls								
<i>C. gouldii</i> / <i>O. ridei</i>	2	27	2	21	4	2	15	73
<i>C. gouldii</i> / <i>S. balstoni</i>				2			6	8
<i>C. picatus</i> / <i>S. greyii</i>		8		3		1	1	13
<i>S. flaviventris</i> / <i>C. jobensis</i>	8	51	31	16	6	5	35	152
Site Total	40	373	290	1049	116	61	655	2584

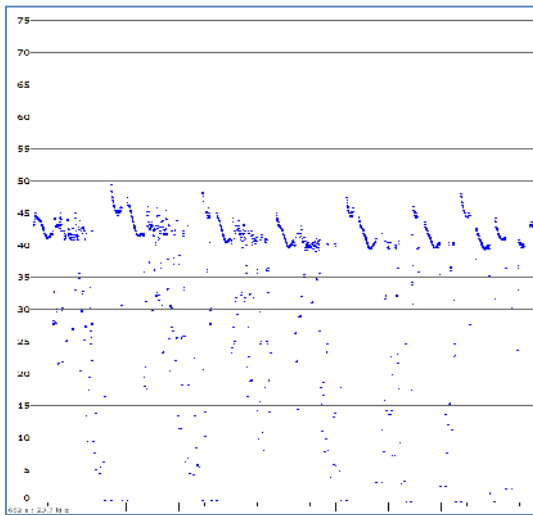
Appendix 1 Representative bat-calls recorded at Humboldt, 21-25 April 2020.
 Time between pulses removed; time-scale (x-axis) 10ms per tick



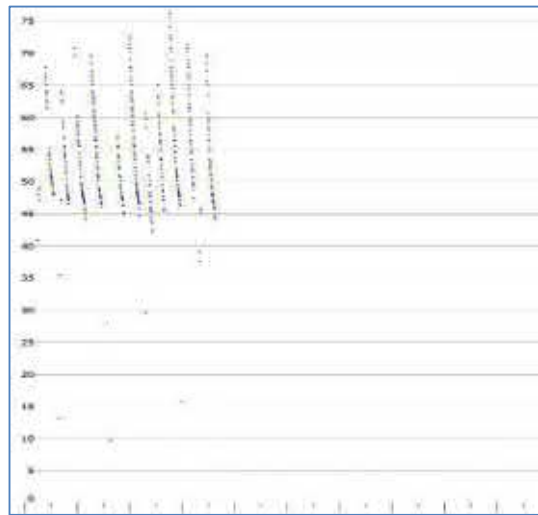
Chalinolobus gouldii



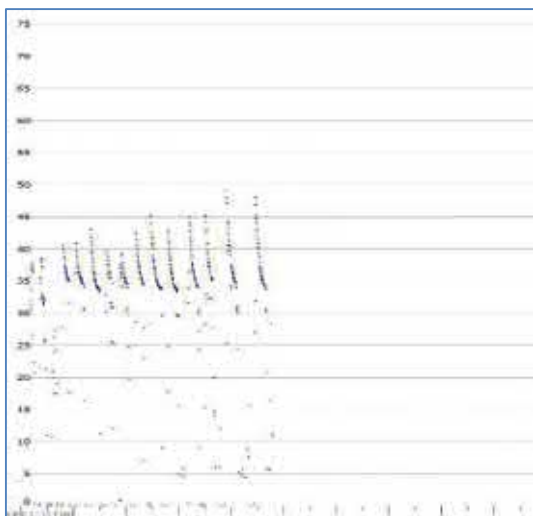
Chalinolobus morio



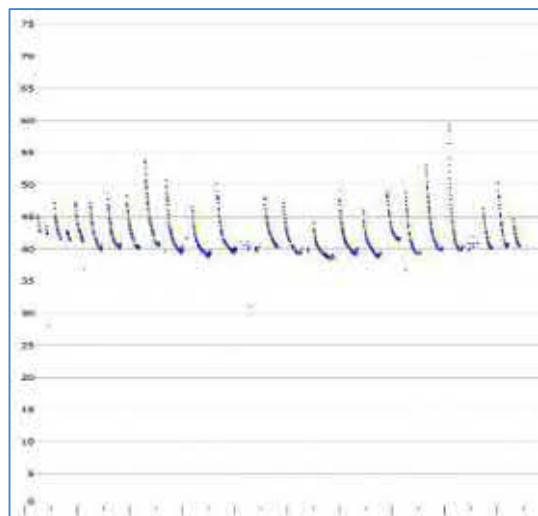
Chalinolobus picatus



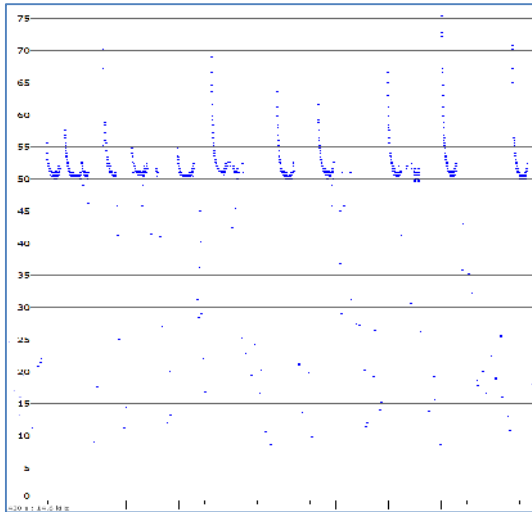
Nyctophilus sp.



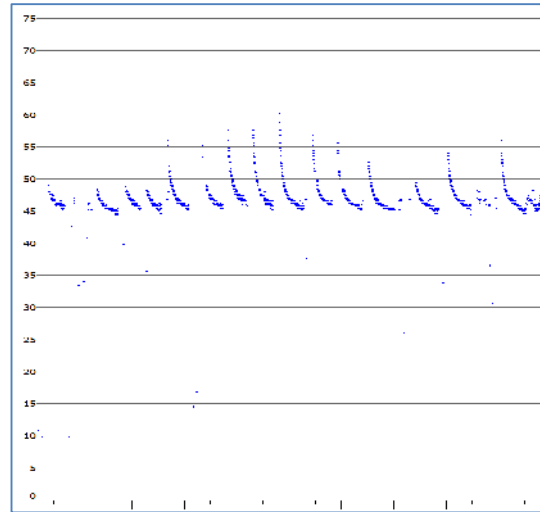
Scotorepens balstoni



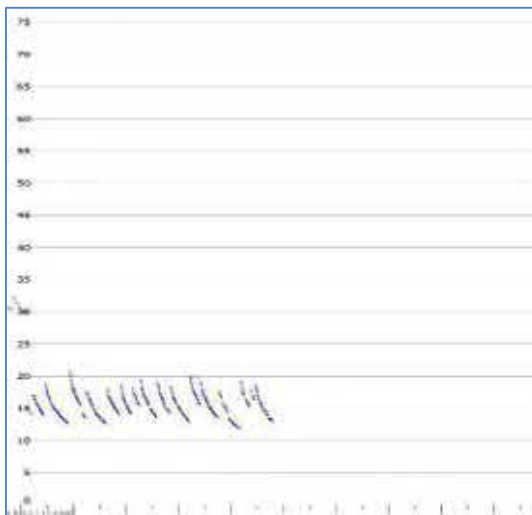
Scotorepens greyii



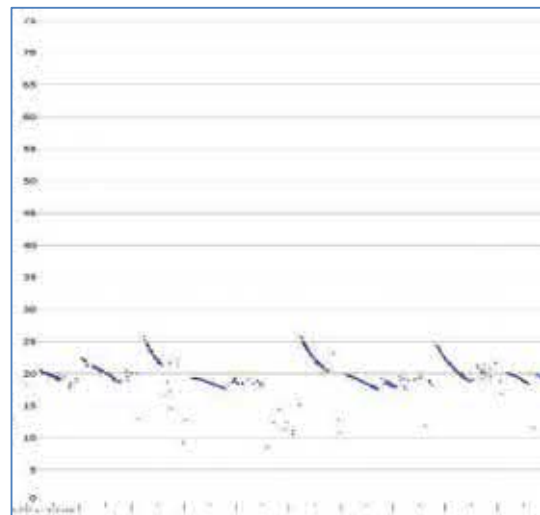
Vespadelus trougtoni



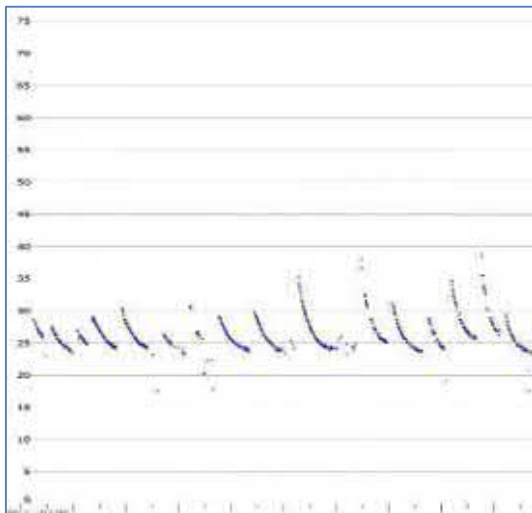
Miniopterus orianae oceanensis



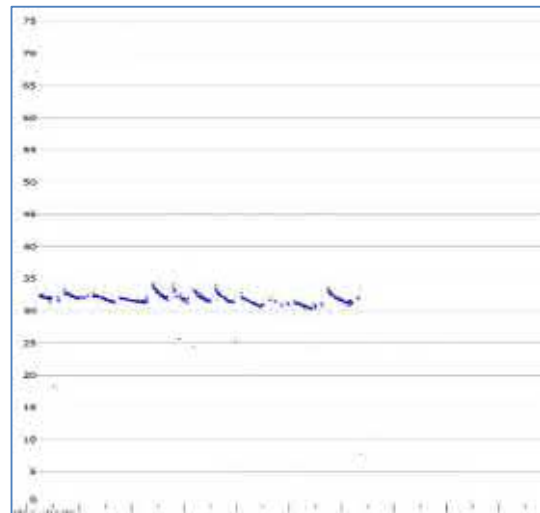
Austronomus australis



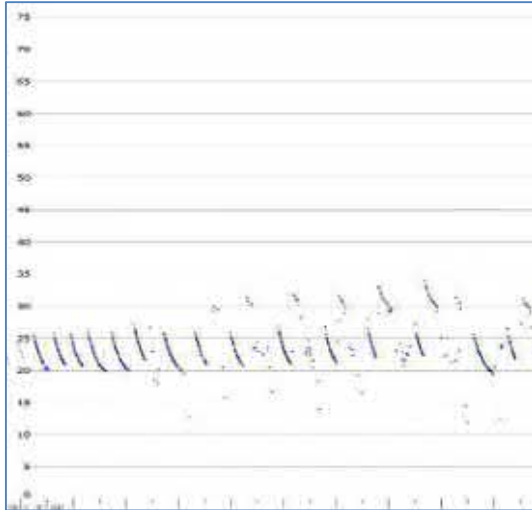
Chaerephon jobensis



Ozimops lumsdenae



Ozimops ridei



Saccolaimus flaviventris

Appendix F

Vegetation community assessment results

F.1 Quaternary assessments - part one of form

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
1	NA	<i>Eucalyptus populnea</i>	<i>Eucalyptus populnea</i> , <i>Acacia excelsa</i>	NA	<i>Geijera parviflora</i> , <i>Psydrax odorata</i> subspecies <i>buxifolia</i> , <i>Eremophila mitchellii</i> ,	<i>Erythroxylum australe</i> , <i>Everistia vacciniifolia</i> , <i>Carissa ovata</i>	<i>Cenchrus ciliaris</i> , <i>Aristida caput medusae</i>	T1	16	25
3	<i>Corymbia tessellaris</i>	<i>Eucalyptus camaldulensis</i> , <i>Eucalyptus melanophloia</i> , <i>Eucalyptus populnea</i> , <i>Corymbia tessellaris</i>	<i>Terminalia oblongata</i> , <i>Corymbia tessellaris</i> , <i>Grevillea striata</i> , <i>Acacia salicina</i>	NA	<i>Terminalia oblongata</i> , <i>Geijera parviflora</i>	<i>Carissa ovata</i> , <i>Senna artemisioides</i> ,	<i>Cenchrus ciliaris</i> , <i>Aristida sp.</i> ,	T1	22	45
4	NA	<i>Corymbia clarksoniana</i> , <i>Eucalyptus populnea</i> , <i>Eucalyptus melanophloia</i>	<i>Alphitonia excelsa</i> , <i>Acacia excelsa</i> , <i>Geijera parviflora</i>	NA	<i>Erythroxylum australe</i> , <i>Ventilago viminalis</i> , <i>Acacia sparsiflora</i> , <i>Senna artemisioides</i> ,	NA	<i>Aristida calycina</i> , <i>Hibiscus sturtii</i> , <i>Cenchrus ciliaris</i> , <i>Calyptochloa gracillima</i>	T1	13	5
5	NA	<i>Corymbia clarksoniana</i> , <i>Eucalyptus melanophloia</i>	NA	NA	<i>Pittosporum spinescens</i> , <i>Erythroxylum australe</i> , <i>Geijera parviflora</i> , <i>Eremophila mitchellii</i> , <i>Alstonia constricta</i>	NA	<i>Cenchrus ciliaris</i> , <i>Aristida calycina</i> ,	T1	15	15

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
6	NA	<i>Acacia harpophylla</i>	<i>Eremophila mitchellii</i>	NA	<i>Geijera parviflora</i> , <i>Atalaya hemiglauca</i> , <i>Eremophila desertii</i> ,	<i>Carissa ovata</i> , <i>Capparis lasiantha</i> ,	<i>Salsola australis</i> , <i>Aristida sp</i> , <i>Enteropogon acicularis</i> , <i>Cenchrus ciliaris</i> ,	T1	12	25
7	NA	<i>Eucalyptus populnea</i> , <i>eucalyptus melanophloia</i>	NA	NA	<i>Acacia crassula</i> , <i>eucalyptus melanophloia</i>	NA	<i>Eriachne mucronata</i> , <i>Cenchrus ciliaris</i> , <i>heteropogon contortus</i> ,	T1	9	10
8	NA	<i>Eucalyptus cambageana</i>	<i>Acacia harpophylla</i>	NA	<i>Eremophila mitchellii</i> , <i>Geijera parviflora</i> ,	<i>Carissa ovata</i>	<i>Paspalidium sp.</i> <i>Cenchrus ciliaris</i>	T1	15	40
9	NA	<i>Geijera parviflora</i> , <i>Acacia excelsa</i> , <i>Flindersia dissosperma</i>	NA	NA	<i>Carissa ovata</i>	NA	<i>Cenchrus ciliaris</i>	T1	4.5	25
10	NA	<i>Eucalyptus populnea</i> , <i>Brachychiton populneus</i>	NA	NA	<i>Geijera parviflora</i> , <i>Lysiphyllum carronii</i> , <i>Erythroxylum australe</i> , <i>Archidendropsis basaltica</i> ,	NA	<i>Cenchrus ciliaris</i>	T1	13	15
11	NA	<i>Eucalyptus melanophloia</i> , <i>Brachychiton populneus</i>	NA	NA	<i>Geijera parviflora</i>	<i>Psydrax odorata</i> subspecies <i>buxifolia</i> , <i>Erythroxylum australe</i> , <i>Acacia excelsa</i> , <i>Acacia crassula</i>	<i>Eriachne mucronata</i> , <i>Bothriochloa bladhi</i> , <i>Cymbopogon refractus</i> , <i>Cenchrus ciliaris</i>	T1	12	5

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
12	NA	<i>Eucalyptus crebra</i> , <i>Eucalyptus melanophloia</i> , <i>Eucalyptus cambageana</i>	<i>Acacia harpophylla</i>	NA	<i>Geijera parviflora</i> , <i>Erythroxylum australe</i> , <i>Acacia excelsa</i>	<i>Carissa ovata</i>	<i>Cenchrus ciliaris</i>	T1	14	25
13	NA	<i>Eucalyptus populnea</i> , <i>Eucalyptus cambageana</i> ,	<i>Acacia catenulata</i>	NA	<i>Geijera parviflora</i> , <i>Eremophila mitchellii</i> ,	NA	<i>Cenchrus ciliaris</i>	T1	13	10
14	NA	<i>Acacia harpophylla</i>	<i>Terminalia oblongata</i> , <i>Eucalyptus populnea</i> , <i>Acacia excelsa</i>	NA	<i>Geijera parviflora</i> , <i>Terminalia oblongata</i>	NA	<i>Cenchrus ciliaris</i>	T1	17	25
15	NA	<i>Eucalyptus populnea</i>	NA	NA	<i>Geijera parviflora</i> , <i>Terminalia oblongata</i> , <i>Eremophila mitchellii</i>	NA	<i>Cenchrus ciliaris</i>	T1	7	20
16	NA	<i>Eucalyptus melanophloia</i>	<i>Eucalyptus melanophloia</i> , <i>Acacia excelsa</i>	NA	<i>Geijera parviflora</i> , <i>Erythroxylum australe</i>	NA	<i>Cenchrus ciliaris</i>	T1	14	25
17	NA	<i>Acacia harpophylla</i> , <i>Terminalia oblongata</i> ,	NA	NA	<i>Geijera parviflora</i>	<i>Carissa ovata</i>	<i>Cenchrus ciliaris</i>	T1	4	50
19	NA	<i>Eucalyptus populnea</i> , <i>Acacia harpophylla</i> , <i>Brachychiton rupestris</i>	<i>Acacia harpophylla</i>	NA	<i>Geijera parviflora</i> , <i>Eremophila mitchellii</i> ,	<i>Carissa ovata</i>	<i>Cenchrus ciliaris</i> , <i>Aristida sp.</i> ,	T1	12	35

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
20	NA	NA	NA	NA	<i>Acacia shirleyi</i> , <i>Alphitonia excelsa</i> , <i>Acacia leiocalyx</i>	<i>Seringia corollata</i> , <i>Grewia latifolia</i>	<i>Aristida caput-medusae</i> , <i>Aristida jerichoensis</i> , <i>Melinis repens</i> , <i>Sida sp.</i>	S1	1.5	15
21	NA	<i>Eucalyptus melanophloia</i> , <i>Corymbia dallachiana</i> , <i>Eucalyptus populnea</i> , <i>Brachychiton populneus</i>	<i>Eucalyptus melanophloia</i> , <i>Corymbia clarksoniana</i> , <i>Corymbia dallachiana</i> , <i>Melaleuca tamariscina</i>	NA	<i>Acacia leiocalyx</i> , <i>Petalostigma pubescens</i> , <i>Grewia latifolia</i>	NA	<i>Eriachne mucronata</i> , <i>Themeda triandra</i> , <i>Heteropogon contortus</i>	T1	13	10
22	NA	<i>Eucalyptus melanophloia</i> , <i>Eucalyptus populnea</i>	<i>Acacia excelsa</i> , <i>Acacia leiocalyx</i> , <i>Geijera parviflora</i> , <i>Eremophila mitchellii</i>	NA	<i>Senna artemisioides</i> , <i>Grewia latifolia</i> , <i>Alphitonia excelsa</i>	NA	<i>Heteropogon contortus</i> , <i>Themeda triandra</i> , <i>Cenchrus ciliaris</i> , <i>Eriachne mucronata</i>	T1	0	15
23	NA	<i>Corymbia clarksoniana</i>	NA	NA	<i>Acacia leiocalyx</i> , <i>Petalostigma pubescens</i>	NA	<i>Eriachne mucronata</i> , <i>Heteropogon contortus</i> , <i>Melinis repens</i>	T1	17	5
24	NA	<i>Eucalyptus melanophloia</i> , <i>Eucalyptus populnea</i>	<i>Eucalyptus melanophloia</i> , <i>Melaleuca tamariscina</i>	NA	<i>Acacia leiocalyx</i> , <i>Eucalyptus melanophloia</i>	<i>Carissa ovata</i>	<i>Themeda triandra</i> , <i>Heteropogon contortus</i> , <i>Cenchrus ciliaris</i> , <i>Bothriochloa bladhii</i>	T1	13	30
25	NA	<i>Eucalyptus populnea</i> , <i>Alectryon oleifolius</i>	<i>Eucalyptus populnea</i> , <i>Acacia excelsa</i> , <i>Eremophila mitchellii</i>	NA	<i>Eremophila mitchellii</i> , <i>Dodonaea viscosa</i> , <i>Elaeodendron australe</i> , <i>Erythroxylum australe</i> , <i>Opuntia tomentosa</i>	<i>Carissa ovata</i> , <i>Owenia acidula</i> , <i>Acacia leiocalyx</i> , <i>Senna artemisioides</i>	0	T1	15	35

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
26	NA	<i>Acacia shirleyi</i>	NA	NA	<i>Carissa ovata</i> , <i>Solanum cocosoides</i> , <i>Hibiscus divaricatus</i> , <i>Alphitonia excelsa</i>	NA	<i>Cenchrus ciliaris</i> , <i>Melinis repens</i> , <i>Aristida jerichoensis</i> , <i>Waltheria indica</i> , <i>Phyllanthus fuernrohrii</i>	S1	4	10
27	NA	<i>Acacia shirleyi</i>	NA	NA	<i>Capparis mitchellii</i> , <i>Brachychiton rupestris</i> , <i>Acalypha eremorum</i>	NA	<i>Aristida caput-medusae</i> , <i>Cymbopogon refractus</i> , <i>Ancistrachne uncinulata</i>	T1	9	40
28	NA	<i>Corymbia clarksoniana</i> , <i>Eucalyptus melanophloia</i>	<i>Hakea lorea</i> , <i>Acacia excelsa</i> , <i>Geijera parviflora</i> , <i>Cassia brewsteri</i> , <i>Brachychiton rupestris</i>	NA	<i>Eremophila mitchellii</i> , <i>Hovea longipes</i> , <i>Carissa ovata</i> , <i>Erythroxylum australe</i>	NA	<i>Cenchrus ciliaris</i> , <i>Heteropogon contortus</i> , <i>Aristida jerichoensis</i>	T1	18	15
29	NA	<i>Eucalyptus populnea</i> , <i>Corymbia tessellaris</i> , <i>Brachychiton rupestris</i> , <i>Brachychiton populneus</i>	<i>Eucalyptus populnea</i> , <i>Acacia catenulata</i> , <i>Acacia excelsa</i>	NA	<i>Geijera parviflora</i> , <i>Erythroxylum australe</i> , <i>Hakea lorea</i> , <i>Cassia brewsteri</i> , <i>Hovea longipes</i>	<i>Carissa ovata</i> , <i>Capparis loranthifolia</i>	<i>Cenchrus ciliaris</i>	T1	20	20
31	NA	<i>Eucalyptus melanophloia</i> , <i>Eucalyptus populnea</i>	<i>Eucalyptus melanophloia</i> , <i>Terminalia oblongata</i>	NA	<i>Geijera parviflora</i> , <i>Acacia deanei</i> , <i>Melaleuca tamariscina</i> , <i>Brachychiton populneus</i> , <i>Cassia brewsteri</i>	<i>Senna artemisioides</i> , <i>Eucalyptus melanophloia</i>	<i>Themeda triandra</i> , <i>Heteropogon contortus</i> , <i>Cenchrus ciliaris</i> , <i>Aristida caput-medusae</i>	T1	12	20

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
32	NA	<i>Eucalyptus populnea</i> , <i>Eucalyptus melanophloia</i> , <i>Corymbia clarksoniana</i>	<i>Eucalyptus populnea</i> , <i>Cassia brewsteri</i>	NA	<i>Acacia excelsa</i> , <i>Erythroxylum australe</i>	NA	<i>Aristida benthamii</i> , <i>Cenchrus ciliaris</i> , <i>Themeda triandra</i>	T1	11	20
33	NA	<i>Eucalyptus populnea</i> , <i>Acacia shirleyi</i>	<i>Eucalyptus populnea</i> , <i>Alphitonia excelsa</i>	NA	<i>Eremophila mitchellii</i> , <i>Psydrax oleifolia</i> , <i>Erythroxylum australe</i> , <i>Petalostigma pubescens</i> , <i>Geijera parviflora</i>	<i>Carissa ovata</i> , <i>Croton phebalioides</i> , <i>Acacia shirleyi</i> , <i>Enchylaena tomentosa</i> , <i>Grewia latifolia</i>	<i>Aristida caput-medusae</i> , <i>Ancistrachne uncinulata</i> , <i>Aristida jerichoensis</i> , <i>Cenchrus ciliaris</i>	T1	12	35
34	NA	<i>Corymbia clarksoniana</i>	<i>Callitris glaucophylla</i> , <i>Eucalyptus populnea</i> , <i>Corymbia clarksoniana</i> , <i>Acacia shirleyi</i>	NA	<i>Acacia leiocalyx</i> , <i>Alphitonia excelsa</i> , <i>Eremophila mitchellii</i>	<i>Grewia latifolia</i> , <i>Hakea lorea</i> , <i>Sida sp.</i> , <i>Stylosanthes scabra</i> , <i>Melhania oblongifolia</i>	<i>Heteropogon contortus</i> , <i>Themeda triandra</i>	T1	20	20
35	NA	<i>Acacia shirleyi</i>	NA	NA	<i>Croton phebalioides</i> , <i>Geijera parviflora</i> , <i>Denhamia oleaster</i> , <i>Denhamia cunninghamii</i> , <i>Cassia brewsteri</i>	<i>Acacia leiocalyx</i> , <i>Alstonia constricta</i>	<i>Aristida caput-medusae</i> , <i>Ancistrachne uncinulata</i>	T1	11	40
36	NA	<i>Acacia shirleyi</i>	NA	NA	<i>Alstonia constricta</i> , <i>Denhamia oleaster</i>	<i>Carissa ovata</i> , <i>Alphitonia excelsa</i>	<i>Cleistochloa subjuncea</i> , <i>Aristida sp.</i> , <i>Cenchrus ciliaris</i>	T1	13	40
38	NA	<i>Acacia shirleyi</i>	NA	NA	<i>Alstonia constricta</i> , <i>Erythroxylum australe</i> ,	NA	<i>Aristida caput-medusae</i> , <i>Aristida jerichoensis</i> , <i>Hibiscus sturtii</i>	T1	11	30

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
					<i>Alphitonia excelsa</i> , <i>Parsonsia eucalyptophylla</i> , <i>Grewia latifolia</i>					
39	NA	<i>Eucalyptus melanophloia</i> , <i>Corymbia clarksoniana</i> , <i>Acacia shirleyi</i>	<i>Alphitonia excelsa</i> , <i>Acacia cretata</i>	NA	<i>Acacia shirleyi</i> , <i>Alphitonia excelsa</i> , <i>Erythroxylum australe</i> , <i>Alstonia constricta</i>	NA	<i>Eriachne mucronata</i> , <i>Heteropogon contortus</i> , <i>Cenchrus ciliaris</i> , <i>Digitaria brownii</i> , <i>Chrysopogon fallax</i>	T1	12	20
40	NA	<i>Eucalyptus melanophloia</i> , <i>Eucalyptus camaldulensis</i> , <i>Eucalyptus populnea</i> , <i>Terminalia oblongata</i> , <i>Acacia harpophylla</i>	<i>Terminalia oblongata</i> , <i>Melaleuca bracteata</i> , <i>Geijera parviflora</i> , <i>Acacia harpophylla</i> , <i>Brachychiton rupestris</i>	NA	<i>Terminalia oblongata</i> , <i>Atalaya hemiglauca</i> , <i>Melaleuca bracteata</i> , <i>Lysiphyllum hookeri</i>	NA	<i>Megathyrsus maximus</i> , <i>Cenchrus ciliaris</i>	T1	22	35
42	NA	<i>Eucalyptus cambageana</i>	<i>Acacia harpophylla</i>	NA	<i>Carissa ovata</i> , <i>Alectryon diversifolius</i> , <i>Capparis lasiantha</i>	NA	<i>Cenchrus ciliaris</i> , <i>Cenchrus ciliaris</i> , <i>Paspalidium sp.</i>	T2	8	35
43	<i>Eucalyptus cambageana</i> , <i>Eucalyptus camaldulensis</i>	<i>Acacia harpophylla</i> , <i>Terminalia oblongata</i> , <i>Lysiphyllum carronii</i>	<i>Acacia harpophylla</i> , <i>Terminalia oblongata</i>	NA	<i>Alectryon diversifolius</i> , <i>Geijera parviflora</i> , <i>Notelaea microcarpa</i> , <i>Ehretia membranifolia</i> , <i>Terminalia oblongata</i>	<i>Carissa ovata</i> , <i>Harrisia martinii</i> , <i>Enchylaena tomentosa</i> , <i>Capparis lasiantha</i>	<i>Cenchrus ciliaris</i> , <i>Leptochloa digitata</i> , <i>Enteropogon acicularis</i> , <i>Cyperus gracilis</i> , <i>Paspalidium caespitosum</i>	T1	11	50
44	NA	<i>Acacia catenulata</i> , <i>Alstonia constricta</i> ,	<i>Acacia catenulata</i> , <i>Cassia brewsteri</i> , <i>Alstonia constricta</i> ,	NA	<i>Everistia vacciniifolia</i> , <i>Acalypha eremorum</i>	NA	<i>Cenchrus ciliaris</i> , <i>Enteropogon acicularis</i> , <i>Aristida caput-medusae</i>	T1	11	45

