BHP Mitsubishi Alliance

Appendix G

Terrestrial Ecology Matters of National Environmental Significance Assessment

Blackwater Mine - North Extension Project

Terrestrial Ecology Matters of National Environmental Significance Assessment

Prepared for BM Alliance Coal Operations Pty Ltd via SLR Consulting

December 2023

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Blackwater Mine - North Extension Project

Terrestrial Ecology Matters of National Environmental Significance Assessment

Report Number
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Client
BM Alliance Coal Operations Pty Ltd via SLR Consulting

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Prepared by	Approved by
	
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Associate Ecologist	Associate Ecologist
12 December 2023	12 December 2023

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

TABLE OF CONTENTS

Appendices

Tables

Figures

Photographs

Executive Summary

BM 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 1967 and currently operates under an Environmental Authority (EA) EPML00717813, with existing coal production at c.16 million tonnes per annum (Mtpa).

BWM's Mining Leases (MLs) include ML1759, ML1760, ML1761, ML1762, ML1767, ML1771, ML1772, ML1773, ML1792, ML1800, ML1812, ML1829, ML1860, ML1862, ML1907, ML70091, ML70103, ML70104, ML70139, ML70167 and ML70329.

BMA seek approval to extend the current mining operation through the BWM – North Extension Project (the Project). The Project would extend the mining area of the existing BWM to within Surface Area (SA)10 on ML1759 and SA7 on ML1762.

EMM Consulting Pty Ltd (EMM) was commissioned to undertake contemporary baseline terrestrial ecological studies across the Project Study area to support environmental impact assessments. The surveys consisted of seasonal surveys applying methods consistent with survey guidelines across 'the Study area' which encompasses a larger area than that proposed to be developed for mining activities (Figure 1.1).

The purpose of this report is to present information on all terrestrial ecology surveys and findings that have been undertaken by EMM to date in the Study area that relate to MNES. A separate report (EMM 2023a) summarises aquatic ecology baseline assessments relating to MNES.

Matters relating to potential groundwater dependent ecosystems (GDEs) are assessed in a separate report (ESP 2023) where they pertain to Type 1 (stygofauna) or Type 2 (aquatic) GDEs (as defined by Richardson et al 2011a). Type 3 GDEs (terrestrial) are assessed in this report.

This report summarises the federally listed biodiversity values present in the Study area and provides an impact assessment following the *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DoEE 2013).

Most of the habitat across the Study area is considered low quality due to broad-scale vegetation clearing, cattle grazing, weed encroachment and fragmentation. The areas of non-remnant vegetation are now largely dominated by introduced Buffel Grass, have been raked of woody debris and rocks, and continue to be grazed by livestock. Areas of good quality habitat are limited and usually constrained to small vegetation fragments or as narrow corridors fringing creek and drainage-lines.

Results of the field ecology surveys have found that while the Study area has large, disturbed areas of poor condition, there are areas which support ecological values. The key ecological values identified during the flora, fauna and habitat assessments are summarised below.

a Vegetation communities

Ground-truthed vegetation communities in the Study area included the following Regional Ecosystems:

- RE11.3.1 *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains;
- RE11.3.2 *Eucalyptus populnea* woodland on alluvial plains;
- RE11.3.3 *Eucalyptus coolabah* woodland on alluvial plains;

- RE11.3.6 *Eucalyptus melanophloia* woodland on alluvial plains;
- RE11.3.25 *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines; and
- RE11.4.9 *Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains.

Remnant RE11.3.1 mapped along Sagittarius Creek, Taurus Creek and Two Mile Gully represent the largest tract of vegetation within the Study area with a patch of RE11.3.1 along Taurus Creek (6.34 ha) also meeting structural and conditional thresholds for Brigalow TEC.

Remnant sites 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 these sites presented in relatively good condition, all possessed some level of exotic encroachment, most commonly by Buffel Grass dominating the ground layer. All sites also showed evidence of disturbance either by cattle grazing, previous vegetation clearance, or weed encroachment.

b Protected plants

Threatened flora species identified by the desktop assessment were targeted during the flora surveys. No EPBC Act listed species were recorded and there is considered to be a low likelihood of occurrence of those species with potential to occur.

c Fauna habitat assessments

Habitat assessments were completed at 165 sites. Specific habitat attributes were analysed at each site to confirm suitable habitat features for particular threatened species and provide justification for the potential presence or absence of a species due to the presence or absence of suitable microhabitats.

Most habitat observed across the Study 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 Study area is largely fragmented with habitat limited in extent and typically constrained to riparian zones.

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

d Threatened and migratory fauna species

Four threatened and three migratory fauna species were recorded during field surveys. Recorded threatened species include the Australian Painted Snipe via direct observations in an area of gilgai on ML1762 to the east of Taurus Creek within the Study area but outside of the Project footprint, and on two dams in the west of the Study area (one within the project footprint and one outside), Ornamental Snake in an area of gilgai on ML1762 to the east of Taurus Creek (outside the Project footprint) and Squatter Pigeon on two occasions in the general vicinity of dams around Taurus Road (one within the Project footprint). Additionally, old signs of Koala (old scratches) were observed.

These records of the nomadic species, Australian Painted Snipe, suggest it may occur on any natural or artificial wetland habitat within the Study area when conditions are suitable. This species is most likely to utilise ephemeral habitat on site in the wet season then leave once these areas dry up. There is potential that it could remain year-round on larger dams that retain water and have suitable fringing vegetation cover, or other permanent water bodies.

The Ornamental Snake were found in close proximity to each other in an area of gilgai between Taurus Creek and the Blackwater-Rolleston Road on ML1762. It is likely that Ornamental Snake is scarce in the Study area, as only three were found during three nights of searching during March 2020, despite good conditions. Some of the gilgai areas in the Study area are heavily degraded or isolated, and are not considered likely to hold this species (see Section 7.1.3).

Squatter Pigeon was recorded on two occasions in supplementary ecology surveys commissioned in June-August 2023, despite not being recorded in over 600 hours in the earlier baseline surveys. They were recorded in the vicinity of two dams around Taurus Road and are likely to be scarce in the Study area, reflective of the degraded nature of the habitat and extensive Buffel Grass areas. Refer Section 7.1.6 for further details.

Koala was also recorded via indirect observation of old scratches on Queensland Blue Gums along Taurus Creek as well as old scratches on an unnamed creek and a scat along this creek (see Figure 7.4). The scratches on Taurus Creek were present in a small backwater of the main creek line, which was fringed by Queensland Blue Gum which is a preferred foraging resource. Despite extensive transects along creek lines across the remainder of the Study area, no other signs of Koalas were observed, and it is likely that its status in the Study area is limited to occasional transient individuals. Refer Section 7.1.4 for further details.

Additionally, the migratory listed (EPBC Act) Latham's Snipe, Glossy Ibis and Fork-tailed Swift were recorded during field surveys. Refer Sections 7.1.7, 7.1.8 and 7.1.9 for further details on these species and their habitats.

e Summary of MNES significant residual impact assessment

Based on completed impact assessments it has been assessed that significant, residual impacts may occur to Ornamental Snake as a result of the Project. Therefore, offsets will be assessed and proposed for this species in line with the EPBC Act Environmental Offsets Policy.

No other significant impacts were found to occur.

1 Introduction

1.1 Background

BM 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 1967 and currently operates under an Environmental Authority (EA) EPML00717813, with existing coal production at c.16 million tonnes per annum (Mtpa).

BWM's Mining Leases (MLs) include ML1759, ML1760, ML1761, ML1762, ML1767, ML1771, ML1772, ML1773, ML1792, ML1800, ML1812, ML1829, ML1860, ML1862, ML1907, ML70091, ML70103, ML70104, ML70139, ML70167 and ML70329 (Figure 1.1).

BMA seek approval to extend the current mining operation through the BWM – North Extension Project (the Project). The Project would extend the mining area of the existing BWM to within Surface Area (SA)10 on ML1759 and SA7 on ML1762 (Figure 1.1).

EMM Consulting Pty Ltd (EMM) was commissioned to undertake contemporary baseline terrestrial ecological studies across the Project Study area (referred to as Study area hereafter) to support environmental impact assessments, including an assessment of impacts on matters of national environmental significance (MNES). The surveys consisted of seasonal surveys applying methods consistent with survey guidelines across the Study area (Figure 1.1) which encompasses a larger area than that proposed to be developed for mining activities.

The objective of these ecological studies was to:

- undertake baseline ecology surveys, including targeted threatened species surveys, across the larger Study area;
- identify the presence and potential for presence of matters of national and state environmental significance (MNES and MSES);
- map the distribution of those environmental values across the 'Study area'; and
- assess overall ecological condition and habitat function of identified communities and habitats.

Prior to all field ecology surveys being undertaken, including aquatic and terrestrial, desktop ecology assessments were completed by EMM to identify biodiversity values of Federal and State significance that may occur in the Study area including certified regional ecosystems (REs), threatened ecological communities (TECs), threatened species and migratory species and associated habitats. Survey methods and results are summarised in this report.

Findings from the terrestrial ecology assessments relating to MNES are presented in this report. A summary of the baseline aquatic ecology assessments relating to MNES (are provided in a separate assessment (EMM 2023a)).

1.2 Purpose of this report

The purpose of this report is to present information on all terrestrial ecology surveys and findings that have been undertaken by EMM to date in the Study area that relate to MNES. A separate report (EMM 2023b) summarises terrestrial ecological values at a State level. In addition, the Aquatic Ecology assessments associated with MSES and MNES are addressed in a standalone report (EMM 2023a), which includes a summary of aquatic ecology desktop assessments, survey methods and timing, and results. Matters relating to potential aquatic groundwater

dependent ecosystems (GDEs) including Type 1 (stygofauna) or Type 2 (aquatic) GDEs (as defined by Richardson et al 2011a) are assessed in a separate report (ESP 2023). Whereby Type 3 GDEs (terrestrial) are assessed in this report.

This report summarises the federally listed biodiversity values present in the Study area, describes the potential impacts of the Project and details the Project avoidance, mitigation and management measures. f

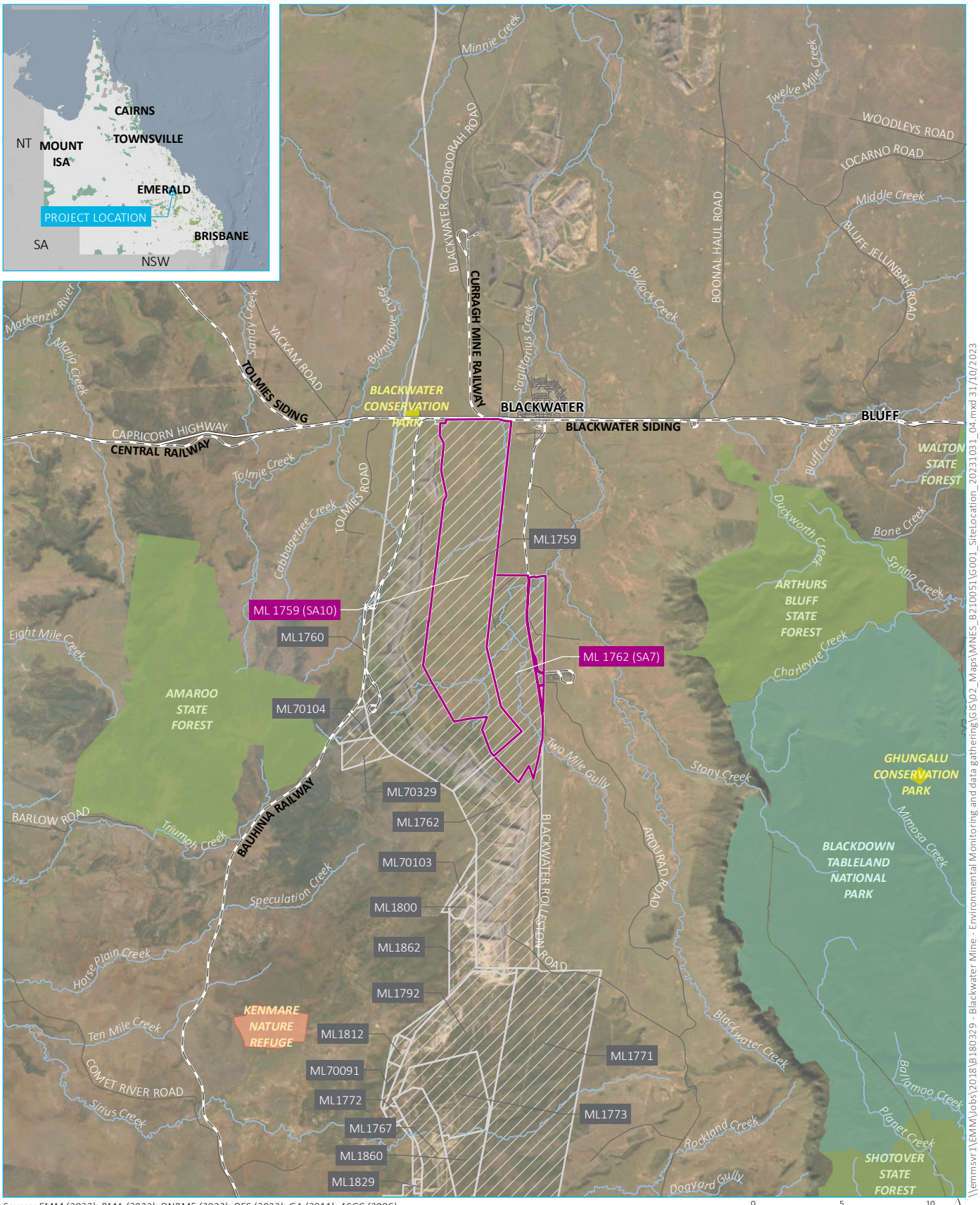
Seasonal surveys were conducted across the Study area on the following dates:

- Early summer flora surveys between 3 December 2018 and 8 December 2018;
- Autumn flora surveys were conducted between 1 April 2019 and 5 April 2019;
- Autumn fauna surveys were conducted between 18 March 2019 and 24 March 2019 (diurnal surveys), and between 11 April 2019 and 15 April 2019 (nocturnal and some diurnal surveys);
- Spring flora surveys were conducted between 29 September 2019 and 4 October 2019;
- Spring fauna surveys were conducted between 28 September 2019 and 4 October 2019 (diurnal surveys), and between 15 October 2019 and 21 October 2019 (nocturnal surveys);
- Aquatic ecology surveys (early-wet season) were conducted between 10 December 2019 and 12 December 2019;
- Supplementary Ornamental Snake (*Denisonia maculata*) nocturnal searches were conducted between 19 March 2020 and 22 March 2020. The purpose of these supplementary surveys to previous seasonal surveys is to further validate the status of Ornamental Snake in the Study area under climatic conditions that maximise their detection (substantial rains had occurred in January and February 2020 filling the gilgai). These surveys also targeted Australian Painted Snipe (*Rostratula australis*);
- Aquatic ecology surveys (late-wet season) were conducted between 19 May 2020 and 21 May 2020; and
- Supplementary terrestrial ecology habitat assessments were completed between 14-17 June 2023 by EMM and in August/September 2023 by E2M to further verify extent of MNES and MSES values across the Study area.

This report includes information on:

- Study area;
- desktop searches and results in the wider desktop Study area (Study area buffered by 50 km);
- field survey methods, survey effort and survey locations;
- timing and weather conditions;
- survey results including ground-truthed REs, TECs, fauna habitat assessments and habitat condition, recorded threatened flora and fauna species and migratory species;
- habitat mapping for listed fauna species known or likely to occur; and

- identification of potential terrestrial groundwater dependent ecosystems (GDEs).



Source: EMM (2023); BMA (2023); DNRME (2022); DES (2022); GA (2011); ASGC (2006)

0 5 10 km

GDA 1994 MGA Zone 55

N

\\emmsvr1\EMM\Jobs\2018\B180329 - Blackwater Mine - Environmental Monitoring and data gathering\GIS\02_Maps\MNES_B210051\G001_SiteLocation_20231031_04.mxd 31/10/2023

KEY

- Study area
- BWM mining lease
- Rail line
- Major road
- Minor road
- Named watercourse
- National park
- State forest
- Conservation park
- Nature refuge

Project location and study area

Blackwater Mine - North Extension Project
Terrestrial MNES Assessment
Figure 1.1

EMM
creating opportunities

2 Project Overview

2.1 General

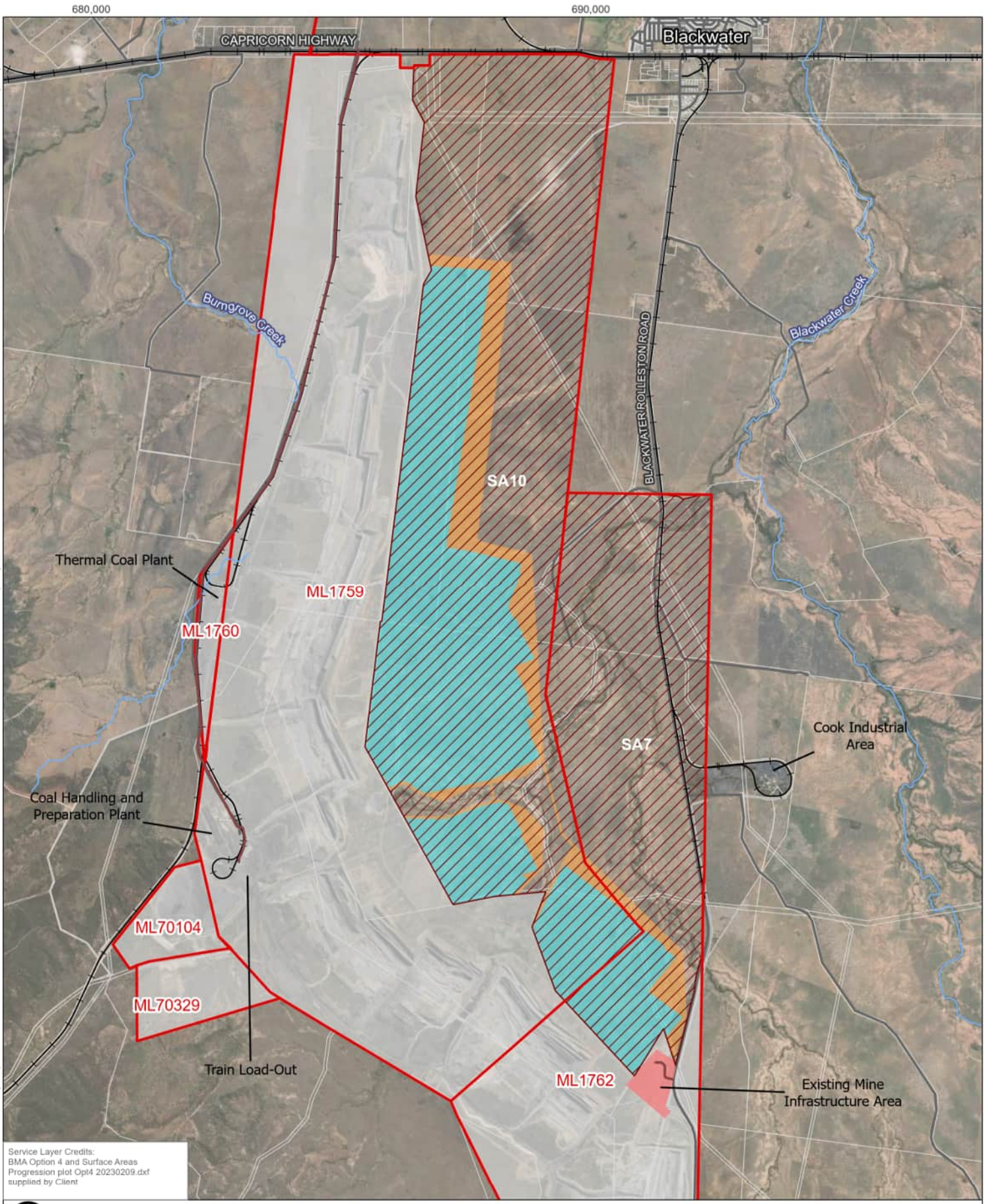
The BWM has been in operation since 1967 and operates in accordance with, amongst other authorisations, Environmental Authority (EA) EPML00717813, granted under the Environmental Protection Act 1994 (Qld) (EP Act). The BWM produces up to 16 million tonnes per annum (Mtpa) of product coal.

BM Alliance Coal Operations Pty Ltd (BMA) seek relevant State and Federal approvals to extend the current mining operation through the BWM – North Extension Project (the Project). The Project would extend the mining area of the existing BWM to within Surface Area (SA)10 on ML1759 and SA7 on ML1762 and increase BWM production to up to 17.6 Mtpa (product coal). Importantly, the Project should be viewed in the context that it is an extension and continuation of ongoing mining operations on a portion of the significantly larger BWM mining operation.

The key elements of the Project include, but are not limited to, the following:

- vegetation clearing, the removal and stockpiling of topsoil material, drilling and blasting of overburden and interburden material;
- removal of overburden and interburden material (dragline and truck and shovel/excavator methods) to uncover coal, which is placed as back fill in the mined-out pit voids (in-pit spoil dumps) as mining advances;
- open cut mining (truck and shovel/excavator methods) of ROM coal from the coal measures in SA10 on ML1759 and SA7 on ML1762;
- continued use of BWM infrastructure (eg Coal Handling and Preparation Plant [CHPP], Thermal Coal Plant [TCP], RoM and product stockpiles, train load-out, water management system and other supporting infrastructure);
- continued disposal of rejects and tailings in accordance with the EA;
- construction and operation of new or relocated infrastructure within SA10 on ML1759 and SA7 on ML1762 to facilitate and/or support the open cut mining extension such as back access roads, access tracks, water management infrastructure and powerlines, laydown areas and build pads;
- a new dragline crossing across Deep Creek;
- ongoing exploration activities within ML1759 and ML1762; and
- progressive rehabilitation of the mine site.

Surface Area SA7 on ML1762 and SA10 on ML1759 cover a total area of approximately 9,010 hectares (ha) (Figure 2.1). The extent of the proposed Project open cut mining area and out of pit disturbance areas is approximately 3,761 ha (Figure 2.1). If approved, and subject to customer demand, the extension is projected to extend mining at the BWM to within SA7 on ML1762 and SA10 on ML1759 from 2025 to 2085.



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	13-Sep-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Project Footprint

- Out of Pit Disturbance
- Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

PROJECT OVERVIEW

BMA
BHP Mitsubishi Alliance

FIGURE 1-2

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro.aprx\620014601_IN_F01_2_Project Overview

3 Relevant legislative, policies and guidelines

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

3.1 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; and
- a water resource, in relation to coal seam gas and large coal mining developments.

The seasonal flora and fauna surveys included an assessment of the presence of TECs and targeted surveys for listed flora and fauna species under the EPBC Act. The field surveys were designed and implemented with consideration of applicable Commonwealth survey guidelines which include:

- EPBC Act survey guidelines for Australia's threatened reptiles (DSEWPC 2011a);
- EPBC Act survey guidelines for Australia's threatened birds (DEWHA 2010a);
- EPBC Act survey guidelines for Australia's threatened bats (DEWHA 2010b);
- EPBC Act survey guidelines for Australia's threatened mammals (DSEWPC 2011b);
- EPBC Act Referral Guidelines for the vulnerable Koala (DoEE 2014) – now superseded but current at time of survey; and

- EPBC Act draft referral guidelines for nationally listed Brigalow Belt reptiles (DSEWPC 2011c).

3.1.1 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 residual 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.

3.1.2 EPBC Act guidelines for the Koala

Assessment of impacts to Koalas (*Phascolarctos cinereus*) were previously addressed within the EPBC Act referral guidelines for the vulnerable Koala (DoEE 2014), now superseded but current at the time of original baseline Koala surveys. The guidelines provided a 'koala habitat assessment tool' to assist in determining the sensitivity, value and quality of lands potentially impacted under development proposals. The assessment tool was 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. The score was based on Koala occurrences, vegetation structure and composition, habitat connectivity, key existing threats and the recovery value of the area. Initial survey work was undertaken with these guidelines in mind.

Post completion of the original baseline surveys, on 12 February 2022, the Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) was listed as endangered under the EPBC Act. Following this listing event, updated guidance has been issued including:

- Identifying habitat for the endangered Koala (DCCEEW 2022a);
- Referral guidance for the endangered Koala (DCCEEW 2022b); and
- National Recovery Plan for the Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (CoA 2022).

It is the department's expectation that a proponent refer any proposed project that is likely to impact the Koala and/or its habitat. This includes disturbance and/or creation of barriers on areas of land that either contains locally important Koala trees, or is land that is provides the means for Koalas to move between patches of habitat. As an endangered species, even small areas of habitat loss (as little as one hectare) can have a significant impact.

Guidance on Koala habitat has been applied to this MNES assessment and survey methods have had regard to relevant literature including 'A review of koala habitat assessment criteria and methods' by Australian National University (ANU) (ANU 2021).

Under DCCEEW's guidance Koala habitat will often include:

- forests or woodlands, especially with a higher proportion of feed tree species, and may include remnant or non-remnant vegetation;
- roadside and railway vegetation and paddock trees;

- safe intervening ground for travelling between trees and patches to forage, shelter and reproduce; and
- access to vegetated corridors or paddock trees to facilitate movement between patches.

Climate refugia such as drainage lines, riparian zones and patches can also be important attributes as they contribute to a location's resilience to drying conditions and are likely to provide a cooler refuge during periods of bushfire and heatwaves.

i National Recovery Plan for the Koala *Phascolarctos cinereus*

This National Recovery Plan for the Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) was made under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This recovery plan is a nationally led, landscape-scale conservation framework for recovery therefore requiring cross-jurisdictional and multi-tenure considerations. It will provide for a national approach to listed Koala conservation, coordinate fragmented actions across many national policies, disciplines and multiple jurisdictions, and prioritise investment to maximise the potential for recovery.

The goal of the recovery plan is to stop the trend of decline in population size of the listed Koala, by having resilient, connected, and genetically healthy metapopulations across its range, and to increase the extent, quality and connectivity of habitat occupied (CoA 2022).

Relevant information has been considered from the recovery plan in assessing Koala habitat in the Study area, potential for impacts to occur, and appropriate avoidance and mitigation measures.

3.1.3 EPBC Act Environmental Offsets Policy

Environmental offsets are required to be delivered in accordance with the *EPBC Act Environmental Offsets Policy 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 required, offsets are considered during the assessment phase of an environmental impact assessment under the EPBC Act. 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 SRI.

Where significant impacts may be found to occur to MNES, and environmental offsets are required, an offsets package will be provided by the proponent. Offsets are required to 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.

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 and the habitat quality of mapped habitat areas.

3.2 Queensland approvals

The Project is being assessed under the *Environmental Protection Act 1994* (EP Act) for an amendment to an existing Environmental Authority (EA). Therefore there is no accredited bilateral assessment or approval process that will apply under EPBC Act for assessments on MNES. A stand alone EPBC Act referral will be submitted, and DCCEEW will determine if the Project is a 'controlled action' and requires an approval.

Relevant state legislation that has informed the terrestrial ecology assessments and field survey methods are summarised below:

- Queensland EP Act
- Queensland Vegetation Management Act 1999 (VM Act)
- Queensland Nature Conservation Act 1992 (NC Act)
- Water Act 2000
- Queensland Environmental Offsets Act 2014
- Queensland Biosecurity Act 2014.

For more detail pertaining to the assessment and legislative requirements associated with State matters refer to the MSES Assessment Report (EMM 2023b).

3.3 Survey guidelines

The timing and survey methods adopted for the seasonal flora and fauna surveys across the Study area were guided by an amalgamation of 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)
- *Referral guidance for the endangered Koala (*DCCEEW 2022)
- *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 the Study area.

4 Assessment methodology

4.1 Project location

The Study area consists of ML1762 (SA7) and ML1759 (SA10) and covers an approximate area of 9,010 ha (Figure 1.1). The 'desktop search area' (as applied in desktop searches) consists of a 50 km buffer zone from a central point in the Study area (Figure 4.1).

The Study 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. The climate is recognised as a local steppe climate which is relatively dry with annual rainfall totals averaging approximately 600 mm.

The extent of the proposed Project open cut mining area and out of pit disturbance areas within the Study area is approximately 3,761 ha (Figure 4.1).

4.1.1 Bioregion/subregion

The Study area is located in the Brigalow Belt Bioregion, and the Isaac-Comet Downs subregion (Figure 4.1).

4.1.2 Hydrology

The Study area lies within the Fitzroy Basin and within the Mackenzie River sub-basin. Within the Study area, Two Mile Gully and Deep Creek flow into Taurus Creek, which flows off-site to meet Blackwater Creek, flowing north and passing to the east of Blackwater. Sagittarius Creek flows off-site at the Capricorn Highway and passes to the west of Blackwater, meeting Blackwater Creek to the north of Blackwater, then into the Mackenzie River.

At a regional scale, the Mackenzie River sub-basin is approximately 12,985 square kilometres (km^2) and the broader Fitzroy River basin is approximately 142,545 km^2 (DES 2020a).

4.1.3 Geology and soils

The following land zones occur within the Study area.

- Land zone 3 - Recent Quaternary alluvial systems, including closed depressions, paleo-estuarine deposits currently under freshwater influence, inland lakes and associated wave-built lunettes. Excludes colluvial deposits such as talus slopes and pediments. Includes a diverse range of soils, predominantly Vertosols and Sodosols; also, with Dermosols, Kurosols, Chromosols, Kandosols, Tenosols, Rudosols and Hydrosols; and Organosols in high rainfall areas.

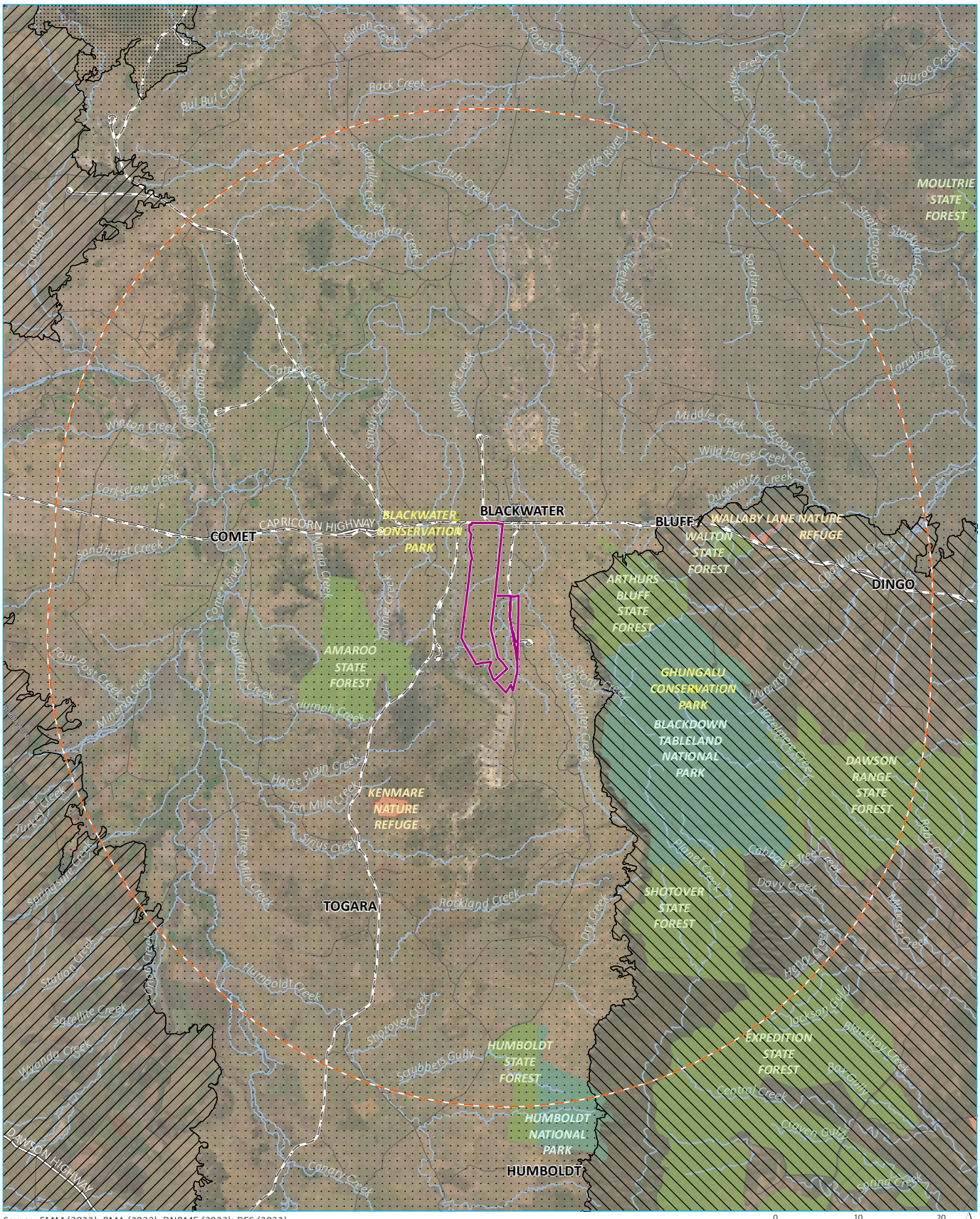
- Land zone 4 - Tertiary-early Quaternary clay deposits, usually forming level to gently undulating plains not related to recent Quaternary alluvial systems. Excludes clay plains formed in-situ on bedrock. Mainly Vertosols with gilgai microrelief, but includes thin sandy or loamy surfaced Sodosols and Chromosols with the same paleo-clay subsoil deposits.

4.1.4 Elevation

The topography of the Study area is gently undulating and low-lying (less than 300 m Australian Height Datum [mAHD]). Elevation ranges from about 235 mAHD near tributaries of Two Mile Gully to about 170 mAHD in the downstream-most reach of Sagittarius Creek.

4.1.5 Land use

The Study area is located in the Bowen Basin, where coal mining is a primary land use. Coal mining and coal seam gas extraction and exploration have been conducted around the Study area for decades. Land within the Study area is predominantly used for grazing with large areas that have been cleared of native vegetation. Land in the Study area is owned by both private landholders and BMA.



KEY

- Study area
- Desktop search area
- Rail line
- Major road
- Minor road
- Named watercourse
- National park
- State forest
- Conservation park
- Nature refuge
- Brigalow Belt North bioregion
- Basalt Downs sub region
- Isaac - Comet Downs sub region
- Northern Bowen Basin sub region
- Brigalow Belt South bioregion
- Woorabinda sub region

Desktop search area and bioregions

Blackwater Mine - North Extension Project
Terrestrial MNES Assessment
Figure 4.1

EMM creating opportunities

4.2 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 desktop search area and Study area.

Desktop searches and assessments were completed in early December 2018 to inform the survey effort and site selection of the first field survey program which was conducted in late 2018. These searches were updated in September 2023 to inform completion of this report, and ensure that any more recent records in Wildlife Online or updates to government mapping layers such as essential habitat or high-risk protected plant trigger mapping were incorporated.

A buffer zone of 50 km was used to establish the desktop Study area as it encompasses a range of landscapes and vegetation communities adjacent to the Study area, including watercourses and protected areas such as Amaroo State Forest, and portions of Blackdown Tableland National Park. This assists in identifying those threatened TECs and flora and fauna species that may utilise the region, and informed field ecology surveys of all potentially occurring MNES matters. However, desktop results will include vegetation communities and habitat types that may not occur in the Study area due to the buffer taking in areas such as the Blackdown Tableland National Park, which is a large, protected area that contains terrain and vegetation communities not found in the Study area. This was taken into consideration when refining the likelihood of occurrence for ecological communities and species to occur in the Study 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 desktop search area, and then the Study area, with an emphasis on MNES matters.

Information sources reviewed are summarised below:

- Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matter Search Tool (PMST) (refer Appendix A);
- DES Wildlife Online database to access a recorded list of wildlife in the desktop search area. Wildlife Online species lists were also assessed for Blackdown Tableland National Park, Arthurs Bluff State Forest and Amaroo State Forest as portions of these protected areas occur in the desktop search 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 may occur in the Study area;
- Atlas of Living Australia (ALA) biodiversity database to access geographic records of flora and fauna species that have been recorded in the desktop search area;
- eBird database to access geographic records of birds and migratory birds that have been recorded in the desktop search area;
- DES website to determine mapped Essential Habitat areas;

- findings of previous ecology surveys that were completed on the larger BWM site commissioned by BMA (including surveys undertaken by Ecological Australia undertaken just southwest of the Study area in March 2017 (Ecological Australia 2018);
- Aerial imagery;
- Protected Plants Trigger Mapping;
- Department of Environment and Science (DES) (2020a) Wetland*Info* Wetland Summary Information (including species listings) for the Mackenzie River drainage sub-basin and the broader Fitzroy Basin, incorporating data from the DES Wildlife Online database, Queensland Museum and Queensland Herbarium;
- DES Queensland Wetland Data Series Version 5 – Queensland Wetlands Map (DES 2020b), to determine the classification, extent and significance of lacustrine, palustrine and riverine systems within the Study area;
- Queensland Groundwater Dependent Ecosystems and Potential Aquifer Mapping 2018 (DES 2020d);
- Bureau of Meteorology, Groundwater Dependent Ecosystem Atlas, Commonwealth of Australia 2023;
- The Fitzroy Natural Resource Management Region Back-on-Track Actions for Biodiversity (the former Queensland Department of Environment and Mines [DERM] 2010);
- Published ecological information on threatened and Special Least Concern (SLC) aquatic flora and fauna species either listed under the EPBC Act or Queensland EP Act.

4.3 Field survey timing and conditions

4.3.1 Climatic conditions

i Autumn (post-wet) season surveys

Autumn flora surveys were conducted in April 2019 with fauna surveys undertaken over March 2019 and April 2019. In the three months preceding field surveys, Blackwater Airport weather station recorded 62 mm of rain in January, 14.6 mm in February and 179.6 mm in March (BOM 2019a).

Temperatures at Blackwater Airport ranged between 20.3°C and 35.3°C during the March surveys and between 14.8 °C and 30.3 °C during April surveys. Temperatures during the April surveys consistently dropped to below 20°C after 10-11pm and as such targeted reptile surveys were performed in the warmer hours immediately post sunset.

ii Spring (pre-wet) season surveys

Spring flora surveys were conducted in September and October 2019 as well as early summer between 3 and 8 December 2018. According to rainfall averages at the Blackwater Airport weather station, the Study area received 89.6 mm of rain in October 2018, 59.0 mm in November 2018 and 56.6 mm in December 2018 (BOM 2019a). Very little rainfall was recorded up to spring of 2019 with 1.4 mm of rain in August 2019, 0.0 mm in September 2019

and 8.2 mm in October 2019 (BOM 2019a). Temperatures at Blackwater Airport ranged between 24.4°C and 40.7°C during the December surveys.

Fauna surveys were conducted in September 2019 and October 2019. Preceding climatic conditions are described above. Although thunderstorms on 17 and 18 October 2019 caused survey and access issues during the targeted fauna searches, it allowed for slightly improved survey conditions for fauna species such as the Ornamental Snake as residual water was present within gilgai, which increased frog activity.

Temperatures at Blackwater Airport ranged between 18.1°C and 35.1°C during the September 2019 surveys and between 22.2°C and 40.5°C during the October 2019 surveys. Temperatures during the October 2019 surveys typically dropped below 20°C after 10 pm and as such surveys focussed on reptile early in the evening to target maximum reptile activity.

iii Supplementary Ornamental Snake surveys

Supplementary Ornamental Snake and Australian Painted Snipe (*Rostratula australis*) surveys were conducted in March 2020. In the three months preceding field surveys, Blackwater Airport weather station recorded 204 mm of rain in January, 66.2 mm in February and 1.6 mm in March (BOM 2019a, BOM 2020a).

Temperatures at Blackwater Airport ranged between 16.9°C and 32.2°C during the March 2020 surveys. On the first two nights, temperatures remained above 19°C all night.

Climatic conditions over the surveys are summarised below in Table 4.1.

Table 4.1 Blackwater climatic conditions – Blackwater airport weather station (BOM, 2019)

Month/year	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Jan-20	Feb-20	Mar-20
Rainfall (mm)	89.6	59.0	56.6	59.8	14.6	179.6	14.0	0.6	22.2	17.2	1.4	0.0	14.0	204	66.2	1.6
Mean minimum temperature (°C)	18.1	18.3	21.7	21.8	22.1	21.4	17.1	13.8	10.0	9.6	10.0	12.1	17.1	22.8	22.9	19.9
Mean maximum temperature (°C)	32.8	34.2	34.8	33.8	36.2	33.7	28.9	26.6	23.1	24.5	25.9	30.5	33.4	35.3	33.7	31.8
Flora survey																
Fauna survey																
Ornamental Snake survey																

In the three months preceding the December 2019 surveys, Blackwater Airport weather station (station 035134) recorded 0.0 millimetres (mm) of rainfall in September, 8.2 mm in October and 1.4 mm in November (BOM 2020). Substantial rainfall (270.2 mm) was recorded in January to February 2020 (BOM 2020). This included intense rainfall, runoff and consequent flooding at each riverine site, as evidenced by flood debris (EMM, 2023a). Only 0.4 mm was recorded at Blackwater Airport in the three months preceding the May 2020 surveys (BOM 2020), leading to dry conditions at most riverine sites at the time of assessment in May 2020 (EMM, 2023a).

Mean minimum and maximum temperatures for December 2019 at Blackwater Airport were 21.9°C and 38.2°C, respectively (BOM 2020). Mean minimum and maximum temperatures for May 2020 at Blackwater Airport were 12.3°C and 25.0°C, respectively (BOM 2020).

iv Supplementary MNES surveys (June-August 2023)

Supplementary terrestrial ecology habitat assessments were completed between 14-17 June 2023 by EMM. Temperatures ranged from 7.9 to 28.1°C at Blackwater Airport during this period. There was no rain, and 0.4 mm of rain fell in the three months prior to survey leading to dry conditions on site.

4.4 Terrestrial fauna field surveys

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

4.4.1 Fauna survey team

Fauna surveys have been conducted by four EMM field ecologists with experience leading and implementing threatened fauna species surveys in central Queensland using a range of survey methods. Lead fauna ecologist is Andrew Jensen.

Curricula vitae for EMM field ecologists are provided in Appendix J.

4.4.2 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 2019 and April 2019) and spring season (September 2019 and October 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.

Surveys in autumn coincide with a period of high vertebrate activity, including dispersal and migration of many species. Autumn surveys are conducted following the wet season, during a period of vegetative growth. This may assist in the detection of granivorous species. Spring surveys are intended to target the increased activity levels associated with breeding in many vertebrate species. These surveys occur before the onset of high summer temperatures, when activity levels for many species decline.

Survey effort was also based on species specific Commonwealth and State survey guidelines for threatened species, described below in Section 4.4.4 and 4.4.6. EMM progressively surveyed the Study area targeting a series of predetermined survey locations.

Survey locations were identified based on desktop review, examination of RE mapping and known locations of essential habitat for threatened species and aerial imagery. Survey locations comprised baseline trap sites and additional targeted survey locations for threatened species.

Conservation significant species with the potential to occur in the Study area were identified. Depending on seasonal behaviour, the potential of the species to occur in the Study area varies depending on the condition of the habitat. Species such as Painted Honeyeater (*Grantiella picta*) have distinct migratory patterns and will, generally, only be seen between April to September as they disperse out of their southeast Australian breeding area, into areas such as Central Queensland. Whereas some species, such as Squatter Pigeon (*Geophaps scripta scripta*), may have a year-round presence, but fluctuating levels of activity and/or abundance due to resource availability.

i Autumn (post-wet) season surveys

Fauna assessments were completed over a total of 12 days, across two separate survey trips. The first survey period was from 18 March 2019 to 24 March 2019 and second was from 11 April to 15 April 2019. The first round of surveys were solely diurnal surveys, while the second survey was conducted over five consecutive nights and focussed on nocturnal survey effort but also included a few hours of diurnal survey effort each afternoon.

ii Spring (pre-wet) season surveys

Fauna assessments were completed over a total of 13 days, across two separate survey trips. The first survey period was from 29 September 2019 to 4 October 2019 and the second was from 15 October 2019 to 21 October 2019. The first round of surveys were solely diurnal surveys, while the second survey was conducted over six consecutive nights and focussed on nocturnal survey effort.

iii Supplementary Ornamental Snake surveys

Spotlighting for Ornamental Snake in areas of gilgai was completed over three nights in March 2020 by a team of three ecologists. This was supplementary to initial spotlighting undertaken in the spring and autumn surveys (see above) and summarised in Table 4.2. During the April 2019 surveys (autumn survey) gilgai habitats were completely inundated after substantial wet season rain, and temperatures were starting to cool. Therefore, detectability of the species may have been reduced (it prefers warmer nights to hunt, and at the end of the season it may have been less active if frogs had been present in abundance for the preceding period).

Likewise, October 2019 surveys (spring survey) took place in extremely dry conditions, and without rain to encourage the frog populations to be active, the species will likely have been inactive down the soil cracks.

Surveys during the hottest part of the year, immediately after rain or while the gilgai hold water and frog activity is high, will enable more confident judgements to be made over its potential presence in the Study area, and therefore these March 2020 supplementary surveys were carried out.

These March 2020 surveys also targeted Australian Painted Snipe as they are also primarily nocturnal and use similar habitats.

A summary of survey effort against targeted threatened fauna species survey guidelines is provided in Table 4.2.

iv Supplementary MNES habitat assessments (June-August 2023)

Supplementary terrestrial ecology habitat assessments were completed between 14-17 June 2023 by EMM.

Survey methods included daytime searches of riparian vegetation for presence of Koalas or their scats/scratches and contemporary habitat assessments for Koala, Squatter Pigeon, Ornamental Snake and Australian Painted Snipe.

Survey effort can be summarised as follows by MNES species which were the focus of the investigations:

Koala – diurnal transects were completed in Deep Creek and an unnamed creek in the centre of the Study area searching for signs of Koala utilisation (eg scratches on smooth barked trees and scats). Searches focussed on the planned project footprint and immediate surrounds. These creeks were also spotlit searching for Koala at night on two separate nights. Additionally, habitat assessments were completed throughout the planned project footprint, identifying where food trees were present to inform habitat mapping.

Squatter Pigeon – searches for the species were completed in particular around water sources such as farm dams. Additionally, habitat assessments were completed throughout the planned project footprint, identifying where native grasses and suitable soil types were present to inform habitat mapping.

Ornamental Snake – habitat assessments were completed throughout the planned project footprint, identifying where suitable soil types, gilgai relief and cracking clays were present to inform habitat mapping. The species was not searched for due to the seasonality although incidental diurnal active searches were completed in gilgai.

Australian Painted Snipe – searches for the species were completed in particular around water sources such as farm dams. Assessments were made of farm dams in the planned project footprint to refine habitat mapping for the species, including assessment of whether dams formed suitable breeding habitat.

4.4.3 Fauna survey sites

Fauna survey sites were selected by targeting areas of remnant vegetation and regrowth across the Study area. 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 geographic spread of survey locations across a range of habitats in the Study area, focussing appropriate survey and trapping methods to certain habitats based on an assessment of the likelihood of species presence.

Site selection was then refined in the field, based on site conditions 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 suitable food trees or patches of eucalypt woodland. Site selection was also guided by advice from the botanists and results from flora surveys completed in December 2018.

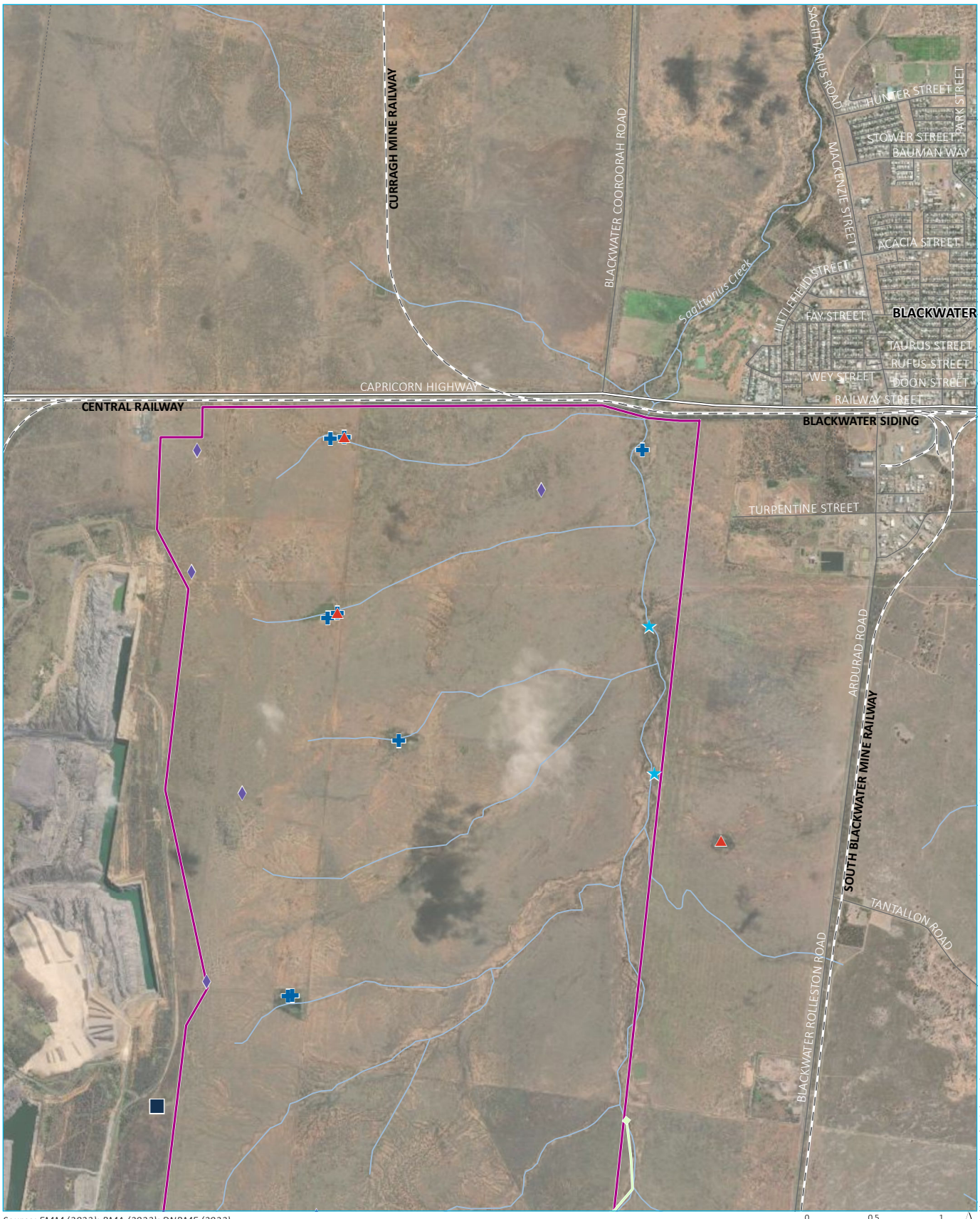
On arrival in the field, trapping sites were established on the first day to enable the full four consecutive nights of trapping to take place (weather dependent). While traversing the site, additional areas to target for certain species (eg well-formed gilgai habitats for Ornamental Snake) were identified and surveyed during the survey campaign. On completion of the diurnal trapping surveys in March 2019 and September 2019, sites were further reviewed and refined for targeting during the April 2019 and October 2019 spotlighting surveys.

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

- a total of four trapping sites in both autumn and spring (trap sites include funnel traps, pitfall traps, Elliott traps, camera trap and an Anabat device);
- two harp trap sites targeting microchiropterans at each survey site location, being a total of eight harp traps for each seasonal survey;

- incidental cameras and Anabats installed around site (predominantly farm dams and waterways);
- dam and waterbody locations to be targeted for active searching, bird surveys and supplementary camera traps/Anabat;
- active search locations in gilgai habitats targeting Ornamental Snake and Australian Painted Snipe;
- spotlighting to target Ornamental Snake, Koalas and Greater Glider (*Petauroides armillatus*); and
- active searches/transects of riparian habitats for Koala and other listed species.

Full details of the survey effort are provided in sections below and survey locations are illustrated in Figure 4.2.



Source: EMM (2023); BMA (2023); DNRME (2022)

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GDA 1994 MGA Zone 55

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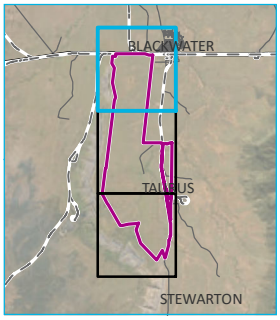

KEY

- Study area
- Rail line
- Major road
- Minor road
- Vehicular track/trail
- Watercourse/drainage line

Fauna survey type

- Trapping site
- Bird survey
- Anabat
- Camera
- Ornamental Snake search
- Koala transect

Fauna survey sites - map 1 of 3

Blackwater Mine - North Extension Project
MNES Assessment
Figure 4.2

EMM creating opportunities

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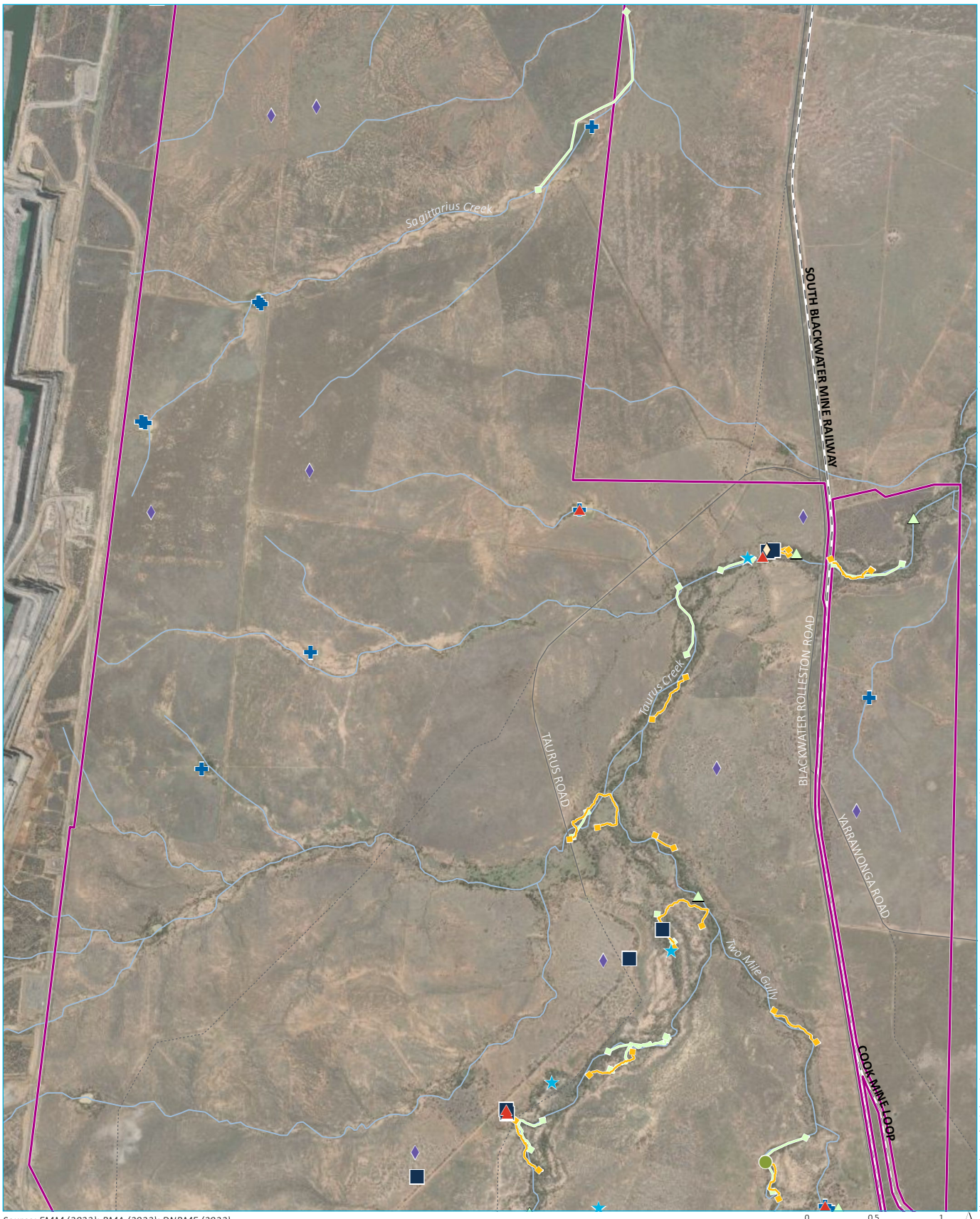

Source: EMM (2023); BMA (2023); DNRME (2022)

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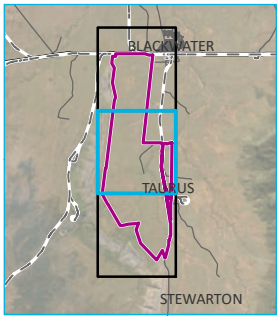


KEY

- Study area
- Rail line
- Minor road
- Vehicular track/trail
- Watercourse/drainage line

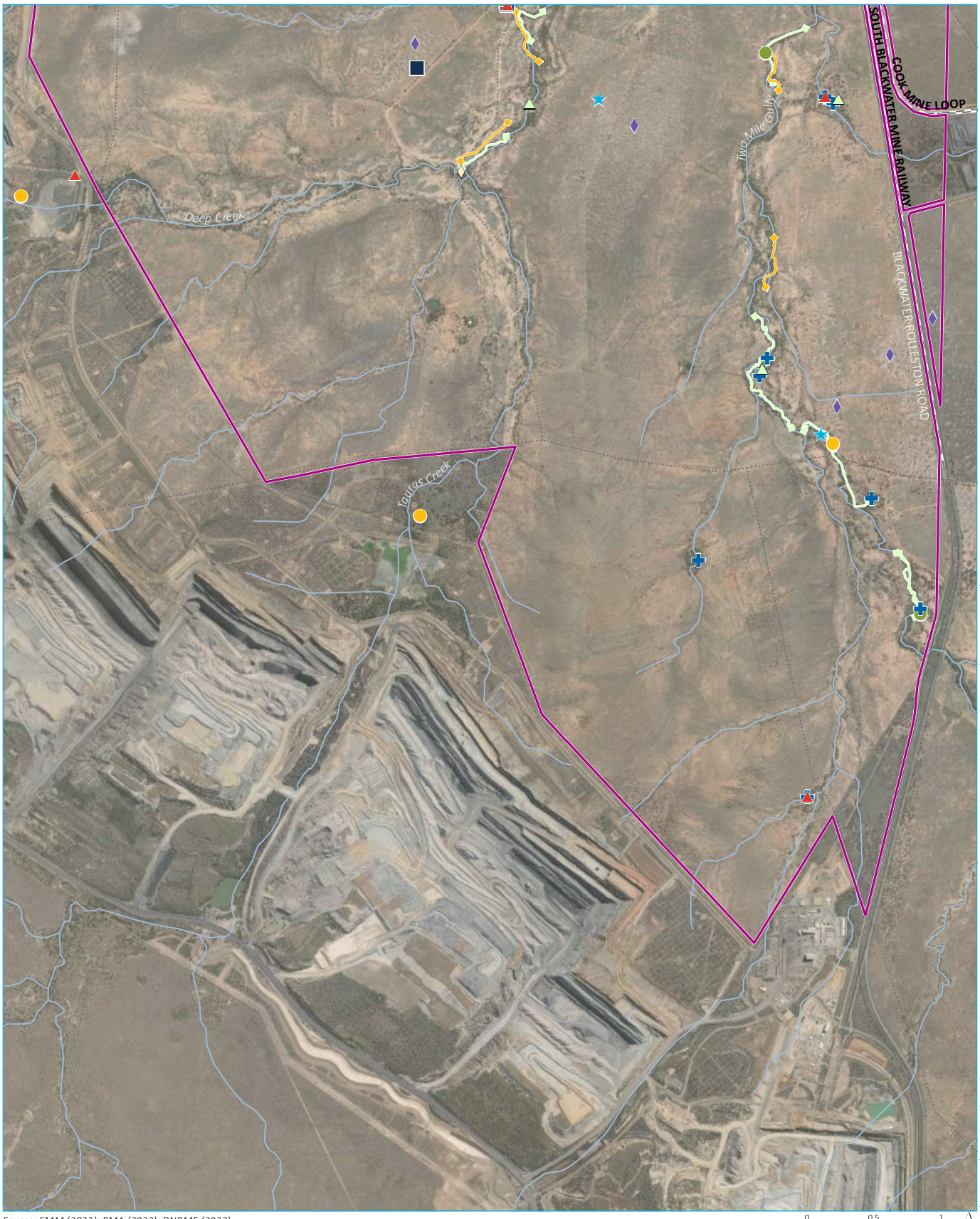
Fauna survey type

- Trapping site
- Bird survey
- Anabat
- Harp trap
- Camera
- Active search
- Ornamental Snake search
- Koala SAT
- Spotlighting transect
- Koala transect

Fauna survey sites - map 2 of 3

Blackwater Mine - North Extension Project
MNES Assessment
Figure 4.2

EMM creating opportunities



Source: EMM (2023); BMA (2023); DNRME (2022)

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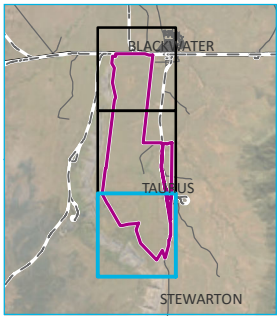

KEY

- Study area
- Rail line
- Minor road
- Vehicular track/trail
- 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

Fauna survey sites - map 3 of 3

Blackwater Mine - North Extension Project
MNES Assessment
Figure 4.2

EMM creating opportunities

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4.4.4 Fauna survey methods

i Baseline trapping survey methodology

Four baseline trap sites were installed across the Study area in each of the seasonal survey periods. The baseline trap sites were placed to adequately sample different habitat types and ecological condition across the Study area. Baseline survey site locations are mapped on Figure 4.2 and an example is shown in Photograph 4.1.

Photograph 4.1 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** – 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. 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 set 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 creek line 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.

- **Spotlighting** – non-intrusive search of between 30 minutes and one hour of each baseline trap site using spotlights was conducted at each trap site. Spotlighting targeted nocturnal mammals, birds and herpetofauna. A red light was utilised 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

ecologists 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 Study 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 4.2) for threatened bat species in preferred habitats – harp trapping targets microchiropterans and may assist in the identification of species which cannot be identified by call. Harp traps are most effective when placed in a restricted 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 4.2 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 Belah communities.

- Spotlighting/diurnal search for Yakka Skink (*Egernia rugosa*) and Collared Delma (*Delma torquata*) – 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.

- Spot Assessment Technique (SAT)/scratches/scat searches/transects for Koalas – these methodologies were employed to search for evidence of Koalas in suitable areas of habitat. The SAT is designed to derive a measure of Koala activity at a site, based on the presence or absence of koala scats around a focal tree.

  The SAT method involves a radial assessment of Koala "activity" within the immediate area surrounding a tree of any species that is known to have been utilised by the species, or otherwise considered to be of some importance. The method is summarised as follows:

  - centre tree is located and marked with flagging tape;
  - the 29 nearest trees to the centre tree were also identified and marked;
  - Koala faecal pellet searches were conducted in a 1 metre radius from the base of 30 trees. Initial inspections were checked on undisturbed ground surface, followed by a more thorough inspection involving disturbance of leaf litter and ground cover (if no faecal pellets were initially detected);
  - an average of approximately two person minutes per tree should be dedicated to the faecal pellet search; and
  - Activity levels can be interpreted using Table 2 from Phillips and Callaghan (2011).

- Transects and searches for scats and scratches of Koala were also carried out along suitable riparian vegetation.

- Spotlighting and assessment of hollow-bearing trees for occupation by owls/mammals. Spotlighting involved walking through areas of potential habitat (i.e. native woodland or forest) with powerful spotlights and shining them into the canopy to try and identify 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 surface.

- 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.

4.4.5 General habitat assessments

General habitat assessments were completed in conjunction with vegetation community assessments. This included a total of 41 general habitat assessments during the autumn flora survey period and 11 during the spring

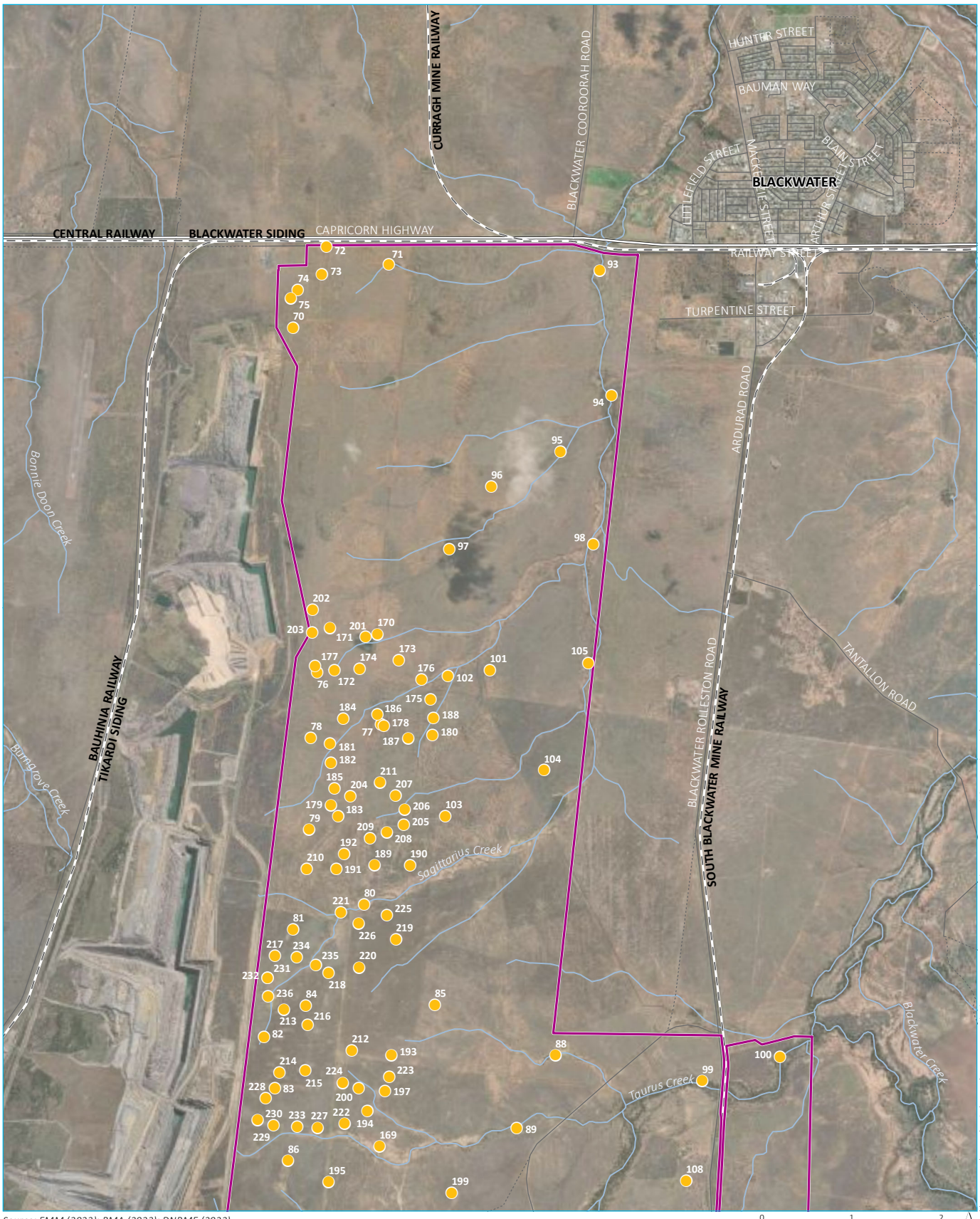
flora survey period, resulting in a total of 52 habitat assessment sites. The primary goal of these assessments was to acknowledge and gauge the availability and suitability of threatened fauna habitat across the Study area.

An additional 83 sites were completed in June 2023 by EMM in supplementary habitat assessments across the project footprint, and a further 30 sites in September 2023, totalling 165 sites.

BHP's habitat assessment criteria as outlined in BHP Ecological Survey Guideline Queensland Coal (BHP 2018) were used to ascertain available habitat features. The locations of habitat assessment sites are shown in Figure 4.3 and numbers on that figure correspond to habitat assessment summary tables in Appendix B.

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.



Source: EMM (2023); BMA (2023); DNRME (2022)

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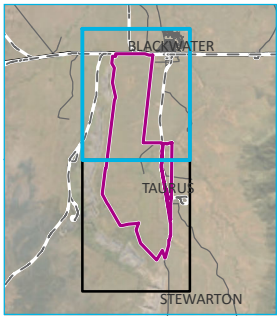
GDA 1994 MGA Zone 55

N



KEY

- Habitat assessment site
- Study area
- Rail line
- Major road
- Minor road
- Vehicular track/trail
- Watercourse/drainage line

Habitat assessment sites - map 1 of 2

Blackwater Mine - North Extension Project
MNES Assessment
Figure 4.3

EMM creating opportunities

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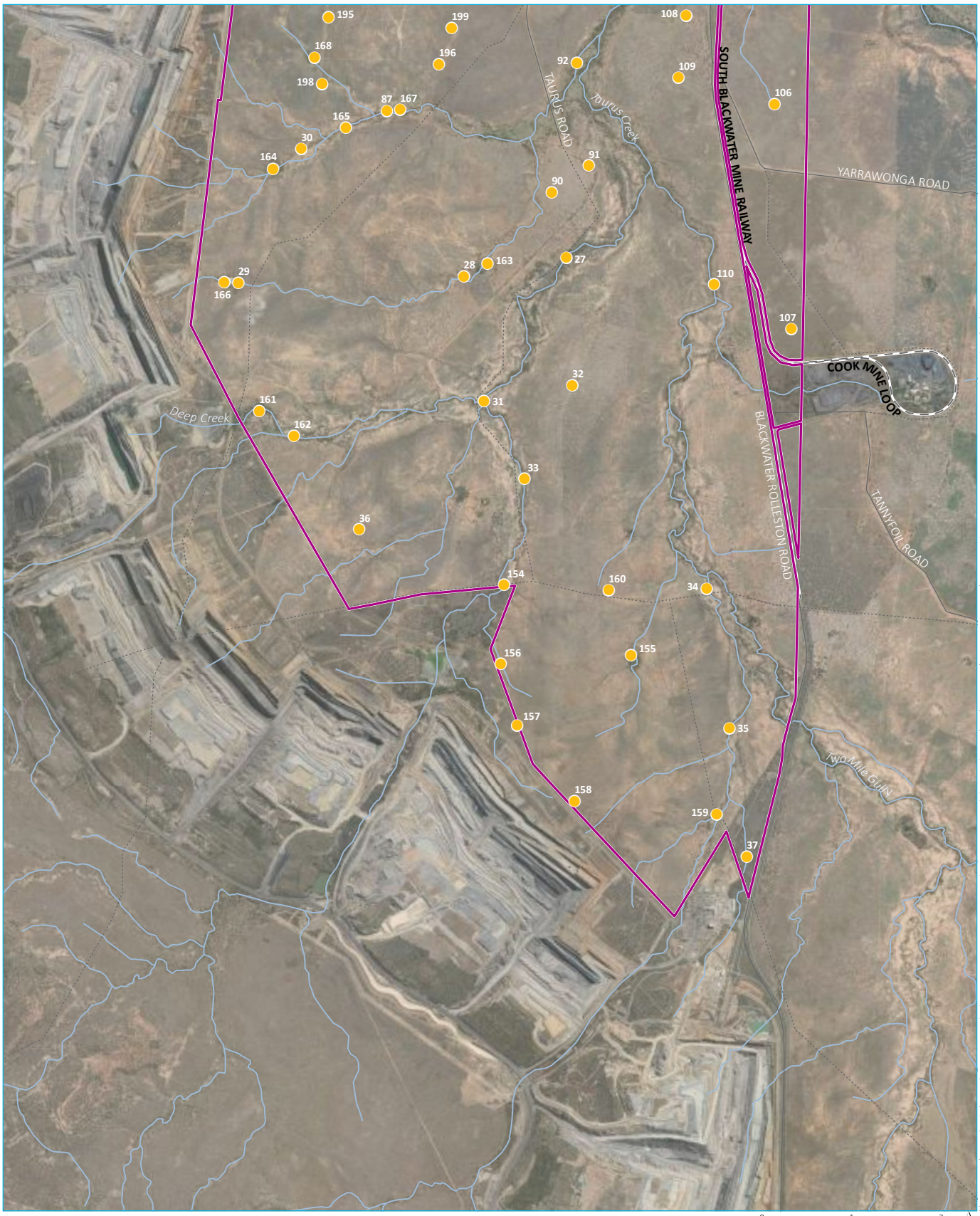
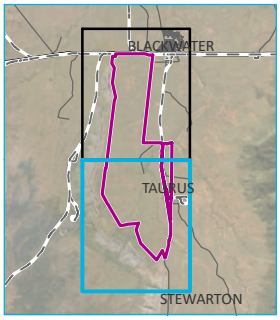


Source: EMM (2023); BMA (2023); DNRME (2022)

0 1 2 km

GDA 1994 MGA Zone 55

N



KEY

- Habitat assessment site
- Study area
- Rail line
- Minor road
- Vehicular track/trail
- Watercourse/drainage line

Habitat assessment sites - map 2 of 2

Blackwater Mine - North Extension Project
MNES Assessment
Figure 4.3

EMM creating opportunities

4.4.6 Targeted survey effort – threatened fauna species

Based on the results of desktop assessments, EMM developed a survey program that incorporated targeted methods for those MNES and MSES species which were assessed as having potential to occur on site. Survey effort for these species is summarised in Table 4.2.

Target Federally listed threatened species included:

- Ornamental Snake (*Denisonia maculata)*;
- Collared Delma (*Delma torquata)*;
- Yakka Skink (*Egernia rugosa*);
- Koala (*Phascolarctos cinereus*);
- Central Greater Glider (*Petauroides armillatus)*;
- Large-eared Pied Bat (*Chalinolobus dwyeri)*;
- Squatter Pigeon (*Geophaps scripta scripta*);
- Painted Honeyeater (*Grantiella picta)*; and
- Australian Painted Snipe (*Rostratula australis*).

Table 4.2 Fauna survey effort for key threatened and migratory species

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
Squatter Pigeon (*Geophaps scripta scripta*)	*Survey methods for diurnal birds* 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. Longer (up to 10 minutes) may be required in complex habitats. Where practicable, two of the bird counts should be done in the early morning (<2 hours after sunrise), two in mid-morning (2 to 4 hours after sunrise), and the remaining two during less optimal times in the day (between 4 hours after sunrise and 2 hours before sunset) (Eyre et al. 2018). No specific requirements for Squatter Pigeon.	*Survey methods for birds* Area searches or transect surveys for 15 hours over 3 days. Applicable in areas of less than 50 ha. Flushing surveys for 10 hours over 3 days (DSEWPC 2010a). Applicable in areas of less than 50 ha.	Time driving around site is accepted to count toward survey effort for this species, as the species often forages on bare dusty ground adjacent to natural habitats. Close inspection of dirt tracks and waterholes by surveyors tends to increase the chance of detection (Porter 2006 pers comm; Squatter Pigeon Workshop 2011). Commencing targeted surveys with slow driving surveys along roads and dusty areas is the most efficient way of detecting the subspecies (SPRAT profile accessed 27 May 2019) (DSEWPC 2010a). **Autumn** 26.5 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 260 person hours were accumulated on site (including driving and walking around the leases) across the March 2019 and April 2019 surveys from 19 days in total (at all times of day from dawn to dusk). Additionally, 42 camera trap nights were completed in the Study area which includes cameras installed on waterbodies such as farm dams and on creek lines. **Summer** In total, approximately 110 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). **Spring**	The extent of survey effort to date is considered appropriate and meets survey guidelines. Surveys have been completed over various seasons and months. The species was not observed during the initial seasonal surveys despite extensive survey effort. However, during recent contemporary surveys in 2023 the species has been observed on a number of occasions in the Study area, all near water sources. The species is known to occur however large areas do not provide suitable habitat due to the dominance of Buffel Grass (*Cenchrus ciliaris*) and clay soils (this species favours sandy soils and a mosaic of open woodland and native grasses). The majority of the Study area comprises extensive areas of dense Buffel Grass cover and clay soils. This species generally requires open forest or scrub on sandy soils, dominated by native grasses, in close association with permanent water (DCCEEW 2023a). 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; DCCEEW 2023a). It often occurs around cattle yards and other disturbed areas, although is unlikely to occur far from wooded areas.

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
			26.6 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 125 person hours were accumulated on site (including driving and walking around the leases) across the September-October 2019 surveys from seven days in total (at all times of day from dawn to dusk). 30 camera trap nights were completed in the Study area, which includes cameras installed on waterbodies such as farm dams and troughs (11 nights) and on creek lines (19 nights). **Supplementary MNES habitat assessments Jun-Aug 2023** Approximately 60 person hours were accumulated on site (including driving and walking around the leases) across four days in total (at all times of day from dawn to dusk). This included surveys of waterpoints in the proposed project footprint. An additional 20 person hours were spent on site in August 2023 during separate surveys. **Total** Approximately 570 person hours have been spent across Study area to date. These were accumulated across the above listed surveys over 48 days in total (at all times of day from dawn to dusk).	
Ornamental Snake (*Denisonia maculata)*	*Survey methods for reptiles* Pitfall trapping with 4 buckets at 7.5 m intervals on T-design; 45 m fence for 4 nights. Funnel trapping with 6 funnels 3 m in on distal ends of T-design; 45 m fence for 4 nights. Diurnal active search for 2 x 30 person-minute searches within 2	*Survey methods for Brigalow Belt reptiles* Targeting water-inundated gilgai, wetlands, riparian habitats and the surrounding environment (eg tracks) and large logs between dusk and early morning hours More effective on warm, humid evenings.	**Autumn** Eight person hours of diurnal active searches (2 x 30 minutes in different quadrants of trap sites). Diurnal searches of gilgai totalling 8.5 person hours. Four trap nights (funnels and pitfalls) at four trap sites, totalling 64 pitfall trap nights and 96 funnel trap nights. Spotlighting surveys of trap sites totalling five person hours, spotlighting searches around dams	Although the habitat for this species is not optimal, the species has been shown to occur in cleared areas of gilgai (eg recent nearby records from Humboldt to the south of the Study area) and the Brigalow Belt reptiles guideline include cleared areas of gilgai as potential habitat for this species. Diurnal searches are unlikely to be successful for this species in the Study area due to a lack of microhabitat in the form of timber/ground logs that would provide refuge when cracks are not

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
	different 50 x 50 m quadrants of the survey site. Nocturnal active search for 2 x 30 person-minute searches within the 100 x 100 m survey site. Camera trapping with 1 camera per site for minimum of 4 nights. Scat and sign search can coincide with the systematic diurnal active searches, within 50 x 50 m quadrates of the survey site. Otherwise incidental sightings are noted (Eyre et al. 2018).	Survey over a minimum of 1.5 person hours per hectare for habitats of average complexity per targeted species. Survey over a minimum of 3 nights. *Active searches* Actively look for reptiles whilst driving along roadways in your Study area especially following heavy rainfall events and during warm evenings for snakes. *Pitfalls* Six 20 litre (500 mm deep) buckets evenly distributed under a 30 m drift fence where optimal microhabitats occur. Place a funnel at each end of a pitfall line. At least 2 replicates per habitat type. Checked every morning and early evening (after the optimal foraging periods) over four days.	totalling five person hours and spotlighting searches of gilgai habitats totalling 14 person hours. This is a total of 24 person hours of spotlighting over four consecutive nights. **Spring** Four 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 100 funnel trap nights. Spotlighting surveys of trap sites totalling two person hours, spotlighting searches around dams totalling six person hours and spotlighting searches of gilgai habitats totalling 41.5 person hours. This is a total of 49.5 person hours of spotlighting over five consecutive nights. **Supplementary March 2020 survey** Spotlighting searches of gilgai habitats totalling 60 person hours were conducted over three consecutive nights. **Supplementary MNES habitat assessments (June-Aug 2023)** Although no targeted searches for the species were completed due to seasonality, incidental diurnal active searches under microhabitat (fallen timber) were completed in gilgai while habitat assessments of these areas were undertaken. **Total** In summary – 20.5 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), 133.5 person hours of nocturnal searches and 128 trap nights of pitfalls and 196 nights of funnels was completed.	available. The Study 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. 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. 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, using a combination of techniques (active searching, pitfall trapping, spotlighting). All survey techniques have been applied and surveys occurred over three to five consecutive nights (depending on survey campaign) meeting guideline requirements. The survey effort has been adapted to the scale of the Study area and condition. Ornamental Snake 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 (DCCEEW 2023b). As such, due to the lack of ground microhabitat and lack of connectivity to large remnant areas of vegetation, habitat in the north is suboptimal for this species and considered below average complexity. The total survey effort applied during field assessment is adequate for this quality of habitat.

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
Koala (*Phascolarctos cinereus*)	*Survey methods for arboreal mammals* Broadcast surveys for 2 sessions of call playback of relevant species at midpoint of survey site. Spotlighting for 2 x 30 person-minute searches within the 100 x 100 m Study area. Scat and sign search can coincide with the systematic diurnal active searches, within 50 x 50 m quadrates of the survey site. Otherwise incidental (Eyre et al. 2018).	*Survey methods for Koalas* Scat SAT for 2 person-minutes under 30 trees at each site. Diurnal strip transects where koala activity and density is high. Spotlighting. Broadcasting surveys during breeding season (August to February). Camera trapping where fresh signs have been detected. Indirect sightings such as scratches and scat (DoE 2014a).	**Autumn** Four SAT surveys, a total of 1,750 m of diurnal transects along Taurus Creek and 1,900 m of diurnal transects along Two Mile Gully. 1,000 m of nocturnal transects along Two Mile Gully and 500 m of nocturnal transect along Taurus Creek with additional searches around two trap sites along Taurus Creek. **Spring** Two SAT surveys, a total of 2,750 m of diurnal transects along Taurus Creek and 1,450 m of diurnal transects along Two Mile Gully. 2,050 m of nocturnal transects along Two Mile Gully and 4,950 m of nocturnal transect along Taurus Creek with additional searches around two trap sites along Taurus Creek and one site on Two Mile Gully. Broadcast surveys at spots along the creek lines were also undertaken. **Supplementary MNES habitat assessments Jun-Aug 2023** Approximately 75 person hours were accumulated on site (including driving and walking around the leases) across the surveys from four days in total (at all times of day from dawn to dusk) and in spotlighting of watercourses in the project footprint for two nights. Approximately 10 km of creekline vegetation was spotlit. **Total** A total of 26.4 km of transects of creek line vegetation along Taurus Creek and Two Mile Gully were completed over the surveys.	Limited value of riparian vegetation for Koala - few Queensland Blue Gum (*Eucalyptus tereticornis*) present or other food trees although *E. coolibah* present was along creek lines. May be used on a sporadic basis as evidenced by some old scratches on some eucalypts which are likely to be attributable to Koalas. Riparian vegetation in the Study area was sporadic with few mature food trees present (DCCEEW 2023c). Given the limited extent of suitable habitat present in the Study area, the survey methods and level of survey effort meets guideline requirements for this species. Survey effort has included both looking for individuals during the day and spotlighting, and their scats/scratches.
Large-eared Pied Bat (*Chalinolobus dwyeri*)	*Survey methods for bats* Echolocation call detection with 1 bat detector for 3 nights	Unattended bat detectors for 16 detector nights over a minimum of 4 nights.	**Autumn** 18 unattended detector nights over five nights. Eight harp trap nights over four nights.	The Large-eared Pied Bat requires a combination of sandstone cliffs and fertile woodland valley within close proximity of each other (DCCEEW 2023d). It is

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
		Attended bat detectors for 6 detector nights over a minimum of 3 nights. Harp traps and/or mist nets for 16 trap or net nights over a minimum of 4 nights.	**Spring** 12 unattended detector nights over four nights. Eight harp trap nights over four nights. **Total** 30 unattended detector nights over nine nights. 16 harp trap nights over eight nights.	known from the Blackdown Tableland National Park, but habitat on site is not suitable. There is limited potential for the species to occur in the Study area. Survey methods required have been implemented. Survey methods and effort meets guideline requirements for this species.
Collared Delma (*Delma torquata*)	*Survey methods for reptiles* Pitfall trapping with 4 buckets at 7.5 m intervals on T-design; 45 m fence for 4 nights. Funnel trapping with 6 funnels 3 m in on distal ends of T-design; 45 m fence for 4 nights. Diurnal active search for 2 x 30 person-minute searches within 2 different 50 x 50 m quadrants of the survey site. Nocturnal active search for 2 x 30 person-minute searches within the 100 x 100 m survey site. Camera trapping with 1 camera per site for minimum of 4 nights.	*Survey methods for Brigalow Belt reptiles* 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. Optimal survey time is during the coolest parts of the day. Survey over a minimum of 1.5 person hours per hectare for habitats of average complexity per targeted species. Survey over a minimum of 3 days. *Survey methods for Australia's threatened reptiles* 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.	**Autumn** Eight person hours of diurnal active searches (2 x 30 minutes in different quadrants of trap sites). Four trap nights (funnels and pitfalls) at four trap sites, totalling 40 pitfall trap nights and 96 funnel trap nights. Spotlighting surveys of trap sites totalling five person hours and spotlighting searches around dams totalling five person hours. This is a total of 10 person hours of spotlighting over four consecutive nights. **Spring** Four 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 56 pitfall trap nights and 100 funnel trap nights. Spotlighting surveys of trap sites totalling two person hours and spotlighting searches around dams totalling six person hours. This is a total of eight person hours of spotlighting over five consecutive nights. **Total** In summary – 12 person hours of diurnal active searching, 18 person hours of nocturnal searches and 32 trap nights (combination of funnels and pitfalls over eight trap sites in total).	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 Study area. Survey methods and effort meets guideline requirements for this species.

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
Yakka Skink (*Egernia rugosa*)	Diurnal search for 20 minutes per hectare in a single search. – Search 20% of suitable habitat when the project area is 50 ha or greater. – Search 40% of suitable habitat when the project area is less than 50 ha. • 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.	*Survey methods for Brigalow Belt reptiles* 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. Optimal survey time is during the coolest parts of the day. Survey over a minimum of 1.5 person hours per hectare for habitats of average complexity per targeted species. Survey over a minimum of 3 days. 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 Target colony sites through diurnal surveys of suitable habitat 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 Check every morning and early evening (after the optimal foraging periods) over four days *Survey methods for Australia's threatened reptiles* Searching for burrow systems and communal defecation sites. The species can be confirmed by Elliott trapping around the burrows, by	**Autumn** Eight person hours of diurnal active searches (2 x 30 minutes in different quadrants of trap sites). Four trap nights (funnels and pitfalls) at four trap sites, totalling 40 pitfall trap nights and 96 funnel trap nights. 42 camera trap nights were also completed across the Study area. Spotlighting surveys of trap sites totalling five person hours and spotlighting searches around dams totalling five person hours. This is a total of 10 person hours of spotlighting over four consecutive nights. **Spring** Four 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 56 pitfall trap nights and 100 funnel trap nights. 19 camera trap nights were also completed across the Study area at trap sites or in riparian vegetation. Spotlighting surveys of trap sites totalling two person hours and spotlighting searches around dams totalling six person hours. This is a total of eight person hours of spotlighting over five consecutive nights. **Total** In summary – 12 person hours of diurnal active searching, 18 person hours of nocturnal searches and 32 trap nights (combination of funnels and pitfalls over eight trap sites in total).	Limited open woodland habitat and fallen timber and rock microhabitat reduce the likelihood of the species being present in the Study area. Survey methods and effort meets guideline requirements for this species.

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
		distant observation with binoculars or by shining a torch down the burrows at night.		
Central Greater Glider (*Petauroides armillatus*)	*Survey methods for arboreal mammals* Spotlighting for 2 x 30 person-minute searches within 100 x 100 m survey site.	No specific requirements for Greater Glider.	**Autumn** 1,000 m of nocturnal transects along Two Mile Gully and 500 m of nocturnal transect along Taurus Creek with additional searches around two trap sites along Taurus Creek. **Spring** 2,050 m of nocturnal transects along Two Mile Gully and 4,950 m of nocturnal transect along Taurus Creek with additional searches around two trap sites along Taurus Creek and one site on Two Mile Gully. **Supplementary habitat assessments Jun-Aug 2023** Approximately 10 km of creekline vegetation was spotlit during supplementary MNES habitat assessments in June 2023. These surveys also included further assessment of habitat suitability from the baseline surveys, including identification of suitable hollow-bearing trees for the species. **Total** A total of 18.5 km of transects of creek line vegetation along Taurus Creek and Two Mile Gully were completed over the autumn and spring surveys.	In general, there are few large mature trees in the creek lines 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 Taurus Creek and Two Mile Gully. The species is considered unlikely to occur. Survey methods and effort meets guideline requirements for this species.
Painted Honeyeater (*Grantiella picta*)	*Survey methods for diurnal birds* Area searches for 4 hours over 4 days per 50 ha of suitable habitat. Searches to focus on spring period	Not listed.	**Autumn** 26.5 hours of dedicated bird surveys (trap sites and dam surveys). **Spring** 26.6 person hours of dedicated bird surveys (trap sites and dam surveys). This included broadcast surveys for this species, which is often extremely responsive to call playback.	The habitat is suboptimal for this species, with vegetation sparse and limited to creek lines. The species is often associated with mistletoe, and this was not noted to be abundant (DCCEEW 2023e). Survey methods and effort meets guideline requirements for this species.

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
			Total 53 person hours of dedicated bird surveys (trap sites and dam surveys) as well as additional time whilst walking around the Study area.	
Australian Painted Snipe (*Rostratula australis*)	*Survey methods for diurnal birds* 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** Diurnal searches of gilgai totalling 8.5 person hours, diurnal surveys of dams totalling 10 person hours. Spotlighting searches around dams totalling five person hours and spotlighting searches of gilgai habitats totalling 14 person hours. 10 camera trap nights in gilgai or dam habitats. **Spring** Diurnal searches of dams totalling 10 person hours. Spotlighting surveys of dams totalling six person hours and spotlighting searches of gilgai habitats totalling 41.5 person hours. This is a total of 47.5 person hours of spotlighting over five consecutive nights. 11 camera trap nights in gilgai or dam habitats. **Supplementary March 2020 survey** Spotlighting searches of gilgai habitats totalling 60 person hours were conducted over three consecutive nights. **Supplementary MNES habitat assessments June to August 2023** Assessments of farm dams in the proposed project footprint were completed to identify whether habitat was suitable for this species (including assessing the potential for breeding habitat). During these surveys, searches were made of the dam perimeters for this species. **Total** In summary, 18.5 person hours of diurnal active searching, 121.5 person hours of nocturnal	The species was recorded at night during spotlighting in an area of gilgai east of Taurus Creek during the autumn surveys and on two farm dams during the spring surveys. Any further presence on site will be sporadic in nature and hard to detect due to the cryptic nature of the species. 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. Survey methods and effort meets guideline requirements for this species.

Target Species	State guidelines	Commonwealth guidelines	Survey effort	Notes
			searches of dams or gilgai habitats, and 21 camera trap nights.	

4.4.7 Survey limitations

i Autumn season surveys

Wet conditions temporarily limited access to some sites in the Study area during the autumn surveys. Sites with constrained vehicle access were accessed on foot where time allowed. Trap sites were located within walking distance of minor access tracks to allow for equipment to be carried in. The preceding wet weather also resulted in debris along creek lines being washed away as the floodwaters passed through. While many of the higher areas of the bank will have been unaffected, it was clear from the debris lines that the ground in some areas would have been underwater and as such any scats (eg from Koala) would have potentially been washed away. There were however several eucalypt species along the creek lines in the Study area that would have been above this water mark and any scats present further away from creekbank would have been retained.

The above limitations were not considered material in limiting the ability to describe the value of the site for MNES. Habitat mapping was conservative, and spring season surveys addressed survey effort, and species in question were not seasonally dependent.

i Spring season surveys

Severe thunderstorms temporarily limited survey effort on 17 October 2019 and 18 October 2019. The limitation was temporary and did not materially impact overall survey effort.

ii March 2020 supplementary surveys

No significant limitations were encountered.

iii June – August 2023 supplementary surveys

No significant limitations were encountered.

4.5 Flora surveys

Flora surveys were completed in three seasonal surveys covering both vegetation communities and listed flora species. Undertaking three seasonal surveys increases the detectability of species in different seasons, including for some species when they are in flower or fruiting.

The vegetation community survey methods were consistent with the Methodology for Survey and mapping of regional ecosystems and vegetation communities in Queensland, Version 5.0 (Neldner et al. 2020) including tertiary and quaternary transects as well as some BioCondition assessments. The objective was to validate the presence of REs and confirm whether they met remnant or high value regrowth status, and their extent. Where appropriate, criteria thresholds for TECs were also evaluated to confirm if the vegetation meets the EPBC Act requirements for that community.

Threatened flora species identified by the desktop assessment (Section 5.6 and Appendix E) were targeted during the flora surveys. The following sections provide information on the seasonal targeted flora surveys that were completed, survey methods and effort applied.

4.5.1 Flora survey team

Flora surveys have been conducted by four EMM field ecologists with experience leading and implementing vegetation surveys in central Queensland, including identification of threatened ecological communities (TECs) and threatened flora species. Lead flora ecologists were Bruce McLennan and Lui Weber. Curricula vitae for EMM field ecologists are provided in Appendix J.

4.5.2 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 (April 2019) and summer/spring season (December 2018 and September/October 2019), and incorporated both pre and post wet-seasonal conditions. The two-phased survey, post-wet season (autumn) and pre-wet season (spring), also increased chances of threatened species detectability by surveying in differing environmental conditions and in-turn, seasonal preferences for growth phases and/or flowering and seeding events.

The initial desktop studies identified REs, TECs and flora species that had potential to occur in the Study area. Depending on the season, the potential of the species to occur in the Study area varied depending on the condition of the habitat. A full list of all identified threatened flora species, REs and TECs with the potential to occur in the Study area, their seasonality requirements was previously reviewed and identified and has been refined post field survey and are summarised in Section 5.6.

i Autumn (post-wet) season surveys

Flora surveys were completed over a total of five days (four field days) between 1 April 2019 and 5 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.

ii Summer and spring (pre-wet) season surveys

Summer flora surveys were completed over a total of six days (five field 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. Additional spring flora surveys were conducted during September/October 2019 as vegetation assessments were required for the newly listed (as of 4 July 2019) TEC - Poplar Box Grassy Woodland on Alluvial Plains. Vegetation mapping was further refined during the September/October 2019 surveys with the inclusion of data from additional vegetation assessments.

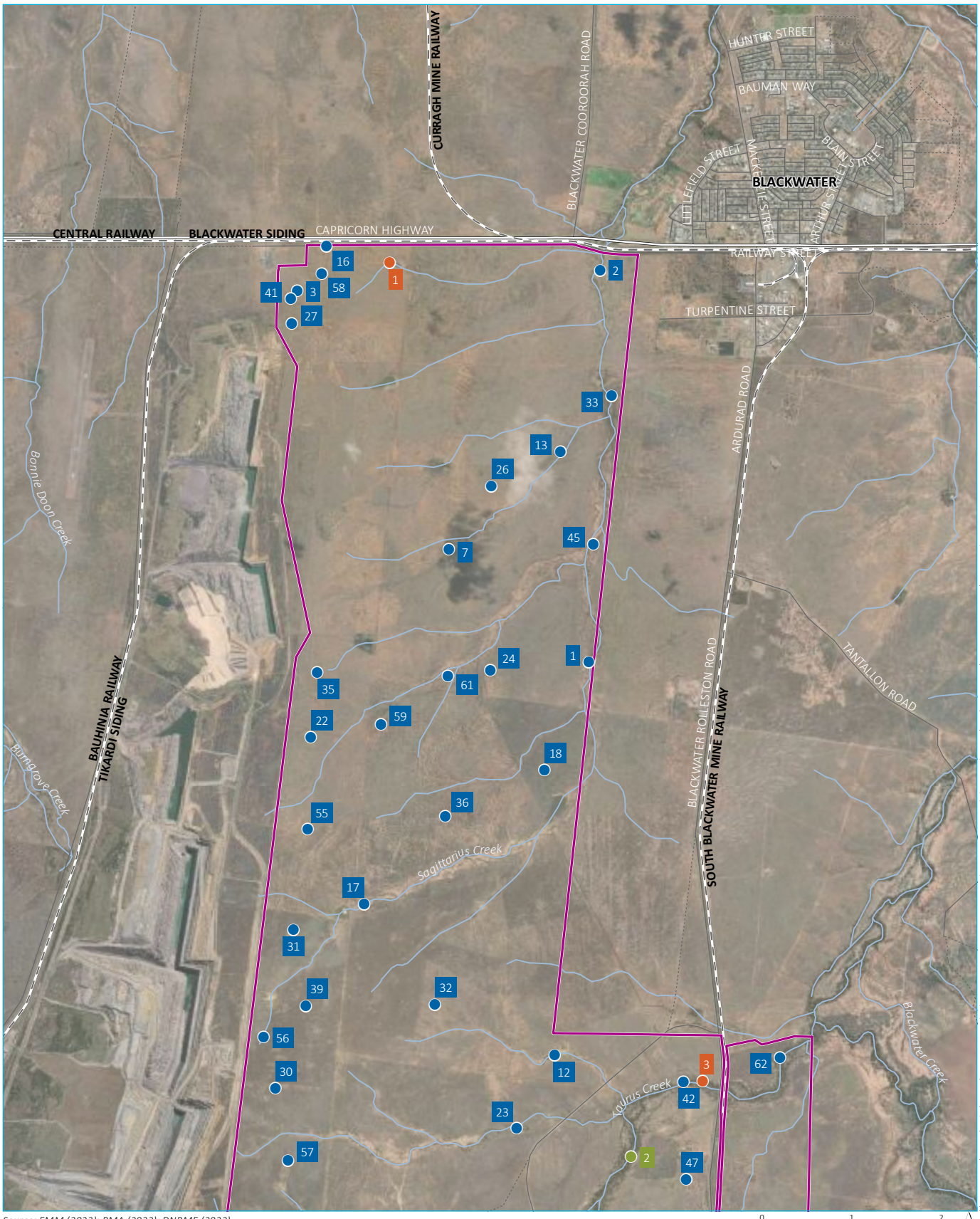
4.5.3 Flora survey sites

Flora surveys of varying methods were completed at 11 sites during 2018 summer surveys, 51 during 2019 autumn surveys and an additional 19 sites during the 2019 spring surveys. Flora survey type, number of sites and timing are summarised below in Table 4.3, focussing on quaternary sites to inform updated vegetation and habitat mapping. Survey sites were selected with consideration of desktop RE mapping, satellite imagery and previous field survey results to cover all unsurveyed vegetation communities across the Study area.

Table 4.3 Flora survey site summary

Survey type	Summer 2018	Autumn 2019	Spring 2019	Total sites
Tertiary assessment	0	3	2	5
Quaternary assessment	11	39	13	63
BioCondition assessment	0	4	0	4
TEC assessment	0	4	4	8

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 threatened flora species. Survey sites for flora across all field survey periods are shown on Figure 4.4.

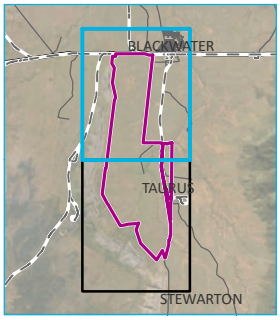


Source: EMM (2023); BMA (2023); DNRME (2022)

0 1 2 km

GDA 1994 MGA Zone 55

N



KEY

- Study area
- Rail line
- Major road
- Minor road
- Vehicular track/trail
- Watercourse/drainage line

Flora survey type

- Quaternary
- Tertiary
- BioCondition

Flora survey sites - map 1 of 2

Blackwater Mine - North Extension Project
MSES Assessment
Figure 4.4

EMM creating opportunities

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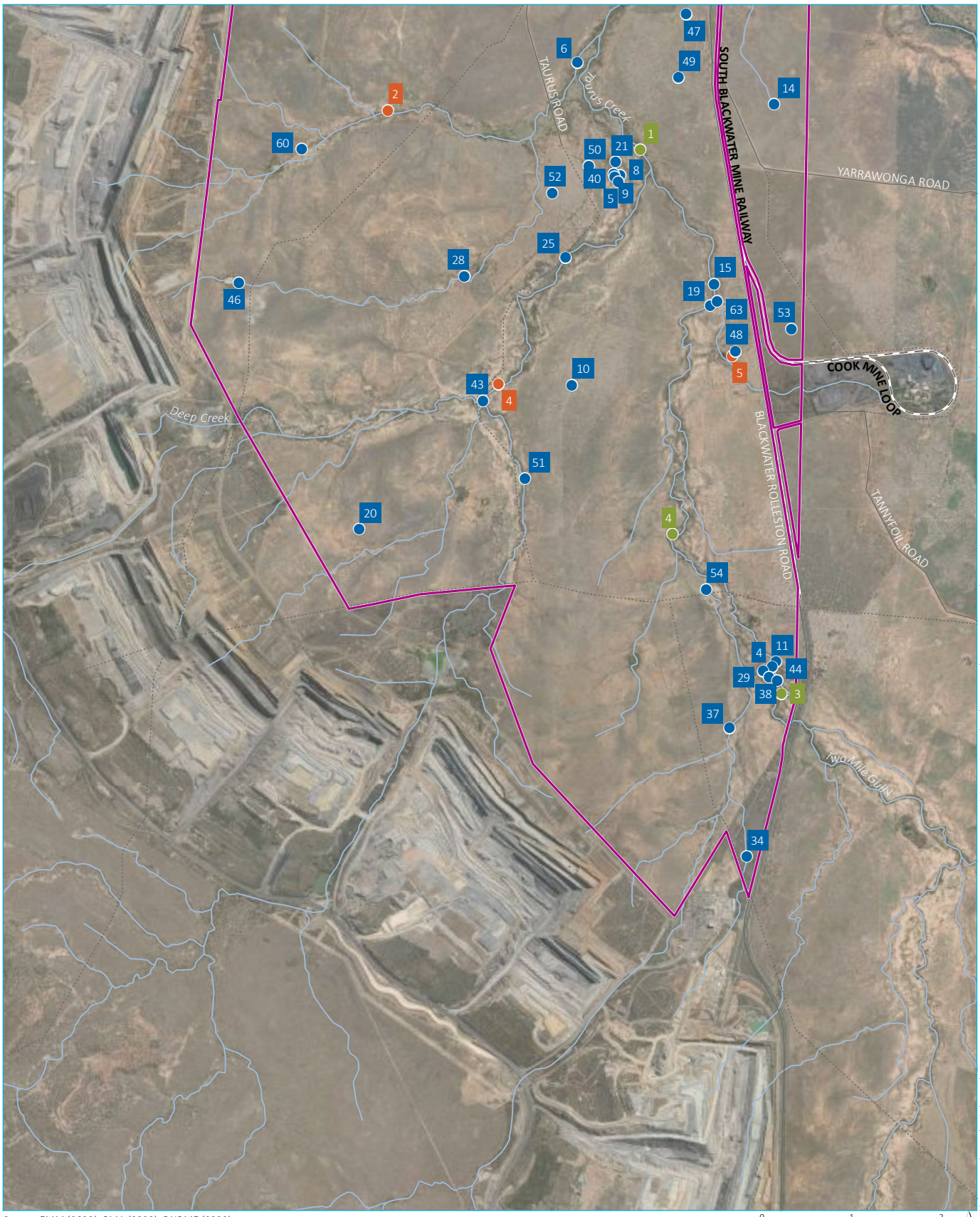
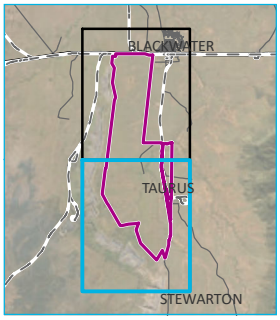


Source: EMM (2023); BMA (2023); DNRME (2022)

0 1 2 km

GDA 1994 MGA Zone 55

N



KEY

- Study area
- Rail line
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Flora survey type

- Quaternary
- Tertiary
- BioCondition

Flora survey sites - map 2 of 2

Blackwater Mine - North Extension Project
MSES Assessment
Figure 4.4

EMM creating opportunities

4.5.4 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 5.0 (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 mapped RE types, determine condition status, and confirm vegetation extent.