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
		<i>Eucalyptus cambageana</i>	<i>Psyrax odorata forma buxifolia</i>							
45	NA	Acacia harpophylla, Eucalyptus thozetiana	NA	NA	Acacia harpophylla	NA	<i>Cenchrus ciliaris</i>	T1	6	60
46	<i>Brachychiton rupestris</i> , <i>Brachychiton australis</i> , <i>Brachychiton populneus</i>	Acacia catenulata, Alstonia constricta, Corymbia tessellaris	Acacia catenulata, Cassia brewsteri, Alstonia constricta	NA	Everistia vacciniifolia, Croton phebaloides	NA	<i>Cenchrus ciliaris</i> , <i>Paspalidium sp.</i> , <i>Oplismenus aemulus</i>	T1	11	40
47	<i>Brachychiton rupestris</i>	Acacia catenulata, Cassia brewsteri, Geijera parviflora, Ventilago viminalis	NA	NA	Croton phebaloides, Erythroxylum australe	Carissa ovata	<i>Cenchrus ciliaris</i>	T1	5	60
48	NA	<i>Eucalyptus thozetiana</i> , <i>Eucalyptus cambageana</i>	Acacia harpophylla, Acacia catenulata	NA	Carissa ovata, Geijera parviflora, Erythroxylum australe, Everistia vacciniifolia, Eremophila mitchellii	Sclerolaena tetracuspis, Enchylaena tomentosa, Capparis lasiantha, Alectryon diversifolius, Maireana sp.	0	T1	20	35
49	NA	<i>Eucalyptus cambageana</i>	Acacia catenulata, Acacia harpophylla, Geijera parviflora	NA	Eremophila mitchellii	Carissa ovata, Sclerolaena birchii	<i>Cenchrus ciliaris</i> , <i>Oplismenus aemulus</i>	T1	18	20
50	NA	Acacia catenulata	Acacia catenulata	NA	Capparis arborea	NA	<i>Aristida caput-medusae</i>	T1	13	60

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
51	NA	<i>Eucalyptus populnea</i> , <i>Brachychiton populneus</i> , <i>Atalaya hemiglauca</i>	<i>Cassia brewsteri</i> , <i>Acacia catenulata</i> , <i>Bursaria incana</i> , <i>Ventilago viminalis</i> , <i>Archidendropsis basaltica</i>	NA	<i>Eremophila mitchellii</i> , <i>Geijera parviflora</i> , <i>Ehretia membranifolia</i> , <i>Atalaya hemiglauca</i> , <i>Cymbidium canaliculatum</i>	<i>Carissa ovata</i> , <i>Acalypha eremorum</i>	<i>Cenchrus ciliaris</i> , <i>Aristida lignosa</i>	T1	16	30
52	<i>Eucalyptus melanophloia</i> , <i>Alphitonia excelsa</i>	NA	NA	NA	<i>Petalostigma pubescens</i> , <i>Bursaria incana</i> , <i>Geijera parviflora</i> , <i>Hovea longipes</i> , <i>Pandorea pandorana</i>	<i>Grewia latifolia</i> , <i>Hibiscus sturtii</i>	<i>Cenchrus ciliaris</i> , <i>Themeda triandra</i>	S1	3	40
53	NA	<i>Acacia shirleyi</i>	NA	NA	<i>Erythroxylum australe</i> , <i>Bertya opposens</i> , <i>Croton phebalioides</i> , <i>Geijera parviflora</i>	NA	<i>Hibiscus sturtii</i>	T1	8	65
54	NA	<i>Acacia shirleyi</i>	NA	NA	<i>Erythroxylum australe</i> , <i>Denhamia oleaster</i> , <i>Croton phebalioides</i> , <i>Psydrax odorata forma buxifolia</i>	NA	<i>Hibiscus sturtii</i> , <i>Cenchrus ciliaris</i> , <i>Cleistochloa subjuncea</i> , <i>Enneapogon lindleyanus</i>	T1	7	45
55	NA	<i>Acacia catenulata</i> , <i>Acacia shirleyi</i> , <i>Eucalyptus thozetiana</i> , <i>Eucalyptus crebra</i>	<i>Acacia catenulata</i> , <i>Geijera parviflora</i>	NA	<i>Erythroxylum australe</i> , <i>Acacia catenulata</i> , <i>Denhamia oleaster</i> , <i>Croton phebalioides</i> , <i>Carissa ovata</i>	NA	<i>Cenchrus ciliaris</i>	T1	12	30

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
56	NA	<i>Eucalyptus melanophloia</i> , <i>Terminalia oblongata</i> , <i>Corymbia tessellaris</i> , <i>Acacia harpophylla</i> , <i>Eucalyptus populnea</i>	<i>Terminalia oblongata</i> , <i>Grevillea striata</i> , <i>Lysiphillum hookeri</i> , <i>Geijera parviflora</i>	NA	<i>Terminalia oblongata</i> , <i>Eremophila mitchellii</i> , <i>Eucalyptus populnea</i> , <i>Alectryon diversifolius</i> , <i>Vachellia farnesiana</i>	NA	<i>Megathyrsus maximus</i> , <i>Themeda triandra</i>	T1	15	30
57	NA	<i>Eucalyptus populnea</i> , <i>Brachychiton populneus</i>	<i>Eucalyptus populnea</i> , <i>Acacia excelsa</i> , <i>Eremophila mitchellii</i> , <i>Ventilago viminalis</i>	NA	<i>Eremophila mitchellii</i> , <i>Alectryon diversifolius</i> , <i>rythroxylum australe</i> , <i>Capparis mitchellii</i> , <i>Geijera parviflora</i>	<i>Carissa ovata</i> , <i>Opuntia tomentosa</i>	<i>Cenchrus ciliaris</i> , <i>Aristida lignosa</i>	T1	12	25
58	NA	<i>Acacia catenulata</i>	<i>Acacia catenulata</i>	NA	<i>Everistia vacciniifolia</i> , <i>Acacia catenulata</i> , <i>Acacia oswaldii</i>	NA	<i>Aristida caput-medusae</i>	T1	9	70
59	NA	<i>Eucalyptus populnea</i> , <i>Brachychiton rupestris</i>	<i>Eucalyptus populnea</i>	NA	<i>Geijera parviflora</i> , <i>Atalaya hemiglauca</i> , <i>Erythroxylum australe</i>	<i>Carissa ovata</i> , <i>Owenia acidula</i>	<i>Cenchrus ciliaris</i> , <i>Ancistrachne uncinulata</i> , <i>Aristida jerichoensis</i> , <i>Themeda triandra</i>	T1	12	15
60	NA	<i>Eucalyptus populnea</i> , <i>Ventilago viminalis</i> , <i>Eucalyptus orgadophila</i>	<i>Ventilago viminalis</i>	NA	<i>Eremophila mitchellii</i> , <i>Cassia brewsteri</i>	<i>Carissa ovata</i> , <i>Alectryon diversifolius</i> , <i>Archidendropsis basaltica</i>	<i>Cenchrus ciliaris</i> , <i>Bothriochloa bladhii</i>	T1	9	5

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
61	NA	<i>Corymbia clarksoniana</i> , <i>Eucalyptus crebra</i> , <i>Eucalyptus exserta</i>	<i>Cassia brewsteri</i> , <i>Eucalyptus melanophloia</i>	NA	<i>Geijera parviflora</i> , <i>Erythroxylum australe</i> , <i>Psydrax odorata forma buxifolia</i> , <i>Ventilago viminalis</i>	NA	<i>Themeda triandra</i> , <i>Aristida sp.</i>	T1	7	10
62	NA	<i>Eucalyptus melanophloia</i> , <i>Eucalyptus populnea</i> , <i>Atalaya hemiglauca</i>	<i>Geijera parviflora</i> , <i>Cassia brewsteri</i> , <i>Eremophila mitchellii</i>	NA	<i>Eremophila mitchellii</i> , <i>Denhamia oleaster</i> , <i>Alectryon diversifolius</i>	<i>Grewia latifolia</i> , <i>Tephrosia brachyodon</i> , <i>Jasminum didymum subsp. lineare</i> , <i>Tinospora smilacina</i>	<i>Cenchrus ciliaris</i> , <i>Bothriochloa bladhii</i> , <i>Aristida lignosa</i>	T1	13	15
63	<i>Eucalyptus populnea</i> , <i>Eucalyptus melanophloia</i> , <i>Ventilago viminalis</i> , <i>Brachychiton rupestris</i>	<i>Acacia catenulata</i> , <i>Terminalia oblongata</i>	<i>Acacia catenulata</i> , <i>Acacia harpophylla</i>	NA	<i>Everistia vacciniifolia</i> , <i>Psydrax odorata forma buxifolia</i> , <i>Geijera parviflora</i>	<i>Carissa ovata</i>	<i>Aristida caput-medusae</i> , <i>Cenchrus ciliaris</i>	T1	10	40
64	NA	<i>Callitris glaucophylla</i> , <i>Eucalyptus melanophloia</i> , <i>Acacia excelsa</i> , <i>Psydrax attenuata</i>	NA	NA	<i>Geijera parviflora</i> , <i>Eremophila mitchellii</i> , <i>Acacia excelsa</i> , <i>Petalostigma pubescens</i>	<i>Callitris glaucophylla</i> , <i>Gossypium australe</i> , <i>Grevillea striata</i> , <i>Acacia cretata</i>	<i>Aristida personata</i> , <i>Aristida jerichoensis</i> , <i>Heteropogon contortus</i> , <i>Eriachne mucronata</i> , <i>Chrysocephalum apiculatum</i>	T1	8	30
65	NA	<i>Eucalyptus populnea</i> , <i>Eucalyptus melanophloia</i>	<i>Acacia excelsa</i> , <i>Geijera parviflora</i> , <i>Lysiphyllum hookeri</i> , <i>Terminalia oblongata</i>	NA	<i>Jasminum didymum subsp. lineare</i> , <i>Geijera parviflora</i>	NA	<i>Cenchrus ciliaris</i> , <i>Megathyrsus maximus</i> , <i>Parthenium hysterophorus</i>	T1	17	35

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
66	NA	<i>Acacia catenulata</i> , <i>Eucalyptus populnea</i>	<i>Acacia catenulata</i> , <i>Geijera parviflora</i>	NA	<i>Acacia catenulata</i> , <i>Erythroxylum australe</i> , <i>Geijera parviflora</i> , <i>Everistia vacciniifolia</i> , <i>Alstonia constricta</i>	NA	<i>Aristida caput-medusae</i> , <i>Cenchrus ciliaris</i>	T1	12	40
67	<i>Eucalyptus crebra</i>	<i>Acacia catenulata</i>	<i>Acacia catenulata</i>	NA	<i>Acacia catenulata</i> , <i>Erythroxylum australe</i> , <i>Croton phebalioides</i>	NA	<i>Aristida caput-medusae</i>	T1	11	40
68	NA	<i>Eucalyptus orgadophila</i>	<i>Corymbia erythrophloia</i> , <i>Eucalyptus orgadophila</i>	NA	<i>Erythroxylum australe</i> , <i>Geijera parviflora</i> , <i>Archidendropsis basaltica</i> , <i>Denhamia oleaster</i> , <i>Santalum lanceolatum</i>	<i>Carissa ovata</i> , <i>Grewia latifolia</i>	<i>Themeda triandra</i> , <i>Cenchrus ciliaris</i>	T1	11	20
69	NA	<i>Acacia harpophylla</i>	<i>Acacia harpophylla</i> , <i>Atalaya hemiglauca</i> , <i>Lysiphyllum carronii</i> , <i>Geijera parviflora</i>	NA	<i>Geijera parviflora</i> , <i>Terminalia oblongata</i> , <i>Eremophila mitchellii</i>	<i>Carissa ovata</i>	<i>Cenchrus ciliaris</i> , <i>Paspalidium caespitosum</i>	T1	13	40
70	<i>Eucalyptus melanophloia</i>	<i>Acacia catenulata</i> , <i>Brachychiton rupestris</i>	<i>Acacia catenulata</i>	NA	<i>Acacia catenulata</i> , <i>Everistia vacciniifolia</i>	NA	<i>Aristida caput-medusae</i>	T1	9	60
71	<i>Eucalyptus melanophloia</i>	<i>Acacia catenulata</i> , <i>Grevillea striata</i>	<i>Acacia catenulata</i> , <i>Grevillea striata</i> , <i>Cassia brewsteri</i> , <i>Geijera parviflora</i> , <i>Alstonia constricta</i>	NA	<i>Acacia catenulata</i> , <i>Alstonia constricta</i>	NA	<i>Bothriochloa bladhii</i> , <i>Themeda triandra</i> , <i>Aristida caput-medusae</i> , <i>Cenchrus ciliaris</i>	T1	10	20

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
72	NA	NA	NA	NA	<i>Citrus glauca</i>	NA	<i>Dichanthium sericeum</i> , <i>Bothriochloa decipiens</i> , <i>Digitaria divaricatissima</i> , <i>Panicum decompositum</i> , <i>Aristida latifolia</i> , <i>Cenchrus ciliaris</i> , <i>Setaria sp.</i>	G	1	90
73	<i>Terminalia oblongata</i> , <i>Corymbia erythrophloia</i>	NA	NA	NA	NA	NA	<i>Dichanthium sericeum</i> <i>Panicum queenslandicum</i> <i>Aristida leptopoda</i> <i>Digitaria Brownii</i> <i>Panicum decompositum</i> , <i>Bothriochloa erianthoides</i> , <i>Abelmoshus moschatus</i> <i>Phyllanthus sp.</i> , <i>Paspalidium sp.</i>	G	1	80
74	NA	<i>Eucalyptus crebra</i>	<i>Eucalyptus crebra</i>	NA	<i>Alphitonia excelsa</i> , <i>Petalostigma pubescens</i>	NA	<i>Urochloa sp.</i> , <i>Melinis repens</i>	T1	12	30
75	<i>Eucalyptus cambadgeana</i>	<i>Acacia shirleyi</i> , <i>Acacia harpophylla</i> , <i>Eucalyptus cambadgeana</i>	<i>Acacia shirleyi</i> , <i>Acacia harpophylla</i> , <i>Geijera parviflora</i>	NA	<i>Carissa ovata</i> , <i>Acacia shirleyi</i>	NA	<i>Cleistochloa sp.</i> , <i>Cenchrus ciliaris</i>	T1	8	50
76	<i>Eucalyptus thozetiana</i>	<i>Acacia shirleyi</i>	<i>Acacia shirleyi</i>	NA	<i>Acacia shirleyi</i>	NA	<i>Calyptochloa stuartii</i> <i>Hibiscus medusae</i> <i>Aristida capita</i>	T1	6	50

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
77	<i>Eucalyptus tereticornis</i>	<i>Eucalyptus tereticornis</i> , <i>Eucalyptus populnea</i>	<i>Lysiphillum carronia</i> , <i>Terminalia oblongata</i> , <i>Acacia harpophylla</i> , <i>Acacia excelsa</i>	NA	<i>Acacia salicina</i> , <i>Acacia excelsa</i> , <i>Vachellia farnesiana</i>	NA	<i>Megathyrsus maximus</i> , <i>Cenchrus ciliaris</i>	T1	14	40
78	NA	NA	NA	NA	<i>Acacia harpophylla</i> , <i>Capparis loranthifolia</i>	NA	<i>Themeda triandra</i> , <i>Cenchrus ciliaris</i> , <i>Aristida latifolia</i> , <i>Bothriochloa bladhii</i>	G	1	90
79	<i>Acacia salicina</i>	<i>Acacia harpophylla</i> , <i>Melaleuca bracteata</i> , <i>Terminalia oblongata</i>	NA	NA	<i>Acacia harpophylla</i>	NA	<i>Cenchrus ciliaris</i> , <i>Parthenium hysterophorus</i>	T1	6	30
80	NA	NA	NA	NA	<i>Acacia harpophylla</i>	NA	<i>Cenchrus ciliaris</i>	S1	1	50
81	NA	NA	NA	NA	<i>Acacia harpophylla</i>	NA	<i>Cenchrus ciliaris</i> , <i>Echinochloa colona</i> , <i>Monochoria cyanea</i>	G	1	80
82	<i>Eucalyptus populnea</i>	<i>Eucalyptus populnea</i> , <i>Acacia catenulata</i>	<i>Cassia brewsteri</i>	NA	<i>Psydrax johnsonii</i> , <i>Grewia latifolia</i>	NA	<i>Cenchrus ciliaris</i>	T1	9	30
83	<i>Brachychiton rupestris</i>	<i>Acacia catenulata</i>	<i>Acacia catenulata</i>	NA	<i>Everistia vacciniifolia</i>	NA	<i>Hibiscus stuartii</i> , <i>Clematicissus Digitaria parviflora</i> , <i>Dianella sp.</i> , <i>Calotus sp.</i> , <i>Oxalis sp.</i> , <i>Wahlenburgia stricta</i>	T1	6	60
84	<i>Eucalyptus cambadgeara</i>	<i>Eucalyptus populnea</i> , <i>Acacia harpophylla</i>	<i>Terminalia oblongata</i>	NA	<i>Eremophila mitchellii</i>	NA	<i>Aristida sp.</i> , <i>Enteropogon sp.</i> , <i>Cenchrus ciliaris</i>	T1	5	40

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
85	NA	<i>Eucalyptus crebra</i>	<i>Alphitonia excelsa</i> , <i>Petalostigma pubescens</i> , <i>Cassia brewsteri</i>	NA	<i>Eremophila mitchellii</i>	NA	<i>Heteropogon contortus</i> , <i>Cenchrus ciliaris</i>	T1	11	30
86	NA	<i>Acacia catenulata</i>	NA	NA	<i>Alstonia constricta</i>	<i>Everistia vacciniifolia</i>	<i>Cenchrus ciliaris</i>	T1	7	40
87	<i>Eucalyptus crebra</i> , <i>Acacia catenulata</i>	<i>Melaleuca tamariscina</i>	NA	NA	<i>Sananantha sp.</i>	<i>Sananantha sp.</i>	<i>Themeda triandra</i> , <i>Cenchrus ciliaris</i> , <i>Euphorbia tannensis</i>	T1	4	50
88	<i>Eucalyptus populnea</i>	<i>Acacia catenulata</i>	<i>Acacia catenulata</i>	NA	<i>Acacia catenulata</i> , <i>Micromyrtus capricornica</i>	<i>Petalistylis labechiana</i>	<i>Aristida spp.</i>	T1	6	50
89	NA	<i>Acacia shirleyi</i>	<i>Eucalyptus exserta</i>	NA	<i>Hovea longipes</i>	<i>Everistia vacciniifolia</i>	<i>Setaria surgens</i> , <i>Sida sp.</i> , <i>Eragrostis sp.</i>	T1	8	60
90	NA	<i>Acacia shirleyi</i> , <i>Eucalyptus exserta</i> , <i>Acacia catenulata</i>	NA	NA	<i>Acalypha eremorum</i> , <i>Erythroxylum australe</i> , <i>Croton phebailioides</i>	NA	<i>Euphorbia tannensis</i> , <i>Aristida caput-medusae</i> , <i>Megathyrsus maximus</i>	T1	7	60
91	<i>Eucalyptus exserta</i>	<i>Alstonia constricta</i> , <i>Alphitonia excelsa</i> , <i>Cassia brewsteri</i>	<i>Jasminum dallachii</i>	NA	<i>Erythroxylum australe</i> , <i>Croton phebailioides</i> , <i>Alectryon diversifolius</i>	<i>Breynia oblongifolia</i> , <i>Myoporum acuminatum</i>	<i>Megathyrsus maximus</i> , <i>Aristida ramosa</i> , <i>Ancistrachne sp.</i>	T1	6	70
92	NA	<i>Eucalyptus populnea</i>	NA	NA	<i>Eremophila mitchellii</i> , <i>Petalostigma pubescens</i> , <i>Alstonia constricta</i>	NA	<i>Cenchrus ciliaris</i>	T1	8	40

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
93	NA	<i>Acacia shirleyi</i> , <i>Eucalyptus exserta</i>	NA	NA	<i>Erythroxylum australe</i> , <i>Alstonia constricta</i> , <i>Eremophila latrobeana mitchellii</i>	NA	<i>Themeda triandra</i> , <i>Aristida caput-medusae</i> , <i>Aristida calycina</i>	T1	7	50
94	<i>Eucalyptus populnea</i>	<i>Eucalyptus populnea</i> , <i>Acacia catenulata</i>	<i>Acacia harpophylla</i> , <i>Cassia brewsteri</i>	NA	<i>Alectryon diversifolius</i> , <i>Hovea longipes</i> , <i>Acalypha eremorum</i>	NA	<i>Cenchrus ciliaris</i>	T1	8	30
95	NA	<i>Corymbia clarksoniana</i> , <i>Eucalyptus crebra</i> , <i>Corymbia dallachyana</i> , <i>Eucalyptus melanophloia</i>	<i>Callitris glaucophylla</i> , <i>Acacia shirleyi</i>	NA	<i>Petalostigma pubescens</i> , <i>Geijera parviflora</i> , <i>Alstonia constricta</i>	NA	<i>Urochloa sp.</i> , <i>Melinis repens</i> , <i>Heteropogon contortus</i>	T1	12	30
96	<i>Brachychiton populneus</i>	NA	NA	NA	<i>Melaleuca tamariscina</i>	NA	<i>Stylosanthes scabra</i> , <i>Megathyrsus maximus</i> , <i>Urochloa sp.</i>	S1	4	50
97	NA	<i>Eucalyptus melanophloia</i> , <i>Eucalyptus populnea</i>	<i>Acacia excelsa</i> , <i>Geijera parviflora</i>	NA	<i>Acacia excelsa</i> , <i>Cassia brewsteri</i> , <i>Psyrax olefolia</i>	NA	<i>Cenchrus ciliaris</i> , <i>Stylosanthes scabra</i> , <i>Themeda triandra</i> , <i>Galactia tenuiflora</i> , <i>Digitaria brownii</i> , <i>Aristida ramosa</i>	T1	10	40
98	NA	<i>Acacia harpophylla</i>	<i>Acacia harpophylla</i> , <i>Lysiphyllum carronii</i>	NA	<i>Eremophila mitchellii</i>	<i>Citrus glauca</i>	<i>Cenchrus ciliaris</i>	T1	6	40
99	NA	<i>Eucalyptus melanophloia</i>	<i>Geijera parviflora</i> , <i>Cassia brewsteri</i> , <i>Alphitonia excelsa</i>	NA	<i>Geijera parviflora</i> , <i>Cassia brewsteri</i>	NA	<i>Aristida jerichoensis</i> , <i>Aristida calycina</i> , <i>Cenchrus ciliaris</i> ,	T1	9	15

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
							<i>Melinis repens, Sida sp.</i>			
100	NA	<i>Acacia shirleyi</i>	<i>Acacia shirleyi</i>	NA	<i>Croton phebaillioides, Erythroxylum australe</i>	NA	<i>Calyptochloa sp.</i>	T1	9	60
101	NA	<i>Acacia shirleyi</i>	<i>Croton insularis</i> <i>Alphitonia excelsa</i>	NA	<i>Breynia Everistia</i> <i>Acalypha eremorum</i> <i>Ehretia membranifolia</i>	NA	<i>Megathyrsus</i>	T1	8	60
102	NA	<i>Acacia shirleyi</i>	<i>Ehretia membranifolia</i> <i>Alphitonia excelsa, Ventilago viminalis</i>	NA	<i>Acalypha eremorum, Alectryon diversifolius, Elaeodendron australe, Flueggea virosa</i>	<i>Carissa ovata, Jasminum simplicifolium</i>	<i>Megathyrsus maximus, Bidens pilosa, Ancistrachne uncinulata</i>	T2	4	80
103	NA	<i>Eucalyptus crebra, Corymbia clarksoniana</i>	<i>Alphitonia excelsa</i>	NA	<i>Erythroxylum australe, Psydrax odorata, Melaleuca tamariscina</i>	NA	<i>Themeda triandra, Thyridolepis mitchelliana</i>	T1	11	30
104	NA	<i>Eucalyptus populnea</i>	<i>Owenia acidula</i>	NA	<i>Eremophila mitchellii</i>	<i>Cassia brewsteri</i>	<i>Cenchrus ciliaris, Urochloa sp.</i>	T1	14	30
105	NA	<i>Eucalyptus crebra, Corymbia clarksoniana, Corymbia tessellaris</i>	<i>Acacia catenulata, Acacia shirleyi, Acacia cretata, Alphitonia excelsa, Callitris glaucophylla</i>	NA	<i>Erythroxylum australe, Everistia vacciniifolia</i>	NA	<i>Cenchrus ciliaris, Themeda triandra, Aristida caput-medusae</i>	T1	9	10
106	NA	<i>Acacia harpophylla, Owenia acidula</i>	<i>Cassia brewsteri</i>	NA	<i>Capparis mitchellii</i>	<i>Carissa ovata</i>	<i>Cenchrus ciliaris</i>	T1	5	30

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
107	<i>Eucalyptus crebra</i> , <i>Brachychiton populneus</i>	<i>Acacia catenulata</i>	<i>Acacia catenulata</i> , <i>Brachychiton rupestris</i> , <i>Capparis mitchellii</i>	NA	<i>Everistia vacciniifolia</i> , <i>Acacia catenulata</i>	NA	<i>Sida hackettiana</i> , <i>Cenchrus ciliaris</i> , <i>Megathyrsus maximus</i>	T1	7	40
108	<i>Eucalyptus cambadgeana</i>	<i>Eucalyptus cambadgeana</i> , <i>Acacia harpophylla</i> , <i>Acacia catenulata</i>	<i>Geijera parviflora</i>	NA	<i>Geijera parviflora</i> , <i>Erythroxylum australe</i>	<i>Carissa ovata</i>	<i>Carissa ovata</i> , <i>Cenchrus ciliaris</i>	T1	10	30
109	NA	<i>Acacia harpophylla</i> , <i>Lysiphillum caronii</i> , <i>Terminalia oblongata</i>	NA	NA	<i>Geijera parviflora</i> , <i>Terminalia oblongata</i> , <i>Eremophila mitchellii</i>	NA	<i>Cenchrus ciliaris</i> , <i>Megathyrsus maximus</i> , <i>Urochloa sp.</i>	T1	9	50
110	<i>Eucalyptus melanophloia</i> , <i>Eucalyptus populnea</i>	<i>Acacia catenulata</i>	NA	NA	<i>Alphitonia excelsa</i> , <i>Geijera parviflora</i> , <i>Ehretia membranifolia</i>	NA	<i>Megathyrsus maximus</i> , <i>Urochloa sp.</i>	T1	9	50
111	<i>Eucalyptus tereticornis</i>	<i>Terminalia oblongata</i> , <i>Melaleuca bracteata</i>	<i>Terminalia oblongata</i>	NA	<i>Terminalia oblongata</i>	NA	<i>Megathyrsus maximus</i>	T1	9	60
112	NA	<i>Eucalyptus populnea</i>			<i>Eramophila mitchellii</i>	<i>Alectryon diversifolius</i> , <i>Carissa ovata</i>	<i>Cenchrus ciliaris</i>	T1	8	40
113	NA	<i>Eucalyptus cambadgeana</i> , <i>Eucalyptus populnea</i>	<i>Acacia harpophylla</i> , <i>Brachychiton rupestris</i>	<i>Eucalyptus populnea</i>	<i>Geijera parviflora</i> , <i>Hovea longipes</i>	NA	<i>Cenchrus ciliaris</i>	T1	14	35
114	NA	<i>Eucalyptus populnea</i>	NA	NA	<i>Archidendropsis basaltica</i> , <i>Eremophila mitchellii</i>	NA	<i>Cenchrus ciliaris</i>	T1	7	35