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 across a Study area. Information collected includes dominant species in all structural layers, and structural features including height and cover percentage. A description of the landform is also made to aid the description of land zones.

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.

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. Based on desktop assessments, ground-truthed RE's and site observations, three TECs were considered to have a higher likelihood to occur, being Brigalow, Poplar Box Grassy Woodland on Alluvial Plains and Weeping Myall woodland.

The key diagnostic characteristics for each respective community are listed below.

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 the Brigalow Belt North, Brigalow Belt South, Southeast Queensland, Cobar Peneplains, Darling 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 4.4 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	≥ 90% of perennial vegetation cover in ground layer1 is native **And** ≥ 30 native plant species per ha in ground layer	≥ 1 ha
Class A2: A large patch with low perennial weeds and diverse native understorey	≥ 70% of perennial vegetation cover in ground layer1 is native **And** ≥ 30 native plant spp. per ha in ground layer	≥ 5 ha

Table 4.4 Poplar Box TEC

Category and rationale	Native cover and diversity thresholds	Minimum patch size thresholds
Class A3: A large patch with high quality habitat features	≥ 10 trees per ha with ≥ 30 cm dbh2 (and/or with hollows) **And** smaller trees, saplings or seedlings suggestive of periodic recruitment **And** ≥ 20 native plant spp. per ha ground layer	≥ 5 ha
CLASS B MODERATE QUALITY		
A large patch with moderate quality native understorey	≥ 50% of perennial vegetation cover in ground layer1 is native And ≥ 20 perennial native plant species per ha in ground layer **Or** ≥ 10 trees per ha with ≥ 30 cm dbh2 (or hollows)	≥ 5 ha

1. **Perennial vegetation cover in the ground layer** (i.e. below the tree canopy) includes vascular pant 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, cryptograms (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 – Weeping Myall woodland

A patch must include the following key diagnostic characteristics to be considered associated with the Weeping Myall ecological community (derived from DoE 2009):

- the patch of woodland must be at least 0.5 ha (5000 m²) in size;
- the overstorey must have at least 5 per cent tree canopy cover or at least 25 dead or defoliated mature weeping myall trees per hectare;
- the tree canopy must be dominated (at least 50 per cent of trees present) by living, dead or defoliated weeping myall trees, and
- the patch has more than two layers of regenerating weeping myall present, or
    - the tallest layer of living, dead or defoliated weeping myall trees is at least 4 m tall and of the vegetative cover (shrub and ground layers) present, 50 per cent is comprised of native species, and
    - areas of leaf litter and cryptogams (eg lichens, mosses) or soil crusts may be evident and acceptable as part of the ground layer of this ecological community.

Areas that have a total absence of native species in the understorey are considered to be so highly degraded and are excluded as are patches of paddock trees with no native understorey.

ii Habitat quality assessments (derived from BioCondition assessments)

Habitat quality assessments applying the Guide to determining terrestrial habitat quality (DES 2014) were completed at four sites to gauge habitat quality. Sites were selected prior to field surveys using satellite imagery and results from previous vegetation community surveys. They were chosen to represent the range of RE types and condition of vegetation patches across the Study area.

Field methodology was undertaken in accordance with the Guide to determining terrestrial habitat quality (DES 2014). 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.

4.5.5 Targeted survey effort - threatened flora species

Field surveys were conducted by a team of two ecologists and led by a 'suitably qualified person'. The primary field survey method used was timed meander surveys as per Section 6.2.2 of the Flora Survey Guidelines (DES 2020) where habitat types were traversed randomly with maximum coverage until complete or until no new species were recorded for 30 minutes. All flora species (native and non-native) were identified and recorded. Where a threatened plant or possible threatened plant was recorded, the population extent within the Study 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. Where applicable information on location, habit and population were collected.

Threatened flora species were also searched for while completing flora surveys across the wider Study area. This included when traversing the Study area on foot on route to designated survey. Table 4.5 summarises potential Federally listed protected plants identified in the initial desktop searches and the suitability of the survey periods (December 2018 and April 2019) for these species.

Table 4.5 EPBC Act threatened plants and seasonality requirements

Scientific name	Common name	EPBC Act status[1]	NC Act status[2]	Species seasonality requirements
Aristida annua	-	V	V	Flowers and fruits in March, and May-June (DCCEEW 2023f). Surveys were undertaken within an appropriate seasonal timeframe for the species.
Arthraxon hispidus		V	V	Flowers appear in March to July (Harden, 1993) and summer to autumn (Jacobs & Wall, 2007)
Bertya opponens	-	V	-	Flowering has been recorded from June to November, January and March and fruits between June, August and November (DCCEEW 2023g). The species would be detectable year round if present and identification does not rely on fertile material.
Cadellia pentastylis	Ooline	V	V	Species was recorded in historic surveys commissioned by BMA in the Terang lease. This is part of the desktop 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 (DCCEEW 2023h). The distinctive species would be detectable year round if present.
Daviesia discolor	-	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.
Dichanthium queenslandicum	King Blue-grass	E	V	Flowers have been recorded throughout the year, particularly from March (DoE 2013a). Surveys were undertaken within an appropriate seasonal timeframe for the species.
Dichanthium setosum	Bluegrass	V	-	A warm season perennial, the species commences growing in spring, flowers in summers and becomes dormant in late autumn (DCCEEW 2023i). Surveys were undertaken within an appropriate seasonal timeframe for the species.
Eucalyptus raveretiana	Black Ironbox	V	-	Has been recorded in flower from December to March. (DCCEEW 2023j). The species would be detectable year round if present and identification does not rely on fertile material.
Homoranthus decumbens	-	E	V	Flowers from September to December. There is no information available on its fruiting period. (DCCEEW 2023k). The species would be detectable year round if present.
Logania diffusa	-	V	V	Flowers from March to September and fruits in January (DoE 2008c). The species only occurs in Blackdown Tableland.
Macrozamia platyrhachis	-	E	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.
Marsdenia brevifolia	-	V	V	Flowering occurs from October to February and fruiting from January to March (DCCEEW 2023l).

Table 4.5 EPBC Act threatened plants and seasonality requirements

Scientific name	Common name	EPBC Act status[1]	NC Act status[2]	Species seasonality requirements
				The species would be detectable year round if present.
Phaius australis	Lesser Swamp-orchid	E	E	The flowering season is mainly between August and December. Flowers are long lasting and open progressively so that a plant is in flower for several weeks. Both cross and self-pollination have been documented, but the exact breeding system is unknown. Seedlings have only been found in relatively open areas (DCCEEW 2023m). Surveys were undertaken within an appropriate seasonal timeframe for the species.
Polianthion minutiflorum	-	V	V	Flowers throughout the year. Fruits have been recorded in August and November (DoE 2008b). The habitat for the species in the desktop Study area is likely to be restricted to the Blackdown Tableland so it would not be present in the Study area.
Solanum dissectum	-	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.

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

4.5.6 Survey limitations

i Autumn (post-wet) season surveys

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

ii Spring (pre-wet) season surveys

No significant limitations were encountered.

4.5.7 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.

4.6 Terrestrial groundwater dependent ecosystems

4.6.1 Desktop assessment

A desktop assessment was completed to determine the potential presence of Terrestrial Groundwater Dependent Ecosystems (TGDE) within the Study area which included a review of the:

- Groundwater Dependent Ecosystem Atlas (National GDE Atlas) (BOM 2019b), and
- the WetlandMaps, DES, Queensland Government.

The results of the desktop assessment are provided in Section 5.11.

4.6.2 Potential TGDEs

RDM Hydro Pty Ltd (RDM Hydro) et al (2023) undertook a desktop assessment to identify the distribution of potential terrestrial groundwater-dependent ecosystems (TGDEs) at the BWM. A hydrogeological review was undertaken by the desktop assessment to gain an understanding of the groundwater regime with consideration of TGDEs. The focus of the review was on shallow groundwater within the rooting depth of the government mapped vegetation, specifically the water table depth, presence of perched aquifers and the salinity of the shallow groundwater (RDM Hydro et al, 2023). The study produced a continuous depth to water table map for the BWM area. The water table is a subdued reflection of topography. It is generally in excess of 25 m below ground except in the vicinity of drainage lines and topographic lows.

Groundwater quality data from the BWM monitoring data was also assessed by RDM Hydro et al. (2023) to identify whether salinity is likely to constrain the distribution of TGDEs in the landscape. The data indicated that the Rangal Coal Measures have the highest salinities, and the Tertiary Sediments generally the lowest. Electrical conductivities are typically less than 30,000 µS/cm and are therefore unlikely to significantly affect the distribution of TGDEs based on this threshold (RDM Hydro et. al., 2023).

RDM Hydro et al. (2023) presents conceptual ecohydrological models (TGDE types and functions) which are likely to be found in the BWM area and the wider Bowen Basin based on the findings of the desktop study and previous field assessments of other GDE studies in the Bowen Basin. The conceptual ecohydrological models include perched aquifers in alluvium (Types A and B) and systems exhibiting interactions with Tertiary and Permo-Triassic sediments (coal seams and alluvium) (Types C and D). A description of the types and function of the conceptual ecohydrological models summarised from RDM Hydro et al (2023) is included in the BWM – North Extension Project Groundwater Impact Assessment (SLR 2023c).

The potential of the ground-truthed vegetation within the Study area to be a TGDE was assessed based on the groundwater table mapping prepared by RDM Hydro et al (2023) (to be referred to as the RDM Hydro depth to water table) and the vegetation likely reliance on access to groundwater through known rooting depth and vegetation characteristics of the ground-truthed REs. The ground-truthed REs were either categorised as:

- **Unlikely TGDE**, where the groundwater depth to water table range was below the known rooting depth, or
- **Potential TGDE**, where the groundwater depth to water table range was within known rooting depth.

Available rooting depths have been reviewed and the applied rooting depths have been identified in Section 6.2.4.

At this stage other considerations where the RDM Hydro depth to water table did not fully account for ongoing and current approved activities were considered in the likelihood of the relevant RE having access to groundwater, and therefore the probability that would be a TGDE.

4.6.3 TGDE impact assessment method

The impact assessment was completed using detailed analysis within ArcMap (10.8.2). The process involved a number of steps. As follows:

- SLR (2023c) provided the 90th percentile of the predicted 1 m water table drawdown curve from the Uncertainty Analysis as an outer boundary to ensure all potential TGDEs are captured in the assessment, for context this boundary extends outside of the Study area.
- Potential TGDEs within the Study area were identified (as described in Section 4.6.2). Where the predicted extent of groundwater drawdown extended outside the Study area, DNRM RE mapping was reviewed to

assess whether the vegetation represented a potential TGDE using the same approach to the identification of potential TGDEs within the Study area. In addition to the inclusion of previously ground-truthed vegetation provided by BMA within the existing operational ML1760, ML70104, ML70329, ML1762.

- The predicted drawdown range was subtracted from the current depth to groundwater range for each potential TGDE patch to identify the change in GWL. The change in the GWL was assessed against the estimated rooting depth of the RE to determine the likelihood of impact on the mapped potential TGDE. The scale of impact was classified as:

  - **No impact** – zero drawdown (no change in depth to groundwater)

  - Potential Impact – areas of potential TGDE based on analysis to date where there is a predicted change in depth to groundwater (minor to major changes). Site specific analysis required to assess whether the vegetation represents a TGDE and the likelihood of impact.

    Impact probabilities as described above are considered conservative to help address limitations of the assessment. Further assessment is required to determine the likelihood and severity of risk and impact to the potential TGDEs.

4.6.4 Limitations

Limitations of this assessment include:

- The current groundwater levels were sourced from the depth to water table mapping developed by RDM Hydro et al (2023). The RDM Hydro et al (2023) report describes the development of this mapping and any limitations. As described in SLR (2023c), the Groundwater Impact Assessment also produced a depth to water table map (to be referred to as the SLR model) at the end of the calibration period (December 2022) based on groundwater modelling results which overestimates the water table elevation in the shallow two layers. The SLR model however does provide an indication where the depth to water table is lower than predicted in the RDM Hydro depth to water table and was reviewed to assist in informing existing pressures in the groundwater table.

- To date, there has been no site assessment for Isotopic, radon and or leaf water potential studies have not been conducted to confirm linkages and or dependence with the groundwater table and the vegetation.

- Modelled groundwater drawdown was provided by SLR was for the maximum incremental drawdown across the period of the model (FY2025-2085) and is considered a conservative approach (SLR, 2023c).

- For vegetation that occurs outside of the Study area the state RE mapping was applied, the same method of assessment was applied as the GTRE mapping, however as ground truthing was not completed for these locations aerial imagery, Queensland vegetation categories and adjacent ground-truthed vegetation were reviewed to inform probability of mapped RE accuracy and a conservative approach was taken to the assessment.

5 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 desktop search area (which included 50 km buffer to the Study area) and included an evaluation of all MNES. Matters appearing in the PMST are summarised in Sections 5.1 to 5.8. Remaining matters in Sections 5.9 to 5.15 are not MNES but are left for ecological context of the desktop Study area.

5.1 World Heritage and National Heritage Properties

There are no World Heritage or National Heritage properties within the vicinity of the Study area.

5.2 Commonwealth Marine Areas

The Study area is located approximately 200 km west (direct line) of any marine area and is separated hydraulically by at least two sub-catchments (Dawson River and the Fitzroy River) with varying land use and water quality.

5.3 Protected Area estates

There are no nature refuges or national parks within the Study area. The Blackdown Tableland National Park is located approximately 10 km to the east of the Study area. The nearest nature refuge is Kenmare Nature Refuge approximately 20 km to the southwest (Figure 1.1).

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

5.4 Regional ecosystems

The certified Queensland Government RE mapping (DNRM 2018) was analysed and mapped for the Study area to provide ecological context to the MNES desktop results, and potential for presence of MNES habitats as well as the potential for analogous EPBC Act listed TECs to be present. An approximate extent of 26.96 ha remnant (Category B), 368.37 ha of high-value regrowth (Category C) and riverine regrowth (Category R) native vegetation was mapped in the regulated vegetation mapping across the Study area. Large portions of the Study 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 Study area has the potential to support:

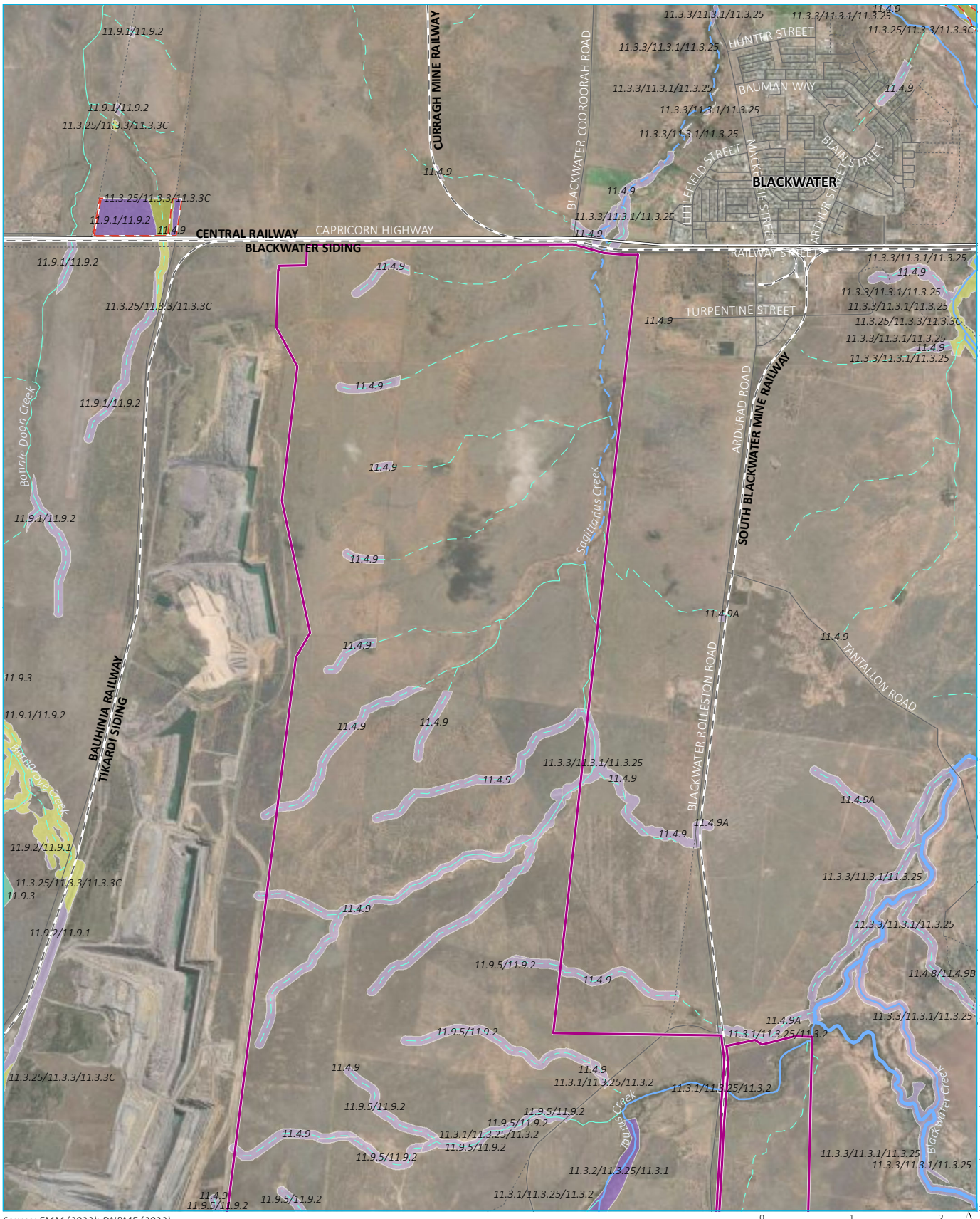
- three Endangered REs; and
- two Of Concern REs (VM Act and BD status).

Certified RE mapping is illustrated in Figure 5.1 with many patches being mixed polygons. A summary of REs mapped as occurring in the Study area, with both VM Act and BD status noted, is provided in Table 5.1 below. Note that all these areas are either mapped as high-value regrowth (Category C) or regrowth vegetation within 50 m of a watercourse (Category R) in the certified mapping apart from a 27 ha patch of remnant (Category B) vegetation along Taurus Creek.

Table 5.1 Regional ecosystems within Study area

Regional ecosystem description	VM Act status	BD status	Potentially Associated TEC	Area (ha) in certified mapping	
				Remnant	HVR
11.3.1 – *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	E	E	Brigalow (*Acacia harpophylla* dominant and co-dominant)	0	83.93
11.3.2 – *Eucalyptus populnea* woodland on alluvial plains	OC	OC	Poplar Box Grassy Woodland on Alluvial Plains Weeping Myall Woodland	26.96	0
11.3.3 – *Eucalyptus coolabah* woodland on alluvial plains	OC	OC	-	0	5.13
11.4.9 – *Acacia harpophylla*, *Lysiphyllum carronii* +/- *Casuarina cristata* open forest to woodland	E	E	Brigalow (*Acacia harpophylla* dominant and co-dominant)	0	202.78
11.9.5 – *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	E	E	Brigalow (*Acacia harpophylla* dominant and co-dominant)	0	76.54

E – Endangered, OC – Of Concern



Source: EMM (2023); DNRME (2022)

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GDA 1994 MGA Zone 55

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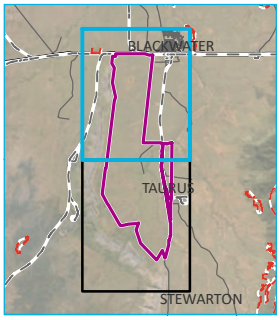

KEY

- Study area
- Rail line
- Major road
- Minor road
- Vehicular track/trail

Stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order

- Protected plant high risk trigger area

Regional ecosystems (VM Act status)

- Remnant - endangered
- High value regrowth - endangered
- Remnant - of concern
- High value regrowth - of concern
- Remnant - least concern

Certified RE mapping - map 1 of 2

Blackwater Mine - North Extension Project
MNES Assessment
Figure 5.1

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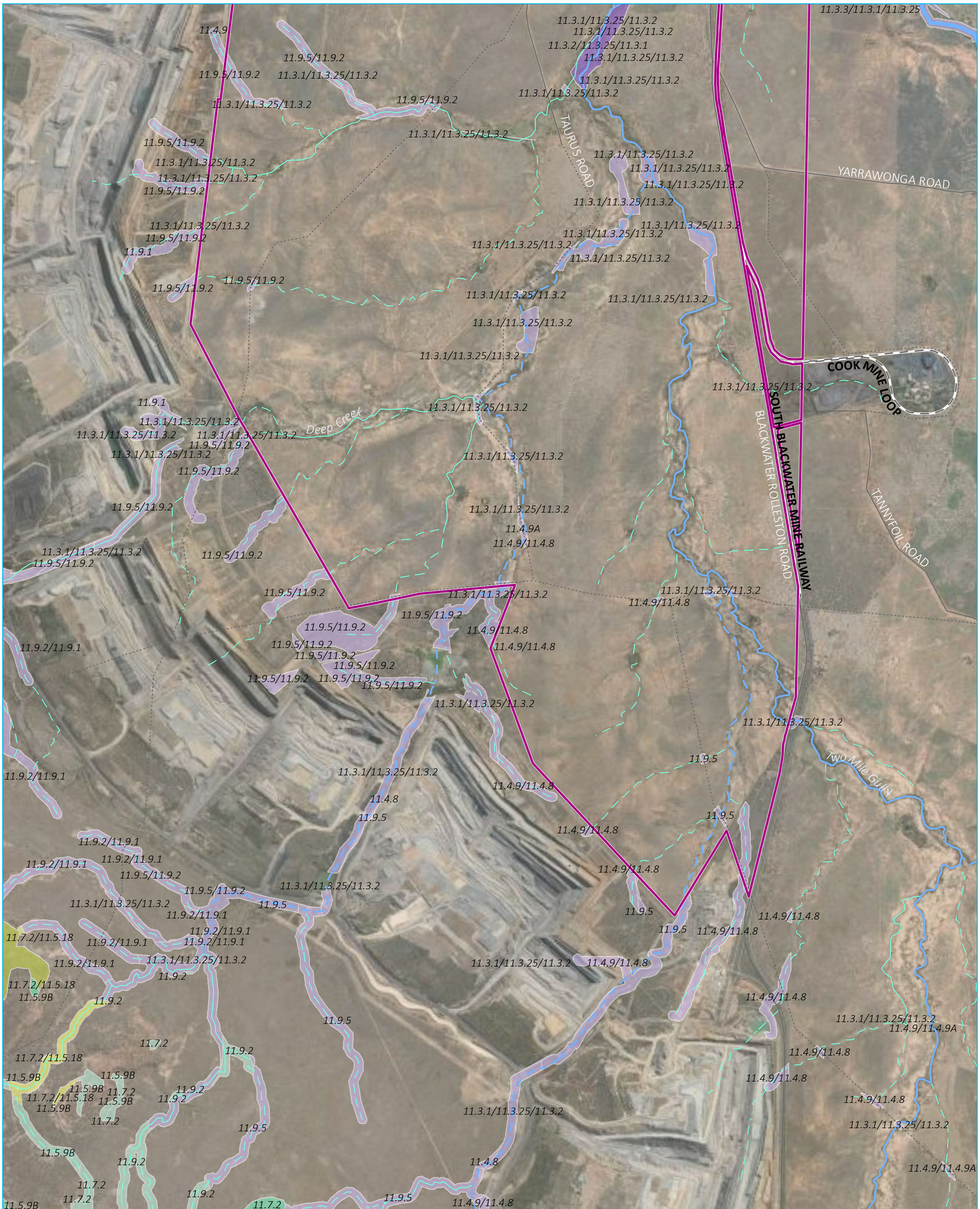
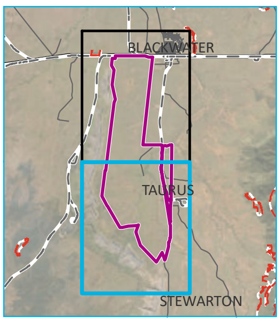


Source: EMM (2023); DNRME (2022)

0 1 2 km
GDA 1994 MGA Zone 55
N



KEY

- Study area
- Rail line
- Minor road
- Vehicular track/trail

Stream order
- 1st order
- 2nd order
- 3rd order
- 4th order
- 5th order

- Protected plant high risk trigger area

Regional ecosystems (VM Act status)
- Remnant - endangered
- High value regrowth - endangered
- Remnant - of concern
- High value regrowth - of concern
- Remnant - least concern
- High value regrowth - least concern

Certified RE mapping - map 2 of 2

Blackwater Mine - North Extension Project
MNES Assessment
Figure 5.1

EMM creating opportunities

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5.5 Threatened Ecological Communities (TECs)

The following database searches were undertaken to identify TECs with potential to occur in the Study area:

- a search of the PMST (Appendix A) to identify the potential for TECs to occur within 50 km of the Study area;
- review of RE mapping for Study area (refer Table 5.1 above); and
- results of a literature review taking into consideration results of previous ecology surveys across the broader Blackwater Mine.

Table 5.2 summarises the TECs with potential to occur in the Study area identified through PMST search. This list is based on an initial desktop Study area of desktop searches.

Based on desktop assessments, ground-truthed RE's and site observations, three TECs were considered to have a higher likelihood to occur, being Brigalow, Weeping Myall woodland and Poplar Box Grassy Woodland on Alluvial Plains.

The list has since been refined following field survey. The table also includes REs in Table 5.1 which occur in the certified mapping, which have been highlighted in bold.

Table 5.2 TECs with potential to occur in Study area

TEC	EPBC Act status	Associated regional ecosystems	Potential to occur, based on RE mapping
Brigalow (*Acacia harpophylla* 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, 11.9.2, 11.9.5, 11.9.6, 11.11.14, 11.12.21	**Possible**
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	no
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	no
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	no
Weeping Myall Woodlands	Endangered	**11.3.2**, 11.3.28	**Possible**
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	**11.3.2**, 11.3.17, 11.4.7, 11.4.12, 12.3.10	**Possible**

5.6 Flora species

The following database searches were undertaken to identify listed flora species under the EPBC Act with potential to occur in the Study area:

- a search of the PMST (Appendix A) for listed flora species with potential to occur within 50 km of the Study area;
- a search of Wildlife Online databases (Appendix A) for listed flora species that occur within 50 km of the Study area and adjacent protected areas including Blackdown Tableland National Park;

- Essential Habitat mapping (DES); and
- results of a literature review taking into consideration results of previous ecology surveys within the Study area and broader Blackwater Mine.

A list of threatened flora species considered to have potential to occur within the Study area based on desktop assessments is provided in Table 5.3 and Figure 5.2. This list is based on desktop searches undertaken prior to fieldwork, which has since been refined following field surveys.

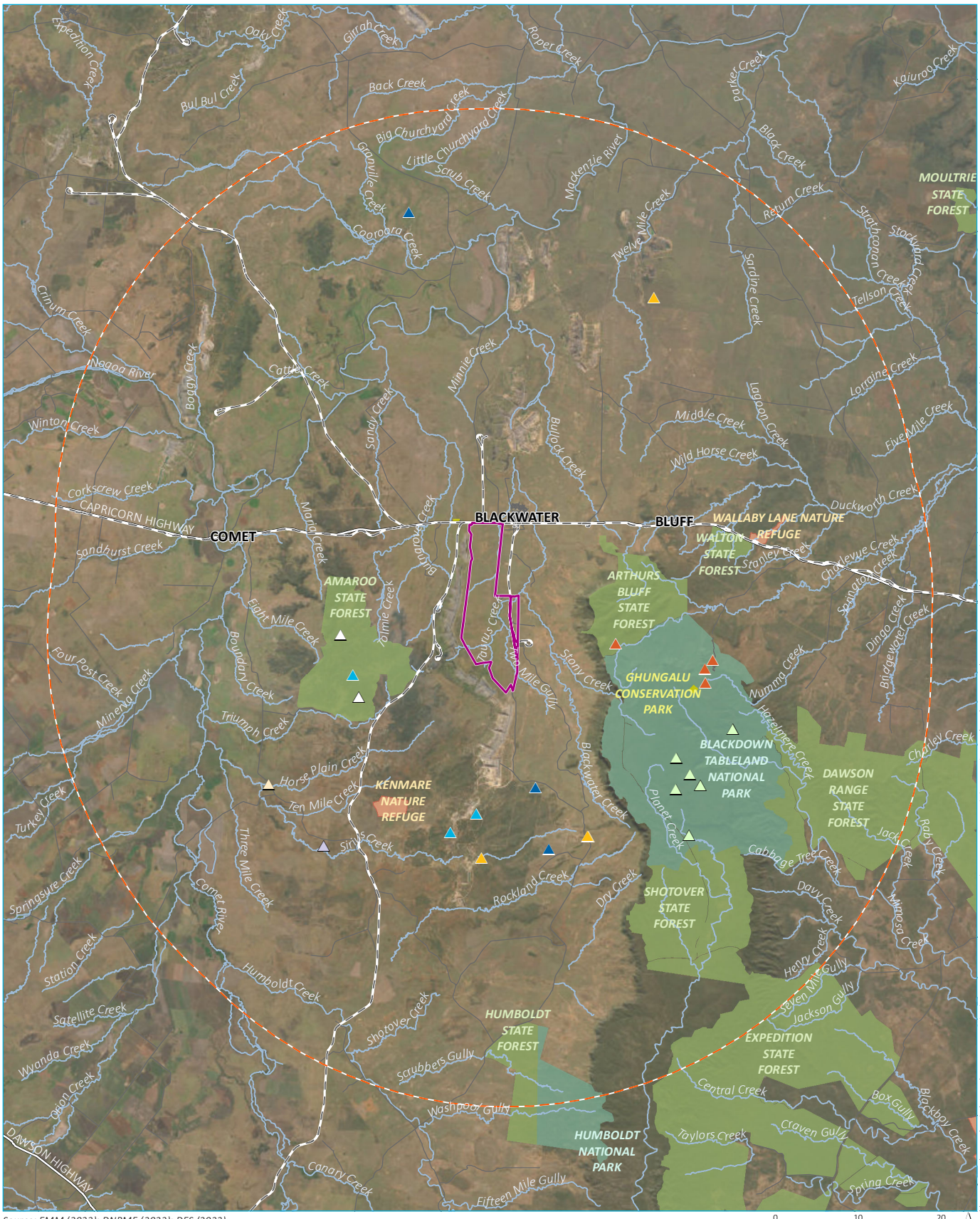
Table 5.3 Flora species with potential to occur

Scientific name	Common name	EPBC Act status[1]	NC Act status[2]	Species recorded in WildNet searches
Aristida annua	-	V	V	✗
Arthraxon hispidus		V	V	✗
Bertya opponens	-	V	-	✓
Cadellia pentastylis	Ooline	V	V	✓
Daviesia discolor	-	V	V	✓
Dichanthium queenslandicum	King blue-grass	E	V	✗
Dichanthium setosum	Bluegrass	V	-	✗
Eucalyptus raveretiana	Black ironbox	V	-	✗
Homoranthus decumbens	-	E	V	✗
Logania diffusa	-	V	V	✓
Macrozamia platyrhachis	-	E	E	✓
Marsdenia brevifolia	-	V	V	✗
Phaius australis	Lesser Swamp Orchid	E	E	✗
Polianthion minutiflorum	-	V	V	✓
Solanum dissectum	-	E	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

The Wetland*Info* database identifies five threatened flora species that have previously been recorded from the broader Fitzroy Basin (DES 2020a), none of which are likely to occur within the Study area.

The WildNet Search results had no records of threatened flora species within the Study area.



Source: EMM (2023); DNRME (2022); DES (2023)

0 10 20 km

GDA 1994 MGA Zone 55

N

KEY

- Study area
- Desktop search area
- Rail line
- Major road
- Minor road
- Named watercourse
- National park
- State forest
- Conservation park
- Nature refuge

Threatened flora species records

- *Aristida annua*
- *Bertya opponens*
- *Cadellia pentastylis*
- *Daviesia discolor*
- *Dichanthium queenslandicum*
- *Eucalyptus raveretiana*
- *Logania diffusa*
- *Polianthion minutiflorum*
- *Solanum dissectum*

Flora database records within the vicinity of the study area

Blackwater Mine - North Extension Project
MNES Assessment
Figure 5.2

EMM creating opportunities

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5.7 Fauna species

The following database searches were undertaken to identify listed fauna species under the EPBC Act with potential to occur in the Study area:

- a search of the PMST (Appendix A) for listed fauna species with potential to occur within 50 km of the Study area;
- a search of Wildlife Online database (Appendix A) for listed fauna species that occur within 50 km of the Study area;
- eBird database to identify records within 50 km of the Study area;
- Essential Habitat mapping (DES); and
- results of a literature review taking into consideration results of previous ecology surveys within the broader Blackwater Mine.

A list of threatened fauna species considered to have potential to occur within the Study area is provided in Table 5.4 and Figure 5.3. This list is based on an initial desktop Study area of desktop searches undertaken prior to fieldwork, which has since been refined following field survey.

Listing changes following the survey have also been amended in the updated report – for example Yellow-bellied Glider (*Petaurus australis australis*) was listed as vulnerable under the EPBC Act on 2 March 2022, and Koala was uplisted to endangered on 12 February 2022. Aquatic species are excluded from this table and are addressed in the relevant aquatic ecology report (EMM 2023a).

Table 5.4 Threatened fauna species with potential to occur within the Study area

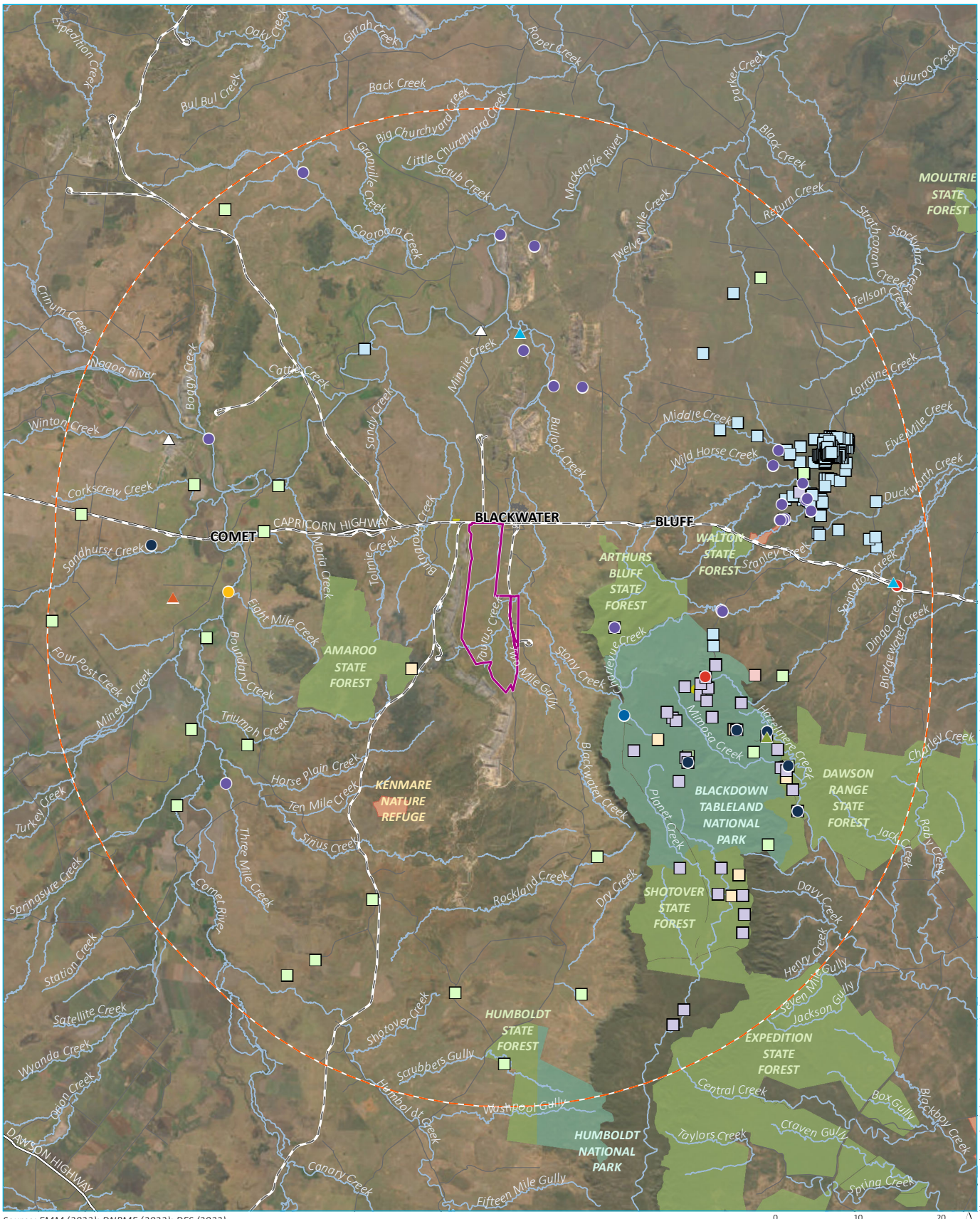
Scientific name	Common name	EPBC Act status[1]	NC Act status[2]	Species recorded in historic ecology surveys of BWM	Species recorded within WildNet searches
Birds					
Calidris ferruginea	Curlew Sandpiper	CE	E	×	×
Erythrotriorchis radiatus	Red Goshawk	V	E	×	×
Falco hypoleucos	Grey Falcon	V	V	×	×
Geophaps scripta scripta	Squatter Pigeon (southern)	V	V	✓	✓
Grantiella picta	Painted Honeyeater	V	V	×	✓
Hirundapus caudacutus	White-throated Needletail	V	V	×	✓
Neochmia ruficauda ruficauda	Star Finch	E	E	×	×
Poephila cincta cincta	Southern Black-throated Finch	E	E	×	×
Rostratula australis	Australian Painted Snipe	E	E	×	×
Stagonopleura guttata	Diamond Firetail	V	V	×	×
Turnix melanogaster	Black-breasted Button-quail	V	V	×	×
Small terrestrial mammals					

Table 5.4 Threatened fauna species with potential to occur within the Study area

Scientific name	Common name	EPBC Act status[1]	NC Act status[2]	Species recorded in historic ecology surveys of BWM	Species recorded within WildNet searches
Antechinus argentus	Silver-headed Antechinus	E	V	×	✓
Dasyurus hallucatus	Northern Quoll	E	-	×	×
Onychogalea fraenata	Bridled Nailtail Wallaby	E	E	×	✓
Arboreal mammals					
Petauroides armillatus	Central Greater Glider	E	E	×	✓
Petaurus australis australis	Yellow-bellied Glider	V	V	×	✓
Phascolarctos cinereus	Koala	E	E	×	✓
Bats					
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	×	✓
Macroderma gigas	Ghost Bat	V	E	×	×
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	×	×
Pteropus poliocephalus	Grey-headed Flying Fox	V	V	×	×
Reptiles					
Denisonia maculata	Ornamental Snake	V	V	×	×
Delma torquata	Collared Delma	V	V	×	✓
Egernia rugosa	Yakka Skink	V	V	×	✓
Elseya albagula	Southern Snapping Turtle	CE	E	×	✓
Furina dunmalli	Dunmall's Snake	V	V	×	×
Hemiaspis damelii	Grey Snake	E	E	×	×
Lerista allanae	Allan's Lerista	E	E	×	×
Rheodytes leukops	Fitzroy River Turtle	V	V	×	✓

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 (2023); DNRME (2022); DES (2023)

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KEY

- Study area
- Desktop search area
- Rail line
- Major road
- Minor road
- Named watercourse
- National park
- State forest
- Conservation park
- Nature refuge

Threatened fauna species records

- Collared Delma
- Grey Snake
- Ornamental Snake
- White-throated Snapping Turtle
- Painted Honeyeater
- Red Goshawk
- Squatter Pigeon
- Star Finch
- White-throated Needletail
- Bridled Nail-tail Wallaby
- Ghost Bat
- Greater Glider
- Koala
- Yellow-bellied Glider

Fauna database records within the vicinity of the study area

Blackwater Mine - North Extension Project
MNES Assessment
Figure 5.3

EMM
creating opportunities

5.8 Migratory species

To identify a list of candidate migratory species for further consideration and assessment, the following databases searches were undertaken:

- a search of the PMST (Appendix A) to identify migratory species with potential to occur in the Study area;
- a search of the WildNet database to identify migratory species listed under the EPBC Act previously recorded in the Study area;
- a search of eBird to identify previous records of migratory species in the Study area; and
- results of a literature review taking into consideration results of previous ecology surveys within the broader Blackwater Mine.

A list of the migratory species considered to have potential to occur within the Study area is provided in Table 5.5. This list is based on an initial desktop Study area of desktop searches undertaken prior to fieldwork, which has since been refined following field survey, and also updated to include just the northern Study area.

Table 5.5 Migratory species with potential to occur

Scientific name[1]	Common name	EPBC Act status[1]	NC Act status[2]	Species recorded in historic ecology surveys	Species recorded in WildNet searches
Actitis hypoleucos	Common Sandpiper	Mi	SLC	×	×
Apus pacificus	Fork-tailed Swift	Mi	SLC	×	✓
Calidris acuminata	Sharp-tailed Sandpiper	Mi	SLC	✓	✓
Calidris ferruginea	Curlew Sandpiper	CE, Mi	CE	×	×
Calidris melanotos	Pectoral Sandpiper	Mi	SLC	×	×
Cuculus optatus	Oriental Cuckoo	Mi	SLC	×	×
Gallinago hardwickii	Latham's Snipe	Mi	SLC	✓	×
Hirundapus caudacutus	White-throated Needletail	V	V	×	✓
Monarcha melanopsis	Black-faced Monarch	Mi	SLC	×	✓
Monarcha trivirgatus	Spectacled Monarch	Mi	SLC	×	×
Motacilla flava	Yellow Wagtail	Mi	SLC	×	×
Myiagra cyanoleuca	Satin Flycatcher	Mi	SLC	×	×
Pandion haeliaetus (cristatus)	Eastern Osprey	Mi	SLC	×	✓
Plegadis falcinellus	Glossy Ibis	Mi	SLC	×	×
Rhipidura rufifrons	Rufous Fantail	Mi	SLC	✓	✓
Tringa stagnatilis	Marsh Sandpiper	Mi	SLC	×	×

[1] The Glossy Ibis (*Plegadis falcinellus*) , listed as Migratory under the EPBC Act was not recorded in the PMST search for the study area, however this species was recorded during the survey.

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

5.9 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 listed as Restricted Matters under the *Biosecurity Act 2014* (Table 5.6) – 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' control; and
- Category 6 – give food to the 'Restricted Matter.'

Those pest flora species that are declared as Weeds of National Significance (WoNS) are shown in Table 5.6.

Table 5.6 Pest flora and fauna species with potential to occur

Scientific name	Common name	WoNS	Biosecurity Act Category*	Species recorded in PMST search	Species recorded in WildNet searches
Fauna					
Columbia livia	Domestic Pigeon	na	-	✓	×
Passer domesticus	House Sparrow	na	-	×	✓
Streptopelia chinensis	Spotted Turtle-Dove	na	-	✓	×
Sternus vulgaris	Common Starling	na	-	✓	×
Rhinella marina	Cane Toad	na	-	✓	✓
Bos taurus	Domestic Cattle	na	-	✓	✓
Canus lupus familiaris	Domestic Dog	na	3, 4, 6	✓	✓
Felis catus	Domestic Cat	na	3, 4, 6	✓	✓
Lepus capensis	Brown Hare	na	-	✓	✓
Mus musculus	House Mouse	na	-	✓	✓
Oryctolagus cuniculus	European Rabbit	na	3, 4, 5, 6	✓	✓
Rattus rattus	Black Rat	na	-	✓	×
Sus scrofa	Feral Pig	na	3, 4, 6	✓	✓
Vulpes vulpes	Red Fox	na	3, 4, 5, 6	✓	✓
Equus caballus	Horse	na	-	×	✓

Table 5.6 Pest flora and fauna species with potential to occur

Scientific name	Common name	WoNS	Biosecurity Act Category*	Species recorded in PMST search	Species recorded in WildNet searches
Hemidactylus frenatus	House Gecko	na	-	×	✓
Flora					
Acacia nilotica subsp *indica*	Prickly Acacia	✓	3	✓	×
Cryptostegia grandiflora	Rubber Vine	✓	3	✓	✓
Jatropha gossypifolia	Bellyache Bush	✓	3	✓	×
Lantana camara	Lantana	✓	3	✓	×
Opuntia stricta	Prickly Pear	✓	3	✓	✓
Opuntia tomentosa	Velvety Tree Pear	×	3	✓	✓
Opuntia aurantiaca	Tiger Pear	×	3	✓	✓
Opuntia streptacantha	Cardona Pear	×	3	✓	✓
Parkinsonia aculeata	Parkinsonia	×	3	✓	✓
Parthenium hysterophorus	Parthenium	✓	3	✓	✓
Vachellia nilotica	Prickly Acacia	✓	3	✓	✓
Schinus terebinthifolius	-	×	3	×	✓
Harrisia martinii	Harrisia Cactus	×	3	×	✓
Harrisia pomanensis	-	×	3	×	✓
Bryophyllum delagoense	Mother of Millions	×	3	×	✓
Bryophyllum x houghtonii	Mother of Millions hybrid	×	3	×	✓
Solanum elaeagnifolium	Silverleaf Nightshade	✓	3	×	✓
Tamarix aphylla	Athel Pine	✓	3	×	✓

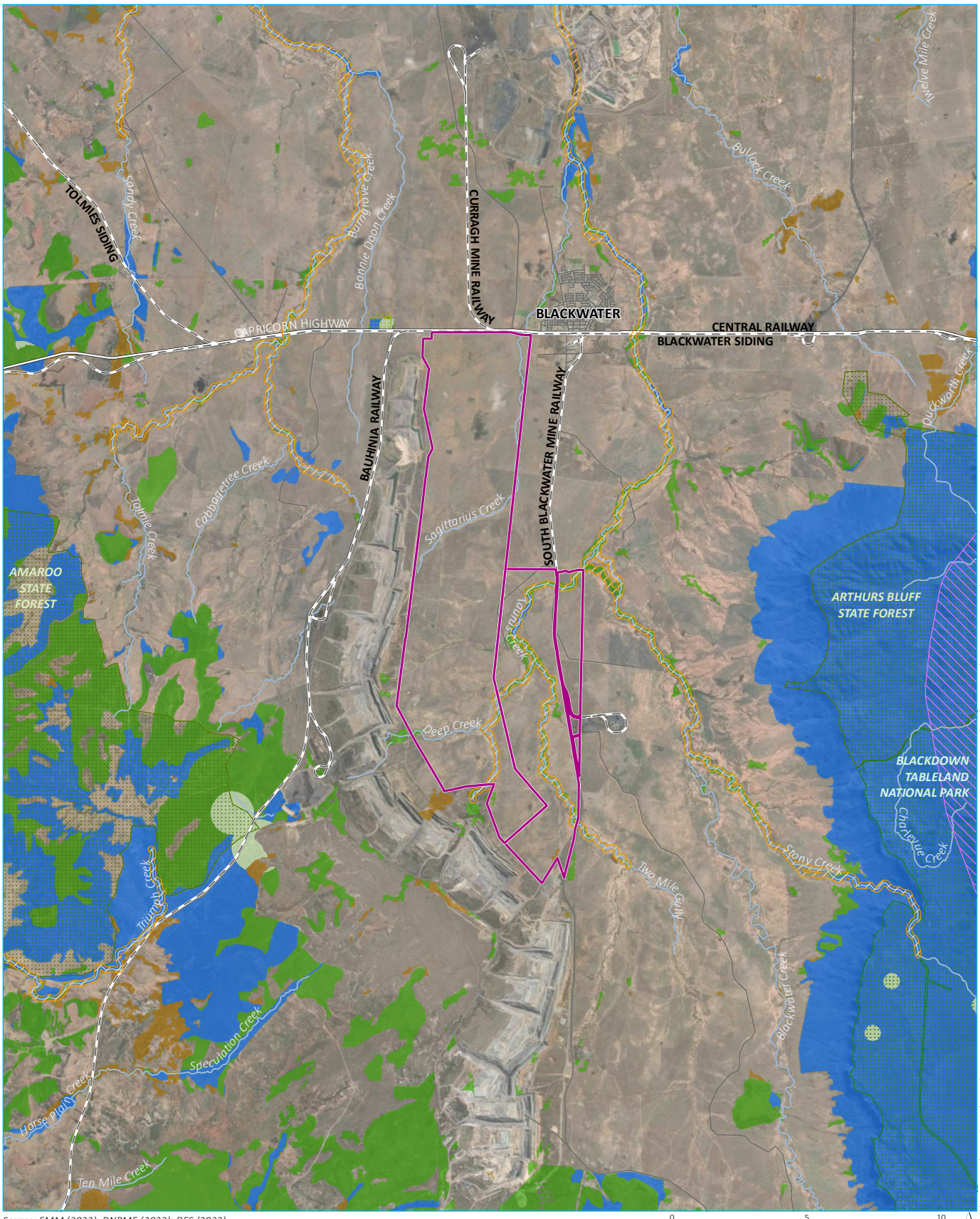
There are 23 introduced wetland indicator plant species known from the Fitzroy Basin (DES 2020a). Those invasive species considered to pose a particular threat to aquatic biodiversity, and that could potentially occur within the Study area, a**s** either a WoNS (DEE 2020d) or Restricted matter category 3 under the Queensland *Biosecurity Act 2014*. Only two of these species were recorded in the Study area: Awnless Barnyard Grass (*Echinochloa colona*) and White Eclipta (*Eclipta prostrata*). Both are still considered an Environmental Weeds, but currently not listed as prohibited and or restricted in Queensland.

5.10 Connectivity

Connectivity is very limited in the Study area due to the cleared and fragmented nature of native vegetation. Connectivity predominantly occurs along creek lines.

A State significant biodiversity corridor is mapped to the east of the Study area; following the higher altitude range of Blackdown Tableland in a north-south direction. At its closest point the State significant biodiversity

corridor is approximately 15 km from the Project. Regionally significant biodiversity corridors associated with the riparian corridor of Taurus Creek also occur within the Study area. These corridors are shown on Figure 5.4.



Source: EMM (2023); DNRME (2022); DES (2022)

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KEY

- Study area
- Major road
- Minor road
- Rail line
- Named watercourse

Biodiversity corridors
- State
- Regional

Protected areas
- National park
- State forest
- Conservation park

Biodiversity significance
- State habitat for EVNT taxa
- State
- Regional
- Local or other values

Biodiversity corridors

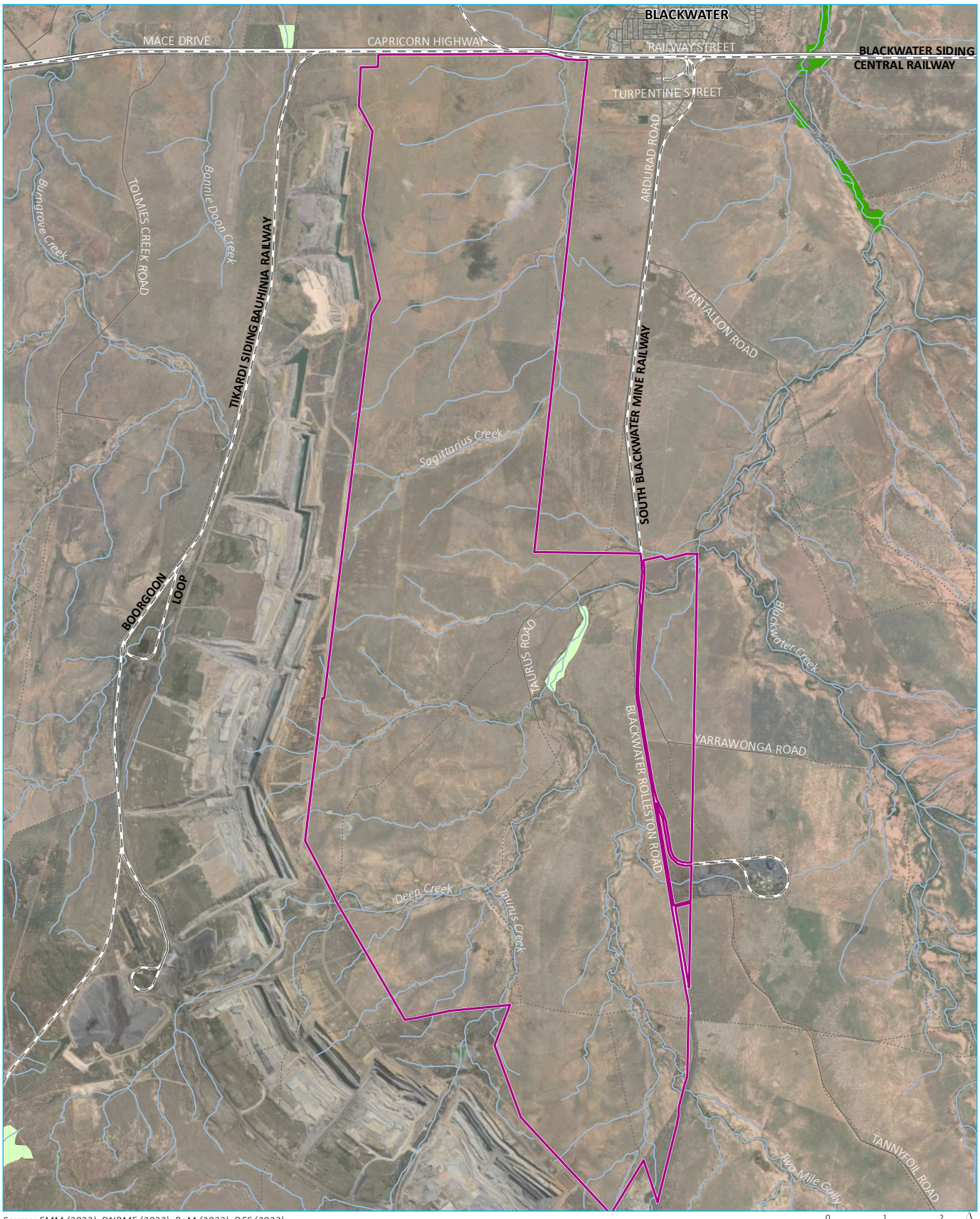
Blackwater Mine - North Extension Project
MNES Assessment
Figure 5.4

EMM creating opportunities

5.11 Groundwater dependent ecosystems

GDEs are ecosystems that have a full or partial reliance on 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). Based on a review of the Groundwater Dependent Ecosystem Atlas (National GDE Atlas) (BOM 2019b) it was identified there are areas to the north-east of the Study area of 'moderate potential' to support terrestrial GDEs (TGDE), and for low potential TGDE along Taurus Creek (Figure 5.5). The DES GDE mapping corresponds with the presence and location of the nationally mapped potential terrestrial GDEs. On both predictive mapping applications, the GDEs are restricted to the creek lines and riparian areas.

The National 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.



Source: EMM (2023); DNRME (2022); BoM (2022); DES (2022)

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KEY

- Study area
- Rail line
- Major road
- Minor road
- Vehicular track/trail
- Watercourse/drainage line

Terrestrial groundwater dependent ecosystems (TGDEs)

- Low potential TGDE - from regional studies
- Moderate potential TGDE - from regional studies

Predicted terrestrial groundwater dependent ecosystems (BoM and DES predictive mapping)

Blackwater Mine - North Extension Project
Terrestrial MNES Assessment
Figure 5.5

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6 Field results

6.1 Fauna

All vertebrate fauna species observed during targeted fauna surveys, flora surveys and incidentally when travelling between survey sites were recorded. A total of 212 fauna species were recorded including 14 amphibians, 31 reptiles, 15 non-volant mammals, 15 bats and 137 birds. A full list of fauna species recorded is provided as Appendix C. Anabat data was analysed by Balance Environmental and results are incorporated into this report. Anabat data analysis is provided in Appendix D.

6.1.1 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 (eg Painted Honeyeater and mistletoe). Habitat usage can be extremely variable and driven by seasonal conditions or in response to a specific event such as recent rainfall or mass flowering events.

General habitat assessments were completed at 165 sites across field survey programs. Specific habitat attributes were analysed at each site to confirm suitable habitat features for particular threatened species and provide justification for the potential presence or absence of a species due to the presence or absence of suitable microhabitats.

Most habitat observed across the Study 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 Study 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 Study 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.

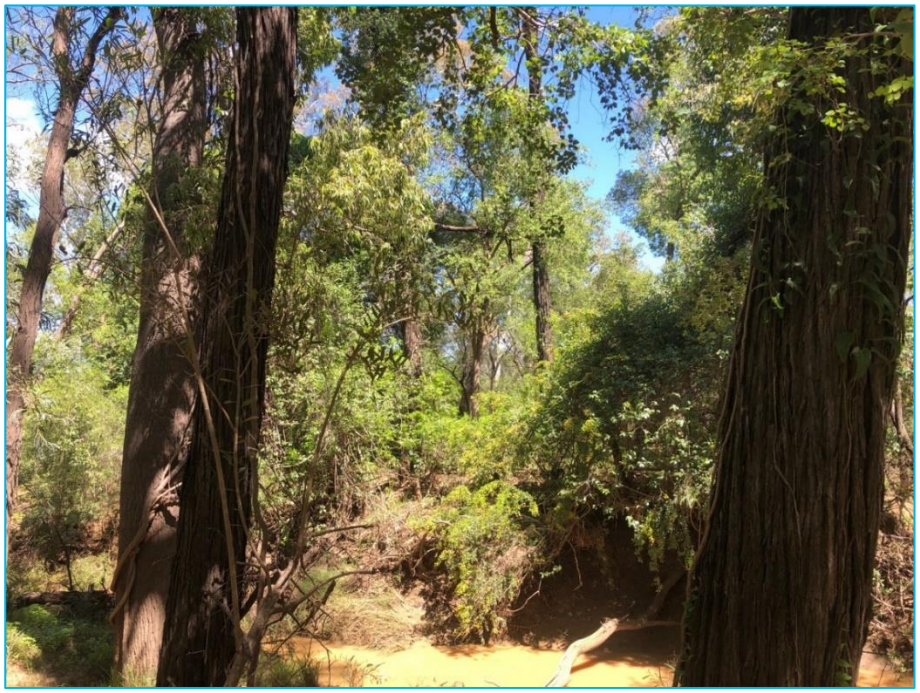
i Riparian vegetation

Riparian vegetation comprises the entirety of the remnant vegetation within the Study area. Vegetation along watercourses such as Taurus Creek and Two Mile Gully (Photographs 6.1 and 6.2) consist of narrow linear patches that fringe the creeks. Vegetation types in riparian zones consisted primarily of Brigalow dominated communities such as RE 11.3.1 and 11.4.9, with some patches supporting large eucalypt species such as Coolibah (*Eucalyptus coolabah*), Queensland Blue Gum and Silver-leaved Ironbark (*E. melanophloia*). Other riparian vegetation includes

11.3.2 dominated by *Eucalyptus populnea*. There is limited potential for Koala to occur in these habitats as riparian vegetation is generally sparse and of low quality.

Within the project footprint, riparian vegetation impacted includes narrow bands ofRE11.3.1 and mixed polygons supporting 11.3.2, 11.3.6 and 11.4.9 including some that are regrowth vegetation with sparse to no woody vegetation.

Eucalypt and Acacia woodlands are the dominant woodland types where remnant vegetation still occurs. Generally narrow bands of sparse riparian woodlands are located on drainage lines in the Study area, particularly Taurus Creek and Two Mile Gully. Remaining watercourses or drainage lines across the site have sparse patches of regrowth along their lengths. Vegetation is most extensive and with most complex structure around the downstream limit of Taurus Creek and Two Mile Gully (Photographs 6.1 and 6.2).



Photograph 6.1 Riparian corridor along Taurus Creek

Photograph 6.2 Riparian corridor along Two Mile Gully

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 mammals.

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.

Many areas of this habitat were fragmented and degraded from clearing activity to the top of bank and within the channel in some areas. In some sections, the creek line vegetation was extremely reduced and patchy, with limited value for fauna (Photographs 6.3 and 6.4). Grazing practices and weed encroachment further reduced the quality of these riparian corridors. There is evidence of weed invasion in these areas (including occurrences of Prickly Pear (*Opuntia* sp) and Rubber Vine (*Cryptostegia grandiflora*)).

Photograph 6.3 Sparse creek line vegetation

Photograph 6.4 Sparse creek line vegetation

Shrubs were relatively sparse, but a grassy ground layer occurs providing cover for ground fauna (for example, Rufous Bettong (*Aepyprymnus rufescens*) were observed in these habitats). Large fallen timber was common in areas, providing potential shelter for a variety of ground fauna including reptiles (Photographs 6.5 and 6.6) and native rodents.

Photograph 6.5 **Prickly Knob-tailed Gecko (*Nephrurus asper*)**

Photograph 6.6 **Brown Tree Snake (*Boiga irregularis*)**

ii Acacia regrowth

Acacia regrowth communities were widespread across the Study area (primarily Brigalow (*Acacia harpophylla*) dominated communities where this community had been previously cleared for grazing). Most of these areas were characterised as small, fragmented areas of regrowth surrounded by grazing land or restricted to creek lines and drainage lines. Habitat value was generally low in these areas as they frequently showed limited groundcover and shrub-layers with exotic understoreys, and a lack of hollow bearing trees. However, leaf litter and fallen woody debris was recorded at some sites, providing microhabitat features for small reptiles and terrestrial mammals. Sites possessing abundant coarse woody debris and leaf litter, cracking clays or gilgai are considered potential habitat for the Ornamental Snake.

iii Gilgai

Areas of gilgai are widespread across the Study area particularly on clay soils (Photographs 6.7 to 6.9) but vary significantly in state of degradation. Most areas exhibit shallow, open gilgai with little remaining vegetation. However, some patches remain in relatively good health exhibiting vegetated areas of Umbrella Canegrass (*Leptochloa digitata*) and Nutgrass (*Cyperus bifax*), generating ample cover for frog, bird and reptile species. Areas of gilgai in the Study area are considered potential habitat for the Ornamental Snake with deeper, more heavily vegetated and deeper cracking areas most preferred (see Section 7.1.3). Additionally, these gilgai provide suitable habitat for the Australian Painted Snipe and Latham's Snipe during suitably wet conditions.

Photograph 6.7 Gilgai east of Taurus Creek (autumn survey while inundated)

Photograph 6.8 Gilgai east of Taurus Creek (spring survey while dry)

Photograph 6.9 Gilgai east of Two Mile Gully (autumn survey while inundated)

iv Other wetland habitats

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

There were several dams in the north of the site, which provided shallow margins, areas of fringing grasses and reeds and were fenced to cattle (Photographs 6.10 and 6.11). Aquatic flora included native water lillies. These dams held waterbirds such as Cotton Pygmy Goose (*Nettapus coromandelianus*), Comb-crested Jacana (*Irediparra gallinacea*) and various duck species. 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 Study 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. Some farm dams were fenced, but had steep sides and were generally of low value for waterbirds with limited shallow margins or fringing aquatic vegetation including Australian Painted Snipe (Photograph 6.12).

Photograph 6.10 Farm dam with natural fringing vegetation, on drainage line and fenced from livestock

Photograph 6.11 Farm dam in east of Study area

Photograph 6.12 Steep sided farm dam in north of Study area

v Non-remnant vegetation

Previously cleared areas dominate much of the Study area with a large proportion recently or currently utilised for cattle grazing activities (Photograph 6.13). 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 (*Astrebla lappacea*) but these were recorded in very 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*). Open country 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 (Photograph 6.14) being the most frequently observed. Other species observed in these habitats included Stripe-faced Dunnart (*Sminthopsis macroura*) (Photograph 6.15) and Desert Mouse (*Pseudomys desertor*) as well as the introduced House Mouse.

Photograph 6.13 Pulled Brigalow regrowth

Photograph 6.14 Red-chested Buttonquail

Photograph 6.15 Stripe-faced Dunnart

6.1.2 Threatened and migratory fauna observations

Four threatened and three migratory fauna species were recorded during field surveys. These species are discussed below.

i Australian Painted Snipe (Endangered)

This species is a highly nomadic and cryptic wetland bird species currently listed as Endangered under the EPBC Act. It can utilise any small wetland when conditions are favourable post rainfall events with preferences for shallow ephemeral wetlands with areas of dense low cover (i.e. Umbrella Canegrass (*Leptochloa digitata*)). Its behaviour is primarily crepuscular or nocturnal and therefore can be extremely cryptic during daylight hours, typically loafing in the safety of wetland fringing vegetation. They are generally encountered singly or in pairs but may gather in small flocks when conditions are highly favourable (DCCEEW 2023n). Sighting locations are displayed in Figure 6.1.

Three Australian Painted Snipe were recorded during the course of surveys. A single Australian Painted Snipe was recorded during a spotlighting survey in the autumn surveys on lease ML1762 in an area of flooded gilgai east of Taurus Creek (Figure 6.1). Two single birds were noted during the spring surveys. One on a spotlighting survey on lease ML1759 in a dam in the north of the site (Photograph 6.16). The dam was formed on an old drainage line and had a shallow muddy inlet in which the bird was observed, with aquatic and fringing vegetation. A second bird was noted later that evening on another dam approximately 8 km south of the first sighting, and probably constituted a second individual.

These records of this nomadic species suggest it may occur on any natural or artificial wetland habitat within the Study area when conditions are suitable. This includes gilgai, flooded drainage-lines, creeks and dams (particularly those which are fenced to exclude cattle, and were formed along old drainage lines with shallow margins and inlets and have good areas of fringing vegetation) which are relatively common across the Study area. This species is most likely to utilise ephemeral habitat on site in the wet season then leave once these areas dry up. There is potential that it could remain year-round on larger dams that retain water and have suitable fringing vegetation cover, or other permanent water bodies.

Photograph 6.16 Australian Painted Snipe observed in Study area

ii Squatter Pigeon (Vulnerable)

Squatter Pigeon is listed as vulnerable under the EPBC Act. It was recorded at two locations in June and August 2023 at locations close to dams and watercourses. One was to the west of Taurus Road within the project footprint (June 2023) and one east of the Blackwater-Rolleston Road in August 2023 outside of the project footprint. The species has potential to occur in the Study area (especially near water sources) although the likelihood is significantly reduced by the dominance of Buffel Grass (*Cenchrus ciliaris*) and clay soils (as the species favours sandy soils and a mosaic of open woodland and native grasses). The Study area is dominated by clay soils, with minor areas of sandy substrates.

iii Ornamental Snake (Vulnerable)

Ornamental Snake is listed as vulnerable under the EPBC Act. Gilgai habitats occur in the Study area however surveys have confirmed they 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.

Some areas of gilgai closer to creek lines (eg to the east of Two Mile Gully) offer better habitat for Ornamental Snake (large well-formed gilgai, more fallen timber). During the March 2020 supplementary surveys, three Ornamental Snake were recorded in this better quality habitat (Photograph 6.17). Three snakes were found in close proximity to each other in an area of gilgai between Taurus Creek and the Blackwater-Rolleston Road on ML1762 (Figure 6.1). Conditions were good during these surveys, with water in some gilgai and many frogs active. All three were found on drying margins of gilgai in cracking clay soils.

It is likely that Ornamental Snake is scarce in most of the Study area as only three were found during three dedicated nights of searching, despite good conditions. Some of the gilgai areas are isolated in expanses of Buffel Grass and are quite degraded and likely to be of limited value to the species. The likelihood of the species occurring in these degraded gilgai is significantly reduced.

Further details and mapping of known and potential Ornamental Snake habitat is provided in Section 7.1.3 of this report. The locations of sightings are shown in Figure 6.1.

Photograph 6.17 Ornamental Snake observed in Study area

iv Koala (Endangered)

The Koala is listed as endangered under the EPBC Act. Three old scratches on Queensland Blue Gums were observed along Taurus Creek on ML1762 in the original baseline surveys, and on an unnamed creek in the centre of the Study area in June 2023 (with an old scat also found on the unnamed creek) (Photographs 6.18 and 6.19) and Figure 6.1. The scratches were present in a small backwater of the main creek line, which was fringed by Queensland Blue Gum which is a preferred foraging resource. Despite extensive transects along creek lines across the remainder of the Study area, no other signs of Koalas were observed, and it is likely that its status in the Study area is limited to occasional transient individuals, if any.

In general, habitat in the north was limited for the species, as there are few large mature trees in the creek lines and suitable food (Eucalypt) trees are sparse, limited to Coolibah, particularly toward the downstream ends of Taurus Creek and Two Mile Gully, occasional Queensland Blue Gum, Silver-leaved Ironbark and patches where Poplar Box (*Eucalyptus populnea*) were prevalent. Habitat is also fragmented with large, cleared areas, therefore Koala use of the area would likely be limited to the narrow riparian vegetation.

Habitat in the north is degraded from broadscale clearing (remnant vegetation limited to creek lines and clearing taken place to top of bank in some areas, leaving a narrow strip of vegetation along the drainage lines). In some areas, the creek line vegetation was extremely sparse (see Photographs 6.3 and 6.4) with extensive dieback and clearing, and in some areas (such as the downstream extent of Taurus Creek) the vegetation was more mature and had greater density and canopy cover (see Photographs 6.1 and 6.2).

The location of these incidental Koala signs are shown in Figure 6.1.

Photograph 6.18 Eucalypt fringing drainage line on which Koala scratches were recorded

Photograph 6.19 Old Koala scratches on Taurus Creek

v 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 (DCCEEW 2023o).

This species was recorded once during the autumn surveys, in an area of gilgai on ML1762. In addition, during the March 2020 supplementary surveys, this species was recorded twice more in gilgai on ML1762 to the east of Taurus Road.

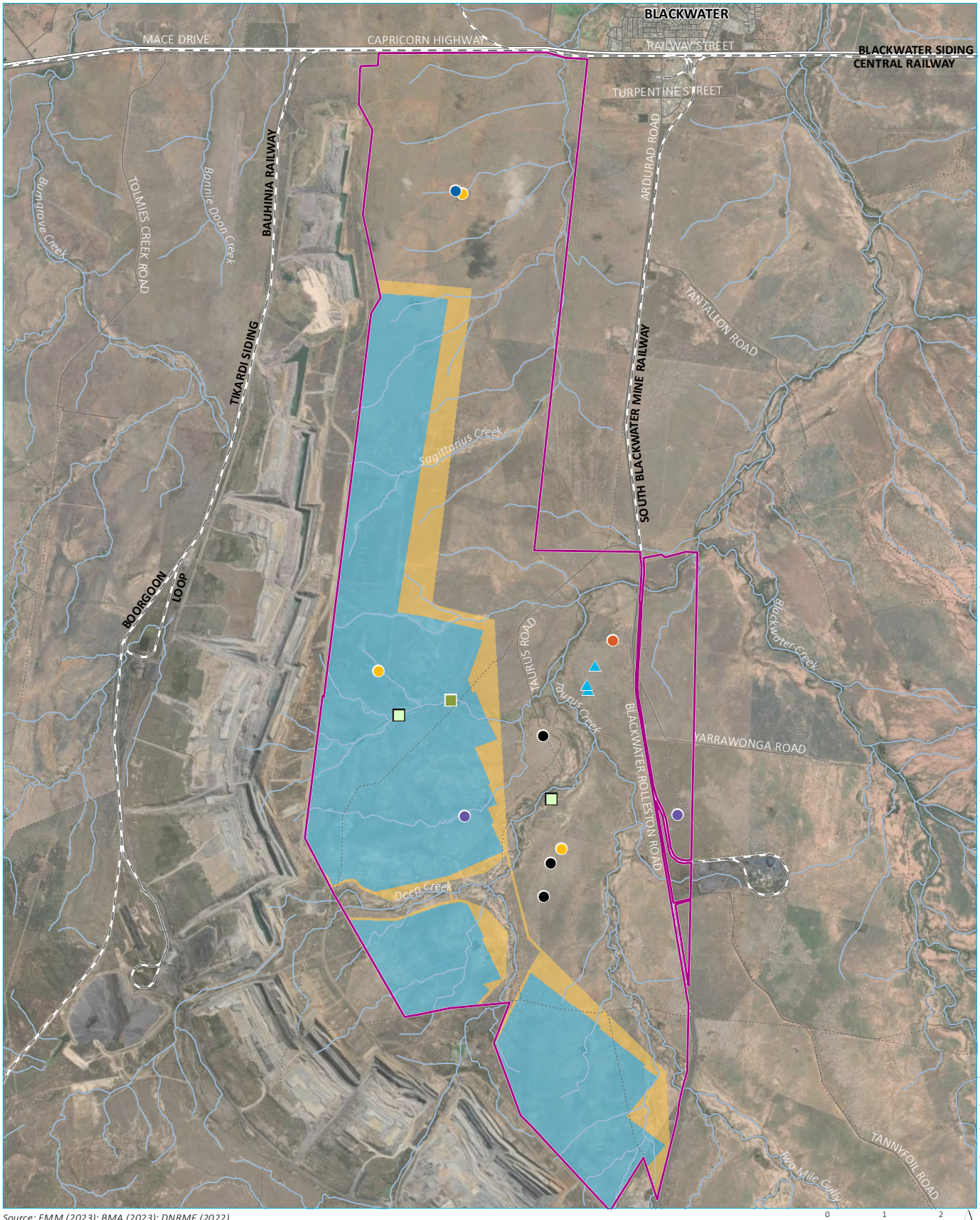
Using similar though less specialised habitats to *R. australis*, this species is likely to regularly occur in any wetland habitat across the Study area during summer months. The sighting locations are shown in Figure 6.1.

vi Fork-tailed Swift (Migratory)

This highly aerial species is listed as Migratory under the EPBC Act (DCCEEW 2023p). It was observed incidentally over ML1762 on 5 April 2019. A direct count of six was recorded in a feeding flock. This species could occur in any airspace over the Study area and occurs in Australia only in the summer months.

vii Glossy Ibis (Migratory)

This species is listed as Migratory under the EPBC Act. This species was recorded once during the autumn surveys on a farm dam in the north of the study area (outside of the project footprint). The sighting location is shown on Figure 6.1.



Source: EMM (2023); BMA (2023); DNRME (2022)

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KEY

- Study area
- Indicative project footprint
- Proposed pit extent
- Proposed out of pit disturbance
- Rail line
- Major road
- Minor road
- Vehicular track/trail
- Watercourse/drainage line

Threatened and migratory fauna observations

- Ornamental Snake
- Australian Painted Snipe
- Fork-tailed Swift
- Glossy Ibis
- Latham's Snipe
- Squatter Pigeon
- Koala (scat)
- Koala (scratches)

Threatened and migratory fauna observations

Blackwater Mine - North Extension Project
Terrestrial MNES Assessment
Figure 6.1

EMM
creating opportunities

6.1.3 Other potential listed species

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

- Greater Glider;
- Large-eared Pied Bat;
- Collared Delma; and
- Yakka Skink.

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

Although not observed in the Study area, the White-throated Needletail was considered likely to occur in the Study area following completion of the field surveys.

i White-throated Needletail

This highly aerial species is listed as Vulnerable under the EPBC Act. It has been observed incidentally by EMM approximately 30 km due south in other surveys in October 2019 and is also likely to occur in the Study area. This species could occur in any airspace over the Study area and occurs in Australia only in the summer months.

White-throated Needletail is widespread over eastern and south eastern Australia during the warmer months. The species breeds in eastern Asia and spend the non-breeding season mainly in Australia, and occasionally in New Guinea and New Zealand. White-throated Needletail arrives in eastern Australia in late October moving south along both sides of the Great Dividing Range as far south as Tasmania. As an aerial foraging species, it could occur over any habitats including heavily disturbed areas (DCCEEW 2023q).

This species is discussed further in Section 7.1.5.

6.1.4 Pest fauna species

Seven introduced terrestrial vertebrate species were recorded within the Study area, (see Appendix C). Of relevance to MNES are observations of Cane Toad (*Rhinella marina*), Rabbit (*Oryctolagus cuniculus*) and Feral Pig (*Sus scrofa*).

Cane Toad were recorded around farm dams and in gilgai habitats, usually in proximity to water.

Relative to introduced species, the following are listed as key threatening processes under the EPBC Act:

- biological effects, including lethal toxic ingestion, caused by Cane Toads;
- predation by the European Red Fox;
- predation by Feral Cats;
- predation, habitat degradation, competition and disease transmission by Feral Pigs; and
- competition and land degradation by rabbits.

6.2 Flora

6.2.1 Vegetation communities

Vegetation assessments were completed at 68 sites consisting of five tertiary assessments and 63 quaternary assessments. Additional TEC assessments were carried out at nine sites as discussed below, and BioCondition assessments were conducted at four sites.

Over half of all sites consisted of heavily degraded, non-remnant vegetation with few to no native plant species. Most 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.

The remaining survey sites consisted of remnant or regrowth vegetation typically fringing creeks and drainage lines. Sites confirmed to support remnant vegetation were very limited and found along Taurus Creek, Sagittarius Creek, Deep Creek and Two Mile Gully – most of which were mapped incorrectly as non-remnant vegetation or a differing RE type. These remnant sites fringing creek lines are all narrow linear tracts but hold some biodiversity value, predominately in the form of connectivity through the mostly cleared landscape (Photograph 6.20). Although some of these sites presented in relatively good condition, all possessed some level of weed encroachment, most commonly by Buffel Grass within the ground-layer.

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

- 30 remnant sites;
- 1 regrowth site; and
- 37 non-remnant sites.

Photograph 6.20 Typical non-remnant vegetation on ML1759

i Regional ecosystems

Ground-truthed RE mapping is provided in Figure 6.2. Detailed vegetation community survey results and changes to desktop RE mapping at each survey site is also provided in Appendix F.

Of relevance to MNES species habitat, ground-truthed vegetation communities in the Study area included the following Regional Ecosystems:

- RE11.3.1 *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains;
- RE11.3.2 *Eucalyptus populnea* woodland on alluvial plains;
- RE11.3.3 *Eucalyptus coolabah* woodland on alluvial plains;
- RE11.3.6 *Eucalyptus melanophloia* woodland on alluvial plains;
- RE11.3.25 *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines; and
- RE11.4.9 *Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains.

Table 6.1 provides profiles and general conditional state of each community recorded during field surveys which informs consideration of MNES species habitat.

Table 6.1 Regional Ecosystem profiles

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

- This ecosystem was widespread along the creek lines within the Study area. Most patches are degraded and thinned or suffering dieback. Almost all patches have been invaded by exotic pasture grasses especially Buffel Grass. Many locations have only narrow strips remaining or regrowth following clearing or thinning.
- The canopy is dominated by Brigalow with a sub-canopy including *Lysiphyllum* spp. and Yellow-wood (*Terminalia oblongata*). Occasional Bottle Trees (*Brachychiton* spp) are also present. Scattered emergent eucalypts are a feature of this ecosystem including Poplar Box, Silver-leaved Ironbark, and in some sections Coolibah.
- Groundcover within these communities was largely dominated by Buffel Grass. Native ground species included *Bothriochola bladhii* and *Enteropogon acicularis*.

Table 6.1 Regional Ecosystem profiles

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

- This woodland is likely to have been more extensive on the site prior to clearing and thinning for agriculture. Small stands remain on loamy and sandy floodplains adjacent to creeks. The few small patches remaining are degraded to some extent but some retain native groundcovers where Buffel Grass is less common.
- The canopy is dominated by Poplar Box with occasional Silver-leaved Ironbark in a grassy woodland structure. The mid storey often includes False Sandalwood (*Eremophila mitchellii*) with other smaller trees such as Inland Rosewood (*Alectryon oleifolius*) and *Lysiphyllum spp.*
- The groundcover includes Curly Windmill Grass (*Enteropogon acicularis*) and *Bothriochloa decipens.*

RE11.3.3 *Eucalyptus coolabah* woodland on alluvial plains

- This community is subdominant along Taurus Creek in areas of RE11.3.1.
- The canopy is dominated by Coolabah and occasional Brigalow with a sub-canopy including *Lysiphyllum* spp. and Yellow-wood (*Terminalia oblongata*).
- Groundcover within these communities was largely dominated by Buffel Grass. Native ground species included *Bothriochola bladhii, Bryophyllum delegoense* and *Enteropogon acicularis*.

Table 6.1 Regional Ecosystem profiles

RE11.3.6 *Eucalyptus melanophloia* woodland on alluvial plains.

- This ecosystem is limited to small areas on sandy or loamy alluvium and most have been thinned and heavily grazed. The canopy is dominated by Silver-leaved Ironbark with occasional Moreton Bay Ash (*Corymbia tessellaris*) and Poplar Box. Smaller trees include Whitewood (*Atalaya hemiglauca*), Broughton Willow (*Acacia salicina*) *and* occasional Brigalow.
- The understorey is grassy including Curly Windmill Grass and scattered salt bushes in the family *Chenopodiaceae.* Weeds include Mother of Millions (*Bryophyllum spp*). and Harrisia Cactus (*Harrisia martinii*).

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

- This ecosystem is limited to the sections of the riparian zone along creek lines, billabongs and anabranches. The ecosystem has been degraded by thinning grazing and dieback. The canopy is dominated by Queensland Blue Gum with occasional Clarkson's Bloodwood (*Corymbia clarksoniana*) and Moreton Bay Ash especially on higher terraces.
- Smaller trees include Yellow-wood and *Lysiphyllum spp*. With small clumps of Brigalow. The understorey includes shrubs such as Soft Acalypha (*Acalypha eremorum*) and Desert Lime (*Citrus glauca*).
- The ground layer is mostly degraded by heavy grazing and invasion by Buffel Grass.

Table 6.1 Regional Ecosystem profiles

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

- This ecosystem has been extensively cleared and degraded in the Study area. Only small patches including regrowth remain on cracking clay plains and around gilgai wetlands.
- The canopy is co-dominated by Brigalow and Yellow-wood. Emergent Bottle Trees grow in some patches.
- A diverse smaller tree and shrub layer is present including *Lysiphyllum spp*., *Alectryon spp*., Desert Lime*, Grewia scabrella and* Whitewood. The ground layer has a selection of shrub and grass species including Umbrella Cane Grass (*Leptochloa digitata*) which is a gilgai wetland specialist as well as Saltbushes in the family Chenopodiaeae.
- This ecosystem is extensively invaded by Buffel Grass along with other weeds such as Prickly Pear (*Opuntia spp*). and rarely Parkinsonia (*Parkinsonia aculeata*).

Table 6.2 below presents the ground-truthed regional ecosystems identified within the Study area and potentially associated TEC where applicable.

Table 6.2 Regional Ecosystem profiles

Regional ecosystem	Description	Potentially Associated TEC
11.3.1	*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains	Brigalow dominant and co-dominant
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	Poplar Box Grassy Woodland on alluvial plains
11.3.3	*Eucalyptus coolabah* woodland on alluvial plains	-
11.3.6	*Eucalyptus melanophloia* woodland on alluvial plains	-
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	-
11.4.9	*Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains	Brigalow dominant and co-dominant

1. *Biodiversity Status: E – Endangered, OC – Of concern*
2. *Vegetation Management Act status: E – Endangered, LC – Least concern*

ii Threatened Ecological Communities

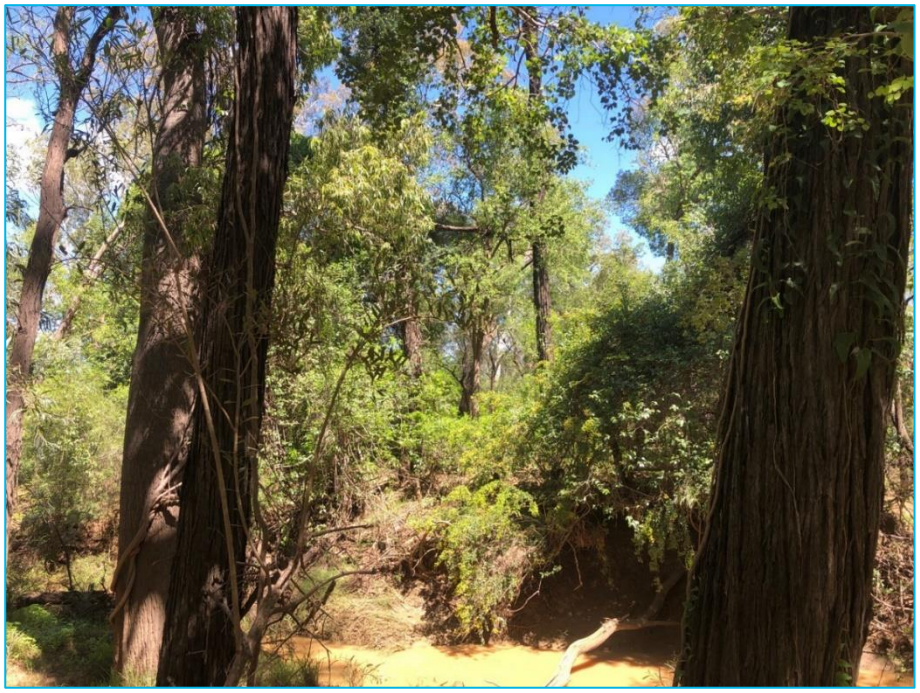
Vegetation polygons confirmed as REs that were potentially associated with a TEC were assessed against applicable TEC diagnostic condition thresholds. These were undertaken at a total of nine sites, with results indicating one vegetation patch of RE11.3.1 *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains met thresholds for Brigalow TEC. This TEC patch was previously mapped as non-remnant vegetation in Queensland Government certified mapping prior to ground-truthing.

This area of Brigalow TEC (Photograph 6.21 and Figure 7.1) exists as riparian vegetation along Taurus Creek on ML1762 covering an area of 6.34 ha. Although the site meets TEC criteria, it exhibits elements of disturbance such as weed encroachment (within TEC thresholds of <50% exotic cover), predominantly from Buffel Grass and/or Rubber Vine.

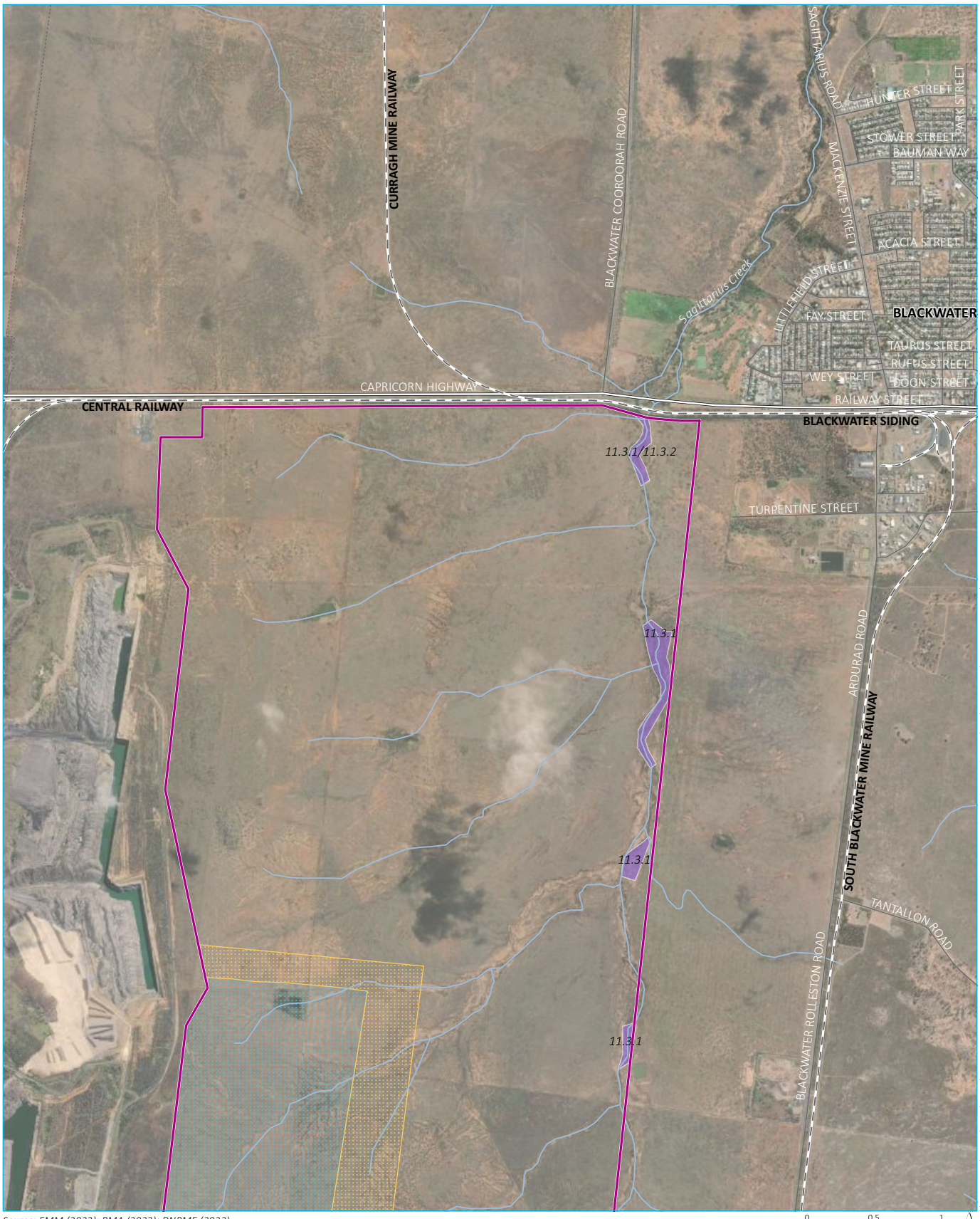
Several areas of ground-truthed RE11.3.2 were recorded in the Study area, where *Eucalyptus populnea* was dominant in the canopy. All areas failed to meet Poplar Box TEC thresholds through excessive weed cover. These areas often had a ground cover dominated by Buffel Grass or other non-native species.

Full TEC assessment results can be found in Appendix G.

No other TECs occur within the Study area.



Photograph 6.21 Brigalow TEC (RE11.3.1) adjacent to Taurus Creek



Source: EMM (2023); BMA (2023); DNRME (2022)

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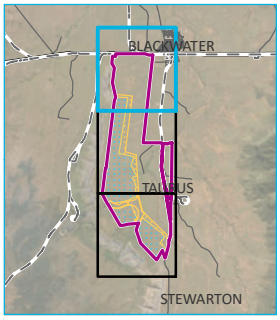


KEY

- Study area
- Rail line
- Major road
- Minor road
- Vehicular track/trail
- Watercourse/drainage line

Indicative project footprint

- Proposed pit extent
- Proposed out of pit disturbance

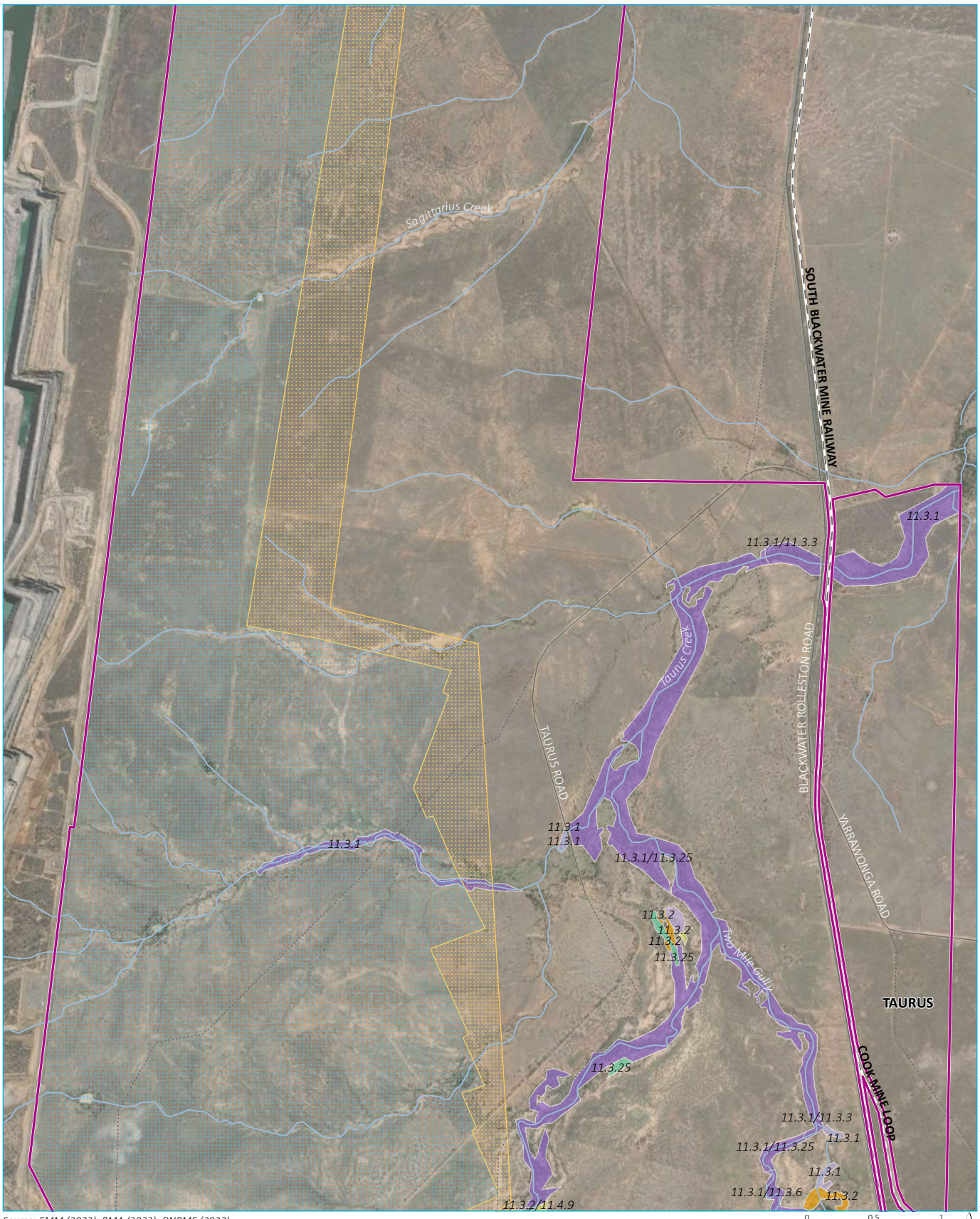
Ground-truthed regional ecosystems

- Remnant - endangered

Ground-truthed regional ecosystems - map 1 of 3

Blackwater Mine - North Extension Project
Terrestrial MNES Assessment
Figure 6.2

EMM creating opportunities



Source: EMM (2023); BMA (2023); DNRME (2022)

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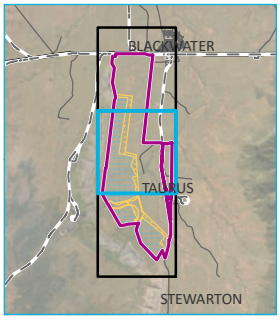

KEY

- Study area
- Rail line
- Minor road
- Vehicular track/trail
- Watercourse/drainage line

Indicative project footprint

- Proposed pit extent
- Proposed out of pit disturbance

Ground-truthed regional ecosystems

- Remnant - endangered
- High value regrowth - endangered
- Remnant - of concern
- High value regrowth - of concern
- Remnant - least concern

Ground-truthed regional ecosystems - map 2 of 3

Blackwater Mine - North Extension Project
Terrestrial MNES Assessment
Figure 6.2

EMM creating opportunities

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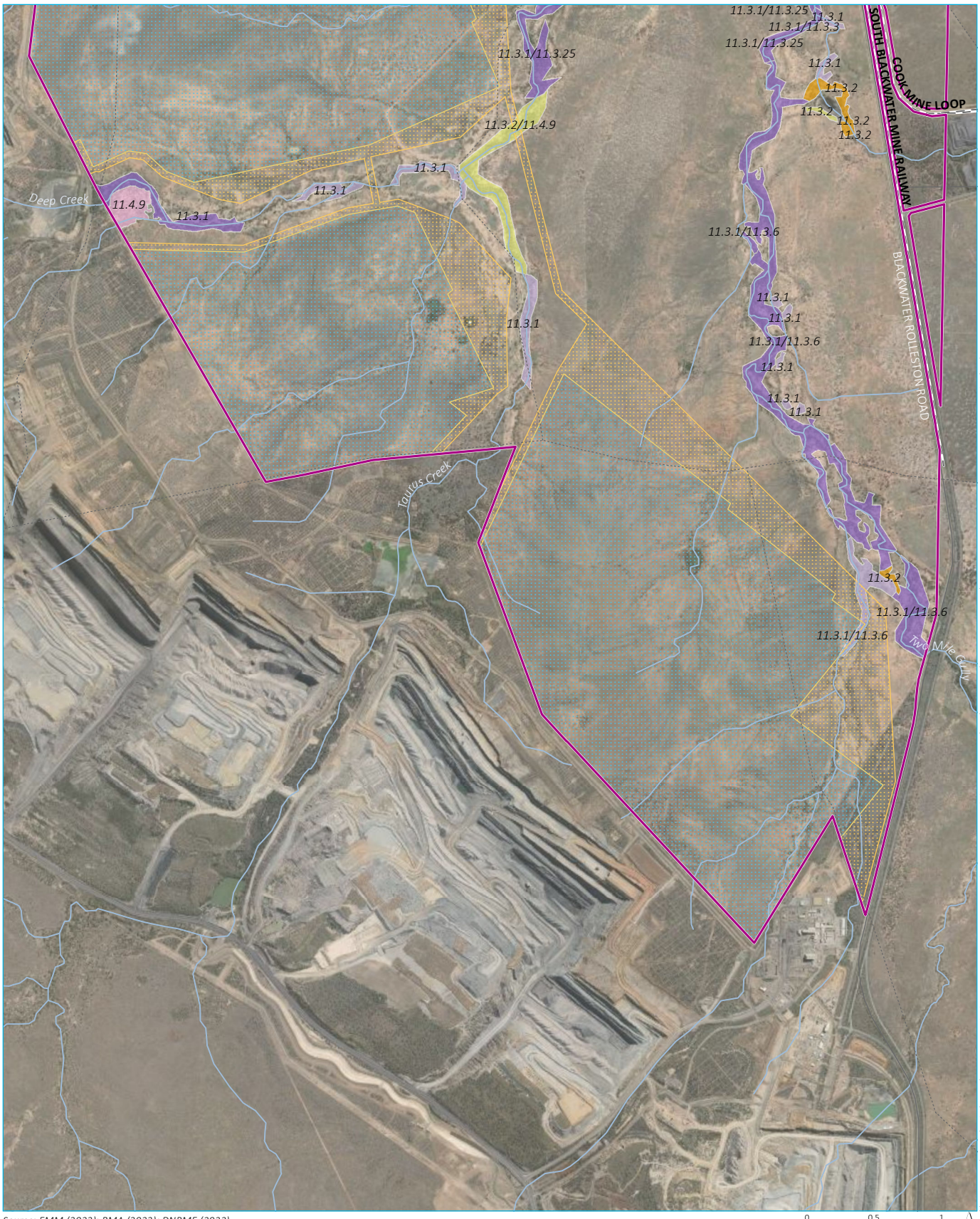

Source: EMM (2023); BMA (2023); DNRME (2022)

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GDA 1994 MGA Zone 55

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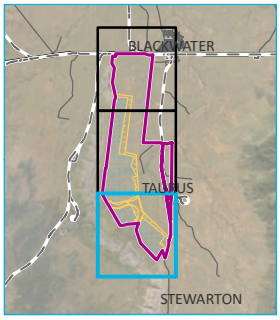

KEY

- Study area
- Rail line
- Minor road
- Vehicular track/trail
- Watercourse/drainage line

Indicative project footprint

- Proposed pit extent
- Proposed out of pit disturbance

Ground-truthed regional ecosystems

- Remnant - endangered
- High value regrowth - endangered
- Regrowth - endangered
- Remnant - of concern
- High value regrowth - of concern

Ground-truthed regional ecosystems - map 3 of 3

Blackwater Mine - North Extension Project
Terrestrial MNES Assessment
Figure 6.2

EMM creating opportunities

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iii Habitat quality assessments

Habitat quality assessments/BioCondition sites were completed at four 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).

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. Commonly recorded weeds in these areas consisted of Buffel Grass, Rubber Vine and Guinea Grass (*Megathyrsus maximus)*.