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
115	NA	<i>Casuarina christata</i> <i>Eucalyptus cambadgeana</i> , <i>Eucalyptus populnea</i>	<i>Melaleuca bracteata</i>	NA	<i>Melaleuca bracteata</i>	NA	<i>Lemna minor</i> , <i>Alternanthera nana</i> , <i>Ammania multiflora</i> , <i>Dichelachne fusca</i> , <i>Echinocloa colona</i> , <i>Ottelia alismifolia</i> , <i>Alisma-plantago aquatica</i> , <i>Monochoria sp.</i>	T1	12	60
116	NA	<i>Eucalyptus cambadgeana</i>	<i>Lysiphyllum caronii</i> , <i>Acacia harpophylla</i>	<i>Acacia harpophylla</i>	<i>Alectryon diversifolius</i> , <i>Hovea longipes</i> , <i>Carissa ovata</i> , <i>Psyrax oleifolia</i>	<i>Carissa ovata</i>	<i>Cenchrus ciliaris</i> , <i>Aristida jericoensis</i>	T1	14	35
117	NA	<i>Eucalyptus tereticornis</i> , <i>Eucalyptus melanophloia</i>	<i>Terminalia oblongata</i> , <i>Acacia harpophylla</i>	NA	<i>Lysiphyllum carronii</i>	NA	<i>Megathyrsus maximus</i>	T1	15	30
118	NA	<i>Eucalyptus populnea</i> , <i>Ventilago viminalis</i>	<i>Acacia excelsa</i>	NA	<i>Eremophila mitchellii</i> , <i>Erythroxylon australe</i> , <i>Psyrax olefolius</i>	NA	<i>Cenchrus ciliaris</i>	T1	10	30
119	<i>Eucalyptus tereticornis</i>	<i>Eucalyptus melanophloia</i> , <i>Eucalyptus tereticornis</i>	<i>Acacia harpophylla</i> , <i>Terminalia oblongata</i> , <i>Geijera parviflora</i>	NA	<i>Notolea longifolia</i> , <i>Terminalia oblongata</i> , <i>Pittosporum angustifolium</i> , <i>Eremophila mitchellii</i> , <i>Lysiphyllum carronii</i>	NA	<i>Urochloa sp.</i> , <i>Megathyrsus maximus</i> , <i>Cenchrus ciliaris</i>	T1	15	30

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
120	<i>Eucalyptus tereticornis</i>	<i>Eucalyptus tereticornis</i> , <i>Eucalyptus camaldulensis</i> , <i>Eucalyptus populnea</i>	<i>Eucalyptus populnea</i> , <i>Terminalia oblongata</i>	NA	<i>Lysiphyllum caronii</i>	NA	<i>Leptochloa digitata</i> , <i>Cenchrus ciliaris</i> , <i>Cyprus exaltatus</i>	T1	21	30
121	<i>Eucalyptus melanophloia</i> , <i>Corymbia clarksoniana</i>	NA	NA	NA	<i>Acacia leiocalyx</i>	<i>Sannantha sp.</i>	<i>Triodia pungens</i> , <i>Bulbostylis barbata</i> , <i>Dianella sp.</i> , <i>Schizachyrium fragile</i> , <i>Goodenia hederacea</i> , <i>Cyprus sp.</i> , <i>Drosera burmanii</i>	S1	2	50
122	NA	<i>Eucalyptus melanophloia</i>	NA	NA	<i>Acacia leiocalyx</i>	<i>Cassia brewsteri</i>	<i>Heteropogon contortus</i> , <i>Themeda triandra</i> , <i>Melinus repens</i> , <i>Cenchrus ciliaris</i> , <i>Digitaria coenicola</i> , <i>Panicum buncei</i>	T1	9	40
123	<i>Eucalyptus crebra</i> , <i>Corymbia clarksoniana</i>	<i>Eucalyptus crebra</i> , <i>Corymbia clarksoniana</i>	<i>Alphitonia excelsa</i> , <i>Acacia leiocalyx</i>	NA	<i>Senna artemesioides</i> , <i>Grewia latifolia</i>	NA	<i>Heteropogon contortus</i> , <i>Melinus repens</i> , <i>Sida hackettiana</i>	T1	10	30
124	<i>Eucalyptus crebra</i>	<i>Acacia shirleyi</i>	<i>Acacia shirleyi</i>	NA	<i>Acacia shirleyi</i>	NA	<i>Heteropogon contortus</i> , <i>Themeda triandra</i> , <i>Aristida caput-medusae</i> , <i>Sida hackettiana</i> , <i>Trachymene sp.</i>	T1	9	40
125	<i>Eucalyptus melanophloia</i>	<i>Eucalyptus melanophloia</i> , <i>Acacia shirleyi</i>	NA	NA	<i>Acacia leiocalyx</i>	NA	<i>Heteropogon contortus</i> , <i>Thyridolepis mitchelliana</i> , <i>Ptilotus sp.</i> , <i>Themeda triandra</i> , <i>Melinus repens</i>	T1	8	10

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
126	NA	<i>Corymbia clarksoniana</i> , <i>Eucalyptus populnea</i> , <i>Eucalyptus melanophloia</i> ,	<i>Alphitonia excelsa</i> , <i>Grevillea parallela</i>	NA	<i>Petalostigma pubescens</i> , <i>Alphitonia excelsa</i> , <i>Acacia leiocalyx</i>	<i>Alphitonia excelsa</i> , <i>Alstonia constricta</i> , <i>Clerodendrum floribundum</i> ,	<i>Sida hackettiana</i> , <i>Melinis repens</i> , <i>Aristida sp.</i> , <i>Phyllanthus furenrorii</i>	T1	5	20
127	<i>Eucalyptus tereticornis</i>	<i>Corymbia tessellaris</i> , <i>Eucalyptus populnea</i>	<i>Acacia harpophylla</i> , <i>Acacia salicina</i> , <i>Grevillea parallela</i>	NA	<i>Acacia harpophylla</i> , <i>Acacia salicina</i> , <i>Geijera parviflora</i>	NA	<i>Megathyrsus maximus</i>	T1	16	30
128	NA	<i>Eucalyptus tereticornis</i> , <i>Corymbia tessellaris</i>	<i>Terminalia oblongata</i>	NA	<i>Terminalia oblongata</i> , <i>Lysiphyllum carronii</i>	NA	<i>Dichanthium annulatum</i> , <i>Bothriochloa bladhii</i> , <i>Echinochloa colona</i>	T1	16	30
129	<i>Eucalyptus orgadophila</i> , <i>Corymbia erythrophloia</i>	NA	NA	NA	<i>Bursaria incana</i>	NA	<i>Sehima nervosum</i> , <i>Heteropogon contortus</i> , <i>Indigophora linnifolia</i> , <i>Wahlenburgia sp.</i> , <i>Brunoniella sp.</i> , <i>Vittadinia scabra</i>	T1	15	10
130	NA	<i>Eucalyptus orgadophila</i> , <i>Corymbia erythrophloia</i>	NA	NA	<i>Bursaria incana</i> , <i>Lysiphyllum hookeri</i>	NA	<i>Desmodium brachypidon</i> , <i>Rostellularia sp.</i> , <i>Grewia latifolia</i> , <i>Pandorea sp.</i> , <i>Cleomele sp.</i>	T1	12	20
131	<i>Brachychiton rupestris</i> , <i>Brachychiton australis</i>	<i>Lysiphyllum hookeri</i> , <i>Ventilago viminalis</i> , <i>Planchonella pubescens</i>	NA	NA	<i>Acalypha eremorum</i> , <i>Croton plebailioides</i>	NA	<i>Nicotinana sp.</i> , <i>Cenchrus ciliaris</i> , <i>Sigesbeckia sp.</i> , <i>Amaranthus viridius</i>	T1	4	60

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
132	NA	<i>Eucalyptus orgadophila</i> , <i>Corymbia erythrophloia</i>	NA	NA	<i>Bursaria incana</i> , <i>Archidendropsis basaltica</i>	NA	<i>Cenchrus ciliaris</i> , <i>Sehemia sp.</i> , <i>Indigophora linnifolia</i>	T1	11	25
133	<i>Eucalyptus thozetiana</i>	<i>Acacia harpophylla</i> , <i>Eucalyptus thozetiana</i>	<i>Atalaya hemiglauca</i> , <i>Geijera parviflora</i>	NA	<i>Eremophila mitchellii</i> , <i>Erythroxylum australe</i> , <i>Pittosporum spinescens</i> , <i>Psydrax odorata</i>	<i>Carissa Psydrax</i>	<i>Aristida jerichoensis</i> , <i>Enteropogon sp.</i> , <i>Ancistrachne</i> .	T1	6	30
134	<i>Ventilago viminalis</i> , <i>Acacia catenulata</i>	<i>Croton insularis</i> , <i>Ventilago viminalis</i> , <i>Erythroxylum australe</i>	NA	<i>Erythroxylum australe</i> , <i>Acalypha eremorum</i>	NA	NA	<i>Paspalidium Abutilon</i> <i>Carissa</i>	E	4	60
135	NA	<i>Acacia catenulata</i> , <i>Owenia acidula</i> , <i>Ventilago viminalis</i>	<i>Acacia catenulata</i>	NA	<i>Acacia catenulata</i>	NA	<i>Cleistochloa sp.</i> , <i>Pasplidium sp.</i> , <i>Abutilon sp.</i>	T1	9	60
136	<i>Eucalyptus melanophloia</i> , <i>Corymbia clarksoniana</i>	<i>Alphitonia excelsa</i> , <i>Ventilago viminalis</i>	NA	NA	<i>Hovea longipes</i> , <i>Geijera parviflora</i> , <i>Psydrax odorata</i>	NA	<i>Megathyrsus maximus</i> , <i>Sida hackettiana</i>	E	12	10
137	<i>Eucalyptus tereticornis</i>	<i>Eucalyptus tereticornis</i>	<i>Acacia harpophylla</i> , <i>Lysiphyllum hookeri</i> , <i>Terminalia oblongata</i> , <i>Geijera parviflora</i> , <i>Alphitonia excelsa</i> , <i>Melaleuca bracteata</i>	NA	NA	NA	<i>Eleocharis plana</i> , <i>Cyperus exaltatus</i> , <i>Cyperus concinnus</i> , <i>schoneoplectus sp.</i> , <i>Cyperus difformis</i> , <i>Balsamicum polystachion</i> , <i>Ammania multiflora</i> , <i>Centipeda minnima</i> , <i>Persicaria sp.</i> , <i>Glinus lotoides</i> , <i>Leersia</i>	T1	9	30

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
138	NA	<i>Eucalyptus cambageana</i> , <i>Eucalyptus thozetiana</i>	<i>Acacia catenulata</i>	NA	<i>Geijera parviflora</i> , <i>Everistia vacciniifolia</i> , <i>Acacia catenulata</i> , <i>Erythroxylum australe</i>	NA	<i>Eremochloa bimaculata</i> , <i>Aristida caput-medusae</i> , <i>Aristida queenlandica</i> , <i>Sida rohlenae</i> , <i>Sigesbeckia orientalis</i> , <i>Cenchrus ciliaris</i> , <i>Caryratria sp.</i> , <i>Jasminum didimum</i> , <i>Nyssanthes diffusa</i>	T1	17	40
139	NA	<i>Eucalyptus cambageana</i> , <i>Eucalyptus thozetiana</i>	<i>Acacia catenulata</i> , <i>Opuntia tomentosa</i>	NA	<i>Geijera parviflora</i> , <i>Everistia vacciniifolia</i> , <i>Acacia catenulata</i> , <i>Erythroxylum australe</i> , <i>Hovea longipes</i>	<i>Carissa ovata</i>	<i>Eremochloa bimaculata</i> , <i>Portulaca oleracea</i> , <i>Aristida caput-medusae</i> , <i>Abutilon sp.</i> , <i>Enneapogon truncatus</i> , <i>Harissia martinii</i> , <i>Abutilon oxycarpum</i> , <i>Paspalidium sp.</i> , <i>Sida rohlenae</i> , <i>Cenchrus ciliaris</i>	T1	21	40
140	<i>Grevillea striata</i>	<i>Acacia catenulata</i> , <i>Brachychiton australis</i>	<i>Alstonia constricta</i> , <i>Cassia brewsteri</i> , <i>Tinospora smilacina</i>	NA	<i>Everistia vacciniifolia</i> , <i>Acacia catenulata</i>	NA	<i>Abutilon oxycarpum</i> , <i>Sida fibulifira</i> , <i>Hibiscus sturtii</i> , <i>Harissia martinii</i> , <i>Paspalidium sp. x2</i> , <i>Aristida benthamii</i> , <i>Enneapogon truncatus</i> , <i>Cenchrus ciliaris</i> , <i>Portulaca oleracea</i>	T1	11	45

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
141	NA	<i>Eucalyptus cambageana</i>	<i>Acacia harpophylla</i> , <i>Lysiphyllum carronii</i> , <i>Geijera parviflora</i> , <i>Eremophilla mitchellii</i> , <i>Alectryon diversifolius</i> , <i>Citrus glauca</i> , <i>Archidendropsis basaltica</i>	NA	NA	NA	<i>Clematicissus opaca</i> , <i>Cenchrus ciliaris</i> , <i>Ancistrachne uncinata</i> , <i>Aristida jerichoensis</i> , <i>Sclerolaena birchii</i>		0	0
142	NA	<i>Eucalyptus melanophloia</i>	NA	NA	<i>Erythroxylum australe</i> , <i>Psydrax attenuata</i> , <i>Notolea microcarpa</i> , <i>Acacia sp.</i> , <i>Everistia vacciniifolia</i> , <i>Grewia latifolia</i>	NA	<i>Themeda triandra</i> , <i>Chrysopogon fallax</i> , <i>Panicum diffusum</i> , <i>Fimbristylis dichotoma</i> , <i>Sida sp.</i> , <i>Hibiscus sturtii</i> , <i>Waltheria indica</i> , <i>Sida spinosa</i>	T1	12	20
143	NA	<i>Acacia harpophylla</i> , <i>Lysiphyllum carronii</i> , <i>Geijera parviflora</i> , <i>Alectryon diversifolius</i>	NA	NA	<i>Alectryon diversifolius</i>	NA	<i>Cenchrus ciliaris</i> , <i>Cucumis sp.</i> , <i>Malvastrum americanum</i> , <i>Macroptilium afroperpurium</i> , <i>Enteropogon acicularis</i> , <i>Dactyloctenium radulans</i> , <i>Clematicissus opaca</i> , <i>Aceranthes aspera</i> , <i>Amenia multiflora</i> , <i>Bidens p</i>	T1	6	60

Site	Emergent species dominance	T1 species dominance	T2 species dominance	T3 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height average	EDL cover
144	NA	<i>Eucalyptus populnea</i> , <i>Eucalyptus crebra</i> , <i>Eucalyptus cambageana</i> , <i>Acacia sherleyi</i>	<i>Alphitonia excelsa</i> , <i>Eucalyptus crebra</i> , <i>Eucalyptus cambageana</i> , <i>Acacia sherleyi</i>	NA	<i>Geijera parviflora</i> , <i>Erythroxylum australe</i> , <i>Alphitonia excelsa</i> , <i>Jasminum didimium</i>	<i>Carissa ovata</i>	<i>Digitaria ramularis</i> , <i>Aristida caput-medusae</i> , <i>Aristida jerichoensis</i> , <i>Ancestrachne uncinulata</i> , <i>Waltheria indica</i> , <i>Solanum ellipticum</i> , <i>Abutilon sp.</i> , <i>Hibiscus sp.</i> , <i>Calotis dentex</i>	T1	11	45
145	NA	<i>Acacia catenulata</i>	<i>Acacia catenulata</i>	NA	<i>Acacia catenulata</i> , <i>Erythroxylum australe</i>	NA	<i>Aristida caput-medusae</i> , <i>Sida fibulifira</i> , <i>Hibiscus sp.</i> , <i>Waltheria indica</i> , <i>Dysphania valida</i> ,	T1	9	50
146	<i>Eucalyptus populnea</i>	<i>Acacia harpophylla</i>	NA	NA	<i>Eremophila mitchellii</i> , <i>Alectryon diverifolius</i> , <i>Erythroxylum australe</i>	NA	<i>Cenchrus ciliaris</i> , <i>Hetropogon contortus</i> , <i>Themeda triandra</i> , <i>Digitaria brownii</i>	T1	8	20
147	NA	<i>Acacia harpophylla</i>	NA	NA	<i>Acacia harpophylla</i>	NA	<i>Cenchrus ciliaris</i>	T1	6	20
148	NA	<i>Acacia harpophylla</i>	NA	NA	<i>Acacia harpophylla</i>	NA	<i>Cenchrus ciliaris</i>	T1	5	20
149	NA	<i>Corymbia clarksoniana</i> , <i>Eucalyptus populnea</i>	NA	NA	<i>Corymbia clarksoniana</i>	NA	<i>Cenchrus ciliaris</i>	T1	8	10
150	NA	<i>Acacia harpophylla</i>	NA	NA	<i>Geijera parviflora</i> , <i>Santalum lanceolatum</i>	NA	<i>Megathyrsus maximus</i> , <i>Cenchrus ciliaris</i> , <i>Echinocloa colona</i>	T1	14	30

F.2 Quaternary assessments - part two of form

Site	Structure type cover	Verified RE condition	Verified RE code	Comments
1	Sparse (10-30%)	REM	11.5.3	
3	Sparse (10-30%)	REM	11.3.25	
4	Very sparse (<10%)	REM	11.5.3	
5	Very sparse (<10%)	REM	11.5.9	Uncleared naturally sparse eucalyptus community
6	Sparse (10-30%)	RGW	11.9.5	Old advanced regrowth
7	Very sparse (<10%)	RGW	11.5.3	
8	Sparse (10-30%)	REM	11.4.8	
9	Sparse (10-30%)	NR		No canopy trees
10	Very sparse (<10%)	REM	11.5.3	Probably landzone 5 rather than 3. Difficult to tell where the old alluvium would be with the levy bank now stopping flow. Soils are deeply weathered red sands.
11	Very sparse (<10%)	RGW	11.5.9a	
12	Sparse (10-30%)	REM	11.5.9/11.4.8	Southern edge is 11.5.9. Northern edge is 11.4.8. Mixed up community, probably once was ecotone.
13	Very sparse (<10%)	RGW	11.3.2/11.3.25	Mixed up sparse patch
14	Sparse (10-30%)	REM	11.3.1	
15	Sparse (10-30%)	RGW	11.3.2	Very dense understory, mostly old regrowth, patchy
16	Sparse (10-30%)	REM	11.5.9a	

Site	Structure type cover	Verified RE condition	Verified RE code	Comments
17	Sparse (10-30%)	RGW	11.4.9	
19	Sparse (10-30%)	REM	11.3.2/11.3.1	Mixed community, small patch partly non remnant
20	Very sparse (<10%)	NR	NA	
21	Very sparse (<10%)	REM	11.5.9a	
22	Very sparse (<10%)	REM	11.5.9a	
23	Very sparse (<10%)	REM	11.5.9	
24	Sparse (10-30%)	REM	11.5.9a	
25	Sparse (10-30%)	REM	11.5.3	
26	Very sparse (<10%)	NR	NA	
27	Sparse (10-30%)	REM	11.7.2	
28	Sparse (10-30%)	REM	11.5.9a	
29	Sparse (10-30%)	REM	11.5.3	
31	Sparse (10-30%)	REM	11.5.9a	

Site	Structure type cover	Verified RE condition	Verified RE code	Comments
32	Sparse (10-30%)	REM	11.5.3	
33	Sparse (10-30%)	REM	11.5.3	
34	Sparse (10-30%)	REM	11.5.9	
35	Sparse (10-30%)	REM	11.7.2	
36	Sparse (10-30%)	REM	11.7.2	
38	Sparse (10-30%)	REM	11.7.2	
39	Sparse (10-30%)	REM	11.5.9a	
40	Sparse (10-30%)	REM	11.3.2	Mixed community with Brigalow areas 11.4.9 enclosed
42	Sparse (10-30%)	RGW	11.4.8	
43	Mid-dense (30-70%)	REM	11.3.1	TEC unlikely due to predominantly Cenchrus ciliaris in ground layer
44	Sparse (10-30%)	REM	11.7.2	
45	Mid-dense (30-70%)	RGW	11.7.1	Not TEC - regrowth on non-TEC RE
46	Sparse (10-30%)	REM	11.7.2	
47	Mid-dense (30-70%)	RGW	11.7.2	

Site	Structure type cover	Verified RE condition	Verified RE code	Comments
48	Sparse (10-30%)	REM	11.7.1	
49	Sparse (10-30%)	REM	11.7.1	
50	Mid-dense (30-70%)	REM	11.7.2	
51	Sparse (10-30%)	REM	11.5.3	
52	Sparse (10-30%)	NR	NA	
53	Mid-dense (30-70%)	RGW	11.7.2	
54	Mid-dense (30-70%)	RGW	11.7.2	
55	Sparse (10-30%)	REM	11.7.2	Cleared in patches
56	Sparse (10-30%)	REM	11.3.2	11.3.2 is the dominant RE on alluvial soils however the watercourse is bounded on the west by clay soils where the vegetation is consistent with 11.4.9
57	Sparse (10-30%)	REM	11.5.3	
58	Mid-dense (30-70%)	REM	11.7.2	
59	Sparse (10-30%)	REM	11.5.3	
60	Very sparse (<10%)	REM	11.5.3	Burned and not recovered
61	Very sparse (<10%)	REM	11.7.4	Soils are red pebble and consolidated ironstone deeply weathered. May be considered LZ 5 with conglomerates or LZ 7 weathered sandstone laterite. <i>Acacia sparsiflora</i> is in the sub canopy but species does not appear in Collector lists.
62	Sparse (10-30%)	RGW	11.5.9a	

Site	Structure type cover	Verified RE condition	Verified RE code	Comments
63	Sparse (10-30%)	REM	11.7.2	Possibly an ecotone between 11.7.2 and 11.5.3 to south
64	Sparse (10-30%)	RGW	11.5.9a	
65	Sparse (10-30%)	REM	11.3.2	
66	Sparse (10-30%)	REM	11.7.2	
67	Sparse (10-30%)	REM	11.7.2	
68	Sparse (10-30%)	REM	11.8.5	
69	Sparse (10-30%)	REM	11.4.9	
70	Mid-dense (30-70%)	REM	11.7.2	
71	Sparse (10-30%)	REM	11.7.2	
72	Dense/Closed (70-100%)	REM	11.8.14	Bluegrass Grassland
73	Mid-dense (30-70%)	REM	11.8.8	Natural grassland black cracking on clays
74	Mid-dense (30-70%)	RGW	11.5.9	Condition varies
75	Mid-dense (30-70%)	REM	11.7.1/ 11.7.2 50/50	Brigalow in Creek Lancewood and Dawson Gum on slopes
76	Mid-dense (30-70%)	REM	11.7.2	
77	Mid-dense (30-70%)	REM	11.3.25	Riparian vegetation
78	Dense/Closed (70-100%)	NR	non-rem	Derived native grassland on brown clay loam
79	Mid-dense (30-70%)	RGW	11.4.9	Regrowth Brigalow not TEC

Site	Structure type cover	Verified RE condition	Verified RE code	Comments
80	Mid-dense (30-70%)	RGW	11.4.9	1m high cleared Brigalow regrowth
81	Dense/Closed (70-100%)	NR	11.4.9	1m high Brigalow with Gilgai wetlands
82	Mid-dense (30-70%)	RGW	11.5.3/11.7.2 80/20	Mixed vegetation communities (80% 11.5.3 - 20% 11.7.2))
83	Mid-dense (30-70%)	RGW	11.7.2	Previously cleared. Course woody debris present.
84	Mid-dense (30-70%)	RGW	11.4.8a	Less than 15 years old not TEC
85	Sparse (10-30%)	REM	11.5.9	Grassy woodland thinned
86	Mid-dense (30-70%)	RGW	11.7.2	Partially cleared
87	Mid-dense (30-70%)	REM	11.5.10	<i>Melaleuca tamariscina</i> shrubland low woodland
88	Mid-dense (30-70%)	RGW	11.7.2	
89	Mid-dense (30-70%)	REM	11.7.2	
90	Mid-dense (30-70%)	REM	11.7.2	
91	Dense/Closed (70-100%)	RGW	11.7.1x1	Small vine thicket patch
92	Mid-dense (30-70%)	RGW	11.5.3	
93	Mid-dense (30-70%)	REM	11.7.2	
94	Mid-dense (30-70%)	RGW	11.5.3/11.7.2 70/30	
95	Sparse (10-30%)	REM	11.5.9	Degraded by past thinning
96	Mid-dense (30-70%)	RGW	11.5.10	

Site	Structure type cover	Verified RE condition	Verified RE code	Comments
97	Mid-dense (30-70%)	RGW	11.5.3	Soil pink Sandy loam
98	Mid-dense (30-70%)	RGW	11.5.16	Does not meet TEC criteria
99	Sparse (10-30%)	RGW	11.5.3	Partially cleared
100	Mid-dense (30-70%)	REM	11.7.2	
101	Mid-dense (30-70%)	REM	11.7.2	
102	Dense/Closed (70-100%)	REM	11.7.1x1	Does not meet SEVT TEC
103	Sparse (10-30%)	REM	11.5.9	
104	Sparse (10-30%)	REM	11.5.3	
105	Sparse (10-30%)	RGW	11.7.2	
106	Mid-dense (30-70%)	RGW	11.5.16	Brigalow Patch on Sandy plain
107	Mid-dense (30-70%)	REM	11.7.2	Vegetation thinned
108	Sparse (10-30%)	RGW	11.4.8	Brigalow thinned subdominant not TEC
109	Mid-dense (30-70%)	REM	11.3.1	Groundlayer consisting of 90% exotic species exceeding TEC thresholds
110	Mid-dense (30-70%)	REM	11.7.2	Red soil rise with laterite underlying
111	Mid-dense (30-70%)	REM	11.3.1/ 11.3.25 90/10	Brigalow and <i>E. populnea</i> on other parts of creek nearby. Groundlayer >90% exotic exceeding TEC thresholds
112	Mid-dense (30-70%)	RGW	11.5.3	young regrowth
113	Mid-dense (30-70%)	REM	11.4.8	Thinned Brigalow community. Groundlayer dominated by <i>Cenchrus ciliaris</i> exceeding TEC thresholds

Site	Structure type cover	Verified RE condition	Verified RE code	Comments
114	Mid-dense (30-70%)	RGW	11.5.3	
115	Mid-dense (30-70%)	REM	11.4.9/11.4.3.a	Significant large wetland flooded forest
116	Mid-dense (30-70%)	REM	11.4.8	Brigalow thinned does not meet TEC thresholds
117	Sparse (10-30%)	REM	11.3.25	Narrow riparian strip
118	Mid-dense (30-70%)	RGW	11.5.3	
119	Mid-dense (30-70%)	REM	11.3.25 /11.3.1/ 1.3.2	Mixed community
120	Sparse (10-30%)	REM	11.3.27d	Vegetation surrounding billabong
121	Mid-dense (30-70%)	REM	11.5.9a	Shrubland Patch
122	Mid-dense (30-70%)	REM	11.5.9a	Community on sandy plain
123	Sparse (10-30%)	RGW	11.5.9	Canopy heavily thinned with Acacias dead.
124	Mid-dense (30-70%)	REM	11.7.2	Vegetation thinned but high diversity of native groundcover persisting.
125	Sparse (10-30%)	RGW	11.5.9a	Vegetation thinned.
126	Sparse (10-30%)	RGW	11.5.9	Less <i>Eucalyptus melanophloia</i> than adjacent 11.5.9a
127	Mid-dense (30-70%)	REM	11.3.4/11.3.2/11.3.1/11.3.25	Mixed riparian woodland
128	Sparse (10-30%)	REM	11.3.25	
129	Very sparse (<10%)	REM	11.8.5	
130	Sparse (10-30%)	REM	11.8.5	

Site	Structure type cover	Verified RE condition	Verified RE code	Comments
131	Mid-dense (30-70%)	REM	11.8.5	Basalt boulders
132	Sparse (10-30%)	REM	11.8.5	
133	Mid-dense (30-70%)	REM	11.7.1	Laterite Conglomerate Boulders
134	Mid-dense (30-70%)	REM	11.7.1x1	SEVT patch on laterite scarp
135	Mid-dense (30-70%)	REM	11.7.2	Lateritic
136	Sparse (10-30%)	RGW	11.5.9a	Some SEVT patches
137	Sparse (10-30%)	REM	11.3.27f	
138	Sparse (10-30%)	REM	11.7.1	
139	Sparse (10-30%)	REM	11.7.1	
140	Sparse (10-30%)	REM	11.7.2	
141				
142	Sparse (10-30%)	REM	11.5.9	
143	Sparse (10-30%)	RGW	11.3.1 or 11.4.9	
144	Sparse (10-30%)	REM	11.7.4	
145	Sparse (10-30%)	REM	11.7.2	
146	Sparse (10-30%)	RGW	11.4.7	
147	Sparse (10-30%)	RGW	11.4.9	

Site	Structure type cover	Verified RE condition	Verified RE code	Comments
148	Sparse (10-30%)	RGW	11.4.8	
149	Very sparse (<10%)	RGW	11.5.9	
150	Sparse (10-30%)	RGW	11.4.9	

F.3 Tertiary assessments - part one of form

Site	Emergent species dominance	Emergent species subdominance	Emergent species codominant	Emergent species associations	T1 species dominance	T1 species subdominance	T1 species codominance	T1 Species associations	T1 height average	T1 cover
1	NA	NA	NA	NA	<i>Corymbia clarksoniana</i>	NA	NA	NA	18	5
2	NA	NA	NA	NA	<i>Eucalyptus populnea</i>	<i>Acacia excelsa</i>	NA	<i>Geijera parviflora</i>	17	30
3	NA	NA	NA	NA	<i>Eucalyptus cambageana</i>	NA	NA	NA	19	30
4	NA	NA	NA	NA	<i>Eucalyptus cambageana</i>	NA	NA	NA	19	30
5	<i>Casuarina cristata</i>	NA	NA	NA	<i>Melaleuca bracteata</i>	NA	NA	NA	7	65
6	NA	NA	NA	NA	<i>Acacia catenulata</i>	<i>Brachychiton rupestris</i>	<i>Corymbia clarksoniana</i>	<i>Brachychiton australis</i>	10	45
7	NA	NA	NA	NA	<i>Eucalyptus populnea</i>	NA	NA	<i>Eucalyptus melanophloia</i>	18	45
8	NA	NA	NA	NA	<i>Eucalyptus thozetiana</i>	NA	NA	NA	19	25
9	NA	NA	NA	NA	<i>Acacia harpophylla</i>	NA	NA	<i>Eucalyptus populnea</i> , <i>Brachychiton rupestris</i>	14	45

F.4 Tertiary assessments - part two of form

Site	T2 species dominance	T2 species subdominance	T2 species codominance	T2 species associations	T2 height average	T2 cover	T3 species dominance	T3 species subdominance	T3 species codominance	T3 species associations
1	NA	NA	NA	NA	0	0	NA	NA	NA	NA
2	<i>Eucalyptus populnea</i>	NA	NA	<i>Allocasuarina leuhmannii</i> , <i>Flindersia dissosperma</i> , <i>Eremophila mitchellii</i> , <i>Cassia brewsteri</i>	8	10	NA	NA	NA	NA
3	<i>Acacia harpophylla</i>	NA	NA	<i>Eucalyptus cambageana</i>	11	40	NA	NA	NA	NA
4	<i>Acacia harpophylla</i>	NA	NA	<i>Eucalyptus cambageana</i>	12	40	NA	NA	NA	NA
5	NA	NA	NA	NA	0	0	NA	NA	NA	NA
6	<i>Acacia catenulata</i>	NA	NA	NA	6	5	NA	NA	NA	NA
7	NA	NA	NA	<i>Terminalia oblongata</i> , <i>Acacia excelsa</i> , <i>Alectryon oleifolius</i> , <i>Cassia brewsteri</i> , <i>Archidendropsis basaltica</i> ,	8	30	NA	NA	NA	NA
8	<i>Acacia harpophylla</i>	NA	NA	NA	11	25	NA	NA	NA	NA
9										

F.5 Tertiary assessments - part three of form

Site	T3 height average	T3 cover	S1 species dominance	S1 species subdominance	S1 species codominance	S1 species associations	T2 height average	T2 cover	S2 species dominance	S2 species subdominance
1	0	0	<i>Acacia leiocalyx</i>	NA	NA	<i>Alphitonia excelsa</i> , <i>Petalostigma pubescens</i>	2.5	80	NA	NA
2	0	0	<i>Eremophila mitchellii</i> , <i>Psyrax oleifolius</i> , <i>Terminalia oblongata</i> , <i>Acacia leiocalyx</i> , <i>Grevillea striata</i> , <i>Geijera parviflora</i>	NA	NA	NA	2.5	25	NA	NA
3	0	0	<i>Eremophila mitchellii</i>	NA	NA	<i>Alectryon diversifolius</i> , <i>Psyrax oleifolius</i> , <i>Terminalia oblongata</i> , <i>Flindersia dissosperma</i> , <i>Santalum lanceolatum</i> , <i>Croton phebalioides</i>	3	25	<i>Carissa ovata</i>	NA
4	0	0	<i>Eremophila mitchellii</i>	NA	NA	<i>Owenia acidula</i> , <i>Psyrax odorata</i> subspecies <i>buxifolia</i>	3	25	<i>Carissa ovata</i>	NA
5	0	0	NA	NA	NA	NA	0	0	NA	NA
6	0	0	<i>Acacia catenulata</i>	<i>Everistia vacciniifolia</i>	NA	<i>Eremophila latrobei</i> subspecies <i>glabra</i> , <i>Sida sp.</i>	1.5	15	NA	NA
7	0	0	NA	NA	NA	<i>Geijera parviflora</i> , <i>Lysiphyllum carronii</i> , <i>Acacia excelsa</i> , <i>Cassia brewsteri</i> , <i>Alectryon diversifolius</i> , <i>Carissa ovata</i>	1.5	10	NA	NA

Site	T3 height average	T3 cover	S1 species dominance	S1 species subdominance	S1 species codominance	S1 species associations	T2 height average	T2 cover	S2 species dominance	S2 species subdominance
8	0	0	<i>Eremophila mitchellii</i>	NA	NA	<i>Geijera parviflora</i> , <i>Alectryon diversifolius</i> , <i>Harissia martinii</i>	3	40	NA	NA
9	0	0	<i>Geijera parviflora</i>	NA	NA	<i>Eremophila mitchellii</i> , <i>Acacia harpophylla</i>	3	30	<i>Carissa ovata</i>	NA

F.6 Tertiary assessments - part four of form

Site	S2 species codominance	S2 species associations	S2 height average	S2 cover	G species dominance	G species subdominance	G species codominance	G species associations	G height average	G cover
1	NA	NA	0	0	<i>Eriachne mucronata</i>	NA	NA	<i>Cenchrus ciliaris</i> , <i>Triodia pungens</i> , <i>Waltheria indica</i>	0.2	5
2	NA	NA	0	0	<i>Enteropogon acicularis</i>	NA	NA	<i>Aristida jerichoensis</i> , <i>Aristida queenslandicus</i> , <i>Heteropogon contortus</i> , <i>Stylosanthes scabra</i> ,	0.2	25
3	NA	<i>Capparis loranthifolia</i> , <i>Owenia acidula</i> , <i>Clematocissus opaca</i> , <i>Enchylaena tomentosa</i> , <i>Brachychiton rupestris</i>	1	25	NA	NA	NA	<i>Aristida queenslandica</i> , <i>Sporobolus actinocladus</i> , <i>Sporobolus carolli</i> , <i>Enteropogon acicularis</i> , <i>Paspalidium sp.</i>	0.6	15
4	NA	NA	1	25	<i>Paspalidium sp.</i>	NA	NA	<i>Ancistrachne uncinulata</i> , <i>Cenchrus ciliaris</i>	0.6	20
5	NA	NA	0	0	<i>Walwhalleya proluta</i>	NA	NA	<i>Diplachne fusca</i> <i>subspecies fusca</i>	0.8	5
6	NA	NA	0	0	<i>Aristida caput-medusae</i>	NA	NA	NA	0.4	60
7	NA	NA	0	0	<i>Cenchrus ciliaris</i>	NA	NA	NA	0.2	50
8	NA	NA	0	0	<i>Paspalidium caespitosum</i>	NA	NA	<i>Aristida sp.</i> , <i>Enchylaena tomentosa</i> , <i>Enteropogon acicularis</i>	0.2	30
9	NA	<i>Acacia harpophylla</i> , <i>Capparis lasiantha</i>	1	5	<i>Enteropogon acicularis</i>	NA	NA	<i>Paspalidium sp.</i> , <i>Cyperus gracilis</i> , <i>Cenchrus ciliaris</i>	0.2	20

F.7 Tertiary assessments - part five of form

Site	Structure	RE area	RE condition	GTRE	Landform	Geology	Disturbance	Level of disturbance	Comments
1	Very sparse (<10%)	>50 ha	REM	11.5.3	Level plain	Unconsolidated material (alluvial/old alluvial plains)	Fire	High	Old fire resulting in dense Acacia shrub canopy
2	Sparse (10-30%)	5-20	REM	11.5.3/11.5.16	Level plain	Unconsolidated material (alluvial/old alluvial plains)	Fire	High	
3	Sparse (10-30%)	>50 ha	REM	11.4.8	Gently undulating plain	Sedimentary rocks (fine grained)	Grazing	High	Area mapped 11.5.3/11.4.8 on north west side is 11.4.8
4	Sparse (10-30%)	1-5 ha	NR	NA	Gently undulating plain	Sedimentary rocks (fine grained)	Grazing	High	Narrow sliver approximately 60 metres wide - possible drainage
5	Mid-dense (30-70%)	5-20	REM	11.4.8	Gently undulating plain	Sedimentary rocks (fine grained)	Grazing	High	Fringed by 11.4.8
6	Sparse (10-30%)	>50 ha	REM	11.9.5a	Undulating low hills	Consolidated weathered material (laterite)	Weeds	Low	The lower slopes of this jump up on the northern side are 11.7.1 (<i>Eucalyptus thozetiana</i> and Brigalow)
7	Sparse (10-30%)	5-20	REM	11.3.2/11.3.1	Undulating plain	Unconsolidated material (alluvial/old alluvial plains)	Grazing	Moderate	
8	Sparse (10-30%)	20-50	REM	11.4.8/11.4.9a	Undulating rises	Consolidated weathered material (laterite)	Weeds	Low	
9	Sparse (10-30%)	20-50	REM	11.3.1	Undulating plain	Sedimentary rocks (fine grained)	Grazing	High	Brigalow TEC

F.8 BioCondition assessments – part one of form

Site	Validated RE condition	Validated RE code	Large trees score (/15)	Tree height score (/5)	Recruitment of canopy species score (/5)	Tree canopy cover (%) score (/5)	Shrub layer cover (%) score (/5)	Coarse wood debris score (/5)	Native species richness (%) for four lifeforms score (/5)	Non-native plant cover (%) score (10)	Native perennial grass cover (%) score (/5)
1	Remnant	11.4.8	5	5	5	5	3	5	0	10	3
2	Remnant	11.4.8	5	5	5	5	3	5	0	10	3
3	Remnant	11.5.9a	5	5	5	5	5	2	0	10	1
4	Remnant	11.7.1	15	5	3	5	3	5	0	10	1
5	Remnant	11.3.2	15	5	5	5	3	2	0	0	0
6	Remnant	11.7.2	10	5	3	5	5	5	0	5	3
7	Remnant	11.7.2	5	5	5	5	3	5	0	0	0
8	Remnant	11.3.2	15	5	0	5	3	5	0	0	0
9	Remnant	11.7.1	10	5	5	2	3	2	0	10	5
10	Remnant	11.7.2	5	5	5	3	5	2	0	10	1
11	Remnant	11.7.2	15	5	3	5	3	5	0	10	1

F.9 BioCondition assessment – part two of form

Site	Litter cover (%) score (/5)	Patch size score (/10)	Connectivity score (/5)	Context score (/5)	Ecological corridors score (/20)	Site condition score (%)	Comments
1	3	5	0	4	0	44	Dawson gum and Brigalow woodland on Cainozoic clays
2	5	5	0	2	0	44	Dawson gum and Brigalow woodland on Cainozoic clays
3	3	10	0	5	0	43	Sparse <i>Corymbia clarksoniana</i> with acacia shrub layer on sand plain
4	3	2	0	2	0	45	Lapunya woodland on lateritic gravels and rocks
5	5	5	0	2	6	46	Silver-leaved ironbark woodland on sandy alluvium
6	3	7	4	4	0	49	Bendee woodland on lateritic duricrust
7	3	7	0	4	0	38	Bendee woodland on lateritic duricrust
8	3	5	0	2	6	42	Silver-leaved ironbark woodland on sandy clay alluvium
9	3	10	2	4	0	48	Lapunya woodland on lateritic gravels and rocks
10	3	10	0	0	0	43	Red Lancewood woodland on lateritic duricrust
11	3	2	0	0	0	46	Bendee woodland on deeply weathered profile

Appendix G

TEC assessment results

G.1 Poplar Box TEC assessment results

Site Information			EPBC TEC Key Diagnostic Criteria		EPBC TEC Condition Thresholds for Class B and A2/A3 quality (≥ 5 ha) and A1 (≥ 1 ha)	
Site	Patch size (ha)	Ground-truthed RE	Is RE associated with Poplar Box TEC (based on landform and species composition)	<i>Eucalyptus populnea</i> is the dominant canopy species	≥ 30 (A1, A2) or ≥ 20 (A3, B) native plant species per ha in ground layer	≥ 90% (A1), ≥ 70% (A2), ≥ 50% (B) cover of native spp. in ground layer, or ≥ 10 large trees (≥ 30 cm) per ha (A3).
1	18.6	11.3.2	Yes	Yes	No	No
2	4.8	11.3.2	Yes	Yes	No	No
3	44.9	11.3.2	Yes	Yes	No	No
4	9.4	11.3.2	Yes	Yes	No	No
5	17.5	11.3.2	Yes	Yes	No	No
6	11.3	11.3.2	Yes	Yes	No	No
7	4.0	11.3.1/11.3.2	Yes	No	No	No
8	2.2	11.3.2	Yes	Yes	No	No
9	2.2	11.3.1/11.3.2	Yes	No	No	No
10	3.9	11.3.2/11.3.25	Yes	No	No	No
11	3.4	11.3.2	Yes	Yes	No	No
12	5.6	11.3.2	Yes	Yes	No	No
13	3.5	11.3.2	Yes	Yes	No	No

G.2 Grasslands TEC assessment results

Site Information			EPBC TEC Key Diagnostic Criteria		EPBC TEC Condition Thresholds for Good Quality				
Site	Patch size (ha)	Ground-truthed RE	Tree canopy absent or sparse (>10% projective crown cover)	Ground layer dominated by perennial native grasses with 3 indicator species	Patch size at least 5 ha	At least 3 native perennial grass species	At least 200 native grass tussocks	Total projected canopy cover of shrubs is greater than 50%	Introduced species is greater than 30% of total plant cover
1	1.8	11.8.11	Absent	Yes	No	Yes	No	No	Yes

G.3 SEVT TEC assessment results

Site Information			EPBC TEC Key Diagnostic Criteria	EPBC TEC Condition Thresholds
Site	Patch size (ha)	Ground-truthed RE	SEVT regional ecosystem	Vegetation meets remnant criteria
1	3.26	11.5.15	Yes	Yes*
2	0.59	11.7.1x1	Yes	Yes*
3	2.73	11.8.13	Yes	Yes*
4	1.48	11.8.13	Yes	Yes*

* according to the *Vegetation Management Act 1999* definition

G.4 Brigalow TEC assessment results

Site information		EPBC TEC Key Diagnostic Criteria		EPBC TEC Condition Thresholds		
Site ID No	Ground-truthed RE	Is RE associated with Brigalow TEC (based on landform and species composition)	<i>Acacia harpophylla</i> is the dominant or codominant canopy species	Species composition and structural elements are broadly typical of one of the listed Brigalow REs	Patch size is greater than 0.5 ha	Exotic perennial cover is less than 50%
1	11.4.8	Yes	Yes	Yes	Yes	Yes
2	11.4.8	Yes	Yes	Yes	Yes	Yes
3	11.4.8	No	No	No	No	No
4	11.3.1	Yes	Yes	Yes	Yes	Yes
5	11.4.9	No	No	No	No	No
6	11.9.5	Yes	Yes	Yes	Yes	Yes
7	11.4.8	No	No	No	No	No
8	11.3.1	No	No	No	No	No – Buffel Grass and Guinea Grass dominant 90% cover
9	11.4.7	No	No	No	No	No - Guinea Grass dominant 80% cover
10	11.4.7	Yes	Yes	Yes	Yes	Yes
11	11.4.8	Yes	Yes	Yes	Yes	No – Buffel Grass and Guinea Grass dominant with 70% cover
12	11.4.9	No	No	No	No	No - Buffel Grass dominant 70% cover
13	11.4.9	No	No	No	No	No - Buffel Grass and Guinea Grass dominant 80% cover
14	11.4.9	No	No	No	No	No
15	11.3.1	No	No	No	No	No - Buffel Grass and Guinea Grass dominant 60% cover

16	11.4.9	No	No	No	No	No - Buffel Grass dominant 90% cover
17	11.4.9	No	No	No	No	No - Buffel Grass dominant 90% cover
18	11.4.9	Yes	Yes	Yes	Yes	No – Buffel Grass dominant with 70% cover
19	11.9.5	Yes	Yes	Yes	Yes	Yes

Appendix H

Habitat quality assessments

Site: 46 (11.4.8) – Endangered		Assessor – Bruce McLennan
Property: Togara	Date: 08/04/2019	
Bioregion: Brigalow Belt	Sub-region: Isaac – Comet Downs	
State mapped RE: 11.4.8	Observed RE: 11.4.8	
Transect Co-ordinates (GDA 94 Datum)		
0 m (start of transect):	-24.036250; 148.711861	
50 m (centre point):	-24.036638; 148.712021	
Elevation (mAHD):	243	
General Site Description		
Landform	Undulating plain	
Soil	Clay	
Dominant vegetation observed	Dawson gum and Brigalow woodland on Cainozoic clays	
100 x 50 m area (0.5 ha)		
Dominant canopy or EDL species with evidence of recruitment (%):	100	
Eucalypt large tree DBH (cm): (from benchmark document)	38	
Number of large Eucalypt trees:	7	
Non-Eucalypt large tree DBH (cm): (from benchmark document)	22	
Number of large Non-Eucalypt trees:	5	
Total large trees/ha:	24	
Tree canopy (EDL) height (m):	16	
Sub-canopy height (m):	9	
Emergent height (m):	na	
Total tree species richness: <i>Acacia harpophylla, Eucalyptus cambageana</i>	2	
50 x 10 m area		
Shrub spp. richness: <i>Eremophila mitchellii, Geijera parviflora, Carissa ovata, Capparis lasiantha, Capparis loranthifolia, Jasminum didymum subsp. lineare, Croton phebaloides, Alectryon diversifolius, Eremophila deserti, Citrus glauca, Abutilon sp.,</i>	11	
Grass spp. richness: <i>Paspalidium caespitosum, Aristida calycina, Aristida sp., Ancistrachne uncinulata, Paspalidium sp.,</i>	5	
Forb spp. richness: <i>Brunoniella australis, Boerhavia dominii, Einadia nutans subsp. linifolia, Hibiscus sturtii, Cyperus gracilis, Phyllanthus virgatus, Salsola australis, Portulaca oleracea, Cheilanthes sieberi, Nyssanthes sp., Sida sp., Rostellularia adscendens, Unident., Commelina lanceolata,</i>	14	
Other spp.: <i>Cynanchum viminale subsp. brunonianum, Parsonsia eucalyptophylla, Clematicissus opaca</i>	3	
Weed spp. and cover as % of area: <i>Cenchrus ciliaris, Opuntia tomentosa, Megathyrsus maximus</i>	3	

Plot attributes (actual)	Unit of measure	Measurement
Tree canopy cover (100 m canopy intercept)	% cover	43.3
Shrub canopy cover (100 m canopy intercept)	% cover	13.6
Native perennial grass cover (1 m x 1 m plots)	% cover	12.2
Litter cover (1 m x 1 m plots)	% cover	80
Coarse woody debris (from 50 m x 20 m plot)	m / ha	1300
Benchmark attributes (source DNRME)	Unit of measure	Measurement
Recruitment of woody perennial species in EDL	%	100
Native plant species richness		
Trees	no. species	3
Shrubs	no. species	10
Grasses	no. species	9
Forbs	no. species	7
Large eucalypts	no. / ha	28
Large non-eucalypts	no. / ha	42
Tree canopy median height	m	17
Tree canopy cover	%	40
Native shrub cover	%	5
Native perennial grass cover	%	20
Organic litter cover	%	37
Coarse woody debris	m / ha	813

Site assessment scoring sheet

Scoring sheet

Attribute	Wooded ecosystem Weighting	Score	Attribute	Wooded ecosystem Weighting	Score
Site - based			Landscape scale		
Recruitment of woody perennial species	5	5	Size of patch	10	5
Native plant species richness: Trees	5	3	Context	5	4
Native plant species richness: Shrubs	5	5	Connectivity	5	0
Native plant species richness: Grasses	5	3	Proximity to Ecological Corridors	6	0
Native plant species richness: Forbs	5	5	Total:	26	9
Tree canopy cover	5	5	Habitat:		
Tree canopy height	5	5	Threats	15	0
Shrub layer cover	5	3	Quality of foraging	10	0
Native perennial grass cover	5	3	Quality of shelter	10	0
Large trees	15	5	Mobility	10	0
Fallen woody material	5	5	Site location	5	0
Weed cover	10	10	Total	50	0
Litter cover	5	3	Site + landscape	106	69
Total	80	60	TOTAL SCORE (Site + landscape + habitat (where relevant))	156	69

Habitat quality score:

7

Site photos



Start point



Mid-point, facing north



Mid-point, facing east



Mid-point, facing south



Mid-point, facing west



Quadrat – 35 m



Quadrat – 45 m



Quadrat – 55 m



Quadrat – 65 m



Quadrat – 75 m

Site: 47 (11.4.8) – Endangered		Assessor – Bruce McLennan
Property: Togara	Date: 08/04/2019	
Bioregion: Brigalow Belt	Sub-region: Isaac – Comet Downs	
State mapped RE: 11.4.8	Observed RE: 11.4.8	
Transect Co-ordinates (GDA 94 Datum)		
0 m (start of transect):	-24.050016; 148.705536	
50 m (centre point):	-24.050455; 148.705429	
Elevation (mAHD):	235	
General Site Description		
Landform	Undulating plain	
Soil	Clay	
Dominant vegetation observed	Dawson gum and Brigalow woodland on Cainozoic clays	
100 x 50 m area (0.5 ha)		
Dominant canopy or EDL species with evidence of recruitment (%):	100	
Eucalypt large tree DBH (cm): (from benchmark document)	38	
Number of large Eucalypt trees:	4	
Non-Eucalypt large tree DBH (cm): (from benchmark document)	22	
Number of large Non-Eucalypt trees:	1	
Total large trees/ha:	10	
Tree canopy (EDL) height (m):	14	
Sub-canopy height (m):	7	
Emergent height (m):	na	
Total tree species richness: <i>Acacia harpophylla, Eucalyptus cambageana, Flindersia dissosperma</i>	3	
50 x 10 m area		
Shrub spp. richness: <i>Eremophila mitchellii, Geijera parviflora, Carissa ovata, Psydrax odorata, Jasminum didymum subsp. lineare, Enchylaena tomentosa</i>	6	
Grass spp. richness: <i>Paspalidium globoideum, Aristida calycina, Aristida jerichoensis, Eremochloa bimaculata, Paspalidium sp., Enteropogon acicularis</i>	6	
Forb spp. richness: <i>Murdannia graminea, Boerhavia dominii, Hibiscus sturtii, Cyperus gracilis, Phyllanthus virgatus, Fimbristylis dichotoma, Portulaca oleracea, Nyssanthes sp., Dipteracanthus australasicus, Portulaca australis</i>	10	
Other spp.: <i>Parsonsia eucalyptophylla,</i>	1	
Weed spp. and cover as % of area: <i>Cenchrus ciliaris, Megathyrsus maximus</i>	5	

Plot attributes (actual)	Unit of measure	Measurement
Tree canopy cover (100 m canopy intercept)	% cover	47.6
Shrub canopy cover (100 m canopy intercept)	% cover	1.8
Native perennial grass cover (1 m x 1 m plots)	% cover	11.8
Litter cover (1 m x 1 m plots)	% cover	50
Coarse woody debris (from 50 m x 20 m plot)	m / ha	1210
Benchmark attributes (source DNRME)	Unit of measure	Measurement
Recruitment of woody perennial species in EDL	%	100
Native plant species richness		
Trees	no. species	3
Shrubs	no. species	10
Grasses	no. species	9
Forbs	no. species	7
Large eucalypts	no. / ha	28
Large non-eucalypts	no. / ha	42
Tree canopy median height	m	17
Tree canopy cover	%	40
Native shrub cover	%	5
Native perennial grass cover	%	20
Organic litter cover	%	37
Coarse woody debris	m / ha	813

Site assessment scoring sheet

Scoring sheet

Attribute	Wooded ecosystem Weighting	Score	Attribute	Wooded ecosystem Weighting	Score
Site - based			Landscape scale		
Recruitment of woody perennial species	5	5	Size of patch	10	5
Native plant species richness: Trees	5	5	Context	5	2
Native plant species richness: Shrubs	5	3	Connectivity	5	0
Native plant species richness: Grasses	5	3	Proximity to Ecological Corridors	6	0
Native plant species richness: Forbs	5	5	Total:	26	7
Tree canopy cover	5	5	Habitat:		
Tree canopy height	5	5	Threats	15	0
Shrub layer cover	5	3	Quality of foraging	10	0
Native perennial grass cover	5	3	Quality of shelter	10	0
Large trees	15	5	Mobility	10	0
Fallen woody material	5	5	Site location	5	0
Weed cover	10	10	Total	50	0
Litter cover	5	5	Site + landscape	106	69
Total	80	62	TOTAL SCORE (Site + landscape + habitat (where relevant))	156	69

Habitat quality score:

7

Site photos



Start point



Mid-point, facing north



Mid-point, facing east



Mid-point, facing south



Mid-point, facing west



Quadrat – 35 m



Quadrat – 45 m



Quadrat – 55 m



Quadrat – 65 m



Quadrat – 75 m

Site: 48 (11.5.9) – Least concern		Assessor – Bruce McLennan
Property: Togara	Date: 08/04/2019	
Bioregion: Brigalow Belt	Sub-region: Isaac – Comet Downs	
State mapped RE: 11.5.3/11.4.8	Observed RE: 11.5.9	
Transect Co-ordinates (GDA 94 Datum)		
0 m (start of transect):	-24.019135; 148.668060	
50 m (centre point):	-24.019289; 148.668518	
Elevation (mAHD):	223	
General Site Description		
Landform	Undulating plain	
Soil	Weathered sands	
Dominant vegetation observed	Sparse <i>Corymbia clarksoniana</i> with acacia shrub layer on sand plain	
100 x 50 m area (0.5 ha)		
Dominant canopy or EDL species with evidence of recruitment (%):	100	
Eucalypt large tree DBH (cm): (from benchmark document)	41	
Number of large Eucalypt trees:	1	
Non-Eucalypt large tree DBH (cm): (from benchmark document)	21	
Number of large Non-Eucalypt trees:	0	
Total large trees/ha:	2	
Tree canopy (EDL) height (m):	13	
Sub-canopy height (m):	7	
Emergent height (m):	na	
Total tree species richness: <i>Corymbia clarksoniana</i> , <i>Alphitonia excelsa</i> , <i>Persoonia falcata</i> , <i>Brachychiton populneus</i> ,	4	
50 x 10 m area		
Shrub spp. richness: <i>Acacia cretata</i> , <i>Xanthorrhoea johnsonii</i> , <i>Petalostigma pubescens</i> ,	3	
Grass spp. richness: <i>Eriachne</i> sp., <i>Aristida</i> sp., <i>Aristida benthamii</i> , <i>Calyptochloa gracillima</i>	4	
Forb spp. richness: <i>Waltheria indica</i> , <i>Hibiscus sturtii</i>	2	
Other spp.: <i>Tinospora smilacina</i>	1	
Weed spp. and cover as % of area: <i>Cenchrus ciliaris</i> , <i>Malvastrum americanum</i> ,	5	

Plot attributes (actual)	Unit of measure	Measurement
Tree canopy cover (100 m canopy intercept)	% cover	20.8
Shrub canopy cover (100 m canopy intercept)	% cover	17
Native perennial grass cover (1 m x 1 m plots)	% cover	3.4
Litter cover (1 m x 1 m plots)	% cover	75.2
Coarse woody debris (from 50 m x 20 m plot)	m / ha	50
Benchmark attributes (source DNRME)	Unit of measure	Measurement
Recruitment of woody perennial species in EDL	%	100
Native plant species richness		
Trees	no. species	3
Shrubs	no. species	6
Grasses	no. species	9
Forbs	no. species	11
Large eucalypts	no. / ha	19
Large non-eucalypts	no. / ha	1
Tree canopy median height	m	17
Tree canopy cover	%	25
Native shrub cover	%	10
Native perennial grass cover	%	26
Organic litter cover	%	30
Coarse woody debris	m / ha	342

Site assessment scoring sheet

Scoring sheet					
Attribute	Wooded ecosystem Weighting	Score	Attribute	Wooded ecosystem Weighting	Score
Site - based			Landscape scale		
Recruitment of woody perennial species	5	5	Size of patch	10	10
Native plant species richness: Trees	5	5	Context	5	5
Native plant species richness: Shrubs	5	3	Connectivity	5	0
Native plant species richness: Grasses	5	3	Proximity to Ecological Corridors	6	0
Native plant species richness: Forbs	5	0	Total:	26	15
Tree canopy cover	5	5	Habitat:		
Tree canopy height	5	5	Threats	15	0
Shrub layer cover	5	5	Quality of foraging	10	0
Native perennial grass cover	5	1	Quality of shelter	10	0
Large trees	15	5	Mobility	10	0
Fallen woody material	5	2	Site location	5	0
Weed cover	10	10	Total	50	0
Litter cover	5	3	Site + landscape	106	67
Total	80	52	TOTAL SCORE (Site + landscape + habitat (where relevant))	156	67

Habitat quality score:

6

Site photos



Start point



Mid-point, facing north



Mid-point, facing east



Mid-point, facing south



Mid-point, facing west



Quadrat – 35 m



Quadrat – 45 m



Quadrat – 55 m



Quadrat – 65 m



Quadrat – 75 m

Site: 49 (11.7.1) – least concern		Assessor – Bruce McLennan	
Property: Ganadero		Date: 08/04/2019	
Bioregion: Brigalow Belt		Sub-region: Isaac – Comet Downs	
State mapped RE: Non-remnant		Observed RE: 11.7.1	
Transect Co-ordinates (GDA 94 Datum)			
0 m (start of transect):		-24.077267; 148.799026	
50 m (centre point):		-24.077248; 148.798645	
Elevation (mAHD):		252	
General Site Description			
Landform		Rises	
Soil		Clay	
Dominant vegetation observed		Lapunya woodland on lateritic gravels and rocks	
100 x 50 m area (0.5 ha)			
Dominant canopy or EDL species with evidence of recruitment (%):		50	
Eucalypt large tree DBH (cm): (from benchmark document)		40	
Number of large Eucalypt trees:		23	
Non-Eucalypt large tree DBH (cm): (from benchmark document)		24	
Number of large Non-Eucalypt trees:		0	
Total large trees/ha:		46	
Tree canopy (EDL) height (m):		23	
Sub-canopy height (m):		10	
Emergent height (m):		na	
Total tree species richness: <i>Eucalyptus thozetiana, Eucalyptus cambageana</i>		3	
50 x 10 m area			
Shrub spp. richness: <i>Eremophila mitchellii, Geijera parviflora, Carissa ovata, Capparis lasiantha, Erythroxylum australe, Hovea longipes, Abutilon otocarpum, Jasminum didymum subsp. lineare, Capparis canescens, Alectryon diversifolius, Cassia brewsteri, Everistia vacciniifolia, Psydrax odorata subsp. buxifolia, Indigofera brevidens</i>		14	
Grass spp. richness: <i>Paspalidium sp., Enteropogon acicularis, Aristida sp., Ancistrachne uncinulata</i>		4	
Forb spp. richness: <i>Brunoniella australis, Boerhavia dominii, Einadia nutans subsp. linifolia, Hibiscus sturtii, Sclerolaena sp., Dipteracanthus sp., Evolvulus alsinoides, Desmodium sp., Sida corrugata</i>		9	
Other spp.: <i>Parsonsia sp., Marsdenia viridiflora, Clematicissus opaca</i>		3	
Weed spp. and cover as % of area: <i>Cenchrus ciliaris, Harrisia martinii</i>		5	

Plot attributes (actual)	Unit of measure	Measurement
Tree canopy cover (100 m canopy intercept)	% cover	32.8
Shrub canopy cover (100 m canopy intercept)	% cover	32.9
Native perennial grass cover (1 m x 1 m plots)	% cover	6.6
Litter cover (1 m x 1 m plots)	% cover	56.2
Coarse woody debris (from 50 m x 20 m plot)	m / ha	800
Benchmark attributes (source DNRME)	Unit of measure	Measurement
Recruitment of woody perennial species in EDL	%	100
Native plant species richness		
Trees	no. species	4
Shrubs	no. species	8
Grasses	no. species	8
Forbs	no. species	9
Large eucalypts	no. / ha	18
Large non-eucalypts	no. / ha	2
Tree canopy median height	m	20
Tree canopy cover	%	27
Native shrub cover	%	10
Native perennial grass cover	%	20
Organic litter cover	%	20
Coarse woody debris	m / ha	424

Site assessment scoring sheet

Scoring sheet

Attribute	Wooded ecosystem Weighting	Score	Attribute	Wooded ecosystem Weighting	Score
Site - based			Landscape scale		
Recruitment of woody perennial species	5	3	Size of patch	10	2
Native plant species richness: Trees	5	3	Context	5	2
Native plant species richness: Shrubs	5	5	Connectivity	5	0
Native plant species richness: Grasses	5	3	Proximity to Ecological Corridors	6	0
Native plant species richness: Forbs	5	5	Total:	26	4
Tree canopy cover	5	5	Habitat:		
Tree canopy height	5	5	Threats	15	0
Shrub layer cover	5	3	Quality of foraging	10	0
Native perennial grass cover	5	1	Quality of shelter	10	0
Large trees	15	15	Mobility	10	0
Fallen woody material	5	5	Site location	5	0
Weed cover	10	10	Total	50	0
Litter cover	5	3	Site + landscape	106	70
Total	80	66	TOTAL SCORE (Site + landscape + habitat (where relevant))	156	70

Habitat quality score:

7

Site photos



Start point



Mid-point, facing north



Mid-point, facing east



Mid-point, facing south



Mid-point, facing west



Quadrat – 35 m



Quadrat – 45 m



Quadrat – 55 m



Quadrat – 65 m



Quadrat – 75 m

Site: 53 (11.3.2) – of concern		Assessor – Bruce McLennan	
Property: Ganadero		Date: 09/04/2019	
Bioregion: Brigalow Belt		Sub-region: Isaac – Comet Downs	
State mapped RE: Non-remnant		Observed RE: 11.3.2	
Transect Co-ordinates (GDA 94 Datum)			
0 m (start of transect):		-24.122358; 148.780411	
50 m (centre point):		-24.122604; 148.780075	
Elevation (mAHD):		222	
General Site Description			
Landform		Gently undulating plain	
Soil		Sandy clay loam	
Dominant vegetation observed		Silver leaved ironbark woodland on sandy alluvium	
100 x 50 m area (0.5 ha)			
Dominant canopy or EDL species with evidence of recruitment (%):		100	
Eucalypt large tree DBH (cm): (from benchmark document)		40	
Number of large Eucalypt trees:		14	
Non-Eucalypt large tree DBH (cm): (from benchmark document)		na	
Number of large Non-Eucalypt trees:			
Total large trees/ha:		28	
Tree canopy (EDL) height (m):		16	
Sub-canopy height (m):		8	
Emergent height (m):		na	
Total tree species richness: <i>Eucalyptus melanophloia, Acacia excelsa, Eucalyptus populnea</i>		3	
50 x 10 m area			
Shrub spp. richness: <i>Geijera parviflora, Eremophila mitchellii, Alectryon diversifolius, Atalaya hemiglauca, Terminalia oblongata, Denhamia oleaster, Enchylaena tomentosa, Sida hackettiana</i>		8	
Grass spp. richness: <i>Enteropogon unispiceus, Aristida jerichoensis, Chrysopogon fallax, Heteropogon contortus, Aristida calycina, Sporobolus caroli, Eragrostis sororia</i>		7	
Forb spp. richness: <i>Cyperus sp., Nyssanthes diffusa, Marsilea drummondii, Portulaca oleracea, Heliotropium moorei, Cyperus bifax, Fimbristylis dichotoma, Rostellularia adscendens, Indigofera linnaei, Brunoniella australis, Calotis lappulacea, Evolvulus alsinoides, Ipomoea sp., Alternanthera nana, Phyllanthus sp., Cyanthillium cinereum, Chamaecrista absus, Cyperus gracilis, Sida sp., Murdannia graminea, Boerhavia dominii, Solanum nemophilum, Sclerolaena birchii, Einadia nutans subsp. linifolia, Glycine sp., Cyperus sp., Lomandra multiflora, Glycine tabacina, Solanum ellipticum, Afrohybanthus enneaspermus</i>		30	
Other spp.: <i>Cymbidium canaliculatum</i>			
Weed spp. and cover as % of area: <i>Cenchrus ciliaris, Megathyrsus maximus, Stylosanthes scabra, Malvastrum americanum, Urochloa mosambicensis, Sida spinosa</i>		80	

Plot attributes (actual)	Unit of measure	Measurement
Tree canopy cover (100 m canopy intercept)	% cover	21.7
Shrub canopy cover (100 m canopy intercept)	% cover	4.7
Native perennial grass cover (1 m x 1 m plots)	% cover	0
Litter cover (1 m x 1 m plots)	% cover	23.6
Coarse woody debris (from 50 m x 20 m plot)	m / ha	1160
Benchmark attributes (source DNRME)	Unit of measure	Measurement
Recruitment of woody perennial species in EDL	%	100
Native plant species richness		
Trees	no. species	2
Shrubs	no. species	2
Grasses	no. species	9
Forbs	no. species	17
Large eucalypts	no. / ha	22
Large non-eucalypts	no. / ha	na
Tree canopy median height	m	18
Tree canopy cover	%	40
Native shrub cover	%	2
Native perennial grass cover	%	35
Organic litter cover	%	30
Coarse woody debris	m / ha	307

Site assessment scoring sheet

Scoring sheet

Attribute	Wooded ecosystem Weighting	Score	Attribute	Wooded ecosystem Weighting	Score
Site - based			Landscape scale		
Recruitment of woody perennial species	5	5	Size of patch	10	5
Native plant species richness: Trees	5	5	Context	5	2
Native plant species richness: Shrubs	5	5	Connectivity	5	0
Native plant species richness: Grasses	5	3	Proximity to Ecological Corridors	6	6
Native plant species richness: Forbs	5	5	Total:	26	13
Tree canopy cover	5	5	Habitat:		
Tree canopy height	5	5	Threats	15	0
Shrub layer cover	5	3	Quality of foraging	10	0
Native perennial grass cover	5	0	Quality of shelter	10	0
Large trees	15	15	Mobility	10	0
Fallen woody material	5	2	Site location	5	0
Weed cover	10	0	Total	50	0
Litter cover	5	5	Site + landscape	106	71
Total	80	58	TOTAL SCORE (Site + landscape + habitat (where relevant))	156	71

Habitat quality score:

7

Site photos



Start point



Mid-point, facing north



Mid-point, facing east



Mid-point, facing south



Mid-point, facing west



Quadrat - 35 m



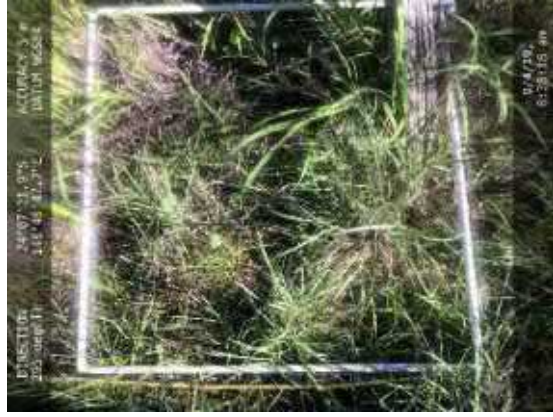
Quadrat - 45 m



Quadrat - 55 m



Quadrat – 65 m



Quadrat – 75 m

Site: 55 (11.7.2) – least concern		Assessor – Bruce McLennan
Property: Ganadero	Date: 09/04/2019	
Bioregion: Brigalow Belt	Sub-region: Isaac – Comet Downs	
State mapped RE: 11.9.5a	Observed RE: 11.7.2	
Transect Co-ordinates (GDA 94 Datum)		
0 m (start of transect):	-24.105431; 148.762634	
50 m (centre point):	-24.105844; 148.762756	
Elevation (mAHD):	266	
General Site Description		
Landform	Low hills	
Soil	Deeply weathered clay loam	
Dominant vegetation observed	Bendee woodland on lateritic duricrust	
100 x 50 m area (0.5 ha)		
Dominant canopy or EDL species with evidence of recruitment (%):	50	
Eucalypt large tree DBH (cm): (from benchmark document)	41	
Number of large Eucalypt trees:	0	
Non-Eucalypt large tree DBH (cm): (from benchmark document)	26	
Number of large Non-Eucalypt trees:	15	
Total large trees/ha:	30	
Tree canopy (EDL) height (m):	11	
Sub-canopy height (m):	7	
Emergent height (m):	na	
Total tree species richness: <i>Acacia catenulata, Hakea lorea, Brachychiton rupestris, Alstonia constricta</i>	4	
50 x 10 m area		
Shrub spp. richness: <i>Acalypha eremorum, Teucrium junceum, Everistia vacciniifolia, Croton phebaloides, Capparis lasiantha</i>	5	
Grass spp. richness: <i>Paspalidium sp., Calyptochloa gracillima, Aristida caput medusae, Aristida lignosa</i>	4	
Forb spp. richness: <i>Cheilanthes sieberi, Sida sp., Nyssanthes sp., Euphorbia tannensis subsp. eremophila, Phyllanthus sp., Hibiscus sturtii</i>	6	
Other spp.: <i>Parsonsia eucalyptophylla, Tinospora smilacina, Clematicissus opaca,</i>	3	
Weed spp. and cover as % of area: <i>Cenchrus ciliaris, Megathyrsus maximus, Stylosanthes scabra, Malvastrum americanum, Urochloa mosambicensis, Sida spinosa</i>	20	

Plot attributes (actual)	Unit of measure	Measurement
Tree canopy cover (100 m canopy intercept)	% cover	53.3
Shrub canopy cover (100 m canopy intercept)	% cover	6.2
Native perennial grass cover (1 m x 1 m plots)	% cover	9
Litter cover (1 m x 1 m plots)	% cover	56
Coarse woody debris (from 50 m x 20 m plot)	m / ha	790
Benchmark attributes (source DNRME)	Unit of measure	Measurement
Recruitment of woody perennial species in EDL	%	100
Native plant species richness		
Trees	no. species	3
Shrubs	no. species	4
Grasses	no. species	5
Forbs	no. species	5
Large eucalypts	no. / ha	10
Large non-eucalypts	no. / ha	26
Tree canopy median height	m	15
Tree canopy cover	%	40
Native shrub cover	%	4
Native perennial grass cover	%	15
Organic litter cover	%	20
Coarse woody debris	m / ha	1214

Site assessment scoring sheet

Scoring sheet

Attribute	Wooded ecosystem Weighting	Score	Attribute	Wooded ecosystem Weighting	Score
Site - based			Landscape scale		
Recruitment of woody perennial species	5	3	Size of patch	10	7
Native plant species richness: Trees	5	5	Context	5	4
Native plant species richness: Shrubs	5	5	Connectivity	5	4
Native plant species richness: Grasses	5	3	Proximity to Ecological Corridors	6	0
Native plant species richness: Forbs	5	5	Total:	26	15
Tree canopy cover	5	5	Habitat:		
Tree canopy height	5	5	Threats	15	0
Shrub layer cover	5	5	Quality of foraging	10	0
Native perennial grass cover	5	3	Quality of shelter	10	0
Large trees	15	10	Mobility	10	0
Fallen woody material	5	5	Site location	5	0
Weed cover	10	5	Total	50	0
Litter cover	5	3	Site + landscape	106	77
Total	80	62	TOTAL SCORE (Site + landscape + habitat (where relevant))	156	77

Habitat quality score:

7

Site photos



Start point



Mid-point, facing north



Mid-point, facing east



Mid-point, facing south



Mid-point, facing west



Quadrat – 35 m



Quadrat – 45 m



Quadrat – 55 m



Quadrat – 65 m



Quadrat – 75 m

Site: 57 (11.7.2) – least concern		Assessor – Bruce McLennan
Property: Ganadero	Date: 09/04/2019	
Bioregion: Brigalow Belt	Sub-region: Isaac – Comet Downs	
State mapped RE: 11.4.8/11.4.9a	Observed RE: 11.7.2	
Transect Co-ordinates (GDA 94 Datum)		
0 m (start of transect):	-24.098501; 148.779663	
50 m (centre point):	-24.098808; 148.780075	
Elevation (mAHD):	254	
General Site Description		
Landform	Low hills	
Soil	Deeply weathered clay loam	
Dominant vegetation observed	Bendee woodland on lateritic duricrust	
100 x 50 m area (0.5 ha)		
Dominant canopy or EDL species with evidence of recruitment (%):	100	
Eucalypt large tree DBH (cm): (from benchmark document)	41	
Number of large Eucalypt trees:	1	
Non-Eucalypt large tree DBH (cm): (from benchmark document)	26	
Number of large Non-Eucalypt trees:	7	
Total large trees/ha:	16	
Tree canopy (EDL) height (m):	11	
Sub-canopy height (m):	5	
Emergent height (m):	na	
Total tree species richness: <i>Acacia catenulata</i> , <i>Brachychiton australis</i> , <i>Brachychiton rupestris</i> , <i>Alstonia constricta</i>	4	
50 x 10 m area		
Shrub spp. richness: <i>Hovea longipes</i> , <i>Jasminum didymum</i> subsp. <i>lineare</i> , <i>Carissa ovata</i> , <i>Erythroxylum australe</i>	4	
Grass spp. richness: <i>Unident.</i> , <i>Calyptochloa gracillima</i> , <i>Aristida caput medusae</i> ,	3	
Forb spp. richness: <i>Sida</i> sp., <i>Amaranthus</i> sp., <i>Chenopodium</i> sp., <i>Chamaecrista absus</i> , <i>Unident.</i>	5	
Other spp.: <i>Parsonsia eucalyptophylla</i> , <i>Tinospora smilacina</i> , <i>Clematicissus opaca</i> ,	3	
Weed spp. and cover as % of area: <i>Cenchrus ciliaris</i> , <i>Harrisia martinii</i>	50	

Plot attributes (actual)	Unit of measure	Measurement
Tree canopy cover (100 m canopy intercept)	% cover	28.9
Shrub canopy cover (100 m canopy intercept)	% cover	1.6
Native perennial grass cover (1 m x 1 m plots)	% cover	0
Litter cover (1 m x 1 m plots)	% cover	83.8
Coarse woody debris (from 50 m x 20 m plot)	m / ha	840
Benchmark attributes (source DNRME)	Unit of measure	Measurement
Recruitment of woody perennial species in EDL	%	100
Native plant species richness		
Trees	no. species	3
Shrubs	no. species	4
Grasses	no. species	5
Forbs	no. species	5
Large eucalypts	no. / ha	10
Large non-eucalypts	no. / ha	26
Tree canopy median height	m	15
Tree canopy cover	%	40
Native shrub cover	%	4
Native perennial grass cover	%	15
Organic litter cover	%	20
Coarse woody debris	m / ha	1214

Site assessment scoring sheet

Scoring sheet					
Attribute	Wooded ecosystem Weighting	Score	Attribute	Wooded ecosystem Weighting	Score
Site - based			Landscape scale		
Recruitment of woody perennial species	5	5	Size of patch	10	7
Native plant species richness: Trees	5	5	Context	5	4
Native plant species richness: Shrubs	5	5	Connectivity	5	0
Native plant species richness: Grasses	5	3	Proximity to Ecological Corridors	6	0
Native plant species richness: Forbs	5	5	Total:	26	11
Tree canopy cover	5	5	Habitat:		
Tree canopy height	5	5	Threats	15	0
Shrub layer cover	5	3	Quality of foraging	10	0
Native perennial grass cover	5	0	Quality of shelter	10	0
Large trees	15	5	Mobility	10	0
Fallen woody material	5	5	Site location	5	0
Weed cover	10	0	Total	50	0
Litter cover	5	3	Site + landscape	106	60
Total	80	49	TOTAL SCORE (Site + landscape + habitat (where relevant))	156	60

Habitat quality score:

6

Site photos



Mid-point, facing north



Mid-point, facing east



Mid-point, facing south



Mid-point, facing west



Quadrat - 35 m



Quadrat - 45 m



Quadrat - 55 m



Quadrat – 65 m



Quadrat – 75 m

Site: 58 (11.3.2) – of concern		Assessor – Bruce McLennan	
Property: Ganadero		Date: 09/04/2019	
Bioregion: Brigalow Belt		Sub-region: Isaac – Comet Downs	
State mapped RE: Non-remnant		Observed RE: 11.3.2	
Transect Co-ordinates (GDA 94 Datum)			
0 m (start of transect):		-24.107222; 148.788773	
50 m (centre point):		-24.106773; 148.788712	
Elevation (mAHD):		227	
General Site Description			
Landform		Gently undulating plain	
Soil		Sandy clay loam	
Dominant vegetation observed		Silver leaved ironbark woodland on sandy clay alluvium	
100 x 50 m area (0.5 ha)			
Dominant canopy or EDL species with evidence of recruitment (%):		0	
Eucalypt large tree DBH (cm): (from benchmark document)		40	
Number of large Eucalypt trees:		14	
Non-Eucalypt large tree DBH (cm): (from benchmark document)		na	
Number of large Non-Eucalypt trees:			
Total large trees/ha:		28	
Tree canopy (EDL) height (m):		17	
Sub-canopy height (m):		9	
Emergent height (m):		na	
Total tree species richness: <i>Eucalyptus melanophloia</i> , <i>Terminalia oblongata</i> , <i>Acacia excelsa</i> , <i>Lysiphyllum carronii</i> , <i>Eucalyptus camaldulensis</i>		5	
50 x 10 m area			
Shrub spp. richness: <i>Notelaea microcarpa</i> , <i>Jasminum didymum subsp. lineare</i> , <i>Capparis lasiantha</i> , <i>Cassia brewsteri</i> , <i>Carissa ovata</i> , <i>Sida hackettiana</i> ,		6	
Grass spp. richness: <i>Enteropogon unispiceus</i> , <i>Aristida jerichoensis</i> , <i>Chrysopogon fallax</i>		3	
Forb spp. richness: <i>Cyperus sp.</i> , <i>Nyssanthes diffusa</i> , <i>Marsilea drummondii</i> , <i>Portulaca oleracea</i> ,		13	
Other spp.: <i>Lysiana subfalcata</i>			
Weed spp. and cover as % of area: <i>Cenchrus ciliaris</i> , <i>Megathyrsus maximus</i> , <i>Parthenium hysterophorus</i> , <i>Malvastrum americanum</i> , <i>Urochloa mosambicensis</i>		80	

Plot attributes (actual)	Unit of measure	Measurement
Tree canopy cover (100 m canopy intercept)	% cover	21.4
Shrub canopy cover (100 m canopy intercept)	% cover	7.3
Native perennial grass cover (1 m x 1 m plots)	% cover	0
Litter cover (1 m x 1 m plots)	% cover	12
Coarse woody debris (from 50 m x 20 m plot)	m / ha	460
Benchmark attributes (source DNRME)	Unit of measure	Measurement
Recruitment of woody perennial species in EDL	%	100
Native plant species richness		
Trees	no. species	2
Shrubs	no. species	2
Grasses	no. species	9
Forbs	no. species	17
Large eucalypts	no. / ha	22
Large non-eucalypts	no. / ha	na
Tree canopy median height	m	18
Tree canopy cover	%	40
Native shrub cover	%	2
Native perennial grass cover	%	35
Organic litter cover	%	30
Coarse woody debris	m / ha	307

Site assessment scoring sheet

Scoring sheet

Attribute	Wooded ecosystem Weighting	Score	Attribute	Wooded ecosystem Weighting	Score
Site - based			Landscape scale		
Recruitment of woody perennial species	5	0	Size of patch	10	5
Native plant species richness: Trees	5	5	Context	5	2
Native plant species richness: Shrubs	5	5	Connectivity	5	0
Native plant species richness: Grasses	5	3	Proximity to Ecological Corridors	6	6
Native plant species richness: Forbs	5	3	Total:	26	13
Tree canopy cover	5	5	Habitat:		
Tree canopy height	5	5	Threats	15	0
Shrub layer cover	5	3	Quality of foraging	10	0
Native perennial grass cover	5	0	Quality of shelter	10	0
Large trees	15	15	Mobility	10	0
Fallen woody material	5	5	Site location	5	0
Weed cover	10	0	Total	50	0
Litter cover	5	3	Site + landscape	106	65
Total	80	52	TOTAL SCORE (Site + landscape + habitat (where relevant))	156	65

Habitat quality score:

6

Site photos



Start point



Mid-point, facing north



Mid-point, facing east



Mid-point, facing south



Mid-point, facing west



Quadrat – 35 m



Quadrat – 45 m



Quadrat – 55 m



Quadrat – 65 m



Quadrat – 75 m

Site: 61 (11.7.1) – least concern		Assessor – Bruce McLennan
Property: Ganadero	Date: 10/04/2019	
Bioregion: Brigalow Belt	Sub-region: Isaac – Comet Downs	
State mapped RE: 11.4.8/11.4.9a	Observed RE: 11.7.1	
Transect Co-ordinates (GDA 94 Datum)		
0 m (start of transect):	-24.095621; 148.791916	
50 m (centre point):	-24.096022; 148.792404	
Elevation (mAHD):	238	
General Site Description		
Landform	Rises	
Soil	Clay	
Dominant vegetation observed	Lapunya woodland on lateritic gravels and rocks	
100 x 50 m area (0.5 ha)		
Dominant canopy or EDL species with evidence of recruitment (%):	100	
Eucalypt large tree DBH (cm): (from benchmark document)	40	
Number of large Eucalypt trees:	7	
Non-Eucalypt large tree DBH (cm): (from benchmark document)	24	
Number of large Non-Eucalypt trees:	0	
Total large trees/ha:	14	
Tree canopy (EDL) height (m):	14	
Sub-canopy height (m):	9	
Emergent height (m):	na	
Total tree species richness: <i>Eucalyptus thozetiana</i> , <i>Eremophila mitchellii</i> , <i>Acacia harpophylla</i>	3	
50 x 10 m area		
Shrub spp. richness: <i>Eremophila deserti</i> , <i>Chenopodium desertorum</i> , <i>Enchylaena tomentosa</i> , <i>Abutilon otocarpum</i> .	4	
Grass spp. richness: <i>Paspalidium sp.</i> , <i>Enteropogon acicularis</i>	2	
Forb spp. richness: <i>Brunoniella australis</i> , <i>Salsola australis</i> , <i>Sclerolaena tetracuspis</i> , <i>Einadia hastata</i> , <i>Commelina lanceolata</i> , <i>Sida sp.</i> , <i>Sida trichopoda</i> , <i>Sida corrugata</i> , <i>Sclerolaena muricata</i> , <i>Portulaca oleraceae</i>	10	
Other spp.: <i>Clematicissus opaca</i>	1	
Weed spp. and cover as % of area: <i>Opuntia tomentosa</i> , <i>Cenchrus ciliaris</i> , <i>Harrisia martinii</i>	2	

Plot attributes (actual)	Unit of measure	Measurement
Tree canopy cover (100 m canopy intercept)	% cover	6.6
Shrub canopy cover (100 m canopy intercept)	% cover	21.2
Native perennial grass cover (1 m x 1 m plots)	% cover	21
Litter cover (1 m x 1 m plots)	% cover	54
Coarse woody debris (from 50 m x 20 m plot)	m / ha	1210
Benchmark attributes (source DNRME)	Unit of measure	Measurement
Recruitment of woody perennial species in EDL	%	100
Native plant species richness		
Trees	no. species	4
Shrubs	no. species	8
Grasses	no. species	8
Forbs	no. species	9
Large eucalypts	no. / ha	18
Large non-eucalypts	no. / ha	2
Tree canopy median height	m	20
Tree canopy cover	%	27
Native shrub cover	%	10
Native perennial grass cover	%	20
Organic litter cover	%	20
Coarse woody debris	m / ha	424

Site assessment scoring sheet

Scoring sheet					
Attribute	Wooded ecosystem Weighting	Score	Attribute	Wooded ecosystem Weighting	Score
Site - based			Landscape scale		
Recruitment of woody perennial species	5	5	Size of patch	10	10
Native plant species richness: Trees	5	3	Context	5	4
Native plant species richness: Shrubs	5	3	Connectivity	5	2
Native plant species richness: Grasses	5	3	Proximity to Ecological Corridors	6	0
Native plant species richness: Forbs	5	5	Total:	26	16
Tree canopy cover	5	2	Habitat:		
Tree canopy height	5	5	Threats	15	0
Shrub layer cover	5	3	Quality of foraging	10	0
Native perennial grass cover	5	5	Quality of shelter	10	0
Large trees	15	10	Mobility	10	0
Fallen woody material	5	2	Site location	5	0
Weed cover	10	10	Total	50	0
Litter cover	5	3	Site + landscape	106	75
Total	80	59	TOTAL SCORE (Site + landscape + habitat (where relevant))	156	75

Habitat quality score:

7

Site photos



Start point



Mid-point, facing north



Mid-point, facing east



Mid-point, facing south



Mid-point, facing west



Quadrat – 35 m



Quadrat – 45 m



Quadrat – 55 m



Quadrat – 65 m



Quadrat – 75 m

Site: 62 (11.7.2) – least concern		Assessor – Bruce McLennan
Property: Ganadero	Date: 10/04/2019	
Bioregion: Brigalow Belt	Sub-region: Isaac – Comet Downs	
State mapped RE: Non-remnant	Observed RE: 11.7.2 advanced regrowth	
Transect Co-ordinates (GDA 94 Datum)		
0 m (start of transect):	-24.042763; 148.795944	
50 m (centre point):	-24.042557; 148.796371	
Elevation (mAHD):	297	
General Site Description		
Landform	Low hills	
Soil	Clay loam	
Dominant vegetation observed	Red Lancewood woodland on lateritic duricrust	
100 x 50 m area (0.5 ha)		
Dominant canopy or EDL species with evidence of recruitment (%):	100	
Eucalypt large tree DBH (cm): (from benchmark document)	41	
Number of large Eucalypt trees:	1	
Non-Eucalypt large tree DBH (cm): (from benchmark document)	26	
Number of large Non-Eucalypt trees:	0	
Total large trees/ha:	2	
Tree canopy (EDL) height (m):	9	
Sub-canopy height (m):	5	
Emergent height (m):	na	
Total tree species richness: <i>Acacia shirleyi</i> , <i>Alphitonia excelsa</i> , <i>Eucalyptus crebra</i>	3	
50 x 10 m area		
Shrub spp. richness: <i>Erythroxylum australe</i> , <i>Bertya opposens</i> , <i>Psydrax odorata</i> <i>subsp. buxifolia</i>	3	
Grass spp. richness: <i>Thyridolepis mitchelliana</i> , <i>Aristida caput medusae</i> , <i>Paspalidium</i> <i>sp.</i> , <i>Cleistochloa subjuncea</i> , <i>Aristida sp.</i> , <i>Ancistrachne</i> <i>uncinulata</i>	6	
Forb spp. richness: <i>Sida corrugata</i> , <i>Euphorbia tannensis subsp. eremophila</i> , <i>Cheilanthes sieberi</i> , <i>Calotis dentex</i> , <i>Sida sp.</i> , <i>Hibiscus sturtii</i>	6	
Other spp.: <i>Parsonsia eucalyptophylla</i> , <i>Tinospora smilacina</i> ,	2	
Weed spp. and cover as % of area: <i>Stylosanthes scabra</i>	1	

Plot attributes (actual)	Unit of measure	Measurement
Tree canopy cover (100 m canopy intercept)	% cover	47.6
Shrub canopy cover (100 m canopy intercept)	% cover	4.5
Native perennial grass cover (1 m x 1 m plots)	% cover	.2
Litter cover (1 m x 1 m plots)	% cover	78
Coarse woody debris (from 50 m x 20 m plot)	m / ha	2850
Benchmark attributes (source DNRME)	Unit of measure	Measurement
Recruitment of woody perennial species in EDL	%	100
Native plant species richness		
Trees	no. species	3
Shrubs	no. species	4
Grasses	no. species	5
Forbs	no. species	5
Large eucalypts	no. / ha	10
Large non-eucalypts	no. / ha	26
Tree canopy median height	m	15
Tree canopy cover	%	40
Native shrub cover	%	4
Native perennial grass cover	%	15
Organic litter cover	%	20
Coarse woody debris	m / ha	1214

Site assessment scoring sheet

Scoring sheet

Attribute	Wooded ecosystem Weighting	Score	Attribute	Wooded ecosystem Weighting	Score
Site - based			Landscape scale		
Recruitment of woody perennial species	5	5	Size of patch	10	10
Native plant species richness: Trees	5	5	Context	5	0
Native plant species richness: Shrubs	5	3	Connectivity	5	0
Native plant species richness: Grasses	5	5	Proximity to Ecological Corridors	6	0
Native plant species richness: Forbs	5	5	Total:	26	10
Tree canopy cover	5	3	Habitat:		
Tree canopy height	5	5	Threats	15	0
Shrub layer cover	5	5	Quality of foraging	10	0
Native perennial grass cover	5	1	Quality of shelter	10	0
Large trees	15	5	Mobility	10	0
Fallen woody material	5	2	Site location	5	0
Weed cover	10	10	Total	50	0
Litter cover	5	3	Site + landscape	106	67
Total	80	57	TOTAL SCORE (Site + landscape + habitat (where relevant))	156	67

Habitat quality score:

6

Site photos



Start point



Mid-point, facing north



Mid-point, facing east



Mid-point, facing south



Mid-point, facing west



Quadrat – 35 m



Quadrat – 45 m



Quadrat – 55 m



Quadrat – 65 m



Quadrat – 75 m

Site: 63 (11.7.2) – least concern		Assessor – Bruce McLennan	
Property: Ganadero		Date: 10/04/2019	
Bioregion: Brigalow Belt		Sub-region: Isaac – Comet Downs	
State mapped RE: Non-remnant		Observed RE: 11.7.2	
Transect Co-ordinates (GDA 94 Datum)			
0 m (start of transect):		-24.032383; 148.808044	
50 m (centre point):		-24.031811; 148.808105	
Elevation (mAHD):		285	
General Site Description			
Landform		Rises	
Soil		Clay loam	
Dominant vegetation observed		Bendee woodland on deeply weathered profile	
100 x 50 m area (0.5 ha)			
Dominant canopy or EDL species with evidence of recruitment (%):		33.3	
Eucalypt large tree DBH (cm): (from benchmark document)		41	
Number of large Eucalypt trees:		0	
Non-Eucalypt large tree DBH (cm): (from benchmark document)		26	
Number of large Non-Eucalypt trees:		33	
Total large trees/ha:		66	
Tree canopy (EDL) height (m):		11	
Sub-canopy height (m):		6	
Emergent height (m):		na	
Total tree species richness: <i>Acacia catenulata, Hakea lorea, Eucalyptus exserta</i>		3	
50 x 10 m area			
Shrub spp. richness: <i>Everistia vacciniifolia, Eremophila latrobei subsp. latrobei, Carissa ovata, Croton phebalioides, Jasminum didymum subsp. lineare, Abutilon sp.</i>		6	
Grass spp. richness: <i>Paspalidium distans, Aristida caput medusae, Entolasia stricta, Calyptochloa gracillima, Aristida lignosa</i>		5	
Forb spp. richness: <i>Sida sp., Euphorbia tannensis subsp. eremophila, Cheilanthes sieberi, Oxalis sp., Sida cunninghamii., Sida trichopoda, Cyperus gracilis, Brunoniella australis</i>		8	
Other spp.: <i>Parsonsia eucalyptophylla, Tinospora smilacina, Clematicissus opaca</i>		3	
Weed spp. and cover as % of area: <i>Opuntia tomentosa</i>		2	

Plot attributes (actual)	Unit of measure	Measurement
Tree canopy cover (100 m canopy intercept)	% cover	54.1
Shrub canopy cover (100 m canopy intercept)	% cover	29.2
Native perennial grass cover (1 m x 1 m plots)	% cover	2
Litter cover (1 m x 1 m plots)	% cover	69
Coarse woody debris (from 50 m x 20 m plot)	m / ha	1670
Benchmark attributes (source DNRME)	Unit of measure	Measurement
Recruitment of woody perennial species in EDL	%	100
Native plant species richness		
Trees	no. species	3
Shrubs	no. species	4
Grasses	no. species	5
Forbs	no. species	5
Large eucalypts	no. / ha	10
Large non-eucalypts	no. / ha	26
Tree canopy median height	m	15
Tree canopy cover	%	40
Native shrub cover	%	4
Native perennial grass cover	%	15
Organic litter cover	%	20
Coarse woody debris	m / ha	1214

Site assessment scoring sheet

Scoring sheet

Attribute	Wooded ecosystem Weighting	Score	Attribute	Wooded ecosystem Weighting	Score
Site - based			Landscape scale		
Recruitment of woody perennial species	5	3	Size of patch	10	2
Native plant species richness: Trees	5	5	Context	5	0
Native plant species richness: Shrubs	5	5	Connectivity	5	0
Native plant species richness: Grasses	5	5	Proximity to Ecological Corridors	6	0
Native plant species richness: Forbs	5	5	Total:	26	2
Tree canopy cover	5	5	Habitat:		
Tree canopy height	5	5	Threats	15	0
Shrub layer cover	5	3	Quality of foraging	10	0
Native perennial grass cover	5	1	Quality of shelter	10	0
Large trees	15	15	Mobility	10	0
Fallen woody material	5	5	Site location	5	0
Weed cover	10	10	Total	50	0
Litter cover	5	3	Site + landscape	106	72
Total	80	70	TOTAL SCORE (Site + landscape + habitat (where relevant))	156	72

Habitat quality score:

7

Site photos



Start point



Mid-point, facing north



Mid-point, facing east



Mid-point, facing south



Mid-point, facing west



Quadrat – 35 m



Quadrat – 45 m



Quadrat – 55 m



Quadrat – 65 m



Quadrat – 75 m

Appendix I

Curricula vitae

Andrew Jensen

Associate Ecologist

Curriculum vitae

Andrew has 15 years' consulting experience across a range of environmental disciplines and industries including mining, renewables, and oil and gas.

Key aspects of his work have included project management, client liaison, preparation of environmental impact statements, preparation of management plans, ecological reporting and surveying, ecological offset plans, management of subcontractors and health and safety processes.

Andrew routinely reviews environmental technical studies and has developed environmental management plans and negotiated environmental approval conditions for clients. Andrew has also been responsible for conducting a number of species impact significance assessments at both Commonwealth and state level and is familiar with the requirements of this process. Andrew has also been responsible for managing, coordinating and undertaking fieldwork campaigns across Queensland.

Qualifications

- Bachelor of Science (Hons), University of St Andrews, 2003

Career

- Associate Ecologist, EMM Consulting, 2019–present
- Senior Environmental Scientist, CDM Smith, 2017–2019
- Senior Environmental Consultant, Coffey, 2010–2017
- Environmental Scientist, Royal Haskoning UK, 2004–2009
- Field Surveyor, British Trust for Ornithology (UK), 2007–2008
- Technician, Royal Haskoning (UK), 2003–2004
- GIS Technician, Essex County Council (UK), 2001–2002

Representative experience

- Mount Fox Wind Farm, ecological desktop assessments and constraints analysis, Qld (Windlab Limited)
- Blackwater Coal Mine, coordinating and implementing baseline ecological surveys and reporting including threatened fauna species surveys, Blackwater (BHP)
- Cape River Substation, Vegetation clearing permit, Pentland (Windlab)
- Kennedy Energy Park, Ecological assessment and EPBC referral, Hughenden (Windlab)
- McPhillamys Gold Mine, Ecological Surveys and Biodiversity Assessment Report, Blayney NSW (Regis Resources)
- Carmichael Coal Mine, Secondment to Adani Mining for environmental approvals and compliance role, Brisbane (Adani Mining)
- Secondment to BHP for environmental approvals, Brisbane (BHP)
- Tipton West Dalby Pipeline, Ecological Surveys, Dalby (APA Group)
- Rugby Run Solar Farm, Secondment to Adani Renewables, Brisbane/Moranbah (Adani Renewables)
- Reedy Creek Wallumbilla Pipeline, Ecological Surveys, Reedy Creek (APA Group)
- Styx Coal Mine, Supplementary Ecological Surveys, Marlborough (Waratah Coal)
- Bauxite Hills Mine, Ecological Surveys, north of Weipa (Metro Mining)

- Frieda River Project, Aquatic Ecology Impact Assessment, Papua New Guinea (PanAust)
- Chifley Road upgrade, Review of Environmental Factors, Chifley NSW (Roads and Maritime)
- Granville Platform Upgrade, Review of Environmental Factors, Granville NSW (Sydney Trains)
- Erskineville platform upgrade, Review of Environmental Factors, Erskineville NSW (Sydney Trains)
- Menangle Park gas pipeline, Review of Environmental Factors, Menangle Park NSW (Jemena)
- Riverwood Bridge upgrade, Review of Environmental Factors, Riverwood NSW (Sydney Trains)
- P'nyang Project appraisal well, Preparation of ESIA, Papua New Guinea (Oil Search)
- P'nyang Project, Preparation of EIS, Papua New Guinea (Esso PNG P'nyang Ltd)
- Former Mary Kathleen uranium mine, Environmental Condition and Rehabilitation Assessment, near Mount Isa (Queensland Government)
- Sarsfield Gold Mine Expansion Project Supplementary Report to the EIS, Ravenswood (Carpentaria Gold)
- PNG LNG Pipeline Project, Preconstruction Environmental Surveys, Papua New Guinea (Spiecapag)
- PNG LNG Project, Secondment to ExxonMobil, Papua New Guinea (ExxonMobil)
- Moura Pipeline, Ecological Assessment and EPBC Referral, Moura (Queensland Nitrates)
- Hillalong Project, Ecological Surveys for reassignment of vegetation mapping, Glenden (Shandong Energy)
- Surat Gas Project, Supplementary Report to the EIS, Brisbane/Surat Basin (Arrow Energy)
- Arrow LNG Plant, Supplementary Report to the EIS, Brisbane/Gladstone (Arrow Energy)
- Moranbah Gas Project, Threatened Species Management Plan, Brisbane (Arrow Energy)
- Arrow LNG Plant, Preparation of EIS, Brisbane/Gladstone (Arrow Energy)
- Pagham Harbour Coastal Defence Scheme, Preparation of EIS, Pagham UK (Environment Agency)
- QE2 Teesport Berth Development, Preparation of EIS, Teesport UK (PD Teesport)
- Round 3 Offshore Windfarms, Review of Ecological Constraints, Edinburgh UK (Airtricity)
- Onshore Windfarm bird survey methodology design, Edinburgh UK (Enertrag)
- Dover Harbour Terminal 2 Development, Preparation of EIS, Dover UK (Dover Harbour Board)
- Dudgeon Offshore Windfarm, Preparation of EIS, Edinburgh UK (Dudgeon Offshore Wind)
- Elgin Flood Alleviation Scheme, Ecological Surveys, Elgin UK (Moray Council)
- Seaham Harbour Redevelopment, Preparation of EIS, Seaham UK (Durham Council)
- Titchwell Managed Realignment, Preparation of EIS, Norfolk UK (Royal Society for the Protection of Birds)
- Forres (River Findhorn) Flood Alleviation Scheme, Ecological Surveys and Preparation of EIS, Elgin UK (Moray Council)
- Helix Project Phase II, Ecological Surveys, Grangemouth UK (British Waterways)
- Forres (River Findhorn) Flood Alleviation Scheme, Ecological Surveys, Elgin UK (Moray Council)
- Proposed Firth of Forth Windfarm, Review of Constraints, Edinburgh UK (Airtricity)
- Seahouses seawall upgrade, Ecological Surveys, Seahouses UK (Northumbria Council)
- Thames Estuary Maintenance Dredging, Review of Ecological Data, London UK (Port of London Authority)
- BERR Offshore Energy Strategic Assessment, Review of Survey Method, Edinburgh UK (BERR)
- Bo'ness Harbour Development, Wintering Bird Management Plan, Bo'ness UK (ING Estate)
- Brent Decommissioning, Sensitivity Assessment and Environmental Risk, Edinburgh UK (Shell)
- Canvey Biodiesel Plant, Preparation of EIS Addendum, Canvey UK (Sure Green Fuels)
- Barrow Waterfront Harbour Revision Order, Preparation of EIS, Barrow UK (West Lakes Renaissance)
- Trow Quarry Remediation Project, Ecological Surveys and Preparation of EIS, Trow UK (South Tyneside Council)
- Isle of Grain Windfarm, Review of Ecological Data, Isle of Grain UK (British Petroleum)
- Newhaven Desalination Plant, Preparation of EIS, Newhaven UK (Clarity Ltd)



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Bruce McLennan

Senior Ecologist

Curriculum vitae

Bruce is an experienced ecologist with over 12 years working on a range of projects in Queensland and NSW.

Bruce's experience includes targeted surveys for threatened flora species, vegetation community surveys, habitat assessments and mapping of vegetation communities and assessing ecological condition under various frameworks.

Having worked as a Vegetation Planning Officer with Greening Australia for several years, Bruce has a wide knowledge of property planning, vegetation management and rehabilitation techniques at a property scale. Bruce also has specialist skills and experience in the assessment of biodiversity offsets including BioCondition assessments in Qld and working under Biodiversity Assessment Method in NSW.

Qualifications

- Bachelor of Business, Rural Management, University of Queensland, Gatton, Queensland, Australia
- Master of Sustainability Science, University of Southern Queensland, Toowoomba, Queensland, Australia

Career

- Senior Ecologist, EMM Consulting, 2017 – Present
- Senior Ecologist, Arcadian Ecology, 2016 – Present
- Senior Ecologist, Amec Foster Wheeler, 2010 – 2016
- Regional Supervisor Vegetation and Business, Greening Australia Queensland, 2003 – 2010
- Landholder Liaison and Group Coordinator, Queensland Department of Primary Industries, 2001 – 2002
- Field Services Officer, Conservation Farmers Inc, 2000 – 2001

Relevant training and endorsements

- Approved NSW BioBanking, BioCertification & Framework for Biodiversity Assessment Assessor (December 2015) (Assessor number: 189)
- Vegetation Structure Training – Queensland Herbarium
- Regional Ecosystem Training – O2 Ecology
- BioCondition Assessment Training – Queensland Herbarium
- Grass Identification training – Greening Australia
- Native seed collection training – Florabank
- Catch and relocate venomous snakes for regional areas - Working With Wildlife
- Fauna handling training – Geckoes Wildlife
- DEHP approved suitable person under Flora Survey Guideline – Protected Plants

Representative experience

- BMA Blackwater Mine Expansion – various aquatic ecology surveys, Blackwater, Queensland (BHP Billiton)
- Galilee to Moranbah Pipeline, rapid route selection with respect to Black Throated Finch habitat and other MNES and MSES, Queensland (APA Group)
- Moomba to Wilton Pipeline, Cathodic production upgrade ecology surveys, Queensland (APA Group)
- Origin Energy NT – Bushfire management comparisons with existing Queensland operations, Northern Territory (Mendham Consultants)
- North Galilea Basin Rail Project, groundwater monitoring location ecological surveys, Charmichael Mine, Queensland (Adani)
- Regional ecosystem field verification, various ecological surveys, Gladstone (Queensland Oil Refinery)
- Atlas Lateral Project *Rutidosis lanata* translocation, translocation of approximately 120 plans, Southern QLD (DPM Envirosciences)
- Rolleston Coal Mine - Expansion Offsets, Rolleston, Queensland, Australia (Glencore/Xstrata Coal)
- Walton Coal Project – Environmental Offsets Advice (Aquila Resources)
- Bowen Gas Pipeline and Bowen Gas Project – Environmental Offsets (Arrow Energy)
- Wiggins Island Coal Export Terminal (WICET) – environmental offsets monitoring (Greening Australia)
- Carmichael Rail project – ecology/weed surveys for the 450km proposed rail corridor (Carmichael Rail Pty Ltd)
- Olive Downs Linear Infrastructure, & Olive Downs/Willunga Project Terrestrial Ecology Surveys, QLD (Pembroke Resources)
- BMA Blackwater Mine Expansion – Various flora surveys, Blackwater, Queensland (BHP Billiton)
- Shell QGC – Pre-clearance surveys for linear infrastructure project, Chinchilla, Queensland (Shell Australia)
- RES Woodersen Renewable Energy Project, environmental constraints survey / flora assessments, Wooderson (Umwelt)
- Inland Rail Project – Geotechnical site protected plant surveys and pre-clearance surveys, Gowrie to Helidon, Queensland (ARTC Pty Ltd)
- Mt Isa to Injune High Pressure Gas Pipeline – Rapid aerial ecological constraints surveys (Jemena Australia)
- Woolgoolga To Ballina Pacific Highway Upgrade – Ancillary site ecological assessments, Broadwater, NSW (Roads & Maritime NSW)
- Olive Downs Proposed Offset - Regional Ecosystem Ground Truthing Survey and Preliminary Offset Potential Survey, Valkyrie, Queensland (Pembroke Resources)
- Northern Missing Link Offset Monitoring, photo monitoring and condition reporting for offset sites, Central QLD (Aurizon)
- Airport Options Ecological Surveys, environmental constraints assessments, Charmichael Coal, Queensland (Adani)
- Western Slopes Project, survey support and land access, Condobolin NSW (APA Group)
- Kotupna Park Protected Plan Survey, field survey for protected plants, Chinchilla Qld (Private)
- Olive Downs Linear Infrastructure Terrestrial Ecology Survey, flora assessment for the terrestrial ecology component of four linear infrastructure components, Valkyrie, Queensland (Pembroke Resources)
- Johnstone Biodiversity Offset Suitability, field surveys and reporting, Dirranbandi area, Qld (Private)
- Suncoast Distributor Upgrade, impact assessments, Queensland (Energex)
- Vegetation assessment, assessment of vegetation and threatened species, Kogan Queensland (Sunsolar)
- Redcliffe Sewage Treatment Plan Rehabilitation Project, flora assessment and protected plans survey, Redcliffe QLD (UnityWater)
- Vegetation Assessment, assessment of vegetation and threatened species, Felton QLD (McLean Farms)
- Olive Downs/Wilunga Project Terrestrial Ecology Surveys, flora assessment for the terrestrial ecology component of an EIS, Valkyrie Queensland (Pembroke Resources)
- LNP Project, carry out soils and weeds survey, Orana Region, QLD (Australia Pacific LNP)
- North Maclean EPBC Offsets, provide technical input to offset requirements for a development proposal, North Maclean Queensland (28 South)
- LNP Project, collection of weeds and waterway crossing data, Wybara and Moorabinda, QLD (Australia Pacific LNP)
- Water Pipeline Survey and TEC Evaluations, technical advice and field survey expertise on

flora species and vegetation communities,
Emerald QLD (Central Highlands Regional Council)

- Eugene Street Vegetation Assessment, assessment of vegetation extent at Bellbird Park, Ipswich QLD (28 South)
- Keperra Quarry, vegetation assessment, Brisbane QLD (28 South)
- Regional Ecosystem Map Change, technical advice on threatened ecological communities (Central Highlands Regional Council)
- Terranora Interconnector Fire Management System, weed and vegetation quality assessment, Mullumbimby NSW (APA Group)
- Bowen Gas Pipeline and Bowen Gas Project, development of environmental offset strategy, Bowen QLD (Arrow Energy)
- Woolgoolga to Ballina Pacific Highway Upgrade, prepare threatened rainforest communities and rainforest plants management plan, Woolgoolga NSW (NSW RTA)



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Chagi Weerasena

Ecologist

Curriculum vitae

Chagi is an ecologist that has worked on a broad range of projects and environmental management areas. Chagi has assisted in undertaking field ecology surveys for large infrastructure projects in New South Wales and Queensland including flora and fauna surveys. Chagi's skills also include field assessments and preparing environmental reports.

Chagi has well developed skills in field data capture, data analysis and impact assessments.