Photograph 6.22 Habitat assessment site 37

6.2.2 Threatened flora species

As described in Section 5.6, threatened flora species identified by the desktop assessment were targeted during the flora surveys. No EPBC Act listed species were recorded and there is considered to be a low likelihood of occurrence of those species with potential to occur (Appendix E).

6.2.3 Introduced flora species

Weed species were widespread across the Study area. A total of seven Category 3 species listed under the Qld Biosecurity Act were recorded including Mother of Millions (*Bryophyllum delagoense*), Rubber Vine, Harrisia Cactus, Parkinsonia Weed, Parthenium, Prickly Pear and Velvety Tree Pear.

Introduced plant species may also be classified as Weeds of National Significance (WoNS) if they present a serious threat to industry, water supply, human health/safety, plant communities and/or cultural value. Species identified within the Study area classed as WoNS include Parthenium, Rubber Vine and Velvety Tree Pear.

Prickly Pears (*Opuntia spp.*) were common in Brigalow communities, Mother of Millions was particularly common on floodplains near Blackwater Road. Harissia Cactus were common in many areas of regrowth vegetation and pasture. Rubber Vine was uncommon on the site recorded in only a few sections of stream bank climbing up trees and forming thickets. Parkinsonia was only recorded on a couple of dams and wetland and was rare across the site.

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 and degrades MNES species habitat.

A complete list of the flora species, indicating their native or introduced status, is provided in Appendix I.

6.2.4 Potential terrestrial groundwater dependent ecosystems

As described in Section 4.6, SLR (2023c) provided the 90th percentile of the predicted 1 m water table drawdown curve from the Uncertainty Analysis as an outer boundary to ensure all potential TGDEs were captured in the assessment. The potential TGDEs within the Study area have been identified as discussed in Section 4.5.7. The rooting depths are identified in Table 6.3 below.

There are several conflicting resources and literature around the actual rooting depth of the likely TGDE species. While BHP has a TGDE assessment Manual (BHP, 2022) that provides a list of TGDE indicator species, The majority of rooting depths for this assessment are applied from the RDM Hydro et al (2023). BMA commissioned a detailed GDE assessment by RDM Hydro et al in 2023 that discusses the regional applicability of the rooting depth is heavily influenced by the clay soils in the region.

RDM et al (2023) considers vegetation communities that contain River Red Gum (*Eucalyptus camaldulensis*) and Forest Red Gum (*E. tereticornis*), which includes RE11.3.25 as the most likely users of groundwater, with the potential to utilise groundwater down to depths of 15 mbgl[2]. Kallarackal and Somen (1998) reported a maximum rooting depth of 9.3 mgbl for *E. tereticornis,* while Jones et. al (2019) reported a maximum rooting depth of 7.6 mgbl for *E. camaldulensis.* In contrast, Kath et al (2014) describes a rooting depth for *Eucalyptus camaldulensis* from 12.1 mbgl to 22.6 mbgl.

RDM et al (2023) considers the other REs to have a significantly lower groundwater threshold depth set at <5 mbgl with likelihood of groundwater usage decreasing through coolabah (RE11.3.3) and poplar box communities (RE11.3.2), with the lowest likelihood of groundwater usage predicted for those habitats and species associated with heavy clay soils (RE 11.3.1 and RE 11.4.9).

In contrast to RDM et al (2023), Kath et al (2014) describes a rooting depth for *Eucalyptus populnea* (RE 11.3.2) from 12.6 mbgl to 26.6 mbgl. For RE 11.3.2 it is not expected that the rooting depth of this RE would make 12-26

[2] Meters below ground level

m in this location due to the soil characteristics (RDM Hydro et al., 2023). It is also understood that potentially 5 mbgl is too shallow and it is likely the dominant species of the RE, *Eucalyptus populnea* can reach deeper depths, as such a more conservative depth of 10 mbgl has been applied (Table 6.3).

Much of this variation is due to location, soil structure, moisture content and a variety of additional factors. All rooting depths are considered estimations as no specific rooting depth assessments have been completed in this region. For REs that are a combined RE (i.e. 11.3.1/11.3.25) a range is applied to the assessment.

Table 6.3 Rooting depth review

RE	Description	Geology[1]	Dominant canopy species[1]	Rooting depth (mbgl)[1]	Assessment applied rooting depth
RE 11.3.2	Eucalyptus populnea woodland on alluvial plains	Alluvium (flood plain	Eucalyptus populnea Eucalyptus crebra, Eucalyptus melanophloia	<5	10
RE 11.3.3	Eucalyptus coolabah woodland on alluvial plains	Alluvium (flood plain) -heavy clay	Eucalyptus coolabah, Eucalyptus populnea	<5	5
RE 11.3.6	*Eucalyptus melanophloia* woodland on alluvial plains	Alluvium (flood plain)	*Eucalyptus melanophloia, Corymbia tessellaris*	<5	5
RE 11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Alluvium (creek channel)	*Eucalyptus camaldulensis Eucalyptus tereticornis – Corymbia tessellaris Casuarina cunninghamiana*	<15	15
RE 11.4.9	*Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains	Clay plain	*Acacia harpophylla*	<5	5

[1] after RDM Hydro et al. (2023)

As described in Section 4.6, the identification of potential TGDEs in the Study area was based on comparing the RDM Hydro et al (2023) depth to water table mapping range and the estimated rooting depth of the relevant species of the ground-truthed REs. Potential TGDEs were categorised as Unlikely and Potential. The potential TGDE are identified in Figure 6.3 and Table 6.4). The majority of the identified potential TGDEs are along Taurus Creek and contain RE 11.3.2 and 11.3.25.

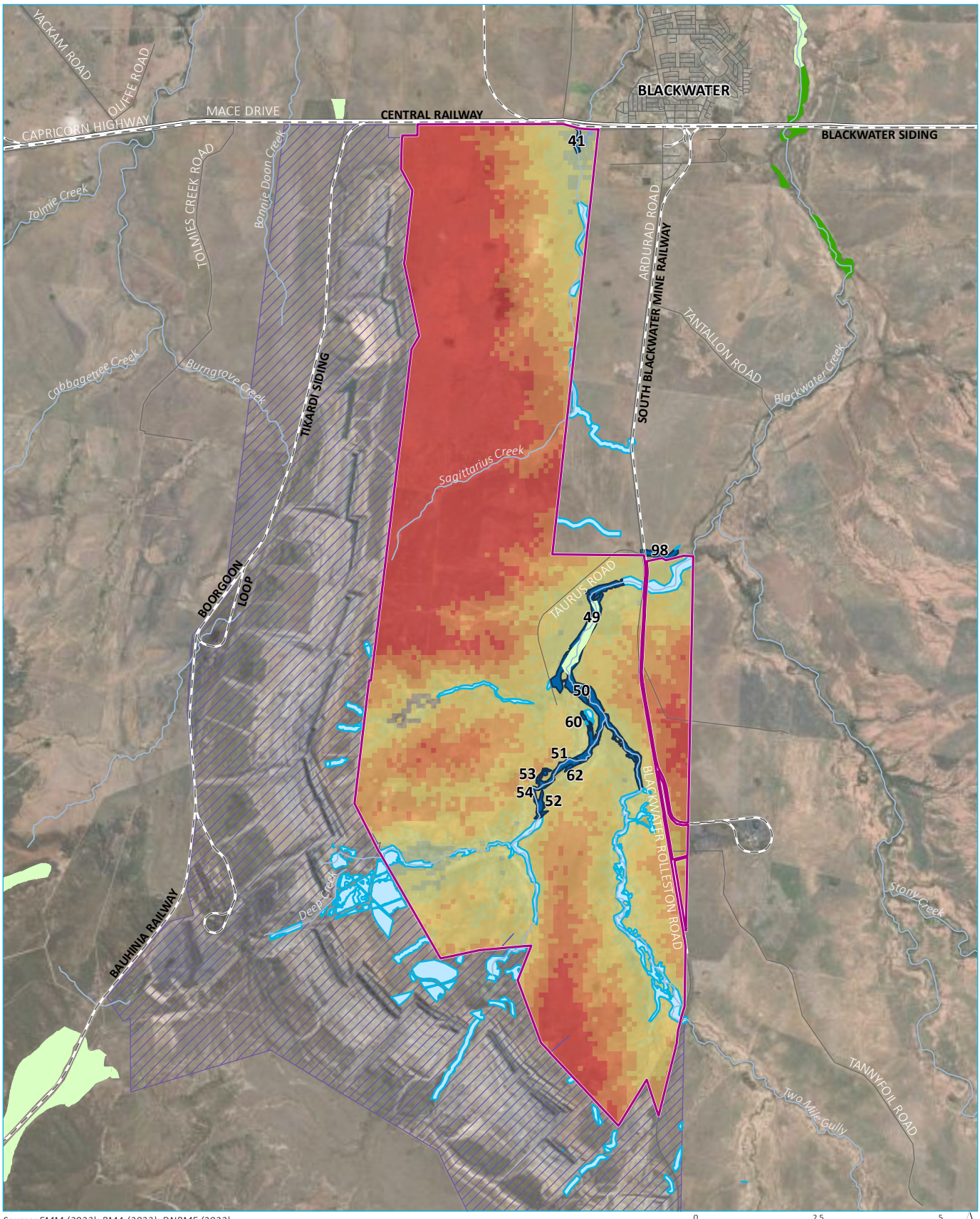
Based on the RDM Hydro depth to water table a number of vegetation patches to the southwest of the Study area were initially identified as potential TGDE. These patches are within the existing BWM operational ML1760, ML70104, ML70329, ML1762 (region is in the blue hatched area of Figure 6.3). These patches were identified as having to very shallow groundwater (less than 5m) in the RDM Hydro depth to water table. However, given the proximity to the active pits it was determined that the groundwater in region has already been heavily modified due to surrounding disturbance. This was further supported by the SLR groundwater model that suggested the GWL in this region could be 10- 20m deeper than in the RDM Hydro depth to water table.

In addition, a number of areas mapped under the DNRM RE mapping were inconsistent with the aerial imagery, where the polygons were over roads and areas already modified and cleared due to the mining activities and access.

Further assessment is completed in Section 8.8 where the potential GDEs are assessed against the predicted changes in the groundwater table and reviewed for likelihood of impact.

Table 6.4 Ground Truthed Regional Ecosystem profiles and TGDE potential in the Study area

Regional ecosystem	Polygon ID *	Range of GWL (mbgl)	Maximum Rooting depth	Area (Ha)	Comment
11.3.1/11.3.2	*41*	0-10	5-10	4.04	Along the northern boundary of the study area
11.3.1/11.3.25	*49*	12-19	5-15	35.9	Polygons 49-50 were part of one inclusive vegetation patch that were separated for the impact analysis due to the high variability in the depth ranges. These polygons were reviewed as individual patches.
11.3.1/11.3.25	*50*	*10-19*	5-15	71.27	
11.3.1/11.3.25	*51*	*12*	5-15	10.04	
11.3.1/11.3.25	*52*	*14-21*	5-15	1.53	
11.3.1/11.3.25	*53*	*15-21*	5-15	8.14	
11.3.1/11.3.25	*54*	*15-18*	5-15	2.99	
11.3.25	*60*	*13-17*	15	1.74	Adjacent to RE 11.3.1/11.3.25
11.3.25	*62*	*15-18*	15	1.08	Adjacent to RE 11.3.1/11.3.25
11.3.1/11.3.25/11.3.2	*98*	*10-17*	5-15	8.1	Polygon is on the border of the Study area, RE is based off of the DNRM RE mapping



Source: EMM (2023); BMA (2023); DNRME (2022)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

\\emmsvr1\EMM\Jobs\2018\B180329 - Blackwater Mine\GIS\02_Maps\MNES_B210051\G028_PotentialGDEsReport_20231212_05.mxd 12/12/2023

KEY

- Study area
- Existing mine area
- Rail line
- Major road
- Minor road
- Named watercourse

Current depth to water table (m)

- 0 - 5
- 6 - 10
- 11 - 15
- 16 - 20
- 21 - 25
- 26 - 30
- > 31

Potential TGDE communities

- Potential
- Unlikely

Terrestrial GDE (BoM and DES predictive mapping)

- Low potential TGDE - from regional studies
- Moderate potential TGDE - from regional studies

Potential TGDE communities in and adjacent to study area

Blackwater Mine - North Extension Project
Terrestrial MNES Assessment
Figure 6.3

EMM creating opportunities

7 Candidate species and communities

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, flora and fauna species and migratory species under the EPBC Act would occur in the Study area that were listed in Sections 4.5 and 4.6.

Definitions used for the refined likelihood of occurrence are described below:

1. **Known** – the species or ecological community has been observed within the Study area either during historical surveys or during recent seasonal surveys;
2. **Likely** – suitable high quality habitat for a species occurs within the Study area and species records are present within the Study area;
3. **Potential** – potential habitat for a species occurs within the Study 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 Study area due to the lack of suitable habitat or the Study area is outside of the species or communities known range;
5. **Does not occur** – the species or community will not occur in the Study area (eg marine species in terrestrial Study area or sufficient evidence to demonstrate the value would not occur).

The likelihood of occurrence assessments with species identified as 'known', 'likely' or with 'potential' to occur in the Study area are provided in Appendix E. Habitat mapping for known or likely species is provided below.

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

7.1 Threatened species assessments and habitat mapping

Known and potential habitat for threatened species (which have been assessed as either 'known' or 'likely' to occur in the Study area) have been mapped across the Study area consistent with BHP Queensland Coal HSE Ecological Survey Guideline (v1b) and with any available definitions from DCCEEW or in relevant documentation for each species.

Within these sections, habitat mapping is provided for the MNES in question, and is stratified by quality of the habitat (eg preferred or suitable). This is consistent with BHP's "*Central Queensland Threatened Species Habitat Descriptions*" version 5 (Kerswell et al, 2020).

It should also be noted that the criteria used has been reviewed against available DCCEEW definitions or relevant governmental documentation for each species (eg DCCEEW 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 mapping has not been provided for the two aerial species (White-throated Needletail and Fork-tailed Swift) as these may occur in any of the airspace over the site, and their presence above the site is assumed across the whole Study area.

Latham's Snipe also does not have a species habitat map prepared – its habitat preferences are broadly similar to Australian Painted Snipe. Similarly, Sharp-tailed Sandpiper and Glossy Ibis are likely to occupy similar areas and also do not have maps and are likely only to be sporadic visitors to the Study area.

Habitat mapping for Australian Painted Snipe, Ornamental Snake, Koala and Squatter Pigeon is shown on Figure 7.2, Figure 7.3, Figure 7.4 and Figure 7.5 respectively.

Full significance assessments following the Significant Impact Guidelines 1.1: Matters of National Environmental Significance (DoEE, 2013) are presented at the end of each species/community section. The significant impact assessments have considered the avoidance, management and mitigation measures outlined in Section 8, as well as the specific measures for MNES described in Table 9.1.

7.1.1 Brigalow TEC

a 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 2013c);
- 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.

b 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 (DCCEEW 2023r).

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).

c 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).

d Threats to the community

The main current threats to this community relate to clearing, fire, plant and animal pests (Butler, 2007). This community has been extensively cleared for cropping or grazing and subject to altered fire regimes.

Clearing remains the most significant threat, despite restrictions on clearing of remnant areas. Brigalow regrowth is also subject to clearance from a variety of developments, and programs of spraying, grazing and burning can affect the viability of these communities long-term with exotic pasture also causing substantial decline in the diversity of communities.

Pasture grasses such as Buffel Grass remain a significant threat to the TEC, partly due to the increase in fire risk in the vegetation (Butler, 2007) as natural fire was probably rare in the TEC (Butler, 2007). Communities with a relatively healthy tree canopy are relatively resistant to weed invasion, including from pasture grasses (Scanlan, 1991).

e Occurrence in the Study area

One vegetation patch of RE11.3.1 *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains met thresholds for Brigalow TEC. This TEC patch was previously mapped as non-remnant vegetation in Queensland Government certified mapping prior to ground-truthing.

This area of Brigalow TEC exists as riparian vegetation along Taurus Creek on ML1762 covering an area of 6.34 ha (refer Figure 7.1). Although the site meets TEC criteria, it exhibits elements of disturbance such as weed encroachment (within TEC thresholds of <50% exotic cover), predominantly from Buffel Grass and/or Rubber Vine. Full TEC assessment results can be found in Appendix G. Remaining Brigalow in the Study area suffered from high levels of weed encroachment (Buffel Grass, Parthenium and Green Panic Grass) or did not have Brigalow as a dominant or co-dominant component in the canopy, and did not meet TEC criteria.

A total of 6.34 ha of Brigalow TEC is mapped in the Study area, and 0 ha within the Project footprint. This is shown on Figure 7.1.

f Significant residual impact assessment

The MNES significant impact assessment for the Brigalow TEC using the Significant Impact Guidelines (DoE 2013b) is summarised below in Table 7.1.

Table 7.1 MNES significant impact assessment Brigalow TEC

Community Profile	**Brigalow (*Acacia harpophylla* dominant and co-dominant)** **Status: Endangered (EPBC Act)**
SIA criteria (Critically endangered and endangered ecological communities)	**Discussion and justification**
Reduce the extent of an ecological community	One vegetation patch of RE11.3.1 *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains met thresholds for Brigalow TEC in the Study area. This consists of a patch of 6.3 ha on Taurus Creek in the east. This patch is approximately 2.5 km from the nearest Project infrastructure and there is no Brigalow TEC in the Project footprint. The patch extent and proximity to impact areas is mapped in Figure 7.1. The extent of the Brigalow TEC would not be reduced by the Project.

Table 7.1 MNES significant impact assessment Brigalow TEC

Community Profile	Brigalow (*Acacia harpophylla* dominant and co-dominant) Status: Endangered (EPBC Act)
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	The Brigalow TEC extends from south of Charters Towers in Queensland, in a broad swathe east of Blackall, Charleville and Cunnamulla, south to northern New South Wales. The size of many Brigalow remnants across the range of the listed ecological community is small, and the community has been significantly cleared and fragmented historically, however they exist throughout the Brigalow Belt Bioregion. As there will be no clearing within the Brigalow TEC patch, the Project will not fragment the patch or increase fragmentation of the community. It remains connected to other vegetation along the creekline which is being retained.
Adversely affect habitat critical to the survival of an ecological community	The Brigalow patch does not occur within the Project footprint and is 2.5 km from any nearby clearing or proposed infrastructure, and therefore will not be directly impacted upon. Further, remnant and HVR vegetation surrounding the patch will also not be disturbed by the Project. To ensure bushfire and weeds do not have an indirect impact on the patch of Brigalow TEC fire management measures and weed control measures will be implemented by the Project through implementation of existing BWM management plans. The Project will not adversely affect habitat critical to the Brigalow TEC in the Study area.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	Due to the large distance between the Brigalow TEC patch and proposed clearing and Project infrastructure no impact is expected to occur on abiotic factors such as surface water or soil. The Brigalow patch occurs on Taurus Creek away from any clearing therefore no sediment runoff or alteration to flows from the Project will occur that will have an impact on the Brigalow vegetation. Mine affected water will be managed in environmental dams, and clean/dirty water drainage systems, and existing release points will be utilised. Management strategies (eg erosion and sediment controls and management of hazardous materials) will be implemented to minimise the potential for impacts on habitat quality of areas of vegetation surrounding the patch of Brigalow TEC (for example along Taurus Creek and Two Mile Gully). Additional to this, progressive rehabilitation of landforms will assist in minimising sediment transport. Brigalow communities develop horizontal root systems (Johnson et al, 2016), and most water uptake takes place in the top 1 m of soil (Tunstall and Connor 1981). Subsoil in these communities typically comprises clays with high levels of salinity and acidity, which reduces the potential rooting depth in these soils (Dang et al, 2008; Grant, 2012). Based on the results of the potential TGDEs as discussed in Section 6.2.4 this patch of TEC was not identified as a Potential TGDE and will not be affected by the predicted drawdown. The Brigalow TEC will not be modified or destroyed by abiotic factors.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	The Brigalow TEC patch does not occur within the Project footprint and is located approximately 2.5 km from any nearby clearing or proposed infrastructure, and therefore will not be directly impacted upon. Due to a lack of proposed activity in the area of the Brigalow TEC patch, no indirect impacts are expected to occur from dust or fragmentation for example as the vegetation surrounding this patch will not be disturbed. With the implementation of fire management and weed management measures under current BWM management plans, the Project will not cause a substantial change to the composition or ecological function of the patch of Brigalow TEC.

Table 7.1 MNES significant impact assessment Brigalow TEC

Community Profile	**Brigalow (*Acacia harpophylla* dominant and co-dominant)** **Status: Endangered (EPBC Act)**
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, **including, but not limited to:** **– assisting invasive species, that are harmful to the listed ecological community, to become established, or** **– causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community**	The confirmed Brigalow TEC patch does not occur within the Project footprint and is approximately 2.5 km from any nearby clearing or proposed infrastructure, and therefore will not be directly impacted upon. Weeds can alter the structure and function of brigalow ecosystems and affect their suitability as habitat for native species. Introduced grasses, such as Buffel Grass (*Cenchrus ciliaris*), Rhodes Grass (*Chloris gayana*) and Green Panic Grass (*Megathyrsus maximus*), pose the greatest threat by drawing fires into the Brigalow TEC and increasing fire severity. There is potential for the Project to facilitate the spread of these weeds through the operation of machinery, vehicles and bringing materials to site. With the implementation of weed management measures, it is unlikely the further establishment of these weeds across the Study area will occur. The application of herbicides would be undertaken in accordance with strict weed management measures and chemicals/pollutants would be stored appropriately according to Australian Standards.
Interfere with the recovery of an ecological community	There is no adopted or made Recovery Plan for this TEC, however recovery actions are identified in the conservation advice for the community. The proposed activities will not interfere with the recovery of the ecological community.
Conclusion	No clearing or disturbance to Brigalow TEC will occur. The Brigalow TEC patch is >2km from any proposed clearing or infrastructure and surrounding vegetation on Taurus Creek will not be disturbed. Fire management measures will be implemented to minimise the risk of fires occurring and resulting in a loss of or reducing ecological condition of the community. Weed hygiene protocols and other management measures will be implemented to minimise the risk of project activities facilitating the spread of weeds. The Project will not have a significant impact on the Brigalow TEC.

7.1.2 Australian Painted Snipe

a 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).
- National Recovery Plan for the Australian Painted Snipe, *Rostratula australis* (Commonwealth of Australia, 2022)

b 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 (DCCEEW 2023n).

c 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 (DCCEEW 2023n).

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 (DCCEEW 2023n).

d Population

Under the EPBC Act Significant Impact Guidelines 1.1 (DoE 2013b), a 'population of a species' is defined 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, southeastern 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. The species is widespread and is considered not to have a limited geographic distribution (DSEWPaC 2013a). The species is considered to occur in Australia as a single contiguous breeding population (DAWE 2021a).

e Threats to the species

The primary threat to the species is the loss or degradation of wetland habitats (predominantly drainage of wetlands and diversion of water for agriculture). Other habitat degradation factors such as grazing and trampling of vegetation by cattle is likely to be a threat to the species. Invasive weeds may also render habitats unsuitable. Predation by feral animals is also a potential threat.

f Occurrence in the Study area and mapped habitat

The species has been recorded from the Study area, with one individual recorded from an area of flooded gilgai in the southeast of the Study area during the autumn 2019 surveys, and two individuals observed at two farm dams during the spring surveys in 2019.

Habitat for the species has been mapped consistent with Kerswell et al (2020) as follows:

Preferred Australian painted snipe habitat 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 is defined as:

- Shallow permanent or ephemeral freshwater or brackish wetlands and other inundated/waterlogged areas with a variable ground cover (eg grasses, shrubs and rushes). Suitable habitat 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.

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) were not confirmed as present in the Study area or the project footprint. Therefore no 'preferred habitat' has been mapped.

'Suitable habitat' for the species has been recorded and is mapped in the Study area where there is an occurrence of shallow permanent or ephemeral freshwater or brackish wetlands and other inundated/waterlogged areas with a variable ground cover (eg grasses, shrubs and rushes). This includes areas of gilgai which will be seasonally inundated and provide temporary habitat during these times.

'Suitable habitat' observed consists of farm dams and areas of gilgai which provide suitable microhabitat. Areas of gilgai habitat mapped as being suitable for the species, relate to areas of gilgai which 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 led 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 better formed, and there were fewer areas of erosion and better water quality.

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, were excluded as they don't meet requirements for suitable habitat.

It should be noted that the species is not present in the Study area on a regular basis, but habitat mapping criteria applies for when this nomadic species is present in the region, which is likely to be infrequent at best and sporadic.

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. As evidenced by the two observations during the spring 2019 survey, there is potential that the species could be present at any time of year on dams that retain water and have suitable fringing vegetation cover. 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, these surveys have confirmed utilisation in two different seasons. There will however be periods of many years with no occurrences and the species should be treated as a scarce visitor at best to the region.

Australian Painted Snipe breeding habitat requirements include shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. Nest records are all, or nearly all, from or near small islands in freshwater wetlands, provided that these islands are a combination of very shallow water, exposed mud, dense low cover and sometimes some tall dense cover (Rogers et al. 2005 in SPRAT profile).

The majority of breeding records are from the Murray-Darling region (DCCEEW 2023n) however breeding has been recorded across its range. In June 2023 EMM conducted additional inspections within the Study area to assess the availability of potential breeding habitat for the species. Potential sites were inspected to assess their suitability for Australian Painted Snipe breeding in relation to water body size, water retention, presence of mudflats and structure of aquatic and fringing vegetation.

The surveys indicated that potential breeding habitat is not present within the Study area - wetlands within the Study area are minor in extent and lack the complex microhabitat features required for this species breeding. There are not suitable islands for breeding present and in general the canopy cover is not present for breeding attempts.

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.

A total of 689.41 ha of suitable habitat is mapped in the Study area for Australian Painted Snipe as shown in Figure 7.2. Within the Project disturbance footprint, 94.31 ha of suitable habitat is mapped, which is associated with areas of gilgai and farm dams as represented on Figure 7.2.

g Significant residual impact assessment

The MNES significant impact assessment for Australian Painted Snipe using the Significant Impact Guidelines (DoE 2013b) is summarised below in Table 7.2.

Table 7.2 MNES significant impact assessment Australian Painted Snipe

Species Profile	**Australian Painted Snipe *(Rostratula australis)*** **Status: Endangered (EPBC Act)**
SIA (endangered species)	
Lead to a long-term decrease in size of a population	Australian Painted Snipe has been recorded on three occasions in the Study area across spring and autumn seasonal surveys in a year where there had been high rainfall. It should be noted that the species is not likely to be present in the Study area on a continuous basis, but habitat mapping criteria applies for when this nomadic species is present in the region. The species may occur on any natural or artificial wetland habitat within the Study area when conditions are suitable. This includes areas of gilgai and dams (particularly those which are fenced to exclude cattle, and were formed along old drainage lines with shallow margins and inlets and have good areas of fringing vegetation) which are relatively common across the Study area. The surveys indicated that potential breeding habitat is not present within the Study area - wetlands within the Study area are minor in extent and lack the complex microhabitat features required for this species breeding. There are no suitable islands for breeding present and in general the canopy cover is not present for breeding attempts. When the species occurs, it is likely to be sporadic and utilising the gilgai areas as a temporary foraging resource. Suitable habitat in the Study area relates to wetlands or inundated areas with variable ground cover. The majority of suitable habitat is located outside the Project footprint within the Study area (Figure 7.2). Approximately 94.31 ha of suitable habitat (out of 689 ha within the Study area) is proposed to be cleared. Due to the likely infrequent occurrence of the species in the Study area and large areas of

Table 7.2 MNES significant impact assessment Australian Painted Snipe

Species Profile	**Australian Painted Snipe *(Rostratula australis)*** **Status: Endangered (EPBC Act)**
	retained suitable habitat within the Study area and in the surrounding region, the Project is unlikely to lead to a long term decrease in the size of a population.
Reduce the area of occupancy of the species	As per the National Recovery Plan, it is acknowledged that the area of occupancy for this species is highly variable within seasons and years, and in response to various abiotic factors such as rainfall and biotic factors such as vegetation and food items. As such, although habitat in which the species is known to have occurred, and/or is likely to occur in the future, there is negligible impact on the area of occupancy of the species. A total of 689 ha of suitable habitat is present in the Study area (total clearing area 94.31 ha) and similar suitable gilgai and farm dam habitats occurs in the wider region.
Fragment an existing population into two or more populations	The Project is unlikely to fragment a population of Australian Painted Snipe. Although the species is known to occur in the Study area and critical habitat is likely to be present as defined in the National Recovery Plan for the species, the Project footprint is largely avoiding areas of suitable habitat (Figure 7.2). Connectivity between other patches of suitable habitat will remain. Due to the availability of suitable habitat within the Study area and wider region for this highly mobile species, fragmentation is not anticipated to be an issue.
Adversely affect habitat critical to the survival of a species	A guide to habitat critical for the survival of the species is provided in the Recovery Plan for the species (Commonwealth of Australia, 2022). It is acknowledged in the plan, that it is not possible to generate one description of habitat critical for survival based on the scarce records and unpredictable movements, and the variety of habitats utilised across the species' range. It suggests a more bioregional approach based on the combination of landforms, substrate, vegetation etc relevant to a specific geographical unit, and that definition should acknowledge the critical habitat forms part of a mosaic of wetland habitats which vary over time due to factors such as flooding and effects of threats. As a guide, it is suggested the following habitat should be considered critical to the survival: • Any natural wetland habitat where the species is known or likely to occur (especially with suitable breeding habitat), within the indicative distribution map for the species (note the study area is just within this indicative distribution). • Any location outside the above area that may be periodically occupied by Australian Painted Snipe when wetland conditions are favourable. Australian Painted Snipe breeding habitat requirements are quite specific: shallow wetlands with areas of bare wet mud and mixed heights of low vegetation. Potential breeding habitat is not present within the Study area - wetlands within the Study area are minor in extent and lack the complex microhabitat features required for this species breeding. The gilgai areas mapped within the Project footprint provide intermittent foraging habitat for the species. The Project footprint is largely avoiding areas of suitable foraging habitat for the species (Figure 7.2). Approximately 94.31 ha of suitable habitat will be cleared for the Project constituting areas of gilgai (only seasonally flooded) and man-made farm dams. Additionally, the habitat is not likely to be occupied on a regular basis, and the species is highly nomadic within its range. Within the Study area, a total of 689 ha of suitable habitat is mapped and available to the species. Additional to the direct impacts described above and under earlier criteria, there is potential for indirect impacts to retained Australian Painted Snipe habitat. Based on the management measures to be implemented, outlined in Section 8, impacts from sediment runoff or alteration to surface water runoff from the Project are unlikely to have a significant impact on areas of gilgai that may support this species. Mine affected water will be managed in environmental dams, and clean/dirty water drainage systems, and existing release points will be utilised. It is anticipated that based on implementation of management strategies (eg water management measures, erosion and sediment controls and management of hazardous materials) that impacts on habitat quality of areas of suitable habitat will be controlled.

Table 7.2 MNES significant impact assessment Australian Painted Snipe

Species Profile	**Australian Painted Snipe *(Rostratula australis)*** **Status: Endangered (EPBC Act)**
Disrupt the breeding cycle of a population	It is unlikely that the Project will disrupt the breeding cycle of a population of this species. The majority of suitable habitat for this species in the Study area is avoided, with 94.31 ha proposed to be disturbed. The species is not likely to breed in the Study area, given the absence of suitable breeding habitat within the Study area. Any occurrence of the species is likely to be related to foraging resources. Australian Painted Snipe breeding habitat requirements can include shallow wetlands with areas of bare wet mud and cover nearby. Its breeding ecology is poorly known but nest records are predominantly from or near small islands in freshwater wetlands (D. Rogers 2002, pers. comm.). Gilgai micro relief, is suitable for the species, however utilisation of this habitat type is limited by the ephemeral nature of the filling of these gilgai. The majority of breeding records are from the Murray-Darling region (DCCEEW 2023n) however breeding has been recorded across its range. Therefore it is considered that the Project footprint does not support breeding habitat.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project footprint will result in the loss of 94.31 ha of suitable habitat as defined in Section 7.1.2 (f). While the Project will result in the loss of suitable Australian Painted Snipe habitat it is not expected to an extent that will cause the species to decline, due to the large areas of available and higher quality habitat that would not be disturbed by the Project within the Study area. Additional to the direct impacts described above and under earlier criteria, there is potential for indirect impacts to occur to Australian Painted Snipe habitat through abiotic factors such as sediment runoff or alterations to surface water runoff from the Project. Based on the management measures to be implemented, outlined in Section 8, impacts from sediment runoff or alteration to surface water runoff from the Project are unlikely to have a significant impact on areas of gilgai that may support this species. Mine affected water will be managed in environmental dams, and clean/dirty water drainage systems, and existing release points will be utilised. It is anticipated that based on implementation of management strategies (eg water management measures, erosion and sediment controls and management of hazardous materials) that impacts on habitat quality of areas of suitable habitat will be controlled.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat	There is limited scope for indirect impacts such as weed and pest interaction with this species resulting from the Project. Pest fauna such as cats are not known as a major threat to the species. Although there is the possibility of individuals being taken by cats, the frequency of such events is likely to be low. The potential for weeds to further impact on the quality of foraging habitat is low. The Study area is already subject to weed invasion and impacts from grazing practices. Gilgai are often infested with Buffel Grass. Weed and pest control measures as outlined in Section 8.6 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape.
Introduce disease that may cause the species to decline	Disease is not recognised as a threat to the Australian Painted Snipe. Given this, it is unlikely that the Project will introduce diseases that cause the species to decline.
Interfere with the recovery of the species	The Recovery Plan (Commonwealth of Australia 2022) objective is to sustain a positive population trend in the number of mature Australian Painted Snipe. Strategies to achieve this are: • Manage and protect known Australian Painted Snipe habitat at the landscape scale. • Develop and apply techniques to measure changes in population trajectory in order to measure the success of recovery actions. • Reduce, or eliminate threats at breeding and non-breeding habitats. • Undertake research to improve knowledge of the habitat requirements, biology and behaviour of Australian Painted Snipe.

Table 7.2 MNES significant impact assessment Australian Painted Snipe

Species Profile	**Australian Painted Snipe *(Rostratula australis)*** **Status: Endangered (EPBC Act)**
	• Engage community stakeholders to improve awareness of the conservation of Australian Painted Snipe. • Coordinate, review and report on recovery process. The Project is unlikely to interfere with any of these objectives. It is unlikely that the species breeds in the Study area and other suitable habitat is available for the species as a foraging resource when it occurs in the region and Study area.
Conclusion	The Project footprint will result in the loss of 94.31 ha of suitable habitat as defined in Section 7.1.2 (f). Although habitat in which the species is known to have occurred, and/or is likely to occur in the future, there is negligible impact on the area of occupancy of the species. A total of 689 ha of suitable habitat is present in the Study area (total clearing area 94.3 ha) and suitable gilgai habitat and man-made farm dams occur in the wider region. The species is not present in the Study area on a regular basis, but habitat mapping criteria applies for when this nomadic species is present in the region, which is likely to be infrequent at best and sporadic. As such no significant impacts are predicted on this species.

7.1.3 Ornamental Snake

a 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.

b 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 (DCCEEW 2023b).

c 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 (DCCEEW 2023b).

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 (DCCEEW 2023b).

Agnew (2010) states that sites where the species is abundant have the following characteristics:

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 (DCCEEW 2023b).

d Important populations

The Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles (DSEWPC 2011) considers 'important habitat' to be a surrogate for 'important populations' of Brigalow Belt reptiles and lists gilgai depressions and mounds as known important habitat for the Ornamental Snake.

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 Study 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.

e Threats to the species

A variety of factors are thought to have contributed to the species' decline including (Brigalow Belt Reptiles Workshop, 2010):

- habitat loss through clearing;
- habitat fragmentation;
- habitat degradation by overgrazing by stock, especially cattle, or grazing of gilgais during the wet season leading to soil compaction and degradation of soil structure;
- alteration of hydrology;
- alteration of water quality;
- contact with Cane Toad;
- predation by feral species; and
- invasive weeds.

f Occurrence in the Study area and mapped habitat

This species was not originally recorded in the first round of baseline surveys in 2019, but was subsequently observed in March 2020, when three individuals were found during targeted surveys. The three records were in an area of gilgai between Taurus Creek and the Blackwater-Rolleston Road on ML1762. Conditions were good during these surveys, with water in some gilgai and many frogs were active. All three were picked up on drying margins of gilgai in cracking clay soils. No ornamental snake records were found within the Project disturbance footprint.

Habitat for the species has been mapped consistent with Kerswell et al (2020) 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.

Gilgai habitats throughout the Study area are generally lacking in microhabitat (fallen timber) which would offer shelter to ornamental snake at times when soil cracks aren't available (ie where the gilgai hold water throughout spring/summer and into autumn depending on seasonal rainfall). Fallen timber has been removed due to historical and extensive stick raking across the grazed paddocks.

Field surveys have confirmed that some areas of gilgai closer to creek lines (eg to the east of Two Mile Gully) offer better habitat for ornamental snake (large well-formed gilgai, more fallen timber, presence of abundant cracking clay soils) and it was in this area the species was recorded. The area of gilgai in which the species was recorded has been mapped as 'preferred habitat'. Nearby similar areas of gilgai, which support similar habitat attributes also meet the criteria for 'preferred habitat' due to abundance of deep soil cracks and gilgai depressions (see photographs 6.7 to 6.9).

No areas of 'suitable habitat' have been mapped as the Study area either supports gilgai which meets the definition of preferred or marginal.

Gilgai in cleared areas are considered in the various habitat categories. 'Marginal habitat' in the Study area comprises patches of gilgai where soil content is sandier in composition, soil cracks are less well formed, and patches are small and isolated in a surrounding matrix of dense Buffel Grass and unsuitable soil types. The species still has potential to occur in these areas especially in times when water is present and prey abundance is high.

Some areas where soil cracks are a little deeper, and wetland species such as Umbrella Grass and sedges present, are mapped as marginal habitat (see photographs 7.1 and 7.2).

Photograph 7.1 Better formed gilgai with wetland species and deep soil cracks

Photograph 7.2 Gilgai with Umbrella Grass indicating periods of inundation

Areas of gilgai in the north of the Study area are surrounded by a matrix of Buffel Grass, in close proximity to the mine, railway line and highway, and are in general isolated from areas of more suitable habitat for the species (see photographs 7.3 to 7.5). Most of these gilgai were dominated by pasture grass (Buffel) with wetland species scattered or largely absent. These areas were also slightly elevated in the landscape, and are unlikely to be subject to seasonal inundation despite being on land zone 4, and exposed with little shade provided from regrowth and unlikely to sustain pools over a sufficient period for native frogs to breed to provide a food source for the species.

These areas are quite degraded and likely to be of limited value to the species (little fallen timber, sandy substrates restricting the formation of soil cracks).

Threats are also high in these areas (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 have been excluded from habitat mapping as they don't provide suitable habitat for the species.

Photograph 7.3 Buffel grass paddocks in the north of the Study area

Photograph 7.4 Shallow gilgai exhibiting extensive cattle damage and lack of microhabitat

Photograph 7.5 Gilgai with sandy substrate and cattle damage

A total of 576.86 ha of preferred habitat, and 95.22 ha of marginal habitat is mapped in the Study area, with 19.77 ha and 65.92 ha respectively in the project disturbance footprint. Mapping is based on both aerial imagery (to view extent of patches) and in-field observations of habitat.

Some of the areas of land zone 4 in the Study area are dominated by expanses of Buffel Grass, and are quite degraded gilgai with little or no soil cracking. These areas are often slightly elevated above the surrounding landscape, and are unlikely to be subject to seasonal inundation and as such do not provide suitable habitat. Threats are also high in these areas (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 have been excluded from habitat mapping as they don't provide suitable habitat for the species.

g Significant residual impact assessment

The MNES significant impact assessment for Ornamental Snake using the Significant Impact Guidelines (DoE 2013b) is summarised below in Table 7.3.

Table 7.3 MNES significant impact assessment Ornamental Snake

Species Profile	**Ornamental Snake *(Denisonia maculata)* Status: Vulnerable (EPBC Act)**
SIA (vulnerable species)	
Lead to a long-term decrease in size of an important population	Gilgai habitats throughout the Study area are generally lacking in microhabitat (fallen timber) which will 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. Additionally, most of these gilgai were dominated by pasture grass (Buffel) with wetland species scattered or largely absent. These areas were also slightly

Table 7.3 MNES significant impact assessment Ornamental Snake

Species Profile	Ornamental Snake *(Denisonia maculata)* Status: Vulnerable (EPBC Act)
	elevated in the landscape, and are unlikely to be subject to seasonal inundation despite being on land zone 4, and exposed with little shade provided from regrowth and unlikely to sustain pools over a sufficient period for native frogs to breed to provide a food source for the species. It is likely that Ornamental Snake is scarce in most of the Study area as only three were found during three dedicated nights of searching, despite suitable weather conditions. Some areas of gilgai closer to creek lines (eg to the east of Two Mile Gully) will offer better habitat for Ornamental Snake (large well-formed gilgai, more fallen timber). During the March 2020 supplementary surveys, three Ornamental Snake were recorded in this better quality habitat. Three Ornamental Snakes were found in close proximity to each other in an area of gilgai between Taurus Creek and the Blackwater-Rolleston Road on ML1762. Habitat conditions were good during these surveys, with water in some gilgai and many frogs active. All three were found on drying margins of gilgai in cracking clay soils. These areas of gilgai are outside of the Project footprint. The majority of gilgai habitat within the Project footprint is of lower quality. Within the Project footprint, there is 19.77 ha of preferred habitat and 65.92 ha of marginal habitat (Figure 7.3). This constitutes only 3.4% of the preferred habitat mapped in the Study area. As per Section 7.1.3 (d) the occurrence of the Ornamental Snake in the Study area constitutes an important population. The Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles (DSEWPC 2011) go on to specify gilgai depressions and mounds (including connectivity between gilgais and other suitable habitat) are known important habitat. However, as stated above the majority of preferred habitat is located outside the Project footprint and as such there is not expected to be a long term decrease in the size of an important population.
Reduce the area of occupancy of an important population	The occurrence of Ornamental Snake in the Study area constitutes an important population as per the Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles (DSEWPC 2011). As such the clearance of 19.77 ha of preferred habitat and 65.92 ha of marginal habitat has the potential to result in a reduction in the area of occupancy of an important population.
Fragment an existing important population into two or more populations	The Project is unlikely to fragment an important population of Ornamental Snake. Although the occurrence of the species in the Study area constitutes an important population, the Project footprint is largely avoiding areas of preferred habitat. One patch of preferred habitat will be cleared for the Project of 19.8 ha. Therefore due to the complete removal of this patch, fragmentation will not occur to/from this patch. 65.92 of marginal habitat will be cleared. Connectivity between other preferred patches of habitat not being disturbed by the Project will remain.
Adversely affect habitat critical to the survival of a species	Habitat critical to the survival of the Ornamental Snake is not defined, however the Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles (DSEWPC 2011) defines important habitat as being gilgai depressions and mounds, with habitat connectivity between gilgais noted as important also. Although the occurrence of the species in the Study area constitutes an important population, the Project footprint is largely avoiding areas of preferred habitat. One patch of preferred habitat will be cleared for the Project of 19.77 ha and an additional 65.92 ha of marginal habitat will be cleared. Approximately 557 ha of preferred habitat occurs within the remainder of the Study area. Additional to the direct impacts described above and under earlier criteria, there is potential for indirect impacts to retained Ornamental Snake habitat. Based on the management measures to be implemented, outlined in Section 8, impacts from sediment runoff or alteration to surface water runoff from the Project are unlikely to have a significant impact on areas of gilgai that may support this species. Mine affected water will be managed in environmental dams, and clean/dirty water drainage systems, and existing release points will be utilised.

Table 7.3 MNES significant impact assessment Ornamental Snake

Species Profile	Ornamental Snake *(Denisonia maculata)* Status: Vulnerable (EPBC Act)
	It is anticipated that based on implementation of management strategies (eg water management measures, erosion and sediment controls and management of hazardous materials) that impacts on habitat quality of areas of suitable habitat will be controlled.
Disrupt the breeding cycle of an important population	The Ornamental Snake is a viviparous species which usually births 6 or 7 live young (DCCEEW 2023b). It is unlikely that the Project will disrupt the breeding cycle of an important population of this species. The majority of preferred habitat for this species in the Study area is avoided, with only 19.77 ha cleared.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project footprint will result in the loss of 85.69 ha of potential habitat as defined in Section 7.1.3 (f). This comprises 19.77 ha of preferred habitat associated with well-formed gilgai and 65.92 ha of marginal habitat (Figure 7.3). Approximately 557 ha of preferred habitat within the Study area would not be disturbed by the Project. Therefore the Project will clear only 3.4% of preferred habitat in the Study area. Additional to the direct impacts described above and under earlier criteria, there is potential for indirect impacts to retained Ornamental Snake habitat. Based on the management measures to be implemented, outlined in Section 8, impacts from sediment runoff or alteration to surface water runoff from the Project are unlikely to have a significant impact on areas of gilgai that may support this species. Mine affected water will be managed in environmental dams, and clean/dirty water drainage systems, and existing release points will be utilised. It is anticipated that based on implementation of management strategies (eg water management measures, erosion and sediment controls and management of hazardous materials) that impacts on habitat quality of areas of suitable habitat will be controlled. While the Project will result in the loss of preferred and marginal Ornamental Snake habitat, it is not expected to an extent that will cause the species to decline, due to the large areas of available habitat that remain and the majority of higher quality habitat being in parts of the Study area that will not be disturbed by the Project.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The presence of the Cane Toad is known to adversely impact populations and individuals of the Ornamental Snake. It is unlikely that the Project will lead to an increase in the number of Cane Toads present on the site. This species is well established in the area, and weed and pest management measures will be implemented. The potential for weeds to further impact on the quality of foraging habitat is low. The Study area is already subject to weed invasion and impacts from grazing practices. Gilgai are often infested with Buffel Grass. Weed and pest control measures as outlined in Section 8.6 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape.
Introduce disease that may cause the species to decline	Disease is not recognised as a threat to the Ornamental Snake. Given this, it is unlikely that the Project will introduce diseases that cause the species to decline.
Interfere substantially with the recovery of the species	No adopted or made Recovery Plans are available for this species. The Project activities do not interfere with the overall objectives of the Draft Recovery Plan for the Queensland Brigalow Belt Reptiles (Richardson 2006). Regional and local recovery actions include but are not limited to: • Identify populations of high conservation priority. • Control introduced pests such as pigs to manage threats at known sites. • Develop and implement a management plan for the control of cane toads in the region. The Project is unlikely to interfere substantially with the recovery of the species.

Table 7.3 MNES significant impact assessment Ornamental Snake

Species Profile	**Ornamental Snake *(Denisonia maculata)*** **Status: Vulnerable (EPBC Act)**
Conclusion	Conservatively, although Ornamental Snake has not been recorded in the patches of gilgai to be cleared by the Project, their occurrence in the area of preferred gilgai habitat, is assumed. Therefore clearing of areas of habitat constitutes a significant impact on the species.

7.1.4 Koala

a 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.
- Approved Conservation Advice for *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory) (Koala Northern Designatable Unit) (TSSC 2012b).
- Commonwealth Listing Advice for *Phascolarctos cinereus* (Koala) (TSSC 2012c).
- National Recovery Plan for the Koala *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DAWE, 2022).
- 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.
- A review of koala habitat assessment criteria and methods (Australian National University 2021).

No formal Queensland or Federal survey guidelines exist for Koala, although survey effort principles within the EPBC Referral Guidelines (current at time of assessment commencing) for the vulnerable Koala were referenced. These are consistent with those referred to in "A review of koala habitat assessment criteria and methods" (Australian National University 2021).

b 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 (Australian National University 2021).

The Study area occurs within the Koala's inland distribution. Within the inland context, Koala habitat is described as Eucalypt forests and woodlands, as well as Acacia woodlands (with emergent food trees) in both riparian and non-riparian environments (DAWE 2022).

Adams-Hosking et al. (2011) predicts that future Koala distributions will be directly affected by global warming due to limiting availability of food trees. It is proposed that climatically suitable habitat, such as cooler regions and mountainous areas, be conserved adequately as future climate refugia to allow assisted relocations of Koalas if current habitat areas become hotter and drier (Adams-Hosking et al. 2011).

c 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 (DCCEEW 2023c).

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 (DCCEEW 2023c).

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 (DCCEEW 2023c).

Koala habitat is land that has attributes that support Koala (such as the presence of feed trees, connectivity to other habitat or being located near to areas with Koala populations) (Australian National University 2021, DAWE 2022).

d Threats to the species

The main threats to the Koala are ongoing habitat loss and habitat fragmentation (DCCEEW 2022). Other factors include (DCCEEW 2022):

- deaths from dog (feral and domestic) attacks;
- deaths from vehicle collisions;
- diseases including Chlamydia strains and Koala Retrovirus; and
- the effects of climate change and droughts.

The National Recovery Plan for the Koala *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DAWE, 2022) lists the objectives by 2032:

- The area of occupancy and estimated size of populations that are declining, suspected to be declining, or predicted to decline are instead stabilised then increased (Objective 1A).
- The area of occupancy and estimated size of populations that are suspected and predicted to be stable are maintained or increased (Objective 1B).
- Metapopulation processes are maintained or improved (Objective 2).
- Partners, communities and individuals have a greater role and capability in listed Koala monitoring, conservation and management (Objective 3).

e Occurrence in the Study area and mapped habitat

In historical assessments koala was classified as known to occur on the basis of old scratches of the species detected in a small area of Blue Gum adjacent to Taurus Creek. In June 2023 further old scratches and a scat were

found on an unnamed creek (see Figure 6.1). The species has not been directly observed over a number of seasonal surveys that occurred between 2019-2020 and recent surveys in June 2023, and its occurrence in the Study area is likely to be sporadic at best due to a lack of koala food trees and refuge.

The desktop review identified a record of the Koala within the desktop Study area from surveys undertaken prior to 2008 from near Comet. Database searches also confirmed records of Koalas in Blackdown Tableland National Park east of the Study area. Connectivity is very limited in the Study area due to the cleared and fragmented nature of native vegetation. Connectivity predominantly occurs along creek lines.

There is potential for the species to occur in riparian habitat along creek lines, although this is likely to be predominantly limited to the higher stream order watercourses in the Study area, of Taurus Creek and Two Mile Gully, where mature eucalypts (dominated by Coolibah and to a lesser extent, Queensland Blue Gum and Poplar Box) occur in the vegetation communities. However, these communities are dominated by Brigalow, which is not a food tree for the species, and the riparian vegetation is extremely sparse and degraded in most areas.

Habitat for the species has been mapped consistent with Kerswell et al (2020) as follows:

Preferred koala habitat in central Queensland is defined as:

- Contiguous remnant and high-value regrowth 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. coolabah, E. crebra, E. melanophloia* and *E. populnea*. These listed Eucalyptus species comprise a subsample of locally important koala habitat trees in the Brigalow Belt across various geological contexts.

  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 eg Clarke-Connors Ranges, Minerva Hills.

Suitable koala habitat 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. Must incorporate one or more palatable food tree species of relative abundance.

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 of a 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.

A landscape across which koalas move, but does not contain (1) palatable tree species, and/or (2) a persistent freshwater aquifer sufficient to maintain leaf moisture at levels sufficient to sustain a resident koala population and/or (3) a habitat structure that provides refuge from predators or the capacity to avoid heat stress, is not considered to provide habitat values for the species.