Qualifications and memberships

- Bachelor of Environmental Science (Honours) (Natural Resource Science), University of Queensland, 2015
- Environmental Institute of Australia and New Zealand Associate Membership and member of the EIANZ Mentoring Program, 2018
- Ecological Society of Australia Membership, 2018
- Women in Mining and Resources Mentoring Program, 2017
- BioCondition and Regional Ecosystems Training, 2018
- 4WD Training, 2018
- White Card – Work Safety in the Construction Industry, 2017
- Biodiversity Offset Scheme Accredited Assessors Course – Competent, 2018

Career

- EMM Consulting, 2017–present
- Contract Environmental Scientist, Amec Foster Wheeler (currently Wood Group), 2017
- Undergraduate GIS Analyst, Healthy Waterways (currently Healthy Land & Water), 2015
- Marine Conservation and Education Intern, Oceans Campus South Africa, 2014

Representative experience

- Blackwater Mine – ecology field surveys including fauna surveys and vegetation assessments, reporting for northern and southern lease ecology surveys, vegetation management, 3D seismic areas and levee banks ecology surveys, Blackwater QLD (BHP Billiton Mitsubishi Alliance)
- Snowy 2.0 (ecologist), ecology field surveys including fauna surveys, vegetation plots, threatened flora transects and review of environmental factors, Kosciuszko National Park NSW (Snowy Hydro Limited)
- Snowy 2.0 (site environmental officer), pre-clearance surveys and environmental compliance, Kosciuszko National Park NSW (Snowy Hydro Limited)

- Carmichael Rail, protected plants reporting, pest and contaminated land reporting, species management program reporting, Glenden QLD (Carmichael Rail Network)
- Quorn Park Solar Farm, flora field surveys, Parkes NSW (Quorn Park Solar Farm Pty Ltd)
- Inland Rail, geotechnical Investigations – protected plant surveys, pre-clearance surveys, matters of national environmental significance reporting, protected plants reporting, pre-clearance reporting, EPBC online referral, Toowoomba QLD (Australian Rail Track Corporation)
- Carmichael Coal Mine, contaminated land and ecology field surveys, and desktop reporting, Mt Coolon QLD (Adani Mining)
- San Jorge Nickel Mine, contributing to environmental impact statement, Solomon Islands (Axiom Mining)
- SunCoast Palmview, flora field surveys, Palmview QLD (Energex)



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Gus Daly

Ecologist

Curriculum vitae

Gus is an ecologist based in EMM's Brisbane office. Gus has experience in flora and fauna identification, particularly avifauna, data collection and analysis, report writing and presentation of results.

Qualifications

- Bachelor of Science (Hons), Southern Cross University, 2017
- Bachelor of Environmental Science majoring in Coastal Management, Southern Cross University, 2015

Career

- EMM Consulting, May 2018–present
- Ecologist (contractor), Australian Broadcasting Corporation, 2018
- Ecologist (contractor), Logan City Council, 2018
- Hydrology Demonstrator/Tutor, Southern Cross University, School of Environmental Science & Engineering 2016

Representative experience

- Snowy 2.0, mammal, reptile, avifauna and weed surveys, Kosciuszko National Park NSW (Snowy Hydro Limited)
- Inland Rail, Protected plant and pre-clearance surveys, Gowrie to Kagaru QLD (ARTC)
- Blackwater Mine Expansion, flora and fauna surveys, Blackwater QLD (BMA)
- McPhillamys Gold Project, fauna surveys, Kings Plains NSW (Regis)
- Wagga Wagga Solar Project, fauna surveys, Wagga Wagga NSW (Vena Energy)
- Karreman Quarry Extension, vegetation assessments, Redland Bay QLD (Karreman Quarries)
- Hunter Valley Operations Offset Assessment, flora and fauna surveys, Belford NSW (HVO)
- Cottage Creek Gas Fields, pre-clearance weed surveys, Roma QLD (FYFE)

Relevant environmental experience

- Conducted mammal and avifauna surveys for biannual monitoring. Project involved field data collection and analysis, Logan, QLD – Logan City Council
- Responsible for fauna identification and data logging of video recordings, Brisbane, QLD – Australian Broadcasting Corporation
- Undertook honours thesis on shorebird foraging ecology and resource partitioning using stable isotope analysis. Project involved field data collection, laboratory analysis and the formation of a scientific manuscript.



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Lui Weber

Senior botanist

Curriculum vitae

Lui is a senior botanist based in EMM's Brisbane office. He has worked as a consultant and in-house specialist for both environmental consultancies and government in Queensland and New South Wales. Lui has diverse project experience including vegetation surveys and mapping, weed management, vegetation rehabilitation and conservation, as well as environmental monitoring, reporting and management plans.

He is proficient in data collection and analysis, and flora identification utilised across a broad range of geographical areas.

Qualifications

- Bachelor of Science (Ecology and Botany), University of Queensland, 2004
- Bachelor of Science (Hons I) (Botany), University of Queensland, 2011

Career

- EMM Consulting, 2019–present
- Principal Botanist, Montane Ecological Solutions, 2014–present
- Senior Botanist, Aspect Ecology, 2014–present
- Senior Botanist, BAAM Pty Ltd, 2011–2014
- Senior Botanist, Sinclair Knight Merz (now Jacobs), 2008–2011
- Vegetation survey and mapping officer, Moreton Bay Regional Council, 2004–2008
- Sub-consultant, Northern Rivers Catchment Management Authority (CMA), 2008
- Sub-consultant, Nature Conservation Trust of NSW, 2005–2008
- Sub-consultant, Ecos Environmental Pty Ltd, 2005–2008
- Plant Physiology Research Assistant, University of Queensland (School of Biological Sciences), 2003–2004

Representative experience

Ecological Monitoring

- Saving our Species Program, *Euphrasia bella* and *Gaultheria viridicarpa* cliff flora survey of Limpinwood NR, Limpinwood NSW (Office of Environment and Heritage)
- Saving our Species Program, *Zieria adenodonta* and *Ozothamnus vagans* cliff flora survey of Wollumbin NP, Mount Warning NSW (Office of Environment and Heritage)
- Bli Bli Quarry, regional ecosystem and threatened flora mapping, Bli Bli Qld (Holcim)
- Waisoi Project, vegetation mapping, Namosi Fiji (Phalaris)
- Wollert Power Station, vegetation mapping, Craigieburn Vic (APA Group)

- Brolga and Canoona Mine Projects, flora and vegetation survey, location Qld (Qld Nickel)
- Wolffdene Quarry, threatened flora survey, location (Hanson)
- Wandoan Gas Project, vegetation mapping and threatened flora survey, Wandoan QLD (QGC)
- Kin Kin Quarry, threatened flora survey and vegetation mapping – Kin Kin QLD (Neilsen's)
- Ballina to Woodburn Pacific Highway Upgrade, threatened flora, lowland rainforest and coastal cypress pine EEC mapping, NSW (SKM/Jacobs)
- Bruce Highway Upgrade– Cooroy to Curra, regional ecosystem mapping and threatened flora survey, Curra Qld (SKM/Jacobs)
- Togara North EIS, regional ecosystem mapping and threatened flora survey, Togara QLD (Xstrata Coal)
- Pacific Highway Upgrade –Wells Crossing to Glenugie, threatened flora surveys, mapping, Glenugie NSW (NSW RMS)
- National Broadband Network, – Optic Fibre Alignment Toowoomba to Marathon Townsville to Tennant Ck QLD and Kalbarrie WA, flora and habitat assessments, (Visionstream)
- Washpool EIS, vegetation mapping, Washpool QLD (Aquila Resources)
- Ward's Well, vegetation constraints analysis, Wards Well QLD (BHP Mitsubishi Alliance (BMA))
- Hail Creek Mine, vegetation mapping and survey, Hair Creek QLD (Rio Tinto)
- Multimodal Transport Corridor, flora survey and vegetation mapping for Stages 1,2,3 & 5, Caloundra Qld (Department of Main Roads)
- Hinze Dam Stage 3, threatened flora surveys, Advancetown Qld (Seqwater)
- Seraji East Coal Project, Seismic Lines Drilling & Exploration, endangered RE mapping and flora survey, Seraji QLD (BMA)
- New Acland Stage 3 Rail Spur, baseline and threatened flora survey, New Acland QLD (New Hope Coal)
- Southern Regional Water Pipeline, baseline flora surveys, vegetation survey and mapping, Mt Crosby to Molendinar QLD (Linkwater)
- Tugun Bypass Project, baseline flora surveys, vegetation mapping, and threatened species translocation, including seed collection, Tugun QLD (Main Roads)
- Flora of North Stradbroke Island, flora survey, photography and collection of specimens, North Stradbroke Is QLD (Environmental Protection Agency)
- Pacific Highway Upgrade – Brunswick Heads Bypass, baseline flora surveys, vegetation survey, mapping and seed collection, Brunswick Hds NSW (NSW RMS)
- Pacific Highway Upgrade – Woodburn to Iluka, baseline flora surveys, vegetation survey and mapping, Woodburn NSW (NSW RMS)
- Pacific Highway Upgrade – Bonville Bypass, baseline flora surveys, vegetation survey and mapping, and threatened species translocation, including seed collection, Bonville NSW (NSW RMS)
- Comprehensive Coastal Assessment, detailed vegetation plots, including floristic and structural data and new records of threatened species, North Coast NSW (Department of Environment and Conservation)
- Brunswick Heads Nature Reserve, threatened species survey, Brunswick Hds NSW (Department of Environment and Conservation)
- Bush Recovery Round 3, property vegetation survey and vegetation mapping, Northern Rivers NSW (Northern Rivers Catchment Management Authority)

Environmental Management

- Saving our Species Program, *Ozothamnus vagans* weed mapping of Limpinwood NR and Wollumbin NPs NSW (Office of Environment and Heritage)
- Wollert Power Station, weed mapping, Wollert Vic (APA Group)
- Wandoan Gas Project, weed mapping, Wandoan QLD (QGC)
- National Broadband Network, Visionstream – Optic Fibre Alignment, weed mapping, Toowoomba to Marathon and Townsville to Tenant Ck QLD (Visionstream)
- Hail Creek Mine, weed mapping, Hail Creek QLD (Rio Tinto)
- Traveston Crossing Dam Pilot Revegetation Project, weed mapping, location (Queensland Water Infrastructure)
- Nerang River Health Study, weed mapping and management priorities, Numinbah Valley QLD (Gold Coast City Council)
- Weed management plans for Lagoon Creek and Godwin Beech Environment Parks, and Campbell's Pocket Rd Council VCA, Caboolture and Sandstone Point QLD (Moreton Bay Regional Council)
- – Weed management plans for 10 conservation covenant properties in northern NSW, (Nature Conservation Trust of NSW)
- Bush Recovery Round 3, property weed survey and management planning, Northern Rivers NSW (Northern Rivers Catchment Management Authority)
- Bundjalung National Park, monitoring of Bitou Bush control measures on native vegetation, Evans Hd NSW (Department of Environment and Conservation)

- Lower Moolooloa River Environmental Reserve, vegetation condition (biocondition) assessment, Moolooloa QLD (Department of Transport and Main Roads)
- Hinze Dam Stage 3, regeneration area selection, regeneration species selection, and planting design, Advancetown QLD (Seqwater)
- Amberley Wildlife Management Strategy, regeneration area selection, wildlife corridor design, regeneration species selection and planting design, Amberley QLD (RAAF)
- Traveston Crossing Dam Pilot Revegetation Project, regeneration species selection and planting design, Traveston QLD (Queensland Water Infrastructure)
- Assessment of properties under Voluntary Conservation Agreements: flora surveys, landholder consultation, weed monitoring and regeneration planning, Caboolture QLD (Moreton Bay Regional Council)
- Assessment of properties under MBRC Land for Wildlife schemes: flora surveys, landholder consultation, weed monitoring and regeneration planning, Caboolture QLD (Moreton Bay Regional Council)
- Bush Recovery Round 3, scoring of property conservation values, landholder liaison and conservation management planning, Northern Rivers NSW (Northern Rivers Catchment Management Authority)
- Bulahdelah Bypass, orchid management and translocation plan, Buldelah NSW (Parsons Brinkerhoff)
- Ecos Environmental – Successful Nomination for Coastal Cypress Pine Forest in The NSW North Coast as an Endangered Ecological Community. Project/site name, project description, Northern Rivers NSW (OEH)
- Moreton Bay Regional Council Regeneration Database, development of regeneration database for the expanded Moreton Regional Council area which includes the old Redcliffe and Pine Rivers Shires, Qld (Moreton Bay Regional Council)

On-site ecological management

- Wolffdene Quarry, Ormeau Bottle Tree translocation, Wolffdene QLD (Hansen)
- Background report to the National Recovery Plan for Littoral Rainforests and Coastal Vine Thickets of Eastern Australia, Eastern Coast Australia (DeSEWPAC)
- Clayton's Gully Grass Tree and Orchid translocation, Cunningham's Gap QLD (Fulton Hogan)
- Hinze Dam Stage 3, propagation and translocation plan and seed/cutting collection for EPBC listed flora species, Advancetown QLD (Seqwater)
- Traveston Crossing Dam Habitat Restoration Strategy - Threatened Flora and Endangered Ecosystems, Brooyar QLD (Queensland Water Infrastructure)
- Jeebropilly Environmental Offsets, desktop assessment of conservation values and environmental offset planning, Jeebropilly QLD (New Hope Coal)
- Flora surveys of proposed covenant areas on private property and assessment of rolling fund properties in North Coast and Nandewar bioregions, NSW (Nature Conservation Trust of NSW)
- Caboolture Shire Council Regeneration Database, development of regeneration database, Caboolture QLD (Caboolture Shire Council)
- Southern Regional Water Pipeline, regeneration plan planting species selection and densities for each regional ecosystem along the 100km alignment, Mt Crosby to Molendinar QLD (Linkwater)
- Regeneration plans for Lagoon Creek and Godwin Beach Environmental Parks, and Campbell's Pocket Rd Council VCA, Caboolture and Sandstone Pt QLD (Moreton Bay Regional Council)
- Woodburn to Ballina Pacific Highway Upgrade, threatened invertebrate (Atlas Ground Beetle and Pink Underwing Moth) monitoring, Coolgardie NSW (Jacobs and Roads and Maritime Services)
- Ballina to Woolgoolga Pacific Highway Upgrade, threatened flora monitoring, Woodburn NSW (Roads and Maritime Services)
- Weipa and Andoom Annual Rehabilitation Monitoring 2014 – 2018, Cape York QLD (Rio Tinto Alcan)
- Eighteen Mile Swamp, base of escarpment vegetation condition monitoring including hemispherical canopy photography, North Stradbroke Is QLD (Sibelco)
- Trevally Trial and QC Alumina mine rehabilitation monitoring, Weipa Qld (Rio Tinto)
- Vance Sand Mining rehabilitation and analogue site monitoring, North Stradbroke Island Qld (Sibelco)
- Acid Frog habitat monitoring, (Sibelco)
- Bribie Island Groundwater Project, ecological (flora and frog) monitoring, North Stradbroke Island Qld (Seqwater)
- Clermont Mine Creek, diversion monitoring using index of diversion condition, ACARP methodology, Clermont QLD (Rio Tinto)
- Hail Creek Mine, biodiversity monitoring using Corveg and Biocondition methodologies Hail Ck QLD (Rio Tinto)
- Curragh Blackwater Creek Diversion, revegetation monitoring and professional oversight, Blackwater QLD (Wesfarmers)
- Traveston Crossing Dam Pilot Revegetation Project, regeneration baseline monitoring data and target ecosystem reference sites,

including carbon accounting,
Rainforest CRC methodology, Brooyar
QLD (SEQWater)

- Nerang River Health Study, stream condition and riparian vegetation monitoring, Numinbah Valley QLD (Gold Coast City Council)
- Author of MERV plant database for ecological monitoring: 4,200 species over 9 broad habitat types , North Coast and Northern Tablelands NSW (Envite Environmental Training)
- Brisbane Aquifer Project, ecological monitoring, water extraction, baseline ecological studies, Karawatha QLD (SEQWater)
- Feral Pig Monitoring Project, Redland Bay QLD (Redlands Shire Council)

Publications

Yeoh, YK, Dennis, P, Paungfoo-Lonhienne, C, **Weber, L**, Brackin, R, Ragan, M, Schmidt, S & Hugenholtz, P 2017, Evolutionary conservation of a core root microbiome across plant phyla along a tropical soil chronosequence, *Nature Communications* 8: 215.

Low, T & **Weber, L** 2017, Seed Dispersal in the Big Scrub, in *The Big Scrub Rainforest: a Journey Through Time*, Everbest China.

Weber, L, VanDerWal, J, Schmidt, S, McDonald, WJF & Shoo, L 2014, Patterns of rain forest plant endemism in subtropical Australia relate to stable mesic refugia and species dispersal limitations, *Journal of Biogeography* 41(2), pp. 222–238.

Shoo, LP, O'Mara, J, Perhans, K, Rhodes, JR, Runting, R, Schmidt, S, Traill, LW, **Weber, LC**, Wilson, KA & Lovelock, CE 2012, Moving beyond the conceptual: specificity in regional climate change adaptation actions for biodiversity in South East Queensland, Australia, *Regional Environmental Change* 14(2), pp. 435–447.

Price, R, **Weber, L**, Weber, E, Latansio-Aidar, S & Hagger, V 2010, Rainforests in South East Queensland, in *South East Queensland Climate Adaptation Research Initiative, Biodiversity - Vulnerability of Focal Habitats to Climate Change: Milestone Report, April 2010*, School of Biological Science, University of Queensland, St Lucia.

Weber, L 2013, Plants that Miss the Megafauna *Wildlife Australia* 50(3), pp. 22–25.

Weber, LC 2009, A new population of Minyon Quandong (*Elaeocarpus sedentarius*) from northern New South Wales, *Australasian Plant Conservation* 17(4), pp. 20–21.

Sheringham, PR, Benwell, A, Gilmour, P, Graham, MS, Westaway, J, **Weber, L**, Bailey, D & Price, R 2008, Targeted Vegetation Survey of Floodplains and Lower Slopes on the Far North Coast. A report prepared for the Comprehensive Coastal Assessment. Department of Environment and Climate Change (NSW), Coffs Harbour, NSW.

Watsford, P, Elliott, M, Price, R & **Weber, L** 2006, *Plants of the Forest Floor: A guide to small native plants of subtropical eastern Australia*, Nullum Publications, Murwillumbah.



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Overview

David is an environmental scientist with over 15 years of experience in ecology, environmental impact assessment and management. He combines scientific knowledge with industry experience to devise practical impact mitigation and management measures to facilitate sustainable development. David has developed skills across a broad range of environmental sciences including aquatic and terrestrial ecology, soil and water management. He has applied these skills across many sectors including water, transport, agriculture, waste, Defence, coal seam gas, mining, power generation and transmission.

David maintains relevant construction, petroleum and mining industry inductions, and has gained substantial experience in the environmental aspects of a broad range of projects. This includes site secondment in the roles of Senior Environmental Advisor and Environment Superintendent for BMA Coal, as well as Environmental Advisor and Ecologist roles for Origin Energy.

In addition to his work history, David holds a Bachelor of Applied Science in Ecology and Environmental Science (with majors in Water Science, and Vegetation and Wildlife Ecology). He is an Accredited Ecologist for the Australian River Assessment System (AusRivAS) in Queensland and NSW, a Senior Operator in electrofishing practice, a Certified Environmental Practitioner, and a 'suitably qualified ecologist' as recognised by the Commonwealth Department of the Environment.

Competencies

- strong personal commitment to safety & the environment
- extensive project management experience
- practical and analytical problem-solving abilities
- effective leadership, communication & interpersonal skills

Qualifications

Bachelor of Applied Science (Ecology & Environmental Science), University of Canberra, 2002

Certified Environmental Practitioner, Environment Institute of Australia and New Zealand, 2009

Australian River Assessment System (AusRivAS) Accreditation, University of Canberra, 2004

Senior Operator in Electrofishing Practice, 2008

RPAS Controller and Operator, Civil Aviation Safety Authority, 2015

NSW BAM Accredited Assessor (BAAS19003), 2019

Areas of expertise

Environmental impact assessment

Ecology

Water quality

Permits and Approvals

QUEENSLAND:

Animal Ethics Committee Approval CA 2017/03/1043

Scientific Purposes Permit WISP14748714

General Fisheries Permit 192554

Rehabilitation Permit WA0002595 (Spotter Catcher)

NEW SOUTH WALES:

Animal Care Ethics Committee Animal Research Authority

NPWS Scientific Licence SL101497

DPI Fisheries Scientific Collection Permit P14/0041-1.2

Insurances

Professional Indemnity \$5M

Public Liability \$20M

Aviation (UAV) operations \$10M

Workplace Personal Injury and WorkCover Insurances

Employment History

- July 2014 – Present Principal Environmental Scientist / Director
DPM Envirosciences Pty Ltd
Buderim, Queensland
www.dpm-enviro.com.au
- Oct 2012 – July 2014 Principal Ecologist / Team Leader
Ecosure Pty Ltd
Maroochydore, Queensland
www.ecosure.com.au
- Mar 2012 – Oct 2012 Principal Ecologist
Unidel / AMEC Environment & Infrastructure Pty Ltd
Brisbane, Queensland
www.amec.com
- Mar 2007 – Mar 2012 Senior Environmental Scientist
HLA Envirosciences / ENSR / AECOM Australia Pty Ltd
Brisbane, Queensland
www.aecom.com
- Mar 2003 – Mar 2007 Environmental Scientist
Geolyse Pty Ltd
Orange, New South Wales
www.geolyse.com

Volunteer Experience

- 2012 – Present 1300 ANIMAL wildlife rescuer
RSPCA Queensland
- 2003 – 2007 Firefighter (Deputy Captain and Crew Leader)
NSW Rural Fire Service

Licences and Permits

- Driver's Licence (Car, Medium Rigid Truck, Marine, Motorcycle, Recreational Pilot)
- ASIC Airside Security Clearance, Civil Aviation Safety Authority
- RPAS (drone) Controller and Operator Certificates, Civil Aviation Safety Authority
- Weapons Licence (Occupational – Category A and B), Queensland
- Chainsaw Licence – Tree Feller, NSW Rural Fire Service
- Senior Operator Electrofishing, Aquateco Consulting
- Scientific Purposes Permits (NSW / QLD) – Terrestrial & Aquatic Ecological Surveys
- General Fisheries Permits (NSW / QLD) – Aquatic Ecological Surveys
- Rehabilitation Permit (QLD) – Fauna Spotter Catcher

Relevant training

- Wildlife Health and Chemical Immobilisation Course (2018)
- NSW Biodiversity Offsets Scheme Accredited Assessors Course (2018)
- Generic Induction (Refresher) Queensland – Coal Surface (2018)
- (Gas) Industry Safety Induction (2018)
- Apply First Aid (2017) and CPR (2018)
- Mining Supervisor training S1, S2 and S3 (2016)
- Operate side-by-side utility vehicles – AHCMOM211 (2016)
- Transport plant and equipment – RIIHAN206D (2018)
- Fluvial Geomorphology and River Styles, Water Technology (2016)
- Sediment and Erosion Control Training: Preparing and Reviewing Sediment and Erosion Control Plans (2014)
- General Induction for Construction (2003)
- Contaminated Machinery Washdown Certification (2013)
- Operate Vehicles in the Field – PMASUP236B (2012) and Operate Light Vehicle – RIIVEH201D (2018)
- BMA Defensive Driving, SOPs and Light Vehicle Authorization (2010)
- Drive 4WD Vehicles in Operational Conditions, NSW Rural Fire Service (2006)
- 4WD Recovery using Advanced Techniques, Australian 4WD Driver Training (2009)
- Wildlife Rescue, RSPCA (2012)
- Venomous Snake Relocation, Educational Reptile Displays (2009)
- Wildlife Carer Education – Advanced Bat Handling and Care, BCRQ / RSPCA (2013)
- Wildlife Carer Education – Fractures Management, Dr Howard Ralph (2014)
- Bushfire Fighter (2003), Advanced Firefighter (2005) & Crew Leader – Wildfire (2007), NSW Rural Fire Service
- Developing Future Leaders Program, Australasian Fire Authorities Council (2004)
- Queensland Regional Ecosystem and Vegetation Structure Training (2009), Queensland Herbarium
- Best Practice in Project Management (2009), Chifley Business School

Referees

Andrew Brownlow, Environment Manager – Premise
(my former manager whilst at Geolyse [now part of Premise] 2003 to 2007, now a client)
Phone: 02 6393 5000. Email: andrew.brownlow@premise.com.au

Joe Fittell, Environmental Project Manager – Resource Strategies
(client of DPM Envirosciences)
Phone: 0403 411 932. Email: jfittell@resourcestrategies.com.au

Key project experience

Date	Project	Client	Project Position	Role
Surface Water and Aquatic Ecology				
2019	Mount Isa Mines Environmental Evaluation – Assessment of Ecological Values, North QLD	Eco Logical Australia / SLR Consulting	Principal Aquatic Ecologist	Field investigations and assessment of aquatic ecological values, including surface water chemistry, aquatic flora, riparian vegetation, aquatic habitat and macroinvertebrate community compositions.
2019	Ecological impact assessment, Atlas Lateral Project, Southern QLD	Jemena	Principal Ecologist	Waterway assessments and watercourse determinations to inform project approvals for the Atlas Lateral Project, a proposed gas pipeline connecting a gas compressor facility near Wandoan to a gas export pipeline near Yuleba, Southern Queensland.
2018	Aquatic ecology impact assessment, Olive Downs Project, Central QLD	Resource Strategies / Pembroke Resources	Principal Aquatic Ecologist	Desktop assessment, field investigations and preparation of an aquatic ecology assessment to inform an EIS for the proposed Olive Downs Project in the Bowen Basin. Subsequent preparation of an Offset Strategy involving wetlands of High Ecological Significance (HES wetlands).
2018	Aquatic habitat assessment and surface water sampling, Southern QLD	Eco Logical Australia / ARTC	Principal Aquatic Ecologist	Surface water sampling and aquatic habitat assessment of waterways intersected by the NSW/QLD Border to Gowrie section of the proposed Inland Rail Project.
2018	Stream health monitoring, Macquarie River and Summer Hill Creek, NSW	Geolyse / Orange City Council	Principal Aquatic Ecologist	Stream health monitoring in accordance with NSW AusRivAS protocols, using macroinvertebrates as bio-indicators of stream health, to satisfy regulatory requirements and project commitments associated with Orange City Council's water supply augmentation.
2018	Receiving Environment Monitoring Program, Lady Annie Mine, Mt Isa, QLD	EMM Consulting / CST Minerals	Principal Aquatic Ecologist	Implementation of the 2018 Receiving Environment Monitoring Program, including water and sediment sampling, macroinvertebrate sampling, aquatic habitat assessment and reporting, associated with an acid leaching copper extraction facility.
2018	Baseline aquatic habitat assessments, Rolleston, QLD	Golder	Principal Aquatic Ecologist	Desktop and field investigations to inform a subsequent impact assessment for a coal seam gas project.
2017-2018	Contamination investigations at: RAAF Base Richmond, NSW RAAF Base Williamstown, NSW Army Aviation Centre Oakey, QLD	AECOM / Defence	Principal Aquatic Ecologist	Contribution to the ecological and human health risk assessment of PFAS. Sampling surface water, sediment, marine invertebrates, marine fish, freshwater invertebrates and freshwater fish, sample processing, stream health assessment following NSW AusRivAS protocols, in-situ water quality measurement, habitat assessment, and reporting on behalf of AECOM.