Koala habitat varies in quality and function throughout the Study area, with higher quality habitat occurring in alluvial areas (riparian corridors) where food trees are present such as *Eucalyptus tereticornis* and *Eucalyptus populnea*. Remnant vegetation across the Study area is limited to riparian zones and consists primarily of Brigalow dominated communities such as RE 11.3.1 and RE 11.4.9. These patches do support some eucalypt species such as Coolibah (*Eucalyptus coolabah*), Queensland Blue Gum (*Eucalyptus tereticornis*) and Silver-leaved Ironbark (*E. melanophloia*). There are some small remnant and regrowth patches mapped which are dominated by *Eucalyptus coolabah*, *Eucalyptus tereticornis* and *Eucalyptus populnea* including REs 11.3.2, 11.3.25 and 11.3.3. Some patches of vegetation are small and isolated such as those in north-east.

Consistent with Kerswell et al. (2020), preferred habitat is defined as contiguous remnant or high value regrowth Eucalyptus open forest to woodlands on alluvial and/or cracked rock groundwater where palatable food tree species occur frequently (and are usually dominant). Preferred habitat areas are 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. Only a few small patches of RE11.3.2 and 11.3.25 have been mapped as 'preferred habitat' due to dominance of eucalypt species and being on alluvial flats where leaf moisture will be higher.

Within the Study area, koala habitat is predominantly mapped as 'suitable' or 'marginal' habitat. A number of first order watercourses traverse the Study area and drain into Taurus Creek, Two Mile Gully and ultimately Blackwater Creek. These watercourses are minor in nature, with limited vegetation and have been cleared to top of bank in most instances. Vegetation along these watercourses is often sparse, and reflects the disturbed nature of the site, being dominated by species such as Yellowwood (*Terminalia oblongata*), Brigalow (*Acacia harpophylla*), Red Bauhinia (*Lysiphyllum carronii*), Sully Wattle (*Acacia salicina*) and Narrow-leaved Bottletree (*Brachychiton rupestris*).

Following Kerswell et al (2020) 'suitable habitat' 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, and one or more food tree must be present. Within the Study area, the unnamed creek that runs from west to east into Taurus Creek meets this description, as sections of this riparian woodland are Eucalypt dominant or co-dominant. In surveys in June 2023, old Koala scratches were recorded in two locations along this creek and other scratches were indeterminate and could have belonged to this species. There is also a small patch of Blue Gum woodland on the northern alluvial outwash of this creek in one small section that is also mapped as 'suitable habitat'.

Marginal habitat is defined consistent with Kerswell et al (2020) 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. Within the Study area, vegetation along Deep Creek was observed in a degraded condition and dominated by Acacia and other non-Eucalypt species with occasional Eucalypts present such as Poplar Box. This creek line will offer a small area of isolated habitat (individual trees, with extensive clearing to top of bank and cut off by the existing mine to the west) and doesn't meet criteria for preferred or suitable. An example of this vegetation is shown in Photograph 7.6.

Photograph 7.6 Sparse eucalypts along creek

Regrowth and non-remnant vegetation has been included as 'marginal habitat' 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.

Remaining parts of the Study area constitute non-remnant or pasture grassland areas, with occasional patches of Acacia dominated scrub and do not form habitat for this species. This includes all other creeks in the Study area, including Sagittarius Creek, where eucalypts aren't present. Examples are shown in photographs 7.7 and 7.8.

Photograph 7.7 Creekline dominated by Brigalow and Grevillea

Photograph 7.8 Creekline with sparse non-food-tree regrowth

An approximate total of 11.24 ha of preferred habitat, 316.55 ha of suitable habitat and 45.34 ha of marginal habitat is mapped in the Study area, with 0 ha, 20.28 ha and 6.62 ha respectively in the project footprint.

Habitat areas are shown on Figure 7.4.

f Significant residual impact assessment

The MNES significant impact assessment for Koala using the Significant Impact Guidelines (DoE 2013b) is summarised below in Table 7.4.

Table 7.4 MNES significant impact assessment Koala

Species Profile	**Koala *(Phascolarctos cinereus)* Status: Endangered (EPBC Act)**
SIA (endangered species)	
Lead to a long-term decrease in size of a population	No Koalas have been recorded in the Study area although indirect evidence (old scratches) was recorded along Taurus Creek as well as old scratches on an unnamed creek (see Figure 7.4). The species has not been directly observed over a number of seasonal surveys that occurred between 2019-2020 and recent surveys in June 2023, and its occurrence in the Study area is likely to be sporadic at best due to a lack of koala food trees and refuge. The Study area does not contain extensive areas of contiguous eucalypt woodland, or retain connectivity to such areas. As such, the habitat mapped has been assessed as marginal for the species as it is highly fragmented and limited in extent, and the likelihood of the species occurring on a regular basis is low. Limited areas of preferred habitat is mapped along Taurus Creek where areas dominated by Eucalypts occur. Suitable habitat comprises all remaining watercourse vegetation where Eucalypts are subdominant.

Table 7.4 MNES significant impact assessment Koala

Species Profile	**Koala *(Phascolarctos cinereus)*** **Status: Endangered (EPBC Act)**
	Vegetation along Deep Creek was in degraded condition and dominated by Brigalow communities with occasional Coolibah and other eucalypt such as Poplar Box or Moreton Bay Ash. This creek line offers small areas of isolated habitat (individual trees, with extensive clearing to top of bank and with bank) and are unlikely to be key habitat for this species. These areas are mapped as marginal habitat. Following Kerswell et al (2020) 'suitable habitat' 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, and one or more food tree must be present. Within the Study area, the unnamed creek that runs from west to east into Taurus Creek meets this description, as sections of this riparian woodland are Eucalypt dominant or co-dominant. In surveys in June 2023, old Koala scratches were recorded in two locations along this creek and other scratches were indeterminate and could have belonged to this species. There is also a small patch of Blue Gum woodland on the northern alluvial outwash of this creek in one small section that is also mapped as 'suitable habitat'. Other watercourses and drainage features in the Project footprint, including Sagittarius Creek and first order watercourses do not contain suitable food trees and are not mapped as habitat for the species. The Project footprint will result in the loss of 20.28 ha of suitable habitat and 6.62 ha of marginal habitat as defined in Section 7.1.4 (e), totalling 26.9 ha (Figure 7.4). This comprises predominantly Brigalow dominated woodland along the riparian corridors, with sparse emergent eucalypts. This suitable habitat also includes small areas of non-remnant habitat dominated by degraded and previously cleared scrub containing Eucalypt species (consistent with the criteria utilised by DCCEEW), and is in reality overmapped as much of this area is degraded with very few suitable food tree species present. The majority of Koala habitat in the Study area persists outside the Project footprint with 346 ha of potential habitat in areas that would not be disturbed by the Project. Large parts of the Study area are cleared areas dominated by Buffel Grass or sparse Acacia scrub, and unsuitable for the species. These areas are excluded from habitat mapping in the Study area including non-remnant areas that have been largely cleared of woody vegetation and are dominated by dense areas of Buffel Grass. The planned sequential clearing of habitat in any mapped remnant woodland to be cleared will provide any Koalas, were they to be present, the opportunity to safely move into adjacent habitats. A sequential clearing protocol where fauna spotter-catchers are present during clearing will ensure Koalas are not harmed during clearing and there are safe movement opportunities. Due to the low likelihood of Koala being present, and as a result of areas of potential Koala habitat within areas undisturbed by the Project, mitigation measures to be put in place (including staging of clearing), the Project is not expected to result in a long-term decrease in the size of a population. The ability of the Study area and surrounding area to offer breeding opportunities, dispersal function and genetic diversity, and additionally to act as a potential climate refugia (as temperatures are predicted to rise and the species potentially contracts in range coastwards), will be available. Connectivity to the broader landscape will remain associated with the vegetation corridors along the major creek lines such as Taurus Creek.
Reduce the area of occupancy of the species	No Koalas have been recorded in the Study area. Indirect evidence (old scratches) which provide characteristic evidence of presence, were recorded during field survey on Taurus Creek and on an unnamed creek (see Figure 7.4). The species has the potential to utilise eucalypt woodlands within the Study area although any presence is likely to be sporadic and infrequent. The Project footprint will result in the loss of 20.28 ha of suitable habitat and 6.62 ha of marginal habitat as defined in Section 7.1.4 (e), totalling 26.9 ha (Figure 7.4). Preferred and suitable habitats are located within riparian corridors which support preferred foraging tree species including Queensland Blue Gum. The Project footprint largely avoids these riparian corridors.

Table 7.4 MNES significant impact assessment Koala

Species Profile	Koala *(Phascolarctos cinereus)* **Status: Endangered (EPBC Act)**
	Due to the low likelihood of the species being present regularly, avoidance of areas of preferred habitat which offer a higher potential of Koala being present) and through mitigation measures to be put in place, including pre-clearance surveys and staging of clearing, the Project is not expected to reduce the area of occupancy of the species.
Fragment an existing population into two or more populations	It is recognised that roads and development are fragmenting Koala habitats and increasing threats to Koala populations. Threats are coming from habitat loss and fragmentation, vehicle strike, dog attack, and increased stress on populations which then increases chance of disease. The Study area is already heavily fragmented as a result of historical and more contemporary clearing for agriculture, predominantly grazing. The Project layout maintains linkages to surrounding habitat (including riparian corridors associated with Taurus Creek and Two Mile Gully). The existing BWM impedes movement to the west and access north and east along these watercourses will be maintained. Vegetation clearance will likely not further significantly impede the movement of any Koalas present in the Study area. The Study area is largely cleared with a dense ground layer of Buffel Grass which will impede existing movements of the species. Any local movements are likely to be restricted to Taurus Creek and Two Mile Gully. The Project is unlikely to impact upon the dispersal capacity of the species through areas of Acacia regrowth or cleared areas. As per DCCEEW guidance (Australian National University 2021) cleared areas and acacia regrowth is considered to have the potential to support dispersal of the species between areas of habitat. Vegetation along Deep Creek will be retained, although the existing creek line will now be surrounded on three sides by mining and access to the east has the potential to be restricted by a road crossing of Taurus Creek just after the confluence with Deep Creek as well as a dragline crossing further west along Deep Creek toward the existing mine linking two of the new pits. These crossings have potential to impact on Koala movement along Deep Creek. It is therefore likely that Deep Creek west of the access road and Taurus Creek south of the access road will be further fragmented and under the influence of effects of noise, light spill, dust and vehicular disturbance. However, the utilisation of these creeks is likely to be limited and the impact of this fragmentation limited, as both creek lines are already fragmented to the west and south by the existing Blackwater Mine. There was no evidence of Koala occurring on this stretch of creek in the form of scats or scratches. Overall, the ability of the Study area and immediate surrounding area to offer breeding opportunities dispersal function and genetic diversity will be maintained.
Adversely affect habitat critical to the survival of a species	Large areas of suitable habitat (being 317 ha) and small areas of preferred habitat (being 11 ha) within the Study area and located in the riparian corridors will not be disturbed by the Project. The majority of Koala habitat in the Project footprint has low potential to be utilised by Koalas as it is dominated by weeds such as Buffel Grass, and contains little woody vegetation. Woody vegetation present largely comprises Acacia species which is not a food tree species. However, conservatively following DCCEEW habitat mapping criteria, the presence of sparse Eucalypt species among acacia regrowth in these areas results in some low quality habitat for the species being within the Project footprint. The Project footprint will result in the loss of 20.28 ha of suitable habitat and 6.62 ha of marginal habitat as defined in Section 7.1.4 (e), totalling 26.9 ha. This comprises predominantly Brigalow dominated woodland along the riparian corridors, with sparse emergent eucalypts, or areas of patchy regrowth. Additional to the direct impacts described above and under earlier criteria, there is potential for indirect impacts to Koala habitat through abiotic factors such as sediment runoff, alterations to

Table 7.4 MNES significant impact assessment Koala

Species Profile	Koala *(Phascolarctos cinereus)* Status: Endangered (EPBC Act)
	surface water runoff and groundwater drawdown. Although some areas of habitat along riparian corridors are not within the mapped clearing extent, the potential for indirect impacts to occur is present. Based on existing controls and mitigation measures described in Section 8, impacts from sediment runoff or alteration to flows from the Project are unlikely to have a significant impact on other areas of vegetation that may support this species. As outlined in Section 8, mine affected water will be managed in environmental dams, and clean/dirty water drainage systems, and existing release points will be utilised. Erosion and sediment control measures will be put in place and appropriate management of hazardous materials as required under Project's EA. There is the potential for indirect impacts on retained areas of habitat in the immediate vicinity of clearing, most likely through the impacts noise and lighting disturbance, and from dust deposition on areas of vegetation. However, the habitat mapped has been assessed as marginal for the species as it is highly fragmented and limited in extent, and the likelihood of the species occurring on a regular basis is low. As such the Project is not likely to have a significant impact on this species. Riparian and alluvial communities, including those containing Queensland Blue Gum and Coolibah may undergo adverse impacts in the medium to long-term if groundwater levels drop in these areas as a result of drawdown activities. If the groundwater levels drop below the rooting depth of trees in these riparian communities, these habitats may suffer tree dieback and become unsuitable for Koala. Water requirements of these communities will vary and include multiple sources, such as soil water stores, surface flow and groundwater. TGDE assessments as outlined in Section 8.8 are showing there is potential for some patches of potential TGDE vegetation to be impacted by groundwater drawdown, however, further site-specific information is required to determine whether the vegetation is a TGDE and if so, the likelihood and extent of impact. Based on an evaluation of vegetation composition and estimated changes to groundwater levels approximately 2.8 ha of preferred habitat and 129.77 ha of suitable Koala habitat identified as a potential TDGE occurs within the predicted extent of drawdown. Further details regarding this assessment and potential for impacts to retained vegetation from groundwater drawdown is described in Section 8.8.
Disrupt the breeding cycle of a population	Female Koalas can potentially produce one offspring each year, with births occurring between October and May (McLean, 2003). Project activities are not expected to significantly disrupt the breeding cycle of a population. Areas of habitat will remain in the Study area and immediate surrounds, including areas of higher quality potential habitat in riparian areas, and movement corridors will be retained. The current utilisation of the Study area by the species is thought to be very low. Despite nearly 600 hours in the Study area, no individuals have been recorded. Fauna spotter-catchers will be present in mapped potential Koala habitat to identify if Koalas are present during the clearing process and ensure they are not harmed as works progress (eg through felling of trees or movement of machinery). If a Koala is observed, the tree in which it is located, and adjacent trees will not be cleared to ensure the animal is not harmed and permitted to move from the area of its own accord, before clearing in that area can recommence. It is unlikely that the Project will disrupt the breeding cycle of a population of the Koala.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project footprint will result in the loss of 20.28 ha of suitable habitat and 6.62 ha of marginal habitat as defined in Section 7.1.4 (e), totalling 26.9 ha. This comprises predominantly Brigalow dominated woodland along the riparian corridors, with sparse emergent eucalypts, or areas of patchy regrowth. Preferred habitats are located within riparian corridors which support preferred foraging tree species including Queensland Blue Gum and these areas are not disturbed by the Project. Additional to the direct impacts described above and under earlier criteria, there is potential for indirect impacts to retained Koala habitat may occur through abiotic factors such as sediment runoff, alterations to surface water and groundwater drawdown. Although areas of habitat along riparian

Table 7.4 MNES significant impact assessment Koala

Species Profile	Koala *(Phascolarctos cinereus)* Status: Endangered (EPBC Act)
	corridors are away from any clearing the potential for indirect impacts to occur is present. These are described under Criteria 4 above. While the Project will result in a loss of low-quality Koala habitat it is not expected to an extent that will cause a population to decline, due to the apparent low utilisation of the Study area and large areas of available habitat that remain within the Study area. However, some of the suitable and preferred koala habitat has the potential to be a TGDE and be impacted by drawdown. Further site-specific information is required to determine whether the vegetation is a TGDE and if so, the likelihood and extent of impact to the preferred and suitable koala habitat. Depending on the outcomes of the site-specific assessment, a monitoring plan for identifying change in vegetation condition may be required.
Result in invasive species that are harmful to a vulnerable species becoming established in the endangered species' habitat	The Project through clearing of vegetation, has the potential to increase light and open up areas which may then increase weed invasion and numbers of pest animals to adjacent areas of potential habitat. Weeds such as Rubber Vine, have the potential to reduce the ability for Koala to move between areas of habitat, and feral animals such as Wild Dog prey on Koalas. This may increase in cleared areas as the hunting of Wild Dogs may become more efficient in these areas. However, the site is already subject to extensive weed infestation and pest fauna presence. Weed and pest management measures will be implemented for the Project. Based on implementing the proposed mitigation measures it is not expected the Project will result in an increase of invasive species in the species habitat.
Introduce disease that may cause the species to decline	The most well-known disease present in the Koala population is associated with particular strains of Chlamydia. Koala Retrovirus was recently identified and is thought to be responsible for a range of conditions, including leukaemia and an immunodeficiency syndrome (DoE 2014a). The Project is not likely to directly result in an increase in Chlamydia in Koalas. This is a broader issue for the population. But through a cumulative loss of Koala habitat and increase in stress on animals from dog attacks and fragmentation of habitat etc the number of Koalas contracting Chlamydia are increasing. Fauna spotter-catchers will be present during clearing in mapped Koala habitat to identify Koalas (were they to occur) and ensure they are not harmed during the clearing process or as works progress (eg movement of machinery). If a Koala is observed the tree in which it is located, and adjacent trees will not be cleared to ensure the animal is not harmed and permitted to move from the area of its own accord. Koalas showing signs of stress or disease will be transported to a vet for treatment. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	The National Recovery Plan for the Koala *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DAWE, 2022) lists the objectives by 2032: • The area of occupancy and estimated size of populations that are declining, suspected to be declining, or predicted to decline are instead stabilised then increased (Objective 1A). • The area of occupancy and estimated size of populations that are suspected and predicted to be stable are maintained or increased (Objective 1B). • Metapopulation processes are maintained or improved (Objective 2). • Partners, communities and individuals have a greater role and capability in listed Koala monitoring, conservation and management (Objective 3). The Project will not interfere substantially with any of these objectives. The ability of the Study area and immediate surrounds to offer breeding opportunities, dispersal function and genetic diversity, and additionally to act as a potential climate refugia as temperatures are predicted to rise and the

Table 7.4 MNES significant impact assessment Koala

Species Profile	Koala *(Phascolarctos cinereus)* **Status: Endangered (EPBC Act)**
	species potentially contracts in range coastwards, will be maintained. Significant areas of habitat for this species in the Study area associated with the riparian corridor of Taurus Creek and Two Mile Gully would not be disturbed by the Project. Connectivity to the broader landscape will be maintained to the east and north.
Conclusion	The Project footprint will result in the direct loss of 20.28 ha of suitable habitat and 6.62 ha of marginal habitat as defined in Section 7.1.4 (e), totalling 26.9 ha. This comprises predominantly Brigalow dominated woodland along the riparian corridors, with sparse emergent eucalypts, or areas of patchy regrowth. Preferred habitats are located within riparian corridors which support preferred foraging tree species including Queensland Blue Gum and these areas will not be disturbed by the Project. This species has not been recorded (despite nearly 600 hours of field survey) within the Study area although old scratches and a scat were present confirming previous utilisation by the species. Through the identified mitigation measures such as staged clearing, retaining Koala habitat on site including riparian corridors, and implementation of management measures, the Project will minimise potential impacts on any local Koala population were one to utilise the Study area. The Study area does not contain extensive areas of contiguous eucalypt woodland, or retain connectivity to such areas. As such, the habitat mapped has been assessed as marginal for the species as it is highly fragmented and limited in extent, and the likelihood of the species occurring on a regular basis is low. The Study area is already heavily fragmented as a result of historical and more contemporary clearing for agriculture, predominantly grazing. The Project layout maintains linkages to surrounding habitat (including riparian corridors associated with Taurus Creek and Two Mile Gully). The Project is not expected to have a significant impact on the Koala. Based on existing controls and mitigation measures described in Section 8, as well as the lack of utilisation of retained habitat closest to proposed infrastructure, indirect impacts from the Project have the potential to increase the significant impact on other areas of vegetation that may support this species. The level of risk however requires confirmation. Further site specific information is required to confirm whether the vegetation is a TGDE and if so, the likelihood and extent of the impact to the preferred and suitable koala habitat. Depending on the outcomes of the site-specific assessment, a monitoring plan for identifying change in vegetation condition may be required.

7.1.5 White-throated Needletail

a 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.

b 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 (DCCEEW 2023q).

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 (DCCEEW 2023q).

c 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 (DCCEEW 2023q). 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 (DCCEEW 2023q). 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.

d Important populations

Although two subspecies of White-throated Needletails breed in separate populations in the Northern Hemisphere, only one occurs in Australia where they do not occur as smaller populations (DAWE 2021a).

DCCEEW does not specify what constitutes an important population for White-throated Needletail. As such, the EPBC Act Significant Impact Guidelines 1.1 (DoE 2013b) 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 Study area is not located near the edge of the species range. There is no evidence to indicate the population of the White-throated

Needletail that may use habitat within the Study 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 Study area is unlikely to constitute an important population.

e Threats to the species

There are no significant threats to swifts in Australia. Deforestation may contribute to a decline in roosting habitat and/or food availability (Tarburton 2014). Individuals occasionally collide with wind turbines, overhead wires, windows and lighthouses (DCCEEW 2023q).

No recovery or threat abatement plans are in place for this species.

No recovery or threat abatement plans are in place for this species. The Commonwealth's Approved Conservation Advice for White-throated Needletail (TSSC 2019) lists the following priority conservation actions:

- Work with governments in East Asia to minimise destruction of breeding habitat.
- Identify and protect important habitats in Australia.
- Enhance existing monitoring programs.
- Improve knowledge of potential threatening processes such as wind turbines and overhead wires.

f Occurrence in the Study 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 Study area, therefore the whole Study area is considered potential foraging habitat. Roosting habitat is extremely limited in the Study area based on the lack of large mature trees, and restricted to riparian corridors.

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 Study area although it is thought that the number of references to Needletails roosting in trees possibly over-emphasises such occurrences (DCCEEW 2023q). 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 Study area.

The Study area comprises approximately 9,010 ha, of which the Project footprint forms approximately 3,761 ha.

g Significant residual impact assessment

The MNES significant impact assessment for White-throated Needletail using the Significant Impact Guidelines (DoE 2013b) is summarised below in Table 7.5.

Table 7.5 MNES significant impact assessment White-throated Needletail

Species Profile	White-throated Needletail *(Hirundopus caudacutus)* Status: Vulnerable (EPBC Act)
SIA Criteria (Vulnerable species)	
Lead to a long-term decrease in size of an important population	White-throated Needletail are a non-breeding visitor to Australia arriving in October and departing by April. Numbers fluctuate on an annual basis and the species is widespread across the eastern coast, moving in response to foraging and weather conditions. The species migrates down the Great Dividing Range, and the Study area is a small component of this broader area and numbers will vary annually in response to weather and foraging conditions. It is an aerial insectivore that spend most of its time aloft, and could occur anywhere over the Study area, therefore the whole Study area is considered potential foraging habitat. As swifts are almost exclusively aerial, direct impacts to their habitat are not expected to occur as a result of vegetation clearance for the Project. There is limited potential the species could roost in an area of woodland across the Study area, although this use will be sporadic, temporary and across a broad area (i.e. not involving regular or repeated roost sites). The majority of suitable roost trees (larger more mature trees) are located within riparian corridors which are largely avoided by the project (see Section 8). Following the draft referral guidelines for migratory species under the EPBC Act (DoE 2015) an ecologically significant proportion of the population of White-throated Needletail is estimated to be 10 birds (0.1% of the total population using the lower population estimate of 10,000 birds). As White-throated Needletail arrive and disperse over a broad front across northern and eastern Australia, it is not expected that the number of birds using the Study area will place an ecologically significant proportion of the population at risk. Further, the mechanisms for the project to impact on this species are limited.
Reduce the area of occupancy of an important population	The Project will not result in clearing of breeding habitats for the species, as they do not breed in Australia. The species roosts in dense forest canopies or occasionally on rock faces. Large tracts of vegetation will be retained surrounding the Study area and loss of roosting habitat for such a widespread and mobile species will be negligible. Foraging habitat will be maintained above the Study area and the majority of the Project footprint comprises cleared grazing land of limited value. The impact arising from the Project will not result in a detectable decrease in the area of occupancy for an important population.
Fragment an existing important population into two or more populations	The species is almost exclusively aerial in Australia across a wide range of habitats. It is not expected that the Project will fragment the habitat for this species. The species regularly forages up to 1,000 m ASL.
Adversely affect habitat critical to the survival of a species	Important habitat for the species is broad as it is found over a range of habitats, but more often over wooded areas where it is almost exclusively aerial (DoE 2015). The species does not breed in Australia so there is no impact on breeding habitat. As an aerial feeder, habitats for foraging are diverse and occur over woodland, cleared areas, urban environments etc. Although vegetation clearing will occur for the Project, there are extensive areas of vegetation in the Study area that would remain, and cleared habitats are still utilised by the species. As described above, as the species is almost exclusively aerial, direct impacts to their habitat are not expected to occur as a result of the Project. White-throated Needletail arrive and disperse over a broad front across northern and eastern Australia, moving down the Great Dividing Range on migration, and the Study area is a small proportion of this migratory corridor.
Disrupt the breeding cycle of an important population	This species does not breed in Australia; therefore, the Project will not disrupt the breeding cycle of the White-throated Needletail.

Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Important habitat for the species is broad as it is found over a range of habitats, but more often over wooded areas where it is almost exclusively aerial (DoE 2015). The species does not breed in Australia so there is no impact on breeding habitat. As an aerial feeder, habitats for foraging are diverse and occur over woodland, cleared areas, urban environments etc. Although vegetation clearing will occur for the Project, there are extensive areas of vegetation within the Study area that would remain, and cleared habitats are still utilised by the species. The majority of the Study area will remain as suitable foraging and roosting habitat for the species. As described above, as the species is almost exclusively aerial, direct impacts to their habitat are not expected to occur as a result of the Project.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Pest fauna such as cats are not known as a major threat to the species. Although there is the possibility of roosting individuals being taken by cats, the frequency of such events is likely to be small. The potential for weeds to impact on the quality of foraging habitat is low. The Study area is already subject to weed invasion and impacts from grazing practices. Nonetheless, weed management measures including use of wash-down facilities, will be implemented to reduce the risk of weeds being brought in with vehicles or machinery.
Introduce disease that may cause the species to decline	This species is not known to be threatened by disease. The Project is unlikely to introduce diseases that cause the species to decline.
Interfere substantially with the recovery of the species	There is no State or Commonwealth recovery plan for this species. The Approved Conservation Advice for White-throated Needletail (TSSC 2019) outlines conservation actions intended to aid the recovery of the species (identification of important habitat in Australia, improve knowledge of threatening processes and quantify levels of organochlorines in individuals and prey species). Given the relatively minor extent of clearing involved in relation to retained habitat in the region, and the large distances covered by this species, any potential impact on White-throated Needletail habitat will be minor and is considered unlikely to interfere with the recovery of the species or any of the actions outlined in the Approved Conservation Advice.
Conclusion	The Project is not expected to have a significant residual impact on White-throated Needletail habitat.

7.1.6 Squatter Pigeon

a 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=64440
- Conservation Advice *Geophaps scripta scripta* squatter pigeon (southern) (TSSC 2015a)
- Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b).

There is no Listing Advice or adopted or made Recovery Plan in place for this species. The following Threat Abatement Plans are relevant to this species:

- threat abatement plan for predation by feral cats (DoE 2015b)
- threat abatement plan for competition and land degradation by rabbits (DoE 2016)
- threat abatement plan for predation by the European red fox (DoE 2008b).

b Distribution and breeding

Squatter Pigeon can breed throughout most of the year if conditions are good, however, optimal conditions for breeding success are likely to be regulated by the abundance of food resources. The generation length is estimated to be five years. Squatter Pigeon usually breed in solitary pairs and pairs may produce two broods of young per season (DCCEEW 2023a).

The Squatter Pigeon is a medium-sized, highly terrestrial pigeon that occurs from Cape York to southern Queensland (formally to northern New South Wales) (DCCEEW 2023a). The distribution of the southern subspecies overlaps with the distribution of the northern subspecies, *Geophaps scripta peninsulae*. The intergrade zone extends from the Delta Downs area of south-western Cape York, east to Chillagoe, south-east to Halifax Bay and along the east coast to just north of Mackay, and west to Hughenden (DCCEEW 2023a).

c Ecology and habitat

Squatter Pigeon can utilise a broad range of habitats including remnant, regrowth, non-remnant, and modified vegetation communities with nearby access to permanent surface water (typically within 1–3 km). Generally, they are recorded in open *Eucalyptus, Corymbia, Acacia* or *Callitris* dominated communities, and occur in their highest densities in those with abundant and diverse native grasses (primary foraging resource). Utilised habitat in these areas have low ground layer cover, typically below 33%. Soils in these areas consist of sandy substrates dissected with low gravely ridges (DCCEEW 2023a).

The species also shows soil and landscape associations with foraging and breeding primarily recorded from flat alluvial plains, gently sloping and undulating plains, as well as low hilly terrain with well-drained, sandy, or loamy soils. Breeding in these areas only generally occurs within 1 km of a permanent water source (artificial or natural) (Squatter Pigeon Workshop 2011). The species is frequently observed around disturbed areas such as access tracks and cattle yards.

Soil landscapes are good indicators of where natural, foraging and breeding habitats for the Squatter Pigeon occur (Squatter Pigeon Workshop 2011). Well-draining, gravelly, sandy or loamy soils support the open-forest to woodland communities with patchy, tussock-grassy understories that support the subspecies' foraging and breeding requirements. Given that the subspecies nests in shallow depressions in the ground, it requires well-draining soils. The species' foraging and breeding habitats are known to be associated with land zones 3, 5 and 7 of which only land zone 3 occurs in the Study area.

d Important populations

Important populations have been identified (Squatter Pigeon Workshop 2011) as being small, isolated and sparsely distributed populations occurring south of the Carnarvon ranges in central Queensland. This includes:

- populations occurring in the Condamine River catchment and Darling Downs of southern Queensland
- the populations known to occur in the Warwick-Inglewood-Texas region of southern Queensland
- any populations potentially occurring in northern NSW.

North of the Carnarvon Ranges the species is relatively common and is considered to be distributed as a single, continuous sub-population (Squatter Pigeon Workshop 2011). As such, the population in the Study area is not considered to be an important population.

e Threats to the species

The main threats to species relate to the loss and fragmentation of habitat due to clearing for agricultural purposes (including degradation of habitat through overgrazing). Degradation of habitat from invasive weeds, such as Buffel Grass which has been widely introduced as an improved pasture species, is also a key threat (DCCEEW 2023a).

Predation by feral predators such as cats and foxes are another threat to the species.

No recovery or threat abatement plans are in place for this species. The Commonwealth's Approved Conservation Advice for Squatter Pigeon (southern) (TSSC 2015a) lists the following priority conservation actions:

- Protect and rehabilitate areas of vegetation that support important sub-populations.
- Protect sub-populations of the listed subspecies through the development of covenants, conservation agreements or inclusion in reserve tenure.
- Develop and implement a stock management plan for key sites.
- Raise awareness of the squatter pigeon (southern) within the local community, particularly among land managers.

f Occurrence in the Study area and mapped habitat

Approximately 495 person hours were spent across the Study area, accumulated across the December 2018, March 2019, April 2019 and September-October 2019 surveys over 42 days in total (at all times of day from dawn to dusk). The species was not recorded during this time. An additional 55 person hours were recorded in June 2023 and during this time a single individual was recorded close to Taurus Road near a farm dam and a further two birds were recorded by E2M to the south near Taurus Road in August 2023 (Figure 7.5). The species has potential to occur in the Study area (especially near water sources) although the likelihood is significantly reduced by the dominance of Buffel Grass (*Cenchrus ciliaris*) and clay soils (as the species favours sandy soils and a mosaic of open woodland and native grasses). The Study area is dominated by clay soils, with minor areas of sandy substrates.

Squatter Pigeon can utilise a broad range of habitats including remnant, regrowth, non-remnant, and modified vegetation communities with nearby access to permanent surface water (typically within 1–3 km of a permanent water source). The species also shows soil and landscape associations with foraging and breeding primarily recorded from flat alluvial plains, gently sloping and undulating plains, as well as low hilly terrain with well-drained, sandy, or loamy soils. Breeding in these areas only generally occurs within 1 km of a permanent water source (artificial or natural) (Squatter Pigeon Workshop 2011).

Habitat for the species has been mapped consistent with Kerswell et al (2020) as follows:

Preferred squatter pigeon habitat in central Queensland is defined as:

- Remnant or regrowth grassy open forest to woodland dominated by Eucalyptus, Corymbia, Callitris or Acacia with patchy, relatively sparse ground cover vegetation (33 %) and sparse shrub layer on well-draining sandy, loamy or gravelly soils within 1 km of a suitable permanent waterbody.

  Preferred habitat may be located on land zones 3, 5, 7, 8, 9 and 10.

Preferred habitat does not include areas dominated by introduced pasture grasses, in particular *Cenchrus ciliaris*, nor heavily grazed areas but these areas may be included in suitable and marginal habitat as defined below.

Suitable squatter pigeon habitat in central Queensland is defined as:

- Remnant or regrowth grassy open forest to woodland dominated by Eucalyptus, Corymbia, Callitris or Acacia with patchy, relatively sparse ground cover vegetation (<33 %) on well-draining sandy, loamy or gravelly soils between 1 and 3 km of a suitable permanent or seasonal waterbody; and
- Non-remnant areas within 100 m of preferred habitat.
- Suitable habitat may be located on land zones 3, 5, 7, 8, 9 and 10.

Marginal Squatter Pigeon habitat in central Queensland is defined as:

- Non-remnant areas, regrowth and remnant woodland or forest areas more than 3 km from a permanent or seasonal waterbody that facilities the movement of the species between patches of preferred or suitable habitat.

Although the species was recorded adjacent to dams near Taurus Road on two occasions, in June and August 2023, the species is considered to be scarce in the Study area due to habitat degradation rendering the Study area unsuitable. A significant factor is likely the extensive areas of dense Buffel grass dominating the Study area. Additionally, the Study area is dominated by clay soils, and sandy substrates are not extensive.

The habitat is typically unsuitable for the species due to a combination of factors, namely:

- Terrain and soils – most of the Study area occurs on clay dominated soils (being land zone 4), which differs from the flat alluvial plains and sandy substrates favoured by the species (Squatter Pigeon Workshop, 2011).
- Groundcover – much of the Study area has been historically cleared and grazed and is dominated by areas of dense grassy groundcover, which differs from the sparse ground cover and grassy understories of open woodland favoured by the species. Feeding opportunities are restricted in such dense grassy understoreys, and the potential for predation is increased.
- Vegetation communities – the species favours open grassy woodlands and disturbed area. The Study area is dominated by extensive Buffel Grass and communities along creek lines such as Acacia dominated communities are more dense.

The majority of the Study area comprises extensive areas of dense Buffel Grass cover and clay soils. This species generally requires open forest or scrub on sandy soils, dominated by native grasses, in close association with permanent water (DCCEEW 2023a). 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; DCCEEW 2023a).

Much of the Study area is considered too weedy and densely vegetated for the species to occur (eg areas of dense Buffel Grass) or areas on heavy clay soils (landzone 4). These areas don't meet the requirements for preferred, suitable or marginal habitat and have been excluded from mapping. Ground cover in these areas is often greater than 90%, and almost exclusively made up of herbaceous weeds and invasive grasses. Annual and perennial

grasses were sparse, and there was little bare ground on which fallen seed could be gleaned. These areas are also not considered as likely to be used by the species for movement between more suitable habitats.

Particularly within areas of Project infrastructure in the centre of the Study area, the habitat is typically unsuitable for the species. Much of the Study area is dominated by areas of dense Buffel Grass groundcover, which differs from the patchy tussock grassy understories of open woodland favoured by the species. Feeding opportunities are restricted in such dense weedy understoreys, and the potential for predation is increased. Therefore, dense Buffel Grass areas have been excluded from mapping (see Photograph 7.9).

Photograph 7.9 Dense Buffel Grass unsuitable for Squatter Pigeon

Preferred habitat was therefore restricted to areas of remnant or regrowth vegetation along major watercourses in the Study area where there was sparse ground cover vegetation (33 %) and is on land zone 3. Waterbodies have been mapped to include stream order 3 and above as well as dams identified on site and through aerial imagery. Preferred habitat is limited to areas along Taurus Creek and Two Mile Gully and around dams in the vicinity of these watercourses where a mix of native and introduced grasses occur, and sufficient bare ground for foraging is present (see photographs 7.10 and 7.11). Remaining sections of these watercourses where introduced grasses are more prevalent form suitable habitat.

Photograph 7.10 Vegetated creekline with areas of bare ground for foraging

Photograph 7.11 Vegetated margins of dam with areas of bare ground for foraging

Suitable habitat was mapped as being non-remnant areas within 100 m of 'preferred habitat' on landzone 3 or 9 where groundcover was suitably sparse. Other habitat factors described above restrict the suitability for the species. Squatter Pigeon are unlikely to move far from woodland trees which provide shelter (Squatter Pigeon Workshop 2011). Where scattered trees occur, and the distance of cleared land between patches of habitat does not exceed 100 m, individuals may be found foraging or dispersing across modified environments (Squatter Pigeon Workshop 2011).

Marginal habitat was all remaining areas that facilitate the movement of the species between patches of preferred or suitable habitat which was determined to be along minor watercourses, two of which being where a Squatter Pigeon was observed. On these watercourses, the groundcover was dominated by introduced grasses (*Cenchrus ciliaris*, *Megathyrsus maximus* and *Bothriochloa pertusa*) although areas of sandier bare ground were present to provide potential habitat for the species dispersing from nearby areas of preferred habitat, particularly to dams present along these ephemeral watercourses.

When foraging resources are unavailable, 'the subspecies may disperse along vegetated corridors to access permanent water sources elsewhere in the region' (DCCEEW 2023a). The existing Blackwater Mine to the west of the Study area is unlikely to comprise habitat for the species, and therefore the potential for dispersal is driven by the riparian corridors in the east of the Study area (Taurus Creek and Two Mile Gully).

The farm dams in close proximity to these watercourses and Deep Creek hold potential to be utilised as a water source for any individuals present in the Study area. Farm dams in the west of the Study area are isolated in the landscape and dispersal is impeded by the dense Buffel Grass paddocks present in the Study area and distance from areas of preferred habitat. Therefore dams in the west of the Study area are less likely to be utilised by the subspecies.

An approximate total of 43.29 ha of preferred habitat, 313.40 ha of suitable habitat and 90.53 ha of marginal habitat is mapped in the Study area, with 0 ha, 0.63 ha and 35.57 ha respectively in the project footprint.

Potential habitat is mapped in Figure 7.5.

g Significant residual impact assessment

The MNES significant impact assessment for Squatter Pigeon using the Significant Impact Guidelines (DoE 2013b) is summarised below in Table 7.6.

Table 7.6 MNES significant impact assessment Squatter Pigeon

Species Profile	**Squatter Pigeon *(Geophaps scripta scripta)* Status: Vulnerable (EPBC Act)**
SIA Criteria (Vulnerable species)	
Lead to a long-term decrease in size of an important population	North of the Carnarvon Ranges the species is relatively common and is considered to be distributed as a single, continuous sub-population (Squatter Pigeon Workshop, 2011). As such, the population in the Study area is not considered to be an important population. Squatter Pigeons were observed on two different occasions while traversing the Study area in June 2023 and August 2023, despite not being seen in approximately 500 hours of survey effort at various times of day and season previously. Although the species was recorded adjacent to dams near Taurus Road on two occasions, in June and August 2023, the species is considered to be scarce in the Study area due to habitat degradation rendering the Study area largely unsuitable. A significant factor is likely the

Table 7.6 MNES significant impact assessment Squatter Pigeon

Species Profile	Squatter Pigeon *(Geophaps scripta scripta)* Status: Vulnerable (EPBC Act)
	extensive areas of dense Buffel grass dominating the Study area. Additionally, the Study area is dominated by clay soils, and sandy substrates are not extensive. The species has potential to occur in the Study area (especially near water sources) although the likelihood is significantly reduced by the dominance of Buffel Grass (*Cenchrus ciliaris*) and clay soils (as the species favours sandy soils and a mosaic of open woodland and native grasses). Extensive areas of grassy woodland and open grassland occurs to the east of the Project footprint along Taurus Creek which is likely to form the core of habitat for the species in the Study area. The habitat in the Project footprint is typically unsuitable for the species due to a combination of factors, namely: • Terrain and soils – most of the Study area occurs on clay dominated soils, which differs from the flat alluvial plains and sandy substrates favoured by the species (Squatter Pigeon Workshop, 2011). • Groundcover – much of the Project footprint is dominated by areas of dense grassy groundcover, which differs from the patchy tussock grassy understories of open woodland favoured by the species. Feeding opportunities are restricted in such dense grassy understoreys, and the potential for predation is increased. • Vegetation communities – the species favours open grassy woodlands and disturbed area. The Study area is dominated by extensive Buffel Grass and communities along creek lines are often dense with clay soils. The majority of the Study area comprises extensive areas of dense Buffel Grass cover and clay soils. This species generally requires open forest or scrub on sandy soils, dominated by native grasses, in close association with permanent water (DoE 2019a). 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); DoE 2019a. The Project is unlikely to lead to a long-term decrease in an important population.
Reduce the area of occupancy of an important population	No important population is present in the Study area. Clearing for the Project is expected to remove up to 36.20 ha of habitat for the species (Figure 7.5). The Project will reduce the area of occupancy in the local area to a very minor extent, and not that of an important population – the species is considered to be scarce in the Study area due to habitat degradation rendering the Study area unsuitable.
Fragment an existing important population into two or more populations	North of the Carnarvon Ranges the species is relatively common and is considered to be distributed as a single, continuous sub-population (Squatter Pigeon Workshop, 2011). As such, the population in the Study area is not considered to be an important population. The species is sparsely distributed across a wide range. Clearing for the Project is expected to remove up to 36.20 ha of habitat for the species. The Study area is already heavily fragmented as a result of historical and contemporary clearing for agriculture, predominantly in form of cattle grazing. The Project layout maintains linkages to surrounding habitat, particularly the maintenance of connectivity along Taurus Creek. The Project is unlikely to fragment an existing important population.
Adversely affect habitat critical to the survival of a species	No critical habitat for the species is defined. The species occurs in grassy woodlands which remain abundant across much of its range. Squatter Pigeon also occur in disturbed areas cleared for cattle grazing and along access tracks. It is not considered that the Study area supports habitat critical to the survival of the species. Areas of habitat within the Study area and access to water points such as farm dams will remain.

Table 7.6 MNES significant impact assessment Squatter Pigeon

Species Profile	**Squatter Pigeon *(Geophaps scripta scripta)*** **Status: Vulnerable (EPBC Act)**
	The Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (DoE 2013) state that critical habitat can include "areas that are necessary for activities such as foraging, breeding, roosting, or dispersal" (DoE 2013). Although forming potential breeding habitat due to the proximity of water sources, the nature of the Study area means that Squatter Pigeon are unlikely to use the Study area for breeding preferentially over more suitable habitat in the surrounding woodlands which offers more shelter (eg retained habitats along Taurus Creek). Noting the other definitions of critical habitat (DoE 2013), specifically areas that are necessary: • for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators) • to maintain genetic diversity and long-term evolutionary development, or • for the reintroduction of populations or recovery of the species or ecological community. It is unlikely that the Study area meets these criteria. The ability of the Study area to support this species will remain. As such the Project is not expected to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	North of the Carnarvon Ranges the species is relatively common and is considered to be distributed as a single, continuous sub-population (Squatter Pigeon Workshop, 2011). As such, the population in the Study area is not considered to be an important population. There is no important population in the Study area. Areas of potential breeding habitat occur within the Study area. Pre-clearance surveys will identify breeding places for this species, and should breeding sites be encountered, an exclusion zone will be placed around the nest until young have fledged.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The species occurs in grassy woodlands which remain abundant across much of its range. Squatter Pigeon also occur in disturbed areas cleared for cattle grazing and along access tracks. Large parts of the Study area in which the majority of Project infrastructure is located is dominated by dense Buffel Grass cover and is unsuitable habitat for the species. While 36.2 ha of habitat will be disturbed by the Project, other areas of habitat within the Study area remain. It is unlikely that the Project will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Degradation of habitat from invasive weeds and predation by feral predators such as cats and foxes are threats to the species. The Project has the potential to facilitate the spread of weeds and pest fauna through machinery, vehicles and materials being bought in from outside the Study area although the Study area is already subject to extensive weed and pest impacts and the magnitude of this impact is likely to be negligible. Weed and pest control measures as outlined in Section 8.6 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape.
Introduce disease that may cause the species to decline	Disease is not a known threat to the species, and it is unlikely that the Project will introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	There is no State or Commonwealth recovery plan for this species. The Approved Conservation Advice for Squatter Pigeon (TSSC 2015a) outlines the main threats to species as relating to the loss and fragmentation of habitat due to clearing for agricultural purposes (including degradation of habitat through overgrazing). Degradation of habitat from invasive weeds, such as Buffel Grass (*Cenchrus ciliaris*) which has been widely introduced as an improved pasture species, is also a key threat.

Table 7.6 MNES significant impact assessment Squatter Pigeon

Species Profile	Squatter Pigeon *(Geophaps scripta scripta)* **Status: Vulnerable (EPBC Act)**
	Weed and pest control measures as outlined in Section 8.6 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape. The long term survival and recovery of the species depends on (Squatter Pigeon Workshop, 2011): • the protection of habitat critical to the survival of the subspecies throughout its range • the restoration of habitat which is potentially critical to the survival of the subspecies, especially in northern NSW and southern Queensland where there is a greater threat of a further contraction in the subspecies' range • the alleviation of mortality caused by predators, particularly cats and foxes • the development of a greater understanding of the subspecies' ecology and use of modified landscapes for foraging, breeding and dispersal. The Project will not conflict with any of these objectives.
Conclusion	Based on an evaluation of all criteria, the Project is considered unlikely to have a significant impact on the Squatter Pigeon. The Project will result in the loss of up to 0 ha of preferred habitat, 0.63 ha of suitable habitat and 35.57 ha of marginal habitat totalling 36.2 ha (though no important populations are present on site).

7.1.7 Latham's Snipe

a 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.

b 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.

c 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 (DCCEEW 2023o). 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 (DCCEEW 2023o).

d Important habitat

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 Study 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 Study 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 (DCCEEW 2023o).

The Study area is unlikely to constitute important habitat for this species.

e Threats to the species

Historically the greatest threat to the species in Australia was the drainage and modification of wetland habitats, and excessive mortality due to hunting (DCCEEW 2023o). Loss of habitat is an ongoing threat.

Some populations occupy wetlands prone to disturbance near industrial complexes etc. Pollution of these wetlands via discharge or inappropriate land management is a potential threat (Melville, 1997).

f Occurrence in the Study area and mapped habitat

This species was recorded once during the autumn surveys, in an area of gilgai on ML1762. In addition, during the March 2020 supplementary surveys, this species was recorded twice more in gilgai on ML1762 to the east of Taurus Road.

A total of 689.41 ha of potential habitat is mapped in the Study area for Latham's Snipe. Within the Project disturbance footprint, 94.31 ha occurs.

g Significant residual impact assessment

The MNES significant impact assessment for Latham's Snipe using the Significant Impact Guidelines (DoE 2013b) is summarised below in Table 7.7.

Table 7.7 MNES significant impact assessment Latham's Snipe

Species Profile	**Latham's Snipe (*Gallinago hardwickii*)** **Status: Marine, Migratory (EPBC Act)**
Criteria (migratory)	**Discussion and justification**

Table 7.7 MNES significant impact assessment Latham's Snipe

Species Profile	Latham's Snipe (*Gallinago hardwickii*) Status: Marine, Migratory (EPBC Act)
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Important habitat for the species is defined (DoE 2017) as being 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 the Study area supports this many individuals in the summer months. Surveys by EMM encountered occasional individuals in gilgai areas (three observations over the surveys). Extensive areas of potential habitat are present within the Study area, in the form of gilgai habitats. Approximately 94.31 ha of habitat will be removed as a result of the Project, although extensive areas of gilgai will remain in the Study area (just under 700 ha). Therefore, the Project is not likely to have a significant impact on an area of important habitat for the species. Although 94.31 ha of potential habitat will be cleared, due to the extensive areas of habitat that remain within the Study area and the transitory nature of any occurrence, the Study area is expected to be able to accommodate Latham's Snipe occurring in the region in the summer months.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or	There is limited scope for indirect impacts such as weed and pest interaction with this species resulting from the Project. Pest fauna such as cats are not known as a major threat to the species. Although there is the possibility of individuals being taken by cats, the frequency of such events is likely to be small. The potential for weeds to further impact on the quality of foraging habitat is low. The Study area is already subject to weed invasion and impacts from grazing practices. Gilgai are often infested with Buffel Grass. Weed and pest control measures as outlined in Section 8.6 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	It is unlikely that the Project will disrupt the lifecycle of an ecologically significant proportion of the population – DoE (2017) defines an ecologically significant proportion of the population as being 18 birds. Any population occurring in the Study area will likely number less than a few birds.
Conclusion	Although 94.31 ha of potential habitat will be cleared for the Project, the loss of this habitat will not have a significant impact on Latham's Snipe and the risk of an impact on an ecologically significant proportion of the population is considered to be low.

7.1.8 Fork-tailed Swift

a 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.

b 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 (DCCEEW 2023p).

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 (DCCEEW 2023p).

c 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 (DCCEEW 2023p)

d Important habitat

The species occurs widely across Australia, although does not breed in the country. The Study 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 Study 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.

As such, the Study area is unlikely to constitute important habitat for the species.

e Threats to the species

There are no significant threats to swifts in Australia. Deforestation may contribute to a decline in roosting habitat and/or food availability (Tarburton 2014). Individuals occasionally collide with overhead wires, windows and

lighthouses (DCCEEW 2023p). No recovery or threat abatement plans are in place for this species. There is no approved conservation advice for this species.

f Occurrence in the Study 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 Study area, therefore the whole Study 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.

The Study area comprises approximately 9,010 ha, of which the Project footprint covers approximately 3,761 ha.

g Significant residual impact assessment

The MNES significant impact assessment for Fork-tailed Swift using the Significant Impact Guidelines (DoE 2013b) is summarised below in Table 7.8.