Date	Project	Client	Project Position	Role
2017	Environmental flow riffle monitoring, Summer Hill Creek, Orange, NSW	Geolyse / Orange City Council	Principal Environmental Scientist and UAV Operator	Riffle habitat mapping of high and low flow environmental releases using a Remotely Piloted Aircraft, data analysis using Pix4D Mapper Pro and ArcGIS to efficiently ground-truth the HEC-RAS model and demonstrate that low flow environmental releases are maintaining sufficient riffle habitat to maintain licence conditions in Summer Hill Creek downstream of Orange's main water supply dam.
2016	Water quality monitoring, Pumicestone Creek, Caloundra, QLD	Rob Carr Engineering	Project manager	Water quality monitoring upstream and downstream of works on a tidal reach of Pumicestone Creek, to assess the impacts of pipeline placement works using a coffer dam and flume pipe.
2016	Aquatic ecology impact assessment, Cameby, QLD	Resource Strategies	Principal Aquatic Ecologist	Field investigations and preparation of an aquatic ecology impact assessment for the proposed modification and continuation of operations at the Cameby Downs (Coal) Mine. Also preparation of a Receiving Environment Monitoring Program (REMP) Design Document.
2016	Assessment of waterway barrier to fish passage, confidential end-client, QLD	AECOM	Principal Aquatic Ecologist	Site visit, assessment of stream geomorphology, fish survey and provision of advice relating to fish passage.
2016	Brisbane City Council Telegraph Road Upgrade, QLD	AECOM	Principal Aquatic Ecologist	Aquatic ecological assessment, including sampling of macroinvertebrates, fish, macrophytes and targeted frog surveys to inform practical impact mitigation measures for stream diversions and realignments.
2016	Contamination investigation, Army Aviation Centre, Oakey, QLD	AECOM	Principal Aquatic Ecologist	Targeted fish sampling using boat-based electrofishing techniques, sample processing, water quality assessment, habitat assessment, and processing of other biota samples on behalf of AECOM.
2015	Origin Energy gas field development – Aquatic Ecological Assessments, QLD	Amec Foster Wheeler	Principal Aquatic Ecologist	Field investigations, impact assessment and reporting of aquatic ecological values in various development areas of the Surat Basin in the vicinity of Miles, Spring Gully and Wandoan. The field surveys and resulting report assessed aquatic macroinvertebrate community compositions; fish and turtle species compositions, age structures and general health; aquatic flora species composition; physical habitat assessment; and a description of likely impacts of an unplanned CSG water spill on identified aquatic ecological values.
2015	Cowra Heavy Vehicle Bypass – Aquatic and Terrestrial Ecology Impact Assessment, NSW	Geolyse	Principal Ecologist	Field investigations and preparation of an aquatic and terrestrial ecology impact assessment for the proposed bypass road and bridge crossing of the Lachlan River.
2014-2015	Arrow Bowen Pipeline (ABP) – Aquatic Values Surveys, QLD	Ecosure	Principal Aquatic Ecologist	Led aquatic ecological surveys of watercourses of stream order 3 and above intersected by the proposal ABP alignment. The surveys were undertaken over two weeks in the 'early wet' season, then repeated in the 'late wet' season, to inform an Aquatic Values Survey Report and an Aquatic Values Management Plan for the project. Field surveys focused on aquatic habitat assessment, macroinvertebrate sampling, fish and turtle sampling.

Date	Project	Client	Project Position	Role
2015	Rio Tinto Coal Australia Hail Creek Transition Project – Aquatic Ecology Impact Assessment, QLD	Resource Strategies	Principal Aquatic Ecologist	Prepared an aquatic ecology impact assessment to form part of a broader Environmental Assessment Report for the Project.
2014	Queensland Energy Resources Aquatic Ecology and Stygofauna Baseline Assessments, Gladstone QLD	Resource Strategies	Project Manager and Principal Aquatic Ecologist	Project management, fieldwork and reporting for an aquatic ecological assessment and stygofauna sampling within and surrounding the proposed development site.
2012-2014	Arrow Surat Pipeline (ASP) – Aquatic Values Surveys and Management Plans, QLD	Arrow Energy	Principal Aquatic Ecologist	Project management, fieldwork and reporting associated with aquatic ecological surveys of watercourses (of stream order 3 and above) intersected by the proposal ASP alignment. The surveys were undertaken in the AusRivAS 'early wet' and 'late wet' sampling seasons. An Aquatic Values Survey Report and an Aquatic Values Management Plan were prepared based on the desktop and field findings. Some minor realignments were proposed to avoid areas of high aquatic ecological value. These were discussed with the client while the team was still on site. Field surveys focused on aquatic habitat assessment, aquatic plants, macroinvertebrate sampling, fish sampling, turtle sampling, and habitat assessment for platypus and turtle breeding places.
2013-2014	Defence South Queensland Water Quality Monitoring Program, South East QLD	Spotless	Project Manager and Principal Aquatic Ecologist	Project management, fieldwork and reporting. Undertake seasonal water and sediment quality sampling within the Evans Head Air Weapons Range, interpretation of results and reporting.
2013-2014	Paragon Coal T9 West Project – Baseline Aquatic Ecological Assessment, South East QLD	Resource Strategies	Project Manager and Principal Aquatic Ecologist	Project management, fieldwork and reporting, including scoping, baseline assessment and reporting on aquatic values within the T9 West project area, Tiaro.
2013	Aquatic Ecological Investigation following sediment release event, South QLD	(Confidential client)	Principal Aquatic Ecologist	Project management, fieldwork and reporting. Legally privileged investigation and assessment of ecological impacts following sedimentation of a high value watercourse.
2013	Watercourse pre-clearance inspections, South and Central QLD	Saipem	Principal Aquatic Ecologist	Project management, fieldwork and reporting. Pre-construction site inspections by an aquatic ecologist at 14 watercourse crossings.
2012-2013	Byerwen Coal Mine Aquatic Ecological Impact Assessment, Central QLD	QCoal	Principal Aquatic Ecologist	Technical lead, fieldwork and reporting. Baseline survey and impact assessment of waterways and wetlands within the proposed Byerwen Coal Mine project area.
2012-2013	Australia Pacific Liquefied Natural Gas Western High Pressure Gas Network (WHPGN) – Aquatic Values Survey and Management Plan, South QLD	Australia Pacific LNG	Principal Aquatic Ecologist	Technical lead, fieldwork and reporting associated with aquatic ecological surveys at 64 waterway crossings intersected by the proposed WHPGN. Field surveys were undertaken to inform the Preparation of an Aquatic Values Survey Report and an Aquatic Values Management Plan, as part of the broader Environmental Management Plan for the project. Field surveys focussed on aquatic habitat assessment, aquatic plants, macroinvertebrate sampling, fish sampling, turtle survey, and habitat assessment for platypus and turtle breeding places.

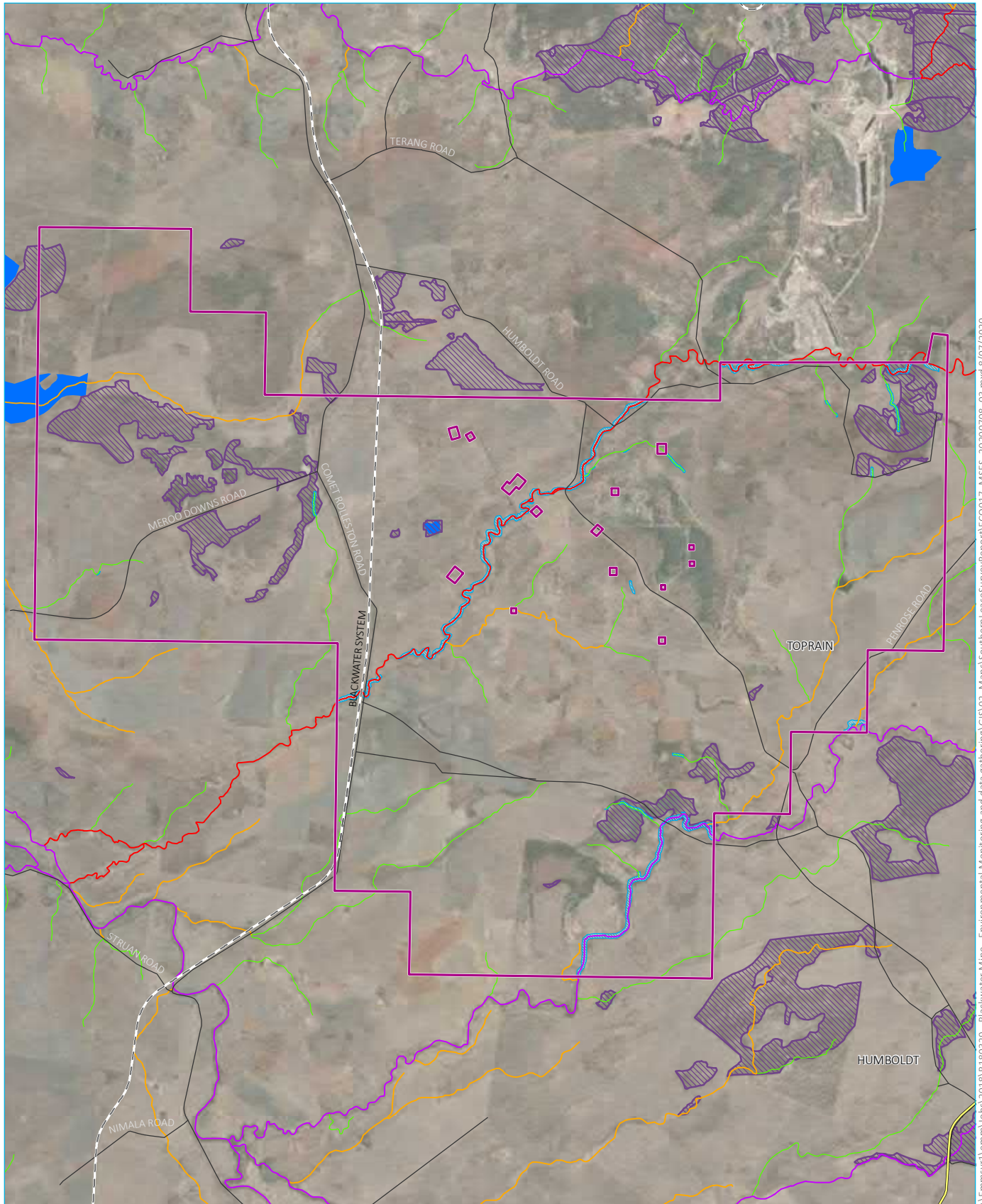
Date	Project	Client	Project Position	Role
2012	SunCoast 132kV Power Project – Platypus Management Plan, South East QLD	ENERGEX	Principal Ecologist	Development of management measures to negate impacts of pole placement on platypus.
2012	Hutton Creek targeted aquatic fauna survey and management plan, South QLD	Saipem	Project Manager and Principal Aquatic Ecologist	Project management, fieldwork and reporting for targeted platypus and turtle survey on Hutton Creek and preparation of a management plan prior to construction of the GLNG Gas Transmission Pipeline.
2012	Water quality monitoring on the Nerang River, South East QLD	Gold Coast Barges	Project Manager and Principal Aquatic Ecologist	Project manager, report structure and technical review. Development and implementation of baseline sampling and a weekly water quality monitoring program for the duration of an erosion mitigation project on the Nerang River.
2012	Roma to Brisbane Pipeline duplication – Aquatic Values Survey and Management Plan, South East QLD	APA Group	Principal Aquatic Ecologist	Technical lead, fieldwork and reporting. Habitat assessment and aquatic flora surveys for the proposed duplication of the Roma Brisbane Pipeline.
2011-2012	Proposed Monto Coal Mine – Aquatic Ecology Impact Assessment, Central QLD	Macarthur Coal	Senior Environmental Scientist	Technical lead and fieldwork. Baseline survey and impact assessment of waterways and wetlands of the Mining Lease Area encompassing the proposed Monto Coal Mine.
2011	Ecological characterisation of the Cobourg Peninsula Ramsar Wetlands, NT	Department of the Environment	Senior Environmental Scientist	Marine field team lead, including assessment of fish and macroinvertebrate community composition of representative marine and estuarine wetlands of the Cobourg Peninsula Ramsar Wetlands.
2011	Aquatic Ecology Impact Assessment for Proposed Gas Fields, NSW	Eastern Star Gas	Senior Environmental Scientist	Technical lead, fieldwork and reporting. Aquatic ecological assessment for proposed gas fields and surface water discharges as part of the project EIS for gas field development in the Pilliga Nature Reserve, NSW.
2011	Contaminant bioaccumulation assessment of intertidal wetlands bordering the Brisbane Airport.	Airservices Australia	Technical lead, including fieldwork and reporting.	Development and implementation of a contaminant bioaccumulation experiment (with reference sites and controls) using oysters. Sampling and assessment of macroinvertebrates and fish tissue and organs.
2009, 2011	BMA Norwich Park Mine - Sediment and Biological Monitoring Program, Central QLD	BMA Coal	Project Manager and Senior Environmental Scientist	Development and implementation of a biological monitoring program. Habitat assessment and collection of macroinvertebrates, data analysis and reporting.
2010-2011	Proposed Foxleigh Plains Mine – Aquatic Ecology Impact Assessment, Central QLD	Anglo Coal	Project Manager and Senior Environmental Scientist	Technical lead, fieldwork and reporting. Baseline surveys and impact assessment of waterways transecting the proposed expansion area.
2010-2011	BMA Norwich Park Mine – Secondment, Central QLD	BMA Coal	Project Manager and Seconded	Senior Environmental Advisor and Acting Environment Superintendent.
2010	Effluent discharge investigation at RAAF Base Amberley, South East QLD	Spotless	Senior Environmental Scientist	Technical lead, fieldwork and reporting. Sediment, surface water and macroinvertebrate sampling, data analysis and reporting to assess the level of impact of treated effluent discharge upon receiving waters.

Date	Project	Client	Project Position	Role
2008-2010	Defence South Queensland Water Quality Monitoring Program, South East QLD	Spotless	Senior Environmental Scientist	Technical lead, fieldwork and reporting. Twice-yearly macroinvertebrate sampling, analysis and reporting for Amberley RAAF Base and Canungra Field Training Area.
2009	Lihir Gold Mine, PNG – Aquatic and Terrestrial Ecology Impact Assessment	Lihir Gold	Senior Environmental Scientist	Field team lead and reporting. Ecological surveys for a proposed dam on the Hurtol River to supply water to the mine processing plant.
Terrestrial Ecology				
2019	Baseline terrestrial fauna surveys, Ensham Resources MDL 217 Conversion Project, Central QLD	AECOM	Principal Ecologist	Comprehensive and targeted fauna surveys, including pitfall trapping, Elliott trapping, camera traps, Anabat recordings, spotlighting, active reptile searches, bird surveys, koala searches and habitat assessments.
2019	Baseline terrestrial fauna surveys, North Galilee Water Scheme, Central QLD	CDM Smith	Principal Ecologist	Fauna habitat assessment and targeted surveys for ornamental snake, including pitfall trapping, spotlighting, active searches and habitat assessment.
2019	Fauna Management Plan and Pest Management Plan, Olive Downs Coking Coal Project, Central QLD	Resource Strategies	Principal Ecologist	Preparation of a Fauna Management Plan and a Weed and Pest Animal Management Plan for the proposed Olive Downs Coking Coal Project in the Bowen Basin.
2019	Atlas Lateral Project, South QLD	Jemena	Principal Ecologist	Baseline weed and pest animal surveys ahead of construction for the proposed 60km Atlas Lateral Pipeline.
2018	Atlas Lateral Project, South QLD	Jemena	Principal Ecologist	Desktop assessment, flora surveys, field verification of Regional Ecosystems and Threatened Ecological Communities, fauna habitat assessment, targeted fauna survey (including harp traps, camera traps, spotlighting and active searches), watercourse / drainage feature determination, and preparation of an Ecological Impact Assessment to support an Environmental Authority for the Atlas Lateral Pipeline.
2018	Terrestrial flora and fauna assessments, Olive Downs Coking Coal Project, Central QLD	Resource Strategies	Principal Ecologist	Desktop assessments, flora surveys, field verification of Regional Ecosystems and Threatened Ecological Communities, fauna habitat assessment, comprehensive fauna survey (trapping), targeted fauna survey, preparation of baseline flora and fauna assessment reports, preparation of a baseline offset investigation report and Offset Strategy for the proposed Olive Downs Coking Coal Project in the Bowen Basin.
2017	Contamination investigation, Army Aviation Centre, Oakey, QLD	AECOM	Principal Ecologist	Contribution to ecological and human health risk assessments. Heath assessment of vegetation communities, bird surveys, fauna habitat assessment, mammal dissections, and provision of a technical report.
2016	Former Petrie Cartonboard Mill – Ecological surveys and management plans, South East QLD	Peter J Ramsay & Associates / Orora	Ecologist	Field data collection of Restricted weeds; ground-truthing vegetation communities; mapping weed distributions and abundance across the 218 ha property; preparation of vegetation, weed, pest animal and fauna management plans for remediation of the site.

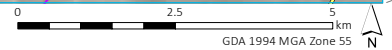
Date	Project	Client	Project Position	Role
2016	Origin Energy gas field development – Weed surveys, Spring Gully, QLD	Amec Foster Wheeler	Ecologist	Field data collection of Declared weeds across areas to be constructed for gas wells, access tracks and flow lines, to quantify the extent and biomass of Declared weeds requiring removal prior to construction.
2016	Ecological investigations at RAAF Base Williamtown, NSW	AECOM	Ecologist	Fieldwork, fauna habitat assessment and provision of a technical report to inform the fauna usage of waterways and adjoining habitats of the study area.
2016	Origin Energy gas field development – Weed surveys, Wandoan, QLD	Amec Foster Wheeler	Ecologist	Field data collection of Declared weeds across areas to be constructed for gas wells, access tracks and flow lines, to quantify the extent and biomass of Declared weeds requiring removal prior to construction.
2015	Proposed expansion of the Daroobalgie Landfill – Ecological Constraints Assessment, Central West NSW	Forbes Shire Council	Ecologist	Fieldwork (floristic surveys, vegetation mapping, fauna habitat assessment, fauna surveys), ecological constraints assessment and provision of a technical report to inform a potential property acquisition.
2015	Proposed Orange to Carcoar potable water pipeline – Flora, fauna and aquatic ecology assessments, Central West NSW	Geolyse	Ecologist	Fieldwork (floristic surveys, vegetation mapping, fauna habitat assessment, fauna surveys, aquatic habitat assessment), impact assessment and provision of a technical report to inform the Review of Environmental Factors.
2015	Mineral Hill Mine – Ecological Impact Assessments for Exploration Drilling, Condobolin, NSW	KBL Mining	Ecologist and vegetation clearing crew supervisor	Ecological impact assessment of proposed surface disturbance in relation to vegetation, flora and fauna species. Completion of Assessments of Significance for threatened fauna species. Development of a vegetation clearing procedure. Fauna pre-clearance surveys/checks and supervision of clearing operations.
2015	Arrow Bowen Pipeline – Terrestrial fauna surveys, QLD	Ecosure	Ecologist	Assistance with detailed (trapping) post-wet season fauna surveys and habitat assessments over a two-week period.
2012	Australia Pacific LNG Western High Pressure Gas Network – Terrestrial Fauna Survey, South QLD	Australia Pacific LNG	Field Team Leader and Terrestrial Ecologist	Habitat assessment and fauna survey using Anabat, harp traps, pit-fall traps, ground Elliot traps, baited camera traps, active reptile searches, spotlighting, morning and evening bird surveys.
Site Secondment Roles				
2014-2015	Origin Energy gas field development – Surat Basin, QLD	Amec Foster Wheeler / Origin Energy	Environment Advisor	Ensure consistency of on-ground works with work packages issued by Origin Energy, present environment considerations daily at toolbox talks, pre-clearance surveys and checks, weed identification and management, monitoring and refinement of sediment and erosion controls.
2014-2015	Origin Energy Gas Field Development, QLD	Amec Foster Wheeler / Origin Energy	Fauna Spotter Catcher	Pre-clearance stage fauna and breeding place relocation; clearing stage fauna salvage, relocation, first aid and euthanasia; monitoring of open excavations; water quality measurement, volume calculations and provision of advice on pit water management.
2010-2011	BMA Norwich Park Mine – Secondment, Central QLD	BMA Coal	Senior Environment Advisor Acting Environment Superintendent	Delegate tasks to team members; monitor surface water, groundwater, air quality and rehabilitation success; manage the mine water balance; monitor the quality and quantity of discharges and receiving waters; investigate and complete planning and approvals for pipeline watercourse crossings and new haul road.

Appendix J

MSES mapping



Source: EMM (2020); DNRME (2020)



KEY

- | | | |
|---|-------------------|----------------|
| Study area | Rail line | Fish passage |
| Major road | Minor road | Risk of impact |
| GBR wetland of high ecological significance | Essential habitat | 1 - low |
| Watercourse vegetation | | 2 - moderate |
| | | 3 - high |
| | | 4 - major |

MSES values

BHP Billiton Mitsubishi Alliance
 Southern lease field ecology survey report
 Appendix I



\\Emmsvr1\emmm\Jobs\2018\B180329 - Blackwater Mine - Environmental Monitoring and data gathering\GIS\02_Maps\SouthernLeaseSurveyReport\ECO017_MSES_20200708_03.mxd 8/07/2020

Appendix K

Ornamental snake habitat assessments

The following table provides a summary of Ornamental Snake habitat in the survey area, based around patches of gilgai that have been ground-truthed. The status of these patches as Ornamental Snake habitat is given, with a rationale as to whether it forms suitable habitat for the species based on microhabitat and proximity to other suitable habitat. The patches of gilgai are shown on Figure 5.5.

Table K.1 Summary of Ornamental Snake habitat

Area of gilgai	Habitat suitability
1	Large patch of gilgai in the southeast of the survey area, which connects to more extensive areas of gilgai further to the east around Humboldt (and habitat in which EMM have previously recorded Ornamental Snake in other surveys for BHP exploration). Area is subject to grazing, and interspersed with patches of regrowth. Little ground timber present although cracking clay soils occur. Gilgai full of Umbrella Cane Grass in places. Ornamental Snake recorded in this patch during spring 2019 survey.
2	Not verified in the field, although aerial imagery shows well-formed gilgai in the vicinity of known habitat polygon.
3	Small patch of gilgai in low-lying area to the west of Shotover Creek, on the floodplain of this watercourse. Bordered by areas of Brigalow woodland associated with slopes of rocky jump up to north. Little ground timber present although cracking clay soils occur. Gilgai full of Umbrella Cane Grass in places. Area is subject to grazing.
4	Extensive area of gilgai between Shotover Creek and the Comet – Rolleston road, in which five Ornamental Snake were recorded during the spring 2019 surveys. Western parts of the polygon comprise large well formed gilgai with cracking clay soils, in generally cleared landscape (although small patches of regrowth are present). Little ground timber present, some gilgai with a sandier component with fewer soil cracks (and where observed in these gilgai, Ornamental Snake seemed to be utilising clumps of Umbrella Cane Grass for shelter. Many of the gilgai were overgrown with Umbrella Cane Grass. To the eastern end of the polygon, areas of Brigalow regrowth occur and fallen ground timber is common. Soils in this area include frequent open scalds with ironstone and a sandier substrate. Area is subject to grazing.
5	Small patches of isolated gilgai, surrounded by Buffel Grass and gilgai themselves infested with Umbrella Cane Grass. Little to no ground timber. Habitat is marginal in this area for Ornamental Snake. Retained as potential habitat due to the proximity of known habitat for the species immediately to the west and east although the suitability of this area is compromised. Area is subject to grazing.
6	Shallow depressions and poorly formed gilgai on sandier soils with ironstone influence. Very few cracks in soil present, and little ground timber. Gilgai surrounded by Buffel Grass. Despite this seemingly poor quality habitat, one Ornamental Snake recorded during autumn 2020 surveys. This small patch of gilgai is located approximately 2 km northwest of an extensive area of gilgai outside of the survey area, in which EMM have previously recorded Ornamental Snake, and a patch of gilgai to the north (within the survey area) in which EMM recorded Ornamental Snakes in the spring 2020 surveys. An area of Brigalow woodland forms the northern part of this polygon, and likely acts as shelter for the species due to the lack of soil cracks and ground timber within the gilgai themselves. Area is subject to grazing.

Area of gilgai	Habitat suitability
7	Two Ornamental Snake recorded in this patch of gilgai during spring 2019 surveys. Reasonably open area of gilgai, with little regrowth (although Brigalow regrowth in cleared rows forms the eastern part of the polygon). The area has been well stick-raked in the past with little ground timber present. Gilgai quite shallow on a slightly stony substrate although some soil cracks present. Area is subject to grazing.
8	<p>Area of well formed gilgai containing abundant aquatic vegetation. Sandy substrate with ironstone between areas of gilgai, although some areas of cracking clay. Little ground timber present.</p> <p>No suitable habitat occurs to the north, and suitable (known) habitat to the south is isolated by a slightly elevated sandy rise and over 1 km distant. Nonetheless, due to the proximity of known habitat in the southwest of the survey area, the species could potentially occur in this patch of gilgai.</p> <p>An area of Brigalow woodland forms the northwestern part of this polygon, and likely acts as shelter for the species due to the lack of soil cracks and ground timber within the gilgai themselves. Area is subject to grazing.</p>
9	Area of large open gilgai, with sparse ground timber (although more predominant around patches of regrowth). Some cracking clay soil present although areas of sandier substrate with ironstone influence. In the southern parts of the polygon, gilgai infested with Umbrella Cane Grass. Area is subject to grazing.
10	Small (c.10 ha) patch of gilgai. Isolated in an area of Buffel Grass, and area is subject to grazing. Habitat is marginal in this area for Ornamental Snake. Retained as potential habitat due to the proximity of known habitat for the species immediately to the east, and potential movement of the species to larger areas of habitat to the west of Rockland Creek. However, habitat in this patch is marginal.
11	Small (c.20 ha) patch of gilgai. Isolated individual gilgai in an area of Buffel Grass, and area is subject to grazing. Habitat is marginal in this area for Ornamental Snake. Retained as potential habitat due to the proximity of known habitat for the species immediately to the east, and potential movement of the species to larger areas of habitat to the west of Rockland Creek. However, habitat in this patch is marginal.
12	A few isolated gilgai in an area of Buffel Grass with Brigalow regrowth around the margins. Borders on to Rockland Creek in the southeast. Little ground timber, although cracking clay soils present. Area is subject to grazing.
13	Not verified in the field, although aerial imagery shows well-formed gilgai in the vicinity of known habitat polygon.
14	<p>A large patch of gilgai, with patches of regrowth Brigalow and other Acacia species occurring throughout. and in these areas fallen timber is more prevalent. Cracking clay occurs throughout. Extensive Buffel Grass areas, and some gilgai dominated by aquatic vegetation. Two Ornamental Snake were recorded in this patch during autumn 2020 surveys.</p> <p>The gilgai patch is curtailed by the presence of the railway line to the west (with gilgai continuing on the other side of the line).</p> <p>A number of small patches of Brigalow woodland and regrowth occur in the polygon, and likely act as shelter for the species.</p>
15	Small (c.10 ha) patch of gilgai. Isolated individual gilgai in an area of Buffel Grass, with gilgai themselves infested with Umbrella Cane Grass, and area is subject to grazing. Some cracking clay soil, but little ground timber. Habitat is marginal in this area for Ornamental Snake. Retained as potential habitat due to the proximity of large area of known habitat for the species immediately to the north, however, habitat in this patch is marginal.
16	Extensive area of gilgai to the west of the railway line. Gilgai surrounded by Buffel Grass and gilgai themselves often inundated with Umbrella Cane Grass reducing visibility in searching for the species. Largely open except for retained areas of Brigalow regrowth interspersing the polygon. In these areas some ground timber present although well stick-raked beyond these narrow strips of regrowth. Known habitat immediately east of the railway line. Area is subject to grazing.

Area of gilgai	Habitat suitability
17	Large patches of gilgai between Meroo Downs Road and Comet Road forming one area of contiguous habitat. In general the gilgai well vegetated in a surrounding area of Buffel Grass, with patches of sparse regrowth. Little ground timber present. Further to the west, sandier substrates with ironstone patches occurring. An area of <i>E. cambageana</i> / <i>A. harpophylla</i> woodland (with abundant ground timber) is included on the western margin of this polygon, and likely acts as shelter for the species due to the lack of soil cracks and ground timber within the gilgai themselves. This area of woodland likely inundates during the wet season. Area is subject to grazing.
18	Area of shallow gilgai, with little ground timber and few soil cracks, Areas of sandy substrate and bare patches between individual gilgai. To the north of the patch, gilgai infested with Umbrella Cane Grass and surrounded by Buffel Grass. Patchy areas of Brigalow and other Acacia regrowth. Area is subject to grazing.
19	Isolated patches of gilgai on alluvial plain bordered by areas of <i>E. melanophloia</i> woodland. Area is subject to grazing. Largely isolated from other areas of gilgai although some connectivity along alluvial corridor to the southwest and extensive areas of gilgai outside the survey area warrants retention as possible habitat.
20	Not verified in the field, although aerial imagery shows well-formed gilgai among area of regrowth.