Table 7.8 MNES significant impact assessment Fork-tailed Swift

Species Profile	**Fork-tailed Swift (*Apus pacificus*)** **Status: Marine, Migratory (EPBC Act)**
Criteria (migratory)	**Discussion and justification**
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Important habitat for the species is broad as it is found over a range of habitats, from inland plains to wooded areas (DoE 2015). The species does not breed in Australia so there is no impact on breeding habitat. As an aerial feeder, habitats for foraging are diverse and occur over woodland, cleared areas, urban environments etc. Although vegetation clearing will occur for the Project, there are areas of vegetation within the Study area that remain, and cleared and urbanised habitats are still utilised by the species. The species is likely to occur on a sporadic basis over the summer months within the Study area. Within the core range of the species, numbers can vary from 0 on one day to over 1,000 the next day with seemingly little pattern, presumably driven by weather and foraging conditions. As Fork-tailed Swift arrive and disperse over a broad front across the whole of Australia, but mainly over inland plains, it is impossible to predict on a long-term basis any patterns of utilisation of a given site, although focal features such as wetlands which may attract a large number of insect prey, could result in an increase in numbers of the species. Several wetlands and dams occur throughout the Study area and it is possible that these could attract larger numbers of this species foraging on occasion. As described above, as swifts are almost exclusively aerial, direct impacts are not expected to occur as a result of the Project. No major wetlands will be removed as a result of the Project and a number of dams and wetland features will remain in the Study area.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or	Pest fauna such as cats are not known as a major threat to the species. The potential for weeds to impact on the quality of foraging habitat is low. The Study area is already subject to weed invasion and impacts from grazing practices. Nonetheless, weed management measures including use of wash-down facilities, will be implemented to reduce the risk of weeds being brought in with vehicles or machinery.

Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	This species does not breed in Australia; therefore, the Project will not disrupt the breeding cycle of the Fork-tailed Swift. As an aerial feeder, habitats for foraging are diverse and occur over woodland, cleared areas, urban environments etc. Although vegetation clearing will occur for the Project, there are areas of vegetation within the Study area that remain, and cleared habitats are still utilised by the species. As described above, as swifts are almost exclusively aerial, direct impacts to their habitat are not expected to occur as a result of the Project.
Conclusion	The Project will not have a significant residual impact on Fork-tailed Swift habitat and the risk of an impact on an ecologically significant proportion of the population (defined by DoE 2015 as being 100 birds or 0.1% of the population) is considered to be low.

7.1.9 Glossy Ibis

a Relevant departmental documents

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

- species profile on SPRAT database: https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=991; and

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

b Distribution and breeding

Widely distributed across northern, eastern and parts of central Australia. The species nests in colonies close to water, either in trees or dense stands of vegetation such as reeds.

c Ecology and habitat

The species favours shallow freshwater habitats, on occasion saltwater. It is sometimes recorded in wooded swamps and artificial wetlands, such as the farm dams of the Study area. The species roosts in trees, usually near waterbodies.

d Important habitat

The species occurs widely across Australia. The Study 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 if the species occurs in the Study area, it is unlikely to constitute an ecologically significant proportion of the population.

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

e) 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

f) habitat that is of critical importance to the species at particular life-cycle stages, and/or

g) habitat utilised by a migratory species which is at the limit of the species range, and/or

h) habitat within an area where the species is declining.

As such, the Study area is unlikely to constitute important habitat for the species.

e Threats to the species

Wetland destruction or degradation is identified as the major threat to Glossy Ibis.

f Occurrence in the Study area and mapped habitat

This species was recorded once during the autumn surveys on a farm dam in the north of the Study area (outside of the project footprint).

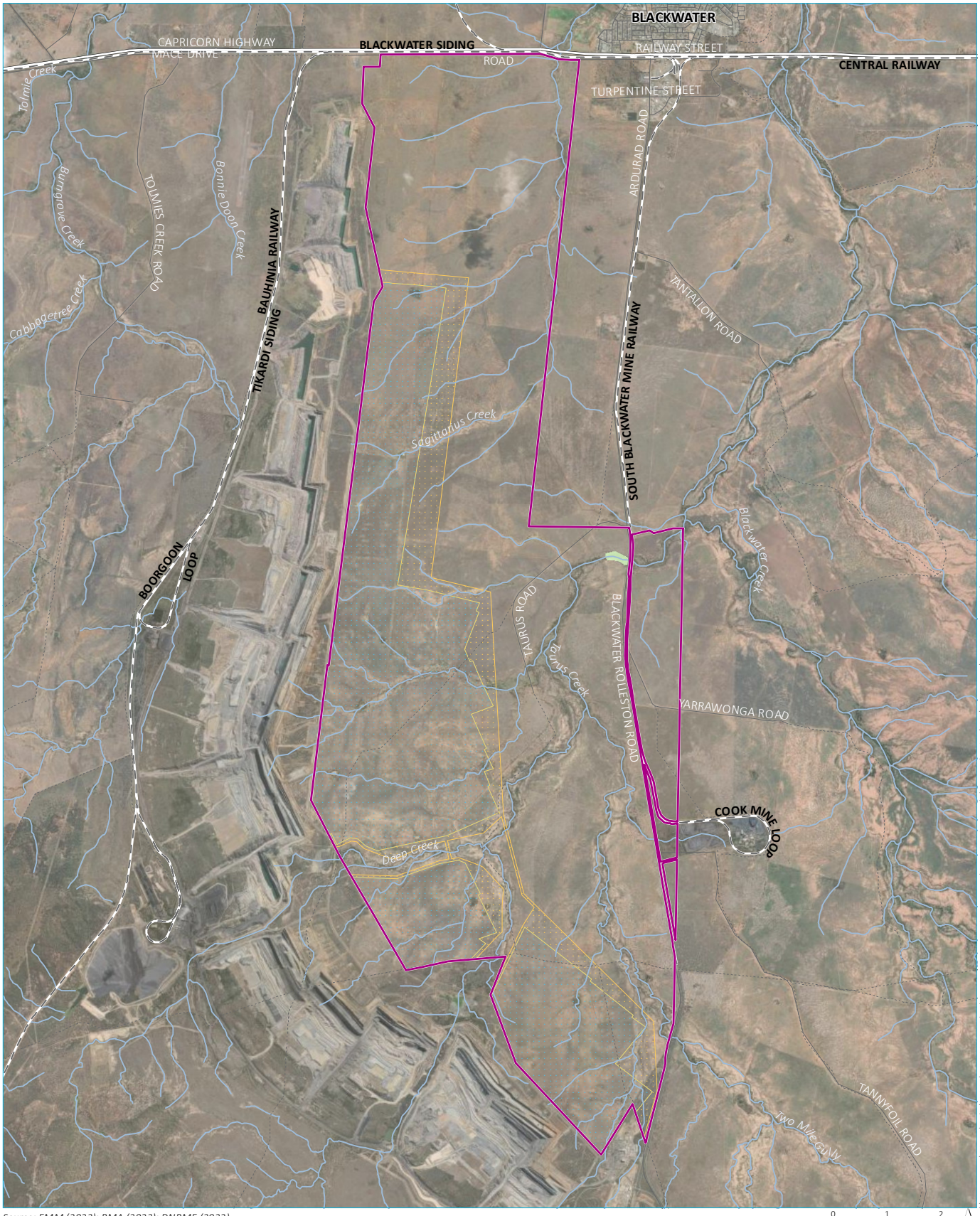
Glossy Ibis does not have a species habitat map prepared – its habitat preferences are broadly similar to Australian Painted Snipe, are likely to occupy similar areas and only to be sporadic visitors to the Study area.

g Significant residual impact assessment

The MNES significant impact assessment for Glossy Ibis using the Significant Impact Guidelines (DoE 2013b) is summarised below in Table 7.9.

Table 7.9 MNES significant impact assessment Glossy Ibis

Species Profile	**Glossy Ibis (*Plegadis falcinellus*)** **Status: Marine, Migratory (EPBC Act)**
Criteria (migratory)	**Discussion and justification**
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Important habitat for the species is not defined, however it favours shallow freshwater habitats, on occasion saltwater. It is sometimes recorded in wooded swamps and artificial wetlands, such as the farm dams of the Study area. Although removal of four dams with suitable vegetated margins will occur for the Project, there are suitable dams within the Study area that remain to still be utilised by the species. The species is likely to occur on a sporadic basis within the Study area.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or	Pest fauna such as cats are not known as a major threat to the species. The potential for weeds to impact on the quality of foraging habitat is low although introduction of aquatic weeds may degrade habitat. The Study area is already subject to weed invasion and impacts from grazing practices. Nonetheless, weed management measures including use of wash-down facilities, will be implemented to reduce the risk of weeds being brought in with vehicles or machinery.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	This species nests in tall stands of emergent vegetation of trees next to water, typically on the margins of swamps. Most nests in Australia have been recorded in a limited number of locations, and the Project is not located in one of these areas. Therefore, the Project will not disrupt the breeding cycle of the Glossy Ibis. A number of suitable farm dams at which the species may forage are retained in the study area and the Project is not expected to disrupt an ecologically significant proportion of the population of a migratory species.
Conclusion	The Project will not have a significant residual impact on Glossy Ibis habitat and the risk of an impact on an ecologically significant proportion of the population is considered to be low.



Source: EMM (2023); BMA (2023); DNRME (2022)

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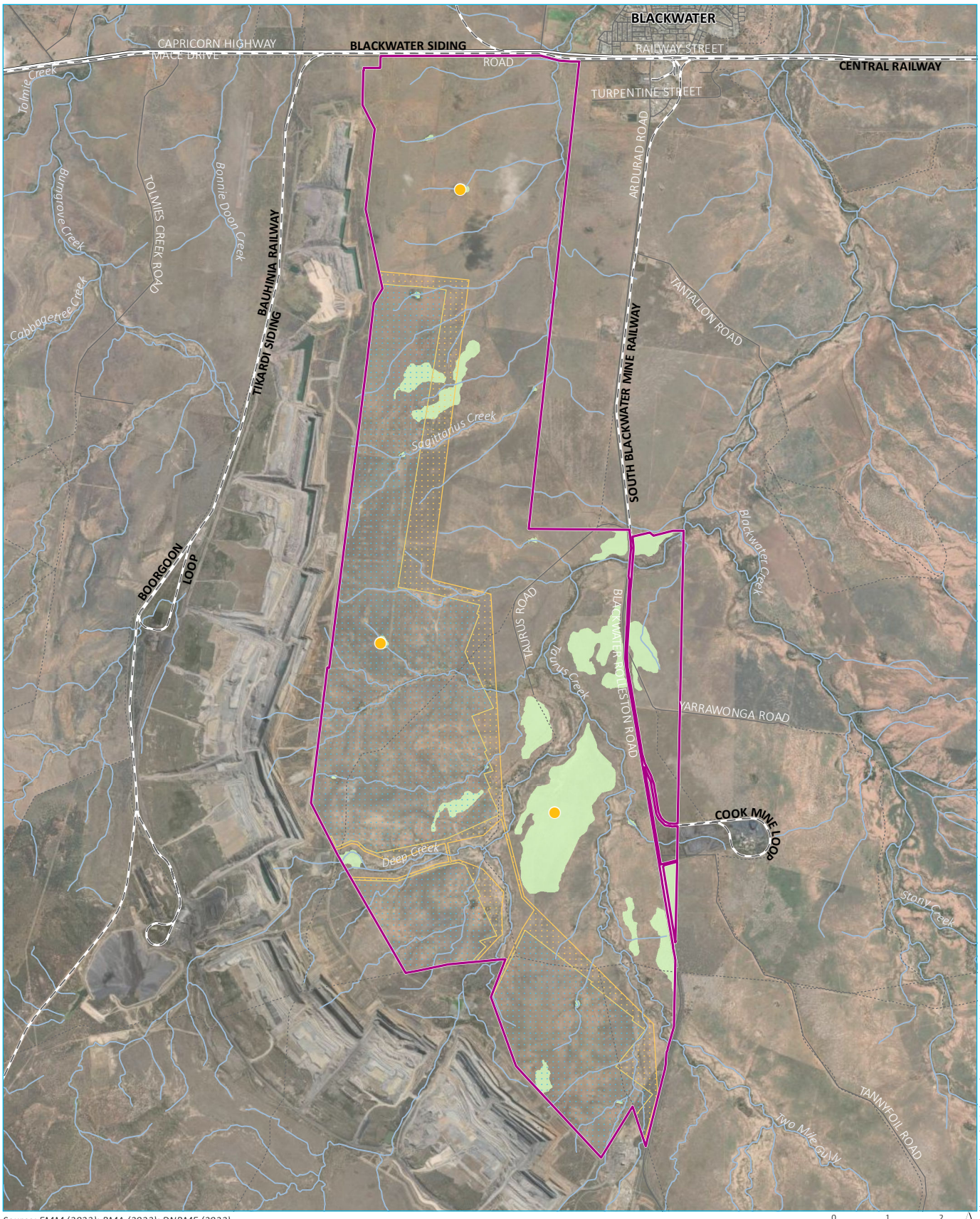
KEY

- Study area
- Indicative project footprint
- Proposed pit extent
- Proposed out of pit disturbance
- Rail line
- Major road
- Minor road
- Vehicular track/trail
- Watercourse/drainage line
- Brigalow TEC

Brigalow TEC

Blackwater Mine - North Extension Project
Terrestrial MNES Assessment
Figure 7.1

EMM
creating opportunities



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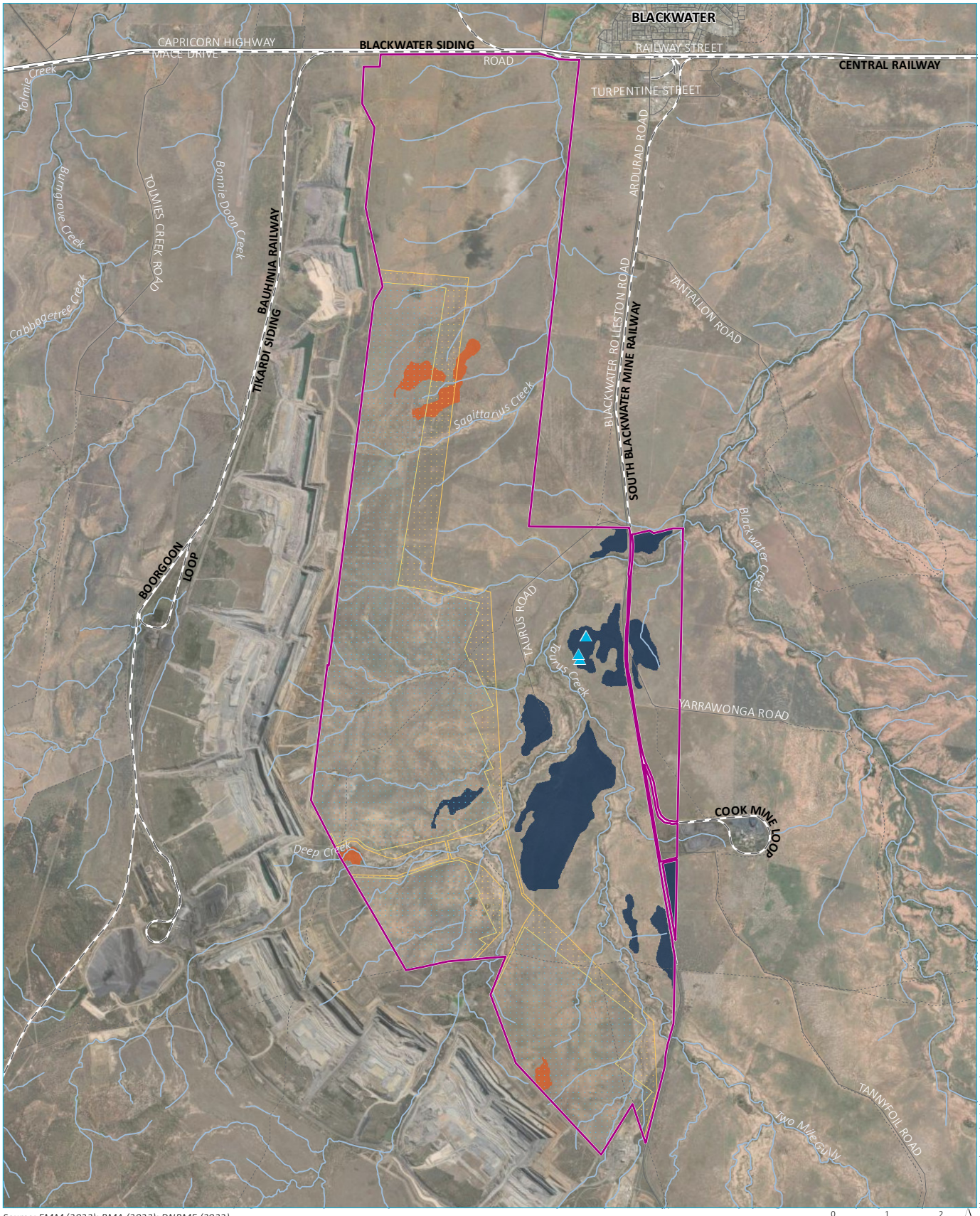
KEY

- Study area
- Northern expansion disturbance footprint
- Proposed pit extent
- Proposed out of pit disturbance
- Rail line
- Major road
- Minor road
- Vehicular track/trail
- Watercourse/drainage line
- Australian Painted Snipe (observed)
- Suitable Australian Painted Snipe habitat

Habitat mapping – Australian Painted Snipe

Blackwater Mine - North Extension Project
Terrestrial MNES Assessment
Figure 7.2

EMM
creating opportunities



Source: EMM (2023); BMA (2023); DNRME (2022)

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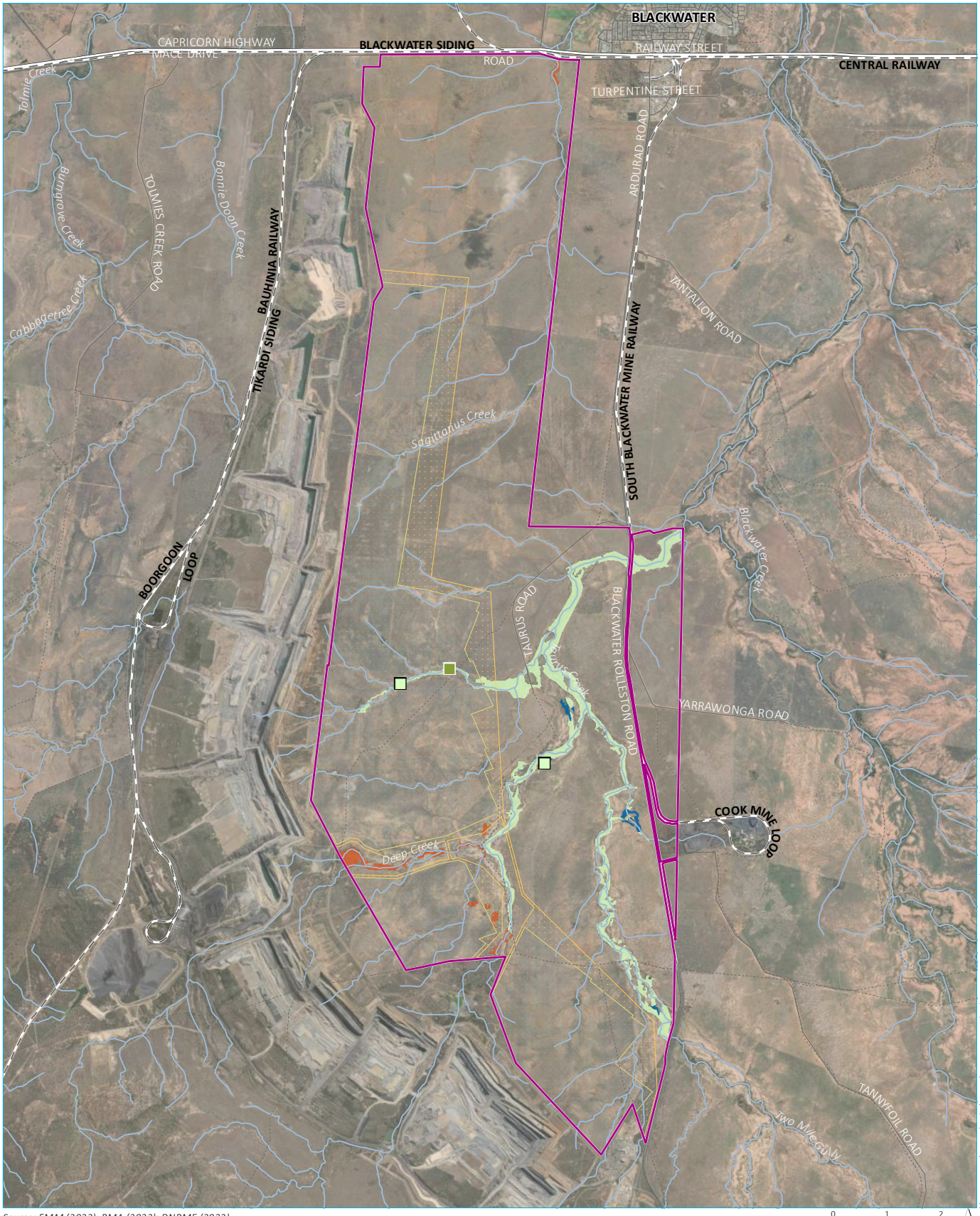
KEY

- Study area
- Indicative project footprint
- Proposed pit extent
- Proposed out of pit disturbance
- Rail line
- Major road
- Minor road
- Vehicular track/trail
- Watercourse/drainage line
- Ornamental Snake (observed)
- Ornamental Snake habitat
- Preferred
- Marginal

Habitat mapping – Ornamental Snake

Blackwater Mine - North Extension Project
Terrestrial MNES Assessment
Figure 7.3

EMM
creating opportunities



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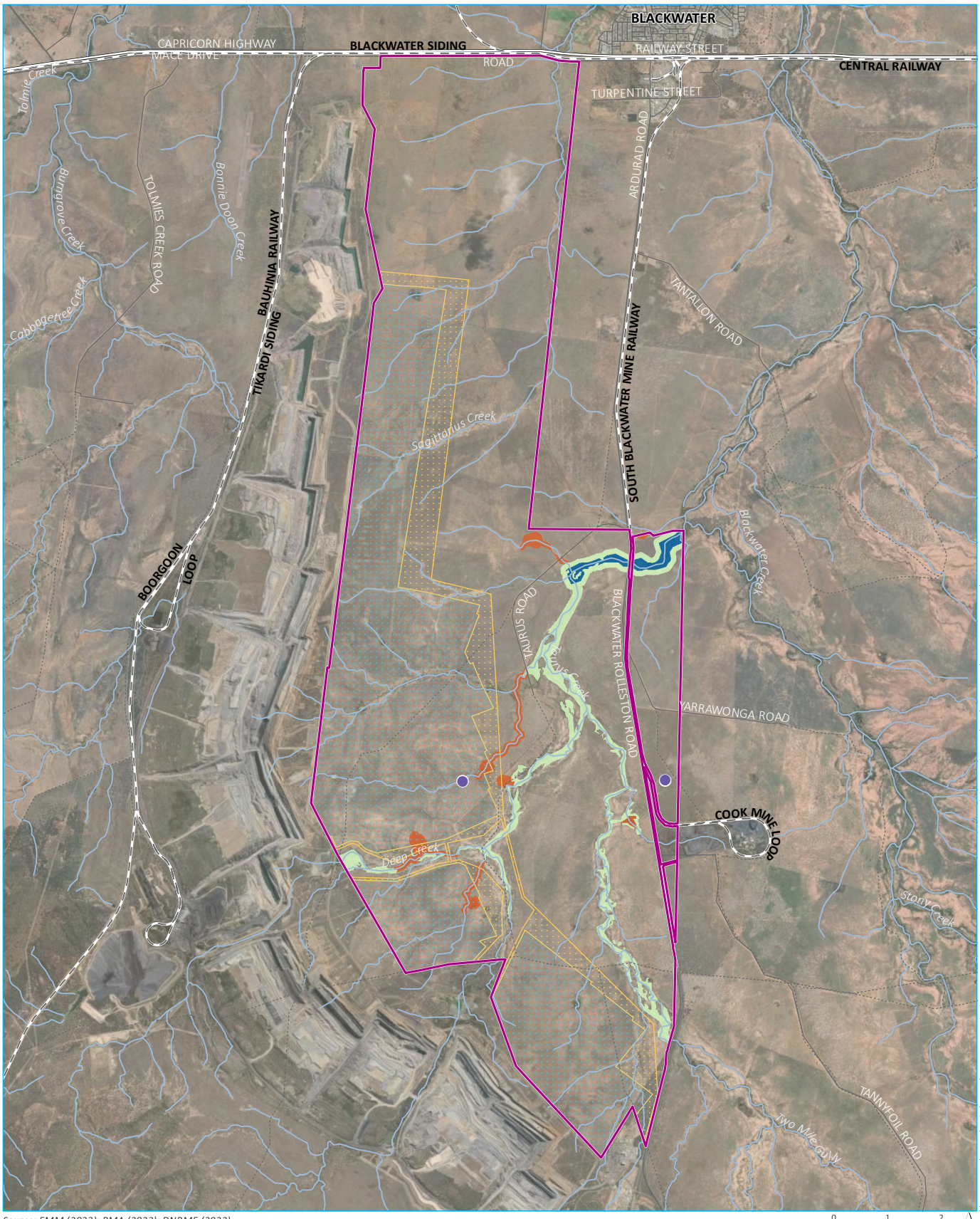
Habitat mapping – Koala

Blackwater Mine - North Extension Project
Terrestrial MNES Assessment
Figure 7.4

EMM
creating opportunities



Source: EMM (2023); BMA (2023); DNRME (2022)

0 1 2 km
GDA 1994 MGA Zone 55

N

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KEY

- Study area
- Indicative project footprint
- Proposed pit extent
- Proposed out of pit disturbance
- Rail line
- Major road
- Minor road
- Vehicular track/trail
- Watercourse/drainage line
- Squatter Pigeon (observed)

Squatter Pigeon habitat

- Preferred
- Suitable
- Marginal

Habitat mapping – Squatter Pigeon

Blackwater Mine - North Extension Project
Terrestrial MNES Assessment
Figure 7.5

EMM
creating opportunities

8 Potential project impacts and proposed avoidance, mitigation and management measures

Ecological surveys of the Study area commenced at an early stage during Project design, and as such the results of the surveys have been able to inform the Project layout. This has resulted in areas of higher ecological significance being avoided to the greatest practical extent, such as avoidance of riparian corridors along Taurus Creek (recognising the limitations around the coal resource requirements). The location of the mine and pits are informed by geological surveys and testing, and limited by the extent of the resource, however where possible riparian areas have been avoided.

Further to the design measures described below, the following general measures will be implemented to avoid and minimise environmental impacts to the greatest practical extent:

- Vegetation clearing will be limited to those areas required for the Project. The disturbance area will be clearly demarcated prior to clearing to avoid unnecessary clearing of vegetation and/or habitats. Clearing will only occur within the area approved via the site's Permit to Disturb process.
- Project infrastructure has been co-located with the planned pit extent footprint area to minimise additional clearing impacts and potential fragmentation impacts.
- Where practicable, ancillary infrastructure has been sited in existing cleared areas or more disturbed areas to minimise impacts on habitat values and connectivity.
- Sequential clearing will occur to minimise impacts on native fauna, particularly arboreal fauna which may utilise tree hollows that may be present.
- Areas which are not required for the ongoing operation of the Project will be rehabilitated as soon as practicable.

8.1 Vegetation clearance/habitat disturbance

The Study area supports small tracts of remnant vegetation and regrowth dominated by acacia. Eucalypt woodlands are typically limited to creek lines and the majority of the Study area is non-remnant habitat. The Project has been designed to avoid any clearing of Brigalow TEC.

Project disturbance will reduce breeding, foraging and sheltering habitat for fauna and flora species, and the process of clearing has potential to result in injury or mortality of native fauna species. Some species which are more sedentary are more prone to impact than others, such as Ornamental Snake. Conversely, migratory birds are unlikely to be impacted from vegetation clearing as they are more mobile and can disperse more easily.

The Project layout has been designed to minimise vegetation clearing and impacts on MNES habitats. This has included:

- making use of existing BWM infrastructure on site to avoid additional disturbance;
- avoiding the patch of Brigalow TEC and minimising clearing of riparian vegetation;

- avoiding vegetation clearance along the higher order watercourses of Two Mile Gully and Taurus Creek; and
- minimising creek crossings (number and width) and selecting locations to minimise disturbance.

The total estimated area of vegetation clearing is 14.32 ha including 10.53 ha of remnant vegetation and 3.79 ha of high-value regrowth. Impacted vegetation communities are detailed in Table 8.1. Clearance of potential MNES habitat is described in Table 8.2.

Table 8.1 Impacted Ground-truthed Regional Ecosystems

RE code	RE occurrence and community percentage	Area (ha)		
		HVR	Remnant	Total
11.3.1	11.3.1	0.0	10.53	10.53
	11.3.1/11.3.6 (90/10)	3.16	0.0	3.16
			Subtotal:	13.69
11.3.2	11.3.2/11.4.9 (50/50)	0.63	0.0	0.63
			Subtotal:	0.63
			Grand total:	14.32

Table 8.2 Estimated clearance of MNES habitat

MNES	Area impacted (ha)		Total area of habitat within Study area (ha)	
Communities				
Brigalow TEC	0		6.34	
Fauna				
Australian Painted Snipe (*Rostratula australis*)	Suitable – 94.31	Total – 94.31	Suitable – 689	Total – 689
Ornamental Snake (*Denisonia maculata*)	Preferred – 19.77	Total – 85.69	Preferred – 576.86	Total – 672.08
	Marginal – 65.92		Suitable – 95.22	
White-throated Needletail (*Hirundopus caudacutus*)	Approximately 3,761 but aerial species so no direct impact		Approximately 9,010	
Squatter Pigeon (*Geophaps scripta scripta*)	Preferred – 0	Total – 36.2	Preferred – 43.29	Total – 447.22
	Suitable – 0.63		Suitable – 313.4	
	Marginal – 35.57		Marginal – 90.53	
Koala (*Phascolarctos cinereus*)	Preferred – 0	Total – 26.9	Preferred – 11.24	Total – 373.13
	Suitable – 20.28		Suitable – 316.55	
	Marginal – 6.62		Marginal – 45.34	
Fork-tailed Swift (*Apus pacificus)*	Approximately 3,761 but aerial species so no direct impact		Approximately 9,010	
Latham's Snipe (*Gallinago hardwickii*)	Potential – 94.31	Total – 94.31	Potential – 689	Total – 689
Glossy Ibis (*Plegadis falcinellus*)	Potential – 94.31	Total – 94.31	Potential – 689	Total – 689

The following measures will be implemented to mitigate and manage impacts as much as practicable during vegetation clearing:

- Land clearing would be carried out progressively over the life of the Project to allow mobile fauna species the opportunity to disperse away from clearing areas.
- Pre-clearance fauna surveys will be undertaken by suitably experience and qualified persons to identify individual fauna at direct risk from clearing activities.
- A suitably qualified fauna spotter-catcher will be present during clearing of MNES and MSES habitat areas, working under the appropriate permits.
- Sequential clearing will occur in areas where remnant vegetation is to be cleared. Clearing will be done in such a way that arboreal fauna are given the opportunity to disperse from the area once clearing has commenced under their own volition.
- BWM procedures for managing injured wildlife will be followed.
- In the (unlikely) event any Koalas are observed, the habitat tree will be identified by flagging tape and/or marking spray on the tree, and nearby trees with overlapping crowns or trees that may impact the Koala's tree during felling will not be cleared until the Koala has moved from the area under its own volition. In most situations the Koala will move from the area overnight. As noted earlier in this report, no Koalas have been observed within the Study area despite 570 plus hours of survey.
- Felling of trees away from retained areas of vegetation where practicable. Where trees unavoidably fall into retained areas, they will be left in-situ to mimic natural tree fall and provide habitat for ground-dwelling fauna.
- Select micro-habitat features such as fallen logs and rocks will be salvaged and moved into adjacent habitat or collected and stored for use in rehabilitation areas.

8.2 Fragmentation

Terrestrial habitat connectivity may be reduced as a result of the Project as clearing has the potential to reduce fauna movement between areas of retained habitats. Such habitat fragmentation will be more prominent where clearing widths are larger, such as over 100m. Clearing linear widths through habitats also has the potential to increase edge effects (additional light entering forest, weed encroachment, feral animal abundance may increase and increased risk of bushfire) which can have a negative impact on ecological functions. Some species will be more prone to this fragmentation of habitat such as Ornamental Snake attempting to move across these larger clearings may prove to be a barrier.

Weed management, pest animal management and bushfire management measures will be implemented to minimise potential impacts from the Project on native species and their habitats.

Large areas of habitat will remain, including riparian corridors and areas of gilgai habitat. This will ensure the threatened species that are known or likely to utilise the Study area still have large areas they can utilise and move through, including to habitats outside the Study area.

The following measures will be implemented to mitigate and manage impacts of fragmentation (and associated edge effects):

- Fencing on site will give consideration to the movement of fauna.
- Clearing widths at creek crossings will be minimised.
- Clearing of native vegetation will be staged, and in out-of-pit disturbance areas habitat trees that can be retained, without compromising safety will be retained to minimise impacts to native fauna species.
- Weed and pest control measures will be implemented in accordance with the BWM procedures (BWM Land and Biodiversity Management Plan) to minimise degradation of habitats and edge effects as a result of the Project.

8.3 Erosion and sedimentation and leaks/spills

Without adequate controls in place, Project activities have the potential to result in erosion and sedimentation and leaks or spills.

Erosion and sedimentation and the accidental release of pollutants (including leaks and other uncontrolled releases) into the surrounding environment and waterways has the potential to degrade habitat quality in the Study area and impact vegetation communities and terrestrial fauna utilising these areas.

It is anticipated that based on implementation of management strategies (e.g erosion and sediment controls and management of hazardous materials) that potential impacts on surrounding habitats will be minimised.

SLR (2023a) conclude that the existing BWM surface water management measures are suitable to manage potential erosion and sedimentation and mitigate potential water quality impacts. Management and mitigation measures are currently conditioned in the existing BWM EA or managed through elements such as the Water Management Plan, Receiving Environment Monitoring Program (REMP), Sediment and Erosion Control Plan and Regulated Structures Design and Inspection Conditions. These plans will be reviewed and where required, updated to incorporate the Project. The Project will not require amendments to the conditions of the existing EA and existing release points will be maintained.

The following measures will be implemented to mitigate and manage potential impacts from erosion and sedimentation and leaks and spills, which have the potential to impact on MNES fauna habitats:

- The BWM Water Management Plan and BWM Erosion and Sediment Control Plan (ESCP) will be reviewed and updated, where necessary, to include the Project to manage water on site and erosion and sedimentation.
- Vehicles and equipment will be maintained to minimise risk of spill or leakage.
- Refuelling facilities, or storage facilities for hydrocarbons and chemicals will be in appropriately designed sites and comply with Australian Standards (eg AS 1940: The storage and handling of flammable and combustible liquids).
- Hazardous materials are to be provided and stored in sealed, labelled containers, without leaks.
- Fuels and chemicals will not be stored or handled within 200 m of waterbodies.
- Personnel will receive appropriate spill clean-up training.

- All vehicles and equipment to be cleaned in designated wash bays fitted with suitable pollution control equipment.

8.4 Bushfire risk

Fire is a natural part of the Australian landscape, and most vegetation communities are adapted to periodic fires. However, changes in the natural fire regime may result in changes in the species composition and / or structure of the vegetation. Potential for increased fire risk as a result of edge effects is discussed in Section 8.2. In addition, the increased presence of construction vehicles and personnel in the Study area may increase fire risk through use of machinery that may generate sparks, use of flammable liquids and idling vehicles being present in areas of ground vegetation.

The BWM Fire Management Plan and Standard Operating Procedure – Action to be taken on outbreak of Fire will be reviewed and updated, where necessary, to include the Project. The intent of the BWM Fire Management Plan is to ensure appropriate resources, systems and infrastructure are in place for the prevention and control of fire at Blackwater Mine, including:

- Fire prevention and control.
- Effective firefighting capability.
- Safety of personnel fighting fires.
- A Workplace Risk Assessment Control (WRAC) to identify all potential fire hazards at the mine.
- Availability at the mine, at all times, of equipment that is appropriate and sufficient to extinguish any potential fire identified by the WRAC.
- Location of portable fire extinguishers on or near equipment and installations identified as potential fire hazards by the WRAC.

Bush fire management strategies for planned burns are developed according to vegetation communities. No hazard reduction burns will be undertaken by BWM within the patch of Brigalow TEC.

As such, it is unlikely the Project would increase the bushfire potential within the surrounding landscape.

8.5 Noise/dust/lighting

These emissions are also associated with the existing BWM, and the landscape around the mine including the proposed extension footprint is heavily cleared, therefore these impacts are already in effect across the study area.

Noise may adversely affect fauna by interfering with communication (eg territorial bird song), masking the sound of predators and prey, causing avoidance reactions and displacement from habitat. Noise will be generated by the Project through the use of machinery, plant, vehicles, and equipment. The generation of noise may be in areas which have the potential to support threatened fauna species. Individuals that occur on or near the Project may leave the affected area.

Artificial lighting from infrastructure and machinery may impact fauna within the Study area. Artificial lighting can have a range of impacts which vary between species. Artificial light can disrupt patterns of both nocturnal and

diurnal species by eliciting responses. Some species may avoid brightly lit areas, potentially due to the perception of being increased risk of predation. Other potential adverse impacts include disruption of breeding and migratory patterns, disorientation and potential collision with structures. Conversely, some species such as nocturnal reptiles, frogs and bats may congregate at artificial light sources to feed on insects attracted to light. Site lighting will be kept to the minimum needed for safety during operation of the Project.

The extension of mining at BWM into SA10 (ML1759) and SA7 (ML1762) will result in ongoing and localised noise and vibration, dust and lighting disturbance in habitats directly adjacent to the Project.

Regarding noise, the extent of impacts will depend on the level of noise, the type of habitat and distance involved. Some species may be more susceptible to this disturbance. However, many species are likely to become habituated to background noise from routine mining operations, aside from the low level of impulsive noise occurring.

Dust emissions from the Project have the potential to temporarily and locally impact flora and fauna values in the vicinity of the Project. Excess generation of dust and subsequent deposition on leaves can impair plant photosynthesis and productivity (also resulting in reduced habitat quality for fauna), impact on respiratory systems of fauna, alter soil properties impacting on plant species assemblages. It is likely that such impacts will be restricted to the immediate vicinity of the project, and the landscape and vegetation communities of the study area is already adapted to a degree, to impacts from dust from the existing mine.

Dust management measures will continue to be implemented at the BWM and dust suppression implemented such as wetting down dirt roads. Areas which are not required for the ongoing operation of the Project will be rehabilitated as soon as practicable.

8.6 Weeds and pests

Project activities have the potential to increase the abundance of weed species in the Study area and facilitate dispersal of weed species. Uncontrolled movement of vehicles, equipment and personnel throughout the Study area is the key vector of transmission, in particular vehicles and equipment sourced from regions beyond the Study area which may introduce new species. Many weed species thrive on ground disturbance and will rapidly colonise disturbed areas in advance of native species recolonisation. Increased weed species abundance has the potential to adversely impacts on native vegetation and biodiversity.

If not managed, Project related activities also have the potential to increase pest fauna abundance in the Study area. This can lead to increased competition with, and predation of native fauna. In addition, habitat degradation may occur through vegetation trampling (eg Feral Pig wallowing). Creation of new access points into areas of intact vegetation may create pathways for feral fauna species to disperse. In addition, the creation of artificial water sources may increase the capacity of the area to support feral species such as Cane Toads. Uncontained waste sources may also attract feral fauna such as Wild Dog.

Most habitat observed across the Study area is considered of relative low quality due to broad-scale vegetation clearing, cattle grazing, weed encroachment and proximity of mining operations. Feral fauna was abundant across the Study area. With appropriate management, the Project is unlikely to significantly worsen existing baseline conditions.

The following measures will be implemented to mitigate and manage potential impacts from weeds and pests :

- BWM's weed and pest management procedures will be reviewed and where necessary, updated to incorporate the Project. The procedures support the BWM Land and Biodiversity Management Plan to manage the risks that weeds and feral animals pose to biodiversity by:

  - preventing the introduction of new weeds through the early detection of, and rapid response to new weeds;
  - identifying and controlling the spread of weeds and feral animal populations at BWM;
  - raising awareness and understanding of the risks associated with weeds and feral animals; and
  - ensuring compliance with regulatory and company requirements.

- Weed hygiene protocols will continue to be implemented using the dedicated vehicle and machinery cleaning bay located at the mine infrastructure area.
- Onsite waste disposal (especially food waste) to discourage presence of pest fauna. Waste will be stored in covered bins/skips to prevent fauna access.
- Rehabilitation materials (eg seed and hay) brought to site to be certified as weed free.
- Any herbicides used on site to be dispensed by an appropriately trained and qualified weed sprayer.

8.7 Fauna mortality

Direct fauna mortality may occur as a result of a Project during vegetation clearing (eg through removal of mature trees containing hollows), earthworks, vehicle collision, or through entrapment in trenches.

Excavation will be required to remove topsoil for pits to be extracted. This will involve removal of ground vegetation, soil and rock which provide fauna habitat (eg fallen timber). Removal of ground timber, and the layer of topsoil in gilgai areas has the potential to impact on Ornamental Snake.

Vehicle movements has the potential to kill or injure fauna on impact. Some species may be particularly susceptible to these impacts mainly ground dwelling or slow moving species.

Were there to be trenching activities, there is potential for fauna to fall into and become trapped in open trenches, where they may perish or become subject to increased predation risk. Particularly susceptible species groups include reptiles, frogs and small mammals.

The following measures will be implemented to minimise the potential for species mortality from Project activities:

- All personnel will be required to follow speed restrictions to minimise the chance of fauna strikes occurring.
- Suitably qualified personnel (eg fauna spotter-catcher) will undertake a pre-clearance survey of the permitted impact area, prior to the commencement of clearing and monitor all clearing works in known habitat.
- Personnel will be educated on the presence of native fauna including threatened species and the need to travel slowly and look out for fauna when driving.
- BWM procedures for managing injured wildlife will be followed.

- For any trenching activities, if trenches remain open after daily site works have been completed, escape ramps or planks and/or shelter (eg sawdust filled bags) for trapped fauna will be put in place. The amount of open trench will be minimised.

8.8 Groundwater Drawdown

The change in groundwater depths using the predicted groundwater drawdown (SLR, 2023c) at each patch of potential TGDE vegetation was assessed to determine the likelihood of impact this change would have on the mapped potential TGDE. The scale of impact was classified as (refer to Section 4.6.3):

- No impact, or
- Potential impact

The results of the assessment are presented in Figure 8.1 and Table 8.3 indicate:

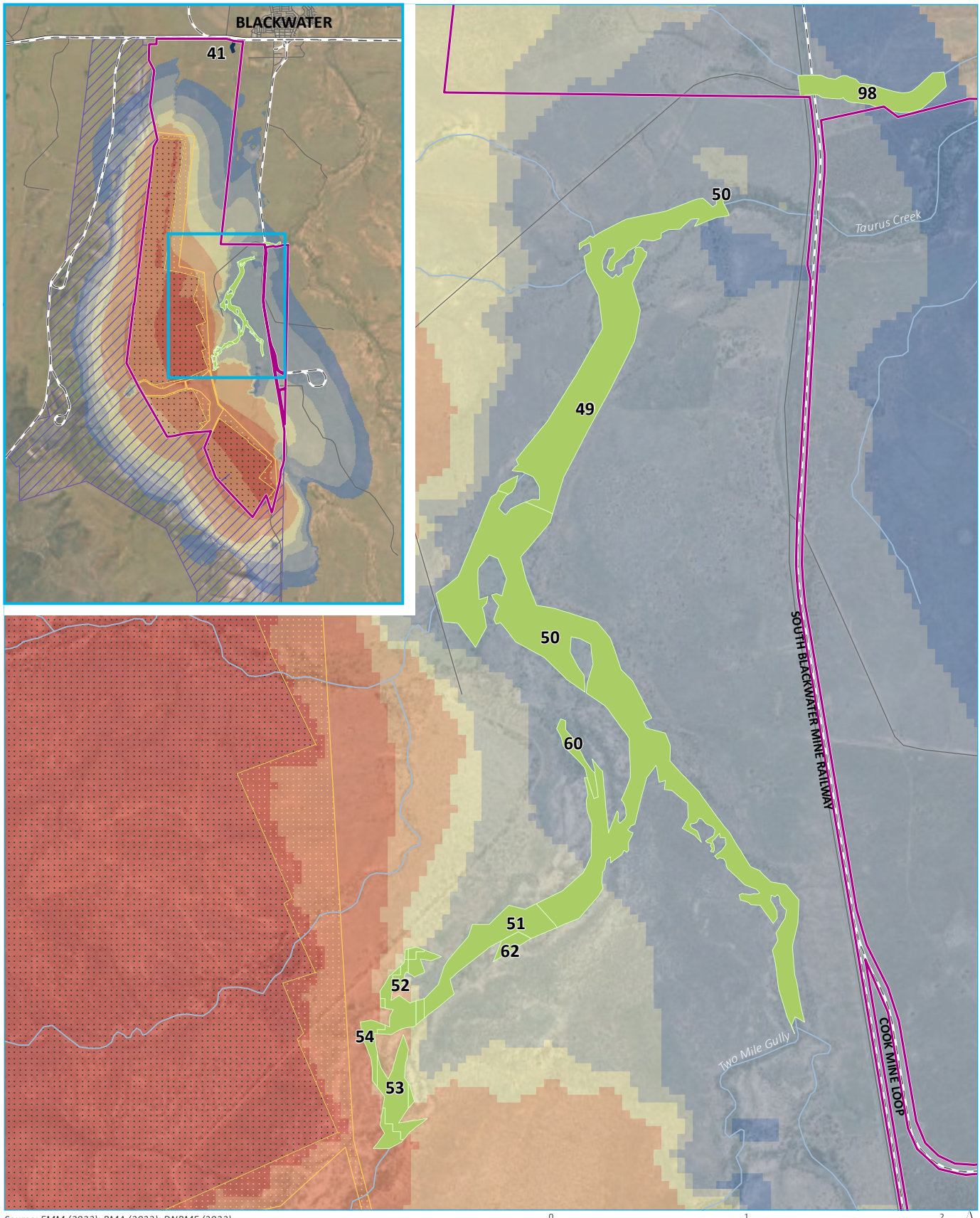
- One patch of RE11.3.1/11.3.2 (polygon ID 41) vegetation near the northern boundary of ML1759 is outside the predicted drawdown extent and therefore not be impacted.
- The patch of RE 11.3.1/11.3.25/11.3.2 (polygon ID 98) vegetation mapped by the Queensland Government as regrowth vegetation adjacent to the northern boundary of ML1762 is considered a potential impact however the drawdown is anticipated to range from 1-2 metres over the area of that patch predicted drawdown. So while the impact is identified as Potential impact the drawdown in this area ranged from mostly 1-2 m and remains within the rooting depth of potential TGDE vegetation.
- Two patches of dominant RE 11.3.25 (polygon ID 60 and 62) occur along Taurus Creek near the confluence with Two Mile Gully. The drawdown at these locations is predicted to exceed the 15 m rooting depth used for the assessment, however the use of groundwater by the vegetation requires site-specific assessment.
- The patches of RE 11.3.1/11.3.25 (polygon ID 49 and 50) contain the DES and the National identified potential GDEs (identified in Section 5.11 and Figure 6.3).
- Polygons 49-54 are part of a contiguous patch of RE 11.3.1/11.3.25 that is identified as having the potential to be impacted. The predicted groundwater drawdown is greater further upstream along Taurus Creek (south and closer to the proposed mine). This patch also aligns with the identified koala habitat in the Study area.

Table 8.3 Assessed Likelihood of impact to identified Potential TGDEs

Regional ecosystem	Polygon ID	Range of GWL (mbgl)	Predicted Drawdown range (mbgl)	Predicted Change in GWL range (mbgl)	Maximum Rooting depth (mbgl)	Area (Ha)	Impact category
11.3.1/11.3.2	*41*	0-10	0	0	5-10	4.04	No impact
11.3.1/11.3.25	*49*	12-19	1-2	14-21	5-15	35.9	Potential
11.3.1/11.3.25	*50*	*10-19*	3-5	13-24	5-15	71.27	Potential

Table 8.3 Assessed Likelihood of impact to identified Potential TGDEs

Regional ecosystem	Polygon ID	Range of GWL (mbgl)	Predicted Drawdown range (mbgl)	Predicted Change in GWL range (mbgl)	Maximum Rooting depth (mbgl)	Area (Ha)	Impact category
11.3.1/11.3.25	*51*	*12*	*6-10*	*18-31*	5-15	10.04	Potential
11.3.1/11.3.25	*52*	*14-21*	*11-19*	*26-30*	5-15	1.53	Potential
11.3.1/11.3.25	*53*	*15-21*	*21-50*	*35-68*	5-15	8.14	Potential
11.3.1/11.3.25	*54*	*15-18*	*51-65*	*43-84*	5-15	2.99	Potential
11.3.25	*60*	*13-17*	*3-4*	*16-21*	15	1.74	Potential
11.3.25	*62*	*15-18*	6-7	21-25	15	1.08	Potential
11.3.1/11.3.25 /11.3.2	*98*	*10-17*	*1-2*	*11-19*	5-15	8.1	Potential



Source: EMM (2023); BMA (2023); DNRME (2022)

0 1 2 km

GDA 1994 MGA Zone 55

N

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KEY

- Study area
- Existing mine area
- Rail line
- Major road
- Minor road
- Watercourse/drainage line

Indicative project footprint

- Proposed pit extent
- Proposed out of pit disturbance

Modelled maximum water table drawdown (m)

- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- > 100

Assessed Likelihood of Impact

- Potential
- No impact

Assessed Likelihood of impact to identified Potential TGDEs

Blackwater Mine - North Extension Project
Terrestrial MNES Assessment
Figure 8.1

EMM creating opportunities

8.8.1 Other considerations to TGDEs on site

It is important to consider that the risk to TGDEs across the Study area may be influenced over different time scales as the modelled maximums are incremental and will occur anytime between 2025 and 2085, as such some locations may have a greater effect near the beginning of the development than at the end of the modelled period. The impacts will not be linear and will likely change seasonally and in risk with prolonged exposure to drought and climate uncertainties.

The various plant species with a mixed community will have different tolerances and linkages to the changes in groundwater, the probability of impact is directly correlated to those GDE indicator species. However, for the purposes of this study we have used the TGDE indicator species to provide the probability of impact. Also depending at the rate in which drawdown occurs will affect the ability for an individual plant's roots to adapt to the change in depth. Other factors like the above ground biomass may influence resource availability to adapt the root system, as such groundwater drawdown may be associated with loss of condition and impaired growth even if some connection with groundwater is maintained (DNRME, 2019).

Potential terrestrial GDEs within the predicted drawdown extent are associated with riparian corridors, including RE 11.3.25, 11.3.1/11.3.25 and 11.3.1/11.3.25/11.3.2 (Figure 8.1). All potential TGDE communities are likely to be facultative, and not solely reliant on groundwater.

As the potential TGDEs are likely to be facultative, species may not necessarily be adversely impacted by a change in the depth to groundwater. Further site specific investigation of groundwater linkages to the potential TGDEs will be completed to determine whether the vegetation is a TGDE and if so, the likelihood and extent of impact. Depending on the outcomes of the site-specific assessment, a monitoring plan to identify the nature and extent of an impact (should it be realised) and facilitate application of targeted management actions, may be required.

9 MNES TEC, threatened and migratory species management

MNES management measures have been developed to be consistent with the S.M.A.R.T principle, to ensure that measures are:

- Specific – prescriptive, with no uncertainty or ambiguity around their purpose or implementation.
- Measurable – the status (i.e. success or failure) and outcomes/results can be measured.
- Achievable – through the chosen method of implementation, by the responsible personnel and within the specified timeframe.
- Relevant – to the action/impact being controlled and to the protected matter.
- Time bound – Measures were given specific and achievable timeframes for implementation in relation to specific development activities or stages.

Significant residual impact assessments have been carried out for MNES that are 'known' or 'likely' to occur in the Study area (see Section 7.1). These are based on the general avoidance and mitigation measures prescribed in Section 8, but also detailed impact mitigation methods according to specific MNES described in Table 9.1.

Table 9.1 summarises the impacts on MNES values and impact assessment findings. Significant impact assessments applying the Significant Impact Guidelines 1.1: Matters of National Environmental Significance (DoEE, 2013) are presented in Sections 7.1.1 to 7.1.9 alongside relevant contextual information for each MNES relating to ecology, habitat and occurrence in the Study area. The significance of impacts on MNES values have been assessed following consideration of general avoidance and mitigation measures described in Section 8, and specific mitigation relevant to each MNES described in Table 9.1.

Table 9.1 Summary of significance assessment

MNES	Area impact (ha)	SRI (yes/no) ?	Avoidance/mitigation measure (including timing and duration)	Effectiveness of measure	Performance outcome	Corrective actions
Communities						
Brigalow TEC	0	No	**Life of Project** The Project avoids clearing of this community. **Clearing activities** Clearing limits will be clearly defined as described in Section 8.1	Highly effective - avoided	No clearing of Brigalow TEC	Incident investigation to determine corrective actions (e.g. improved demarcation of clearance boundaries. review of clearing methods/protocols, increased training and review whether offset under EPBC Act is required if unauthorised clearance has occurred)
			Life of Project Implementation of the BWM Fire Management Plan and Standard Operating Procedure – Action to be taken on outbreak of Fire No hazard reduction burns will be undertaken by BWM within the patch of Brigalow TEC.	Effective management procedure to reduce the risk of bushfire	No hazard reduction burns within Brigalow TEC	Any incidence of bushfire within Brigalow TEC will be investigated to determine the requirement for additional controls. Potential adaptive management measures include revision of the BWM Fire Management Plan and Standard Operating Procedure and measures to increase personnel awareness of bushfire risk
Fauna						
Australian Painted Snipe (*Rostratula australis*)	Total – 94.31	No	**Clearing activities** Clearing limits will be clearly defined as described in Section 8.1	Highly effective – avoided	No clearing of species habitat outside approved limits	Incident investigation to determine corrective actions (e.g. improved demarcation of clearance boundaries, review of clearing methods/protocols and increased training.

Table 9.1 Summary of significance assessment

MNES	Area impact (ha)	SRI (yes/no) ?	Avoidance/mitigation measure (including timing and duration)	Effectiveness of measure	Performance outcome	Corrective actions
			Clearing activities Fauna spotter catchers to be present when clearing in Australian Painted Snipe habitat as described in Section 8.1	Moderate effectiveness – can be hard to detect due to cryptic nature of species – however likely to flush and disperse on activity in vicinity	No mortality of individuals as a result of Project clearing activities	Development and implementation of appropriate corrective actions, examples include but are not limited to: • Review of clearing methods • Review fauna spotter catcher protocols • Increased training
			Life of Project Implementation of the BWM Water Management Plan and BWM Erosion and Sediment Control Plan (ESCP)	Highly effective – industry standard	Site water management and erosion and sediment controls are effective.	Development and implementation of corrective actions (eg. installation of additional erosion controls, increase in frequency of inspections).
			Life of Project BWM's pest management procedures will be reviewed and where necessary, updated to incorporate the Project. The procedures support the BWM Land and Biodiversity Management Plan to manage the risks that feral animals pose to biodiversity by: • identifying and controlling the spread of feral animal populations at BWM; • raising awareness and understanding of the risks associated with feral animals; and • ensuring compliance with regulatory/company requirements.	Highly effective – industry standard	Observations or monitoring indicates no significant increase in pest animal presence, or evidence of damage to MNES habitats.	Development and implementation of corrective actions based on nature and extent of impact, which may include increasing the frequency/extent of control efforts, alternative control strategies and monitoring.
			Life of Project BWM's weed management procedures will be reviewed and where necessary, updated to incorporate the Project. The procedures support the	Highly effective – industry standard	Monitoring indicates no significant increase in cover or presence of weeds,	Development and implementation of corrective actions based on nature and extent of impact, which may include increasing the frequency/extent of control efforts, alternative control strategies and monitoring.

Table 9.1 Summary of significance assessment

MNES	Area impact (ha)	SRI (yes/no) ?	Avoidance/mitigation measure (including timing and duration)	Effectiveness of measure	Performance outcome	Corrective actions
			BWM Land and Biodiversity Management Plan to manage the risks that weeds pose to biodiversity by: • preventing the introduction of new weeds through early detection of, and rapid response to new weeds; • identifying and controlling spread of weeds at BWM; • raising awareness and understanding of the risks associated with weeds; and • ensuring compliance with regulatory and company requirements. Weed hygiene protocols will continue to be implemented using the dedicated vehicle and machinery cleaning bay located at the mine infrastructure area.			
Ornamental Snake (*Denisonia maculata*)	Total – 85.69	**Yes**	**Clearing activities** Clearing limits will be clearly defined as described in Section 8.1	Highly effective - avoided	No clearing of species habitat outside approved limits	Incident investigation to determine corrective actions (eg. improved demarcation of clearance boundaries, review of clearing methods/protocols and increased training
			Clearing activities Fauna spotter catchers to be present when clearing in Ornamental Snake habitat as described in Section 8.1.	Effectiveness is likely to be dependent on whether individual(s) move from their shelter and are able to be caught during the clearing activities	Low mortality of individuals as a result of Project clearing activities	Development and implementation of appropriate corrective actions, including but not limited to: • Review and revision of fauna spotter catcher protocols • Pre-clearance surveys/trapping of target fauna

Table 9.1 Summary of significance assessment

MNES	Area impact (ha)	SRI (yes/no) ?	Avoidance/mitigation measure (including timing and duration)	Effectiveness of measure	Performance outcome	Corrective actions
			Clearing activities For any trenching activities, if trenches remain open after daily site works have been completed, escape ramps or planks and/or shelter (eg sawdust filled bags) for trapped fauna will be put in place. The amount of open trench will be minimised y, as described in Section 8.7.	Highly effective – standard industry practice to ensure trapped animals do not perish	No trapped Ornamental Snake perish	Development and implementation of appropriate corrective actions (e.g. increase frequency of inspections, modify measures implemented to allow fauna to escape, limit extent of disturbance at any time)
			Clearing activities Select micro-habitat features such as fallen logs and rocks salvaged during clearing activities and moved into adjacent habitat or collected and stored for use in rehabilitation areas	Effective if salvaged carefully and placed strategically to enhance existing habitat	Select micro-habitat features have been salvaged during clearing activities	If monitoring/auditing of the vegetation clearance protocol indicates this has not occurred, corrective actions will be implemented.
			Life of Project Implementation of the BWM Water Management Plan and BWM Erosion and Sediment Control Plan (ESCP)	Highly effective – industry standard	Site water management and erosion and sediment controls are effective.	Development and implementation of corrective actions (eg. installation of additional erosion controls, increase in frequency of inspections).
			Life of Project BWM's pest management procedures will be reviewed and where necessary, updated to incorporate the Project. The procedures support the BWM Land and Biodiversity Management Plan to manage the risks that feral animals pose to biodiversity by: • identifying and controlling the spread of feral animal populations at BWM; • raising awareness and understanding of the risks associated with feral animals; and • ensuring compliance with regulatory/company requirements.	Highly effective – industry standard	Observations or monitoring indicates no significant increase in pest animal presence, or evidence of damage to MNES habitats.	Development and implementation of corrective actions based on nature and extent of impact, which may include increasing the frequency/extent of control efforts, alternative control strategies and monitoring.

Table 9.1 Summary of significance assessment

MNES	Area impact (ha)	SRI (yes/no) ?	Avoidance/mitigation measure (including timing and duration)	Effectiveness of measure	Performance outcome	Corrective actions
			Life of Project BWM's weed management procedures will be reviewed and where necessary, updated to incorporate the Project. The procedures support the BWM Land and Biodiversity Management Plan to manage the risks that weeds pose to biodiversity by: • preventing the introduction of new weeds through early detection of, and rapid response to new weeds; • identifying and controlling spread of weeds at BWM; • raising awareness and understanding of the risks associated with weeds; and • ensuring compliance with regulatory and company requirements. Weed hygiene protocols will continue to be implemented using the dedicated vehicle and machinery cleaning bay located at the mine infrastructure area.	Highly effective – industry standard	Monitoring indicates no significant increase in cover or presence of weeds,	Development and implementation of corrective actions based on nature and extent of impact, which may include increasing the frequency/extent of control efforts, alternative control strategies and monitoring.
White-throated Needletail (*Hirundopus caudacutus*)	c. 3,761 but aerial species	No	**Clearing activities** Clearing limits will be clearly defined as described in Section 8.1	Highly effective - avoided	No clearing of species habitat outside approved limits	Incident investigation to determine corrective actions (e.g. improved demarcation of clearance boundaries, review of clearing methods/protocols and increased training).

Table 9.1 Summary of significance assessment

MNES	Area impact (ha)	SRI (yes/no) ?	Avoidance/mitigation measure (including timing and duration)	Effectiveness of measure	Performance outcome	Corrective actions
Squatter Pigeon (*Geophaps scripta scripta*)	Total – 36.2	No	**Clearing activities** Clearing limits will be clearly defined as described in Section 8.1	Highly effective - avoided	No clearing of species habitat outside approved limits	Incident investigation to determine corrective actions (eg. increased signage and/or temporary fencing, review clearing methods, increased training and review whether offset under EPBC Act is required if unauthorised clearance has occurred).
			Clearing activities Fauna spotter catchers to be present when clearing in Squatter Pigeon habitat as described in Section 8.1.	Highly effective – industry standard	No mortality of individuals as a result of Project activities	Development and implementation of appropriate corrective actions, examples include: • Review of clearing methods • Review fauna spotter catcher protocols • Increased training
			Life of Project Implementation of the BWM Water Management Plan and BWM Erosion and Sediment Control Plan (ESCP)	Highly effective – industry standard	Site water management and erosion and sediment controls are effective.	Development and implementation of corrective actions (eg. installation of additional erosion controls, increase in frequency of inspections).

Table 9.1 Summary of significance assessment

MNES	Area impact (ha)	SRI (yes/no) ?	Avoidance/mitigation measure (including timing and duration)	Effectiveness of measure	Performance outcome	Corrective actions
			Life of Project BWM's pest management procedures will be reviewed and where necessary, updated to incorporate the Project. The procedures support the BWM Land and Biodiversity Management Plan to manage the risks that feral animals pose to biodiversity by: • identifying and controlling the spread of feral animal populations at BWM; • raising awareness and understanding of the risks associated with feral animals; and • ensuring compliance with regulatory/company requirements.	Highly effective – industry standard	Observations or monitoring indicates no significant increase in pest animal presence, or evidence of damage to MNES habitats.	Development and implementation of corrective actions based on nature and extent of impact, which may include increasing the frequency/extent of control efforts, alternative control strategies and monitoring.

Table 9.1 Summary of significance assessment

MNES	Area impact (ha)	SRI (yes/no) ?	Avoidance/mitigation measure (including timing and duration)	Effectiveness of measure	Performance outcome	Corrective actions
			Life of Project BWM's weed management procedures will be reviewed and where necessary, updated to incorporate the Project. The procedures support the BWM Land and Biodiversity Management Plan to manage the risks that weeds pose to biodiversity by: • preventing the introduction of new weeds through early detection of, and rapid response to new weeds; • identifying and controlling spread of weeds at BWM; • raising awareness and understanding of the risks associated with weeds; and • ensuring compliance with regulatory and company requirements. Weed hygiene protocols will continue to be implemented using the dedicated vehicle and machinery cleaning bay located at the mine infrastructure area.	Highly effective – industry standard	Monitoring indicates no significant increase in cover or presence of weeds,	Development and implementation of corrective actions based on nature and extent of impact, which may include increasing the frequency/extent of control efforts, alternative control strategies and monitoring.
			Life of project Personnel will be required to follow speed restrictions to minimise the chance of fauna strikes occurring	Highly effective – industry standard	Low incidence of vehicle strike.	Increase signage and/or reduction in speed limits at selected locations

Table 9.1 Summary of significance assessment

MNES	Area impact (ha)	SRI (yes/no) ?	Avoidance/mitigation measure (including timing and duration)	Effectiveness of measure	Performance outcome	Corrective actions
Koala (*Phascolarctos cinereus*)	Direct Total – 26.9 Potential indirect impact total- 132.66 (further assessment of potential TGDEs and likelihood of impact required)	No	**Life of Project** Project disturbance footprint has been developed to minimise direct disturbance to Koala habitat. **Clearing activities** Clearing limits will be clearly defined as described in Section 8.1	Highly effective – avoided	Clearing of Koala habitat has been minimised No clearing of species habitat outside approved limits	Incident investigation to determine corrective actions (e.g. improved demarcation of clearance boundaries, review of clearing methods/protocols, and increased training
			Clearing activities Fauna spotter catchers to be present when clearing in Koala habitat as described in Section 8.1 including use of sequential clearing techniques. In the (unlikely) event any Koalas are observed, the habitat tree will be identified by flagging tape and/or marking spray on the tree, and nearby trees with overlapping crowns or trees that may impact the Koala's tree during felling will not be cleared until the Koala has moved from the area under its own volition. Any incidence of Koala mortality or injury will be recorded. Injured fauna will be taken to a wildlife carer or veterinarian.	Highly effective – industry standard	No mortality of individuals as a result of Project clearing activities	Development and implementation of appropriate corrective actions, including but not limited to: • Review of clearing methods • Review fauna spotter catcher protocols • Increased training

Table 9.1 Summary of significance assessment

MNES	Area impact (ha)	SRI (yes/no) ?	Avoidance/mitigation measure (including timing and duration)	Effectiveness of measure	Performance outcome	Corrective actions
			Life of Project BWM's pest management procedures will be reviewed and where necessary, updated to incorporate the Project. The procedures support the BWM Land and Biodiversity Management Plan to manage the risks that feral animals pose to biodiversity by: • identifying and controlling the spread of feral animal populations at BWM; • raising awareness and understanding of the risks associated with feral animals; and • ensuring compliance with regulatory/company requirements.	Highly effective – industry standard	Observations or monitoring indicates no significant increase in pest animal presence, or evidence of damage to MNES habitats.	Development and implementation of corrective actions based on nature and extent of impact, which may include increasing the frequency/extent of control efforts, alternative control strategies and monitoring.

Table 9.1 Summary of significance assessment

MNES	Area impact (ha)	SRI (yes/no) ?	Avoidance/mitigation measure (including timing and duration)	Effectiveness of measure	Performance outcome	Corrective actions
			Life of Project BWM's weed management procedures will be reviewed and where necessary, updated to incorporate the Project. The procedures support the BWM Land and Biodiversity Management Plan to manage the risks that weeds pose to biodiversity by: • preventing the introduction of new weeds through early detection of, and rapid response to new weeds; • identifying and controlling spread of weeds at BWM; • raising awareness and understanding of the risks associated with weeds; and • ensuring compliance with regulatory and company requirements. Weed hygiene protocols will continue to be implemented using the dedicated vehicle and machinery cleaning bay located at the mine infrastructure area.	Highly effective – industry standard	Monitoring indicates no significant increase in cover or presence of weeds,	Development and implementation of corrective actions based on nature and extent of impact, which may include increasing the frequency/extent of control efforts, alternative control strategies and monitoring.
			Life of Project Implementation of the BWM Fire Management Plan and Standard Operating Procedure – Action to be taken on outbreak of Fire	Effective management procedure to reduce the risk of bushfire	Fire management measures are effective in preventing bushfire within Koala habitat	Any incidence of bushfire within Koala habitat will be investigated to determine the requirement for additional controls. Potential adaptive management measures include revision of the BWM Fire Management Plan and Standard Operating Procedure and measures to increase personnel awareness of bushfire risk

Table 9.1 Summary of significance assessment

MNES	Area impact (ha)	SRI (yes/no) ?	Avoidance/mitigation measure (including timing and duration)	Effectiveness of measure	Performance outcome	Corrective actions
			Life of project Personnel will be required to follow speed restrictions to minimise the chance of fauna strikes occurring	Highly effective – industry standard	No incidence of vehicle strike.	Increase signage and/or reduction in speed limits at selected locations
			Before and Life of project • To confirm indirect risks to koala habitat BWM will complete further site specific investigation to confirm groundwater linkages and assess the risk of impact to TGDEs. • Depending on the outcomes of the site-specific assessment, a monitoring plan to identify the nature and extent of an impact (should it be realised) in preferred and suitable koala habitat and facilitate application of targeted management actions, may be required.	Highly effective – industry standard	Project groundwater drawdown does not result in a significant impact to preferred or suitable Koala habitat	Implementation of targeted management actions or provision of offsets.
Fork-tailed Swift (*Apus pacificus)*	c. 3,761 but aerial species so no direct impact	No	**Clearing activities** Clearing limits will be clearly defined as described in Section 8.1	Highly effective - avoided	No clearing of species habitat outside approved limits	Incident investigation to determine corrective actions (e.g. improved demarcation of clearance boundaries, review of clearing methods/protocols and increased training).
Latham's Snipe (*Gallinago hardwickii*)	Total – 94.31	No	**Clearing activities** Clearing limits will be clearly defined as described in Section 8.1	Highly effective – avoided	No clearing of species habitat outside approved limits	Incident investigation to determine corrective actions (e.g. improved demarcation of clearance boundaries, review of clearing methods/protocols and increased training.

Table 9.1 Summary of significance assessment

MNES	Area impact (ha)	SRI (yes/no) ?	Avoidance/mitigation measure (including timing and duration)	Effectiveness of measure	Performance outcome	Corrective actions
Glossy Ibis (*Plegadis falcinellus*)			**Life of Project** Implementation of the BWM Water Management Plan and BWM Erosion and Sediment Control Plan (ESCP)	Highly effective – industry standard	Site water management and erosion and sediment controls are effective.	Development and implementation of corrective actions (eg. installation of additional erosion controls, increase in frequency of inspections).
			Life of Project BWM's pest management procedures will be reviewed and where necessary, updated to incorporate the Project. The procedures support the BWM Land and Biodiversity Management Plan to manage the risks that feral animals pose to biodiversity by: • identifying and controlling the spread of feral animal populations at BWM; • raising awareness and understanding of the risks associated with feral animals; and • ensuring compliance with regulatory/company requirements.	Highly effective – industry standard	Observations or monitoring indicates no significant increase in pest animal presence, or evidence of damage to MNES habitats.	Development and implementation of corrective actions based on nature and extent of impact, which may include increasing the frequency/extent of control efforts, alternative control strategies and monitoring.
			Life of Project BWM's weed management procedures will be reviewed and where necessary, updated to incorporate the Project. The procedures support the BWM Land and Biodiversity Management Plan to manage the risks that weeds pose to biodiversity by: • preventing the introduction of new weeds through early detection of, and rapid response to new weeds;	Highly effective – industry standard	Monitoring indicates no significant increase in cover or presence of weeds,	Development and implementation of corrective actions based on nature and extent of impact, which may include increasing the frequency/extent of control efforts, alternative control strategies and monitoring.

Table 9.1 Summary of significance assessment

MNES	Area impact (ha)	SRI (yes/no)?	Avoidance/mitigation measure (including timing and duration)	Effectiveness of measure	Performance outcome	Corrective actions
			• identifying and controlling spread of weeds at BWM; • raising awareness and understanding of the risks associated with weeds; and • ensuring compliance with regulatory and company requirements. Weed hygiene protocols will continue to be implemented using the dedicated vehicle and machinery cleaning bay located at the mine infrastructure area.			

10 Offset Requirements

Environmental offsets are required to be delivered in accordance with the *EPBC Act Environmental Offsets Policy* (DoEE 2012) for MNES where a significant, residual impact is predicted to occur after avoidance and mitigation measures are considered. Where appropriate, offsets are considered during the assessment phase of an environmental impact assessment under the EPBC Act (DoEE 2012). Offsets do not reduce the likely impacts of a proposed action, but instead compensate for any significant residual impact.

Significant impact assessments have been completed, and it was found a significant impact will occur to Ornamental Snake as a result of the Project.

It is proposed land-based offsets will be assessed and details provided in an Environmental Offset Strategy for the Project prior to approval being granted which will include confirmation of the offset delivery approach and land-based offset options. Subsequent to the Offset Strategy, an offset area will be finalised and preparation of an Offset Area Management Plan (OAMP) commenced.

An OAMP will be prepared to meet the offset requirements under the EPBC Act Environmental Offsets Policy. The OAMP will provide details of the management actions and monitoring requirements necessary to achieve a conservation outcome for the MNES matters required to be offset for the Project. The OAMP will be submitted for DCCEEW approval prior to Project commencement.

11 Conclusion

Most of the habitat across the Study area is considered low quality due to broad-scale vegetation clearing, cattle grazing, weed encroachment and fragmentation. The areas of non-remnant vegetation are now largely dominated by introduced Buffel Grass, have been raked of woody debris and rocks, and continue to be grazed by livestock. Areas of good quality habitat are limited and usually constrained to small vegetation fragments or as narrow corridors fringing creek and drainage-lines.

Results of the field ecology surveys have found that while the Study area has large disturbed areas of poor condition, there are areas which support ecological values, including listed species and communities under the EPBC Act. The key ecological values identified during the flora, fauna and habitat assessments are summarised below.

a Vegetation communities

Ground-truthed vegetation communities in the Study area included the following REs:

- RE11.3.1 *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains;
- RE11.3.2 *Eucalyptus populnea* woodland on alluvial plains;
- RE11.3.3 *Eucalyptus coolabah* woodland on alluvial plains;
- RE11.3.6 *Eucalyptus melanophloia* woodland on alluvial plains;
- RE11.3.25 *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines; and
- RE11.4.9 *Acacia harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains.

Remnant RE11.3.1 mapped along Sagittarius Creek, Taurus Creek and Two Mile Gully represent the largest tract of vegetation within the Study area with a patch of RE11.3.1 along Taurus Creek (6.34 ha) also meeting structural and conditional thresholds for Brigalow TEC.

Remnant sites 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 these sites presented in relatively good condition, all possessed some level of exotic encroachment, most commonly by Buffel Grass dominating the ground layer. All sites also showed evidence of disturbance either by cattle grazing, previous vegetation clearance, or weed encroachment.

b Protected plants

Threatened flora species identified by the desktop assessment were targeted during the flora surveys. No EPBC Act listed species were recorded and there is considered to be a low likelihood of occurrence of those species with potential to occur.

c Fauna habitat assessments

Habitat assessments were completed at 165 sites. Specific habitat attributes were analysed at each site to confirm suitable habitat features for particular threatened species and provide justification for the potential presence or absence of a species due to the presence or absence of suitable microhabitats.

Most habitat observed across the Study 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 Study area is largely fragmented with habitat limited in extent and typically constrained to riparian zones.

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

d Threatened and migratory fauna species

Four threatened and three migratory fauna species were recorded during field surveys. Recorded threatened species include the Australian Painted Snipe via direct observations in an area of gilgai on ML1762 to the east of Taurus Creek within the Study area but outside of the Project footprint, and on two dams in the west of the Study area (one within the project footprint and one outside), Ornamental Snake in an area of gilgai on ML1762 to the east of Taurus Creek (outside the project footprint) and Squatter Pigeon on two occasions in the general vicinity of dams around Taurus Road (one within the Project footprint). Additionally, old signs of Koala (old scratches) were observed.

These records of the nomadic species, Australian Painted Snipe, suggest it may occur on any natural or artificial wetland habitat within the Study area when conditions are suitable. This species is most likely to utilise ephemeral habitat on site in the wet season then leave once these areas dry up. There is potential that it could remain year-round on larger dams that retain water and have suitable fringing vegetation cover, or other permanent water bodies.

The Ornamental Snake were found in close proximity to each other in an area of gilgai between Taurus Creek and the Blackwater-Rolleston Road on ML1762. It is likely that Ornamental Snake is scarce in the Study area, as only three were found during three nights of searching during March 2020, despite good conditions. Some of the gilgai areas in the Study area are heavily degraded or isolated, and are not considered likely to hold this species (see Section 7.1.3).

Squatter Pigeon was recorded on two occasions in supplementary ecology surveys commissioned in June-August 2023, despite not being recorded in over 600 hours in the earlier baseline surveys. They were recorded in the vicinity of two dams around Taurus Road, and are likely to be scarce in the Study area, reflective of the degraded nature of the habitat and extensive Buffel Grass areas.

Koala was also recorded via indirect observation of old scratches on Queensland Blue Gums along Taurus Creek as well as old scratches on an unnamed creek and a scat along this creek (see Figure 7.4). The scratches on Taurus Creek were present in a small backwater of the main creek line, which was fringed by Queensland Blue Gum which is a preferred foraging resource. Despite extensive transects along creek lines across the remainder of the Study area, no other signs of Koalas were observed, and it is likely that its status in the Study area is limited to occasional transient individuals.

Additionally, the migratory listed (EPBC Act) Latham's Snipe, Glossy Ibis and Fork-tailed Swift were recorded during field surveys.

e Summary of MNES significant residual impact assessment

Based on completed impact assessments it has been assessed that a significant impact may occur to Ornamental Snake as a result of the Project. Therefore offsets will be assessed and proposed for this species in line with the EPBC Act Environmental Offsets Policy. A summary of the significant residual impact assessments is provided below:

- **Brigalow TEC –** no clearing or disturbance to Brigalow TEC will occur. The Brigalow TEC patch is >2km from any proposed clearing or infrastructure and surrounding vegetation on Taurus Creek will not be disturbed. The Project will not have a significant impact on the Brigalow TEC.

- **Australian Painted Snipe –** this nomadic species is likely to only be a sporadic visitor to the Study area when conditions are suitable. No significant impacts are predicted on this species.

- **Ornamental Snake –** conservatively, although Ornamental Snake has not been recorded in the patches of gilgai to be cleared by the Project, their occurrence in the area of preferred gilgai habitat, is assumed. Therefore clearing of areas of habitat constitutes a significant impact on the species.

- **Koala –** the Study area does not contain extensive areas of contiguous eucalypt woodland, or retain connectivity to such areas. As such, the habitat mapped has been assessed as marginal for the species as it is highly fragmented and limited in extent, and the likelihood of the species occurring is low. The Project is not likely to have a significant impact on this species.

- **White-throated Needletail –** The Project is not expected to have a significant residual impact on White-throated Needletail habitat. It is an aerial species not likely to be impacted by the Project.

- **Squatter Pigeon –** based on an evaluation of all criteria, the Project is considered unlikely to have a significant impact on the Squatter Pigeon. The population is unlikely to be an important population, and the species appears to be scarce in the Study area due to large expanses being dominated by unsuitable exotic pasture with high density of ground cover.

- **Latham's Snipe –** although habitat will be cleared for the Project, the loss of this habitat will not have a significant impact on Latham's Snipe and the risk of an impact on an ecologically significant proportion of the population is considered to be low.

- **Fork-tailed Swift –** The Project will not have a significant residual impact on Fork-tailed Swift habitat and the risk of an impact on an ecologically significant proportion of the population is considered to be low. It is an aerial species not likely to be impacted by the Project.

- **Glossy Ibis –** although habitat will be cleared for the Project, the loss of this habitat will not have a significant impact on Glossy Ibis and the risk of an impact on an ecologically significant proportion of the population is considered to be low.

References

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.

BOM 2019b, *Groundwater Dependent Ecosystem Atlas*, retrieved 22 November 2019 from http://www.bom.gov.au/water/groundwater/gde/map.shtml

Borsboom, A.C., Couper P.J., Amey A., Hobson R. & Wilson S.K. (In prep.). (2008). Rediscovery of the endangered Retro Slider (*Lerista allanae*) in the Clermont region of central Queensland. Scientific report. Queensland Department of Environment and Resource Management and the Queensland Museum. Scientific report, Queensland Department of Environment and Resource Management and the Queensland Museum, Brisbane.

Bureau of Meteorology (BoM) 2019a, *Blackwater, Queensland December 2018 to November 2019 daily weather observations*, retrieved 9 December 2019 from http://www.bom.gov.au/climate/dwo/IDCJDW4013.latest.shtml

Bureau of Meteorology (BoM) 2020a, *Blackwater, Queensland January 2020 to March 2020 daily weather observations*, retrieved 14 April 2020 from http://www.bom.gov.au/climate/dwo/IDCJDW4013.latest.shtml

Business Queensland 2020, Identifying invasive freshwater animals, viewed 16 January 2020, https://www.qld.gov.au/environment/plants-animals/animals/pests-diseases/invasive-fish/identifying

Catchment Solutions 2015, *Preliminary investigation into the distribution of Tilapia in the upper Fitzroy Catchment*. Catchment Solutions Pty Ltd. Mackay.

Clayton PD, Fielder DP, Howell S and Hill CJ (2006), Aquatic Biodiversity Assessment and Mapping Method (AquaBAMM): a conservation values assessment tool for wetlands with trial application in the Burnett River catchment. Environmental Protection Agency, Brisbane.

Commonwealth of Australia 2022. National Recovery Plan for the Australian Painted Snipe (*Rostratula australis*).

Department of Agriculture and Fisheries (DAF) 2016, Mapping data – *Queensland Waterways for Waterway Barrier Works*, Version 10.0. Queensland Government, Brisbane.

Department of Agriculture and Fisheries (DAF) 2017, *What is a waterway barrier work?*, retrieved 20 November 2019 from https://www.daf.qld.gov.au/business-priorities/fisheries/habitats/policies-guidelines/factsheets/what-is-a-waterway-barrier-work#:~:targetText=Causeways%20are%20waterway%20crossings%20constructed,movement%2C%20particularly%20at%20lower%20flows.

Department of Agriculture, Water and the Environment (DAWE) 2022. National Recovery Plan for the Koala *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory)

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2022. Conservation Advice for *Petauroides volans* (greater glider (southern and central)). Retrieved from http://www.environment.gov.au/biodiversity/threatened/species/pubs/254-conservation-advice-05072022.pdf

DCCEEW 2023a. *Geophaps scripta scripta in Species Profile and Threats Database*, Retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64440

DCCEEW 2023b. *Denisonia maculata in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1193

DCCEEW 2023c. *Phascolarctos cinereus in Species Profile and Threats Database* retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85104

DCCEEW 2023d. *Chalinolobus dwyeri in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=183

DCCEEW 2023e. *Grantiella picta in Species Profile and Threats Database*, retrieved from https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=470

DCCEEW 2023f. *Aristida annua in Species Profile and Threats Database*, retrieved from https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=17906

DCCEEW 2023g. *Bertya opponens in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=13792

DCCEEW 2023h. *Cadellia pentastylis in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=9828

DCCEEW 2023i. *Dichanthium setosum in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=14159

DCCEEW 2023j. *Eucalyptus raveretiana in Species Profile and Threats Database*, retrieved from https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=16344

DCCEEW 2023k. *Homoranthus decumbens in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=55186

DCCEEW 2023l. *Marsdenia brevifolia in Species Profile and Threats Database*, retrieved from https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64585

DCCEEW 2023m. *Phaius australis in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=5872

DCCEEW 2023n. *Rostratula australis in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=77037

DCCEEW 2023o. *Gallinago hardwickii in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=863

DCCEEW 2023p. *Apus pacificus in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=678

DCCEEW 2023q. *Hirundapus caudacutus in Species Profile and Threats Database*, retrieved from https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=682

DCCEEW 2023r. Brigalow TEC in *Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=28

DCCEEW 2023s. *Antechinus argenteus* in *Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=88218

DCCEEW 2023t. *Calidris ferruginea in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=856

DCCEEW 2023u. *Delma torquata in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1656

DCCEEW 2023v. *Egernia rugosa in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1420

DCCEEW 2023w. *Erythrotriorchis radiatus in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=942

DCCEEW 2023x. *Furina dunmalli in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59254

DCCEEW 2023y. *Neochmia ruficauda ruficauda in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=26027

DCCEEW 2023z. *Onychogalea fraenata in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=239

DCCEEW 2023aa. *Poephila cincta cincta in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64447

DCCEEW 2023ab. *Rheodytes leukops in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1761

DCCEEW 2023ac. *Turnix melanogaster in Species Profile and Threats Database*, retrieved from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=923

Department of Environment (DoE) 2008a, *Approved conservation advice for Daviesia discolor*, retrieved 18 November 2019 from http://www.environment.gov.au/biodiversity/threatened/species/pubs/3567-conservation-advice.pdf

Department of Environment DoE 2008b, *Approved conservation advice for Polianthion minutiflorum*, retrieved 18 November 2019 from http://www.environment.gov.au/biodiversity/threatened/species/pubs/24514-conservation-advice.pdf

Department of Environment DoE 2008c, *Approved conservation advice for Logania diffusa*, retrieved 18 November 2019 from http://www.environment.gov.au/biodiversity/threatened/species/pubs/24159-conservation-advice.pdf

Department of Environment DoE 2009. Weeping Myall Woodlands A nationally threatened ecological community Environment Protection and Biodiversity Conservation Act 1999 Policy Statement 3.17

Department of Environment DoE 2013a, *Approved conservation advice for Dichanthium queenslandicum (king blue-grass)*, retrieved 18 November 2019 from http://www.environment.gov.au/biodiversity/threatened/species/pubs/5481-conservation-advice.pdf

Department of Environment DoE 2013b. Department of the Environment (DoE) (2013). *Matters of National Environmental Significance Significant Impact Guidelines 1.1*. Commonwealth of Australia.

Department of Environment DoE 2013c, *Approved Conservation Advice for the Brigalow (Acacia harpophylla dominant and co-dominant) ecological community,* retrieved 24 May 2021 from http://www.environment.gov.au/biodiversity/threatened/communities/pubs/028-conservation-advice.pdf

Department of Environment DoE 2013d *Conservation advice Rostratula australis*, retrieved 24 May 2021 from http://www.environment.gov.au/biodiversity/threatened/species/pubs/77037-conservation-advice.pdf

Department of Environment DoE 2014a, *EPBC Act referral guidelines for the vulnerable Koala*, Australian Government.

Department of Environment DoE 2014b, *Approved Conservation Advice for Denisonia maculata (Ornamental Snake),* retrieved 24 May 2021 from http://www.environment.gov.au/biodiversity/threatened/species/pubs/1193-conservation-advice.pdf

Department of Environment DoE 2015. *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act*. Commonwealth of Australia.

Department of Environment DoE 2016. EPBC Act referral guideline for the endangered northern quoll *Dasyurus hallucatus* EPBC Act Policy Statement

Department of Environment DoE 2017, *EPBC Act Policy Statement 3.21 Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species*.

Department of Environment and Heritage Protection (DEHP) 2017, *Guide to determining terrestrial habitat quality: A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy Version 1.2 April 2017*, Queensland Government

Department of Environment and Resource Management (DERM) 2010, Fitzroy Natural Resource Management Bioregion Back on Track Actions for Biodiversity. Queensland Government, Brisbane.

Department of Environment and Science, Queensland (2013) Wetland indicator plants of potential groundwater dependent ecosystem aquifer mapping extent, WetlandInfo website, accessed 31 October 2023. Available at: https://wetlandinfo.des.qld.gov.au/wetlands/facts-maps/wildlife/?AreaID=gde-potential-aquifer-extent&Kingdom=plants&SpeciesFilter=WetlandIndicator

Department of Environment and Science (DES) 2014. *Guide to determining terrestrial habitat quality – A toolkit for assessing land based offsets version 1.2, Queensland Environmental Offset Act 2014.*

Department of Environment and Science (DES) 2019a, *Flora Survey Guidelines – Protected Plants, Nature Conservation Act 1992*, Queensland Government

Department of Environment and Science (DES) 2019b, *Acacia storyi*, retrieved 18 November 2019 from https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?acacia-storyi

Department of Environment and Science (DES) 2019c, *Baeckea trapeza*, retrieved 18 November 2019 from https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?baeckea-trapeza

Department of Environment and Science (DES) 2019d, *Bertya pedicellata*, retrieved 18 November 2019 from https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?bertya-pedicellata

Department of Environment and Science (DES) 2019e, *Cerbera dumicola,* retrieved 18 November 2019 from https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?cerbera-dumicola

Department of Environment and Science (DES) 2019f, *Commersonia pearnii*, retrieved 18 November 2019 from https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?commersonia-pearnii

Department of Environment and Science (DES) 2019g, *Daviesia quoquoversus*, retrieved 18 November 2019 from https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?daviesia-quoquoversus

Department of Environment and Science (DES) 2019h, *Solanum elachophyllum*, retrieved 18 November 2019 from https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?solanum-elachophyllum

Department of Environment and Science (DES) 2019i, *Gastrodia crebriflora*, retrieved 18 November 2019 from https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?commersonia-pearnii

Department of Environment and Science (DES) 2019j, *Livistona fulva*, retrieved 18 November 2019 from https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?livistona-fulva

Department of Environment and Science (DES) 2019k, *Melaleuca groveana*, retrieved 18 November 2019 from https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?melaleuca-groveana

Department of Environment and Science (DES) 2019l, *Ochrosperma obovatum*, retrieved 18 November 2019 from https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?ochrosperma-obovatum

Department of Environment and Science (DES) 2019m, *Rutidosis glandulosa*, retrieved 18 November 2019 from https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?rutidosis-glandulosa

Department of Environment and Science (DES) 2019n, *Solanum adenophorum*, retrieved 18 November 2019 from https://wetlandinfo.des.qld.gov.au/wetlands/ecology/components/species/?solanum-adenophorum

Department of Environment and Science (DES) 2020a, Wetland*Info* – *Fitzroy Basin*, viewed 26 June 2020, https://wetlandinfo.ehp.qld.gov.au/wetlands/facts-maps/basin-fitzroy/

Department of Environment and Science (DES) 2020b, Mapping data – *Queensland Wetland Data Version 5 – Queensland Wetlands Map*. Queensland Government, Brisbane.

Department of Environment and Science (DES) 2020c, Mapping data – *Matters of State Environmental Significance*. Queensland Government, Brisbane.

Department of Environment and Science (DES) 2020d, Mapping data – *Queensland Groundwater Dependent Ecosystems and Potential GDE Aquifer Mapping 2018 Version 1.5.1*. Queensland Government, Brisbane.

Department of Science, Information Technology and Innovation (DSITI) 2015, Queensland Groundwater Dependent Ecosystem Mapping Method: A method for providing baseline mapping of groundwater dependent ecosystems in Queensland, Department of Science, Information Technology and Innovation, Brisbane.

Department of Natural Resources and Mines (DNRM) 2001, Queensland Australian River Assessment System (AusRivAS) Sampling and Processing Manual. Queensland Government, Rocklea.

Department of Natural Resources, Mines and Energy (DNRME) 2019, *Vegetation management laws*, retrieved 7 February 2019 from https://www.dnrme.qld.gov.au/land-water/initiatives/vegetation-management-laws

Department of Natural Resources, Mines and Energy (DNRME) 2019, Technical summary: terrestrial groundwater-dependent ecosystems in the Surat Cumulative Management Area: Literature review and desktop impact assessment method Office of Groundwater Impact Assessment, Department of Natural Resources, Mines and Energy. State of Queensland

Department of Sustainability, Environment, Water, Populations and Communities (DSEWPC) 2011, *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles*, retrieved 25 November 2019 from http://www.environment.gov.au/system/files/resources/570964ac-15bf-4e07-80da-848fead7b0cd/files/draft-referral-guidelines-comment-brigalow-reptiles.pdf

DPM Envirosciences Pty Ltd (DPM Envirosciences) 2018, *Olive Downs Coking Coal Project Aquatic Ecology Assessment*.

EMM Consulting Pty Ltd (EMM) 2023a, Aquatic Ecology Baseline Assessment. Blackwater Mine – North Extension Project Prepared for BHP.

EMM Consulting Pty Ltd (EMM) 2023b, Matters of State Environmental Significance Assessment. Prepared for BHP.

Environmental Australia 2001, *Brigalow Regrowth and the Environment Protection and Biodiversity Conservation Act 1999 Information Sheet*, retrieved 24 May 2021 from http://www.environment.gov.au/system/files/resources/43e7adb3-247e-4285-9a2e-386be94c9523/files/brigalow-regrowth.pdf

Ecological Service Professionals (ESP) (2023) Blackwater Mine - North Extension Project Aquatic Ecology Impact Assessment.

Eyre T.J., Ferguson D.J., Hourigan C.L., Smith G.C., Mathieson M.T., Kelly, A.L., Venz M.F., Hogan, L.D. & Rowland, J. (2018). Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland. Department of Environment and Science, Queensland Government, Brisbane.

Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. (2015). BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2. Queensland Herbarium, Department of Science, Information Technology, Innovation and Arts, Brisbane

Hourigan, C. 2012. Glossy black-cockatoo, Calyptorhynchus lathami. Targeted species survey guidelines. Queensland Herbarium, Department of Environment and Science, Brisbane.

Independent Expert Scientific Committee (IESC) 2018, *Assessing Groundwater-Dependent Ecosystems: IESC Information Guidelines Explanatory Note*.

Inglis SN and Howell S 2009, Aquatic Conservation Assessments for the riverine wetlands of the Great Barrier Reef Catchment: Fitzroy region. Department of Environment and Resource Management, Queensland Government.

Kath J, Reardon-Smith K, Le Brocque AF, Dyer FJ, Dafny E, Fritz L & Batterham M (2014). Groundwater decline and tree change in floodplain landscapes: Identifying non-linear threshold responses in canopy condition. *Global Ecology and Conservation*, 2 (148-160).

Kerswell A, Kaveney T, Evans C and Appleby L. (2020) Habitat descriptions for 12 threatened species, specific to central Queensland. Report commissioned by BHP.

Marshall C, Harch BD, Choy SC, Smith MJ 2001, Design and Implementation of Baseline Monitoring (DIBM3), Chapter 8: Aquatic macroinvertebrates as indicators of ecosystem health.

Neldner, V.J., Wilson, B.A., Dillewaar, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F., Addicott, E.P. and Appleman, C.N. (2020) Methodology for Survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 5.1. Updated March 2020. Queensland Herbarium, Queensland Department of Environment and Science, Brisbane.

Queensland Herbarium 2007, *National Multi-species Recovery Plan for the cycads, Cycas megacarpa, Cycas ophiolitica, Macrozamia cranei, Macrozamia lomandroides, Macrozamia pauli-guilielmi and Macrozamia platyrhachis*, Department of the Environment and Water Resources, Canberra.

Queensland Museum (QM) 2019. Echidna: *Tachyglossus aculeatus Short-beaked Echidna*, retrieved 25 November 2019 from https://www.qm.qld.gov.au/Explore/Find+out+about/Animals+of+Queensland/Mammals/Common+mammals+of+south-east+Queensland/Monotremes/Echidna

RDM Hydro Pty Ltd, Groundwater Enterprises and 3D Environmental 2023, Blackwater Mine: Groundwater Dependent Ecosystem Desktop Assessment. Report prepared for BHP.

Richardson S, Irvine E, Froend R, Boon P, Barber S & Bonneville B 2011a, *Australia groundwater-dependent ecosystems toolbox part 1: assessment framework*, National Water Commission, Canberra.

Richardson S, Irvine E, Froend R, Boon P, Barber S & Bonneville B 2011b, *Australia groundwater-dependent ecosystems toolbox part 2: assessment tools*, National Water Commission, Canberra.

Rollason SN and Howell S 2012, Aquatic Conservation Assessments (ACA), using AquaBAMM, for the non-riverine wetlands of the Great Barrier Reef catchment*, Version 1.3*. Published by the Department of Environment and Resource Management, Brisbane.

SLR 2023a. Blackwater Mine - North Extension Project Surface Water Resources Assessment.

SLR 2023b. Blackwater Mine - North Extension Project Groundwater Modelling Technical Report.

SLR 2023c. Blackwater Mine - North Extension Project Groundwater Impact Assessment Report.

Squatter Pigeon Workshop 2011. Proceedings from the workshop for the Squatter Pigeon (southern). 14-15 December 2011. Toowoomba Office of the Queensland Parks and Wildlife Service.

TSSC 2001, *Commonwealth Listing Advice on Brigalow (Acacia harpophylla dominant and co-dominant)* (TSSC 2001), retrieved 24 May 2021 from http://www.environment.gov.au/node/14496

TSSC 2012a, Approved Conservation Advice for *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory) (koala Northern Designatable Unit), retrieved 24 May 2021 from http://www.environment.gov.au/biodiversity/threatened/species/pubs/197-conservation-advice.pdf

TSSC 2012b, Commonwealth Listing Advice for *Phascolarctos cinereus* (Koala), retrieved 24 May 2021 from http://www.environment.gov.au/biodiversity/threatened/species/pubs/197-listing-advice.pdf
TSSC 2013, Commonwealth Listing Advice for *Rostratula australis* retrieved 24 May 2021 from http://www.environment.gov.au/biodiversity/threatened/species/pubs/77037-listing-advice.pdf
TSSC 2015, *Conservation advice Nyctophilus corbeni*, retrieved 19 November 2019 from http://www.environment.gov.au/biodiversity/threatened/species/pubs/83395-conservation_advice-01102015.pdf
Threatened Species Scientific Committee (TSSC) 2016a, *Conservation advice Solanum dissectum*, retrieved 18 November 2019 from http://www.environment.gov.au/biodiversity/threatened/species/pubs/75720-conservation-advice-07122016.pdf
TSSC 2016b, *Conservation advice Macroderma gigas*, retrieved 19 November 2019 from http://www.environment.gov.au/biodiversity/threatened/species/pubs/174-conservation-advice-05052016.pdf
TSSC 2016c, *Conservation advice Petauroides volans volans*, retrieved 19 November 2019 from http://www.environment.gov.au/biodiversity/threatened/species/pubs/254-conservation-advice-20160525.pdf

TSSC 2019, *Conservation Advice Hirundapus caudacutus White-throated Needletail*, retrieved 24 May 2021 from http://www.environment.gov.au/biodiversity/threatened/species/pubs/682-conservation-advice-04072019.pdf

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. Please see the caveat for interpretation of information provided here.

Report created: 05-Sep-2023

Summary

Matters of National Environment 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 (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	6
Listed Threatened Species:	39
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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	3
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	23
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	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.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area	In feature area
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community may occur within area	In buffer area only
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	Community likely to occur within area	In feature area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area	In feature area
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Community likely to occur within area	In buffer area only
Weeping Myall Woodlands	Endangered	Community likely to occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Falco hypoleucos](#) Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Geophaps scripta scripta](#) Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Grantiella picta](#) Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Hirundapus caudacutus](#) White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Neochmia ruficauda ruficauda](#) Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area	In feature area
[Poephila cincta cincta](#) Southern Black-throated Finch [64447]	Endangered	Species or species habitat may occur within area	In feature area
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
[Stagonopleura guttata](#) Diamond Firetail [59398]	Vulnerable	Species or species habitat may occur within area	In feature area
[Turnix melanogaster](#) Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
MAMMAL			
[Chalinolobus dwyeri](#) Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Dasyurus hallucatus](#) Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area	In feature area
Onychogalea fraenata Bridled Nail-tail Wallaby, Bridled Nailtail Wallaby [239]	Endangered	Species or species habitat may occur within area	In buffer area only
Petauroides volans Greater Glider (southern and central) [254]	Endangered	Species or species habitat likely to occur within area	In feature area
Petaurus australis australis Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat likely to occur within area	In feature area
PLANT			
Aristida annua [17906]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Bertya opponens [13792]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Cadellia pentastylis Ooline [9828]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Daviesia discolor [3567]	Vulnerable	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Dichanthium queenslandicum](#) King Blue-grass [5481]	Endangered	Species or species habitat may occur within area	In feature area
[Dichanthium setosum](#) bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
[Eucalyptus raveretiana](#) Black Ironbox [16344]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Homoranthus decumbens](#) a shrub [55186]	Endangered	Species or species habitat likely to occur within area	In buffer area only
[Logania diffusa](#) [24159]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
[Macrozamia platyrhachis](#) cycad [3412]	Endangered	Species or species habitat known to occur within area	In buffer area only
[Polianthion minutiflorum](#) [82772]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
[Solanum dissectum](#) [75720]	Endangered	Species or species habitat known to occur within area	In buffer area only
REPTILE			
[Delma torquata](#) Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Denisonia maculata](#) Ornamental Snake [1193]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Egernia rugosa](#) Yakka Skink [1420]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Elseya albagula			
Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Furina dunmalli			
Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Hemiaspis damelii			
Grey Snake [1179]	Endangered	Species or species habitat may occur within area	In feature 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	In feature area

Listed Migratory Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Cuculus optatus			
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Hirundapus caudacutus			
White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Monarcha melanopsis			
Black-faced Monarch [609]		Species or species habitat likely to occur within area	In buffer area only
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Myiagra cyanoleuca			
Satin Flycatcher [612]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat may occur within area	In buffer area only
Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946]		Species or species habitat may occur within area	In buffer area only
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Defence		
Defence - BLACKWATER TRAINING DEPOT [30270]	QLD	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Hirundapus caudacutus](#) White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area overfly marine area	In buffer area only
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
[Monarcha melanopsis](#) Black-faced Monarch [609]		Species or species habitat likely to occur within area overfly marine area	In buffer area only
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat may occur within area overfly marine area	In feature area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat likely to occur within area	In buffer area only
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat may occur within area overfly marine area	In buffer area only
[Rostratula australis as Rostratula benghalensis (sensu lato)](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
[Symposiachrus trivirgatus as Monarcha trivirgatus](#) Spectacled Monarch [83946]		Species or species habitat may occur within area overfly marine area	In buffer area only

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State	Buffer Status
Blackdown Tableland	National Park	QLD	In buffer area only
Blackwater	Conservation Park	QLD	In buffer area only
Kenmare	Nature Refuge	QLD	In buffer area only

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Development and operation of the Star Coal Project Bulk Sample Project	2023/09502		Completed	In buffer area only
rail track to link the proposed MIM Rolleston coal mine to existing rail network	2002/637		Post-Approval	In buffer area only
Controlled action				
Blackwater creek diversion and coal mine	2007/3925	Controlled Action	Post-Approval	In buffer area only
Blackwater to Gladstone Gas Pipeline Project	2011/6034	Controlled Action	Completed	In buffer area only
Bluff open cut coal mine project, central Queensland	2013/7064	Controlled Action	Post-Approval	In buffer area only
Bowen Gas Project	2012/6377	Controlled Action	Post-Approval	In feature area
Comet Ridge Coal Mine, Comet, QLD	2015/7507	Controlled Action	Further Information Request	In buffer area only
Construct and operate a coal gasification plant and carbon dioxide capture and storage	2006/3040	Controlled Action	Completed	In feature area
Curragh Extension Project, Blackwater, QLD	2015/7508	Controlled Action	Post-Approval	In feature area
Curragh North Coal Mine	2003/1096	Controlled Action	Post-Approval	In buffer area only
Norwich Park & Blackwater CSG Fields & supporting infrastructure Bowen Basin	2011/6032	Controlled Action	Completed	In feature area
Norwich Park to Blackwater Gas Pipeline	2011/6031	Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Santos GLNG Gas Field Development Project, QLD	2012/6615	Controlled Action	Post-Approval	In buffer area only
Walton Coal Project, Bowen Basin, Qld	2017/8077	Controlled Action	Assessment Approach	In buffer area only
Washpool Coal Mine Project	2009/5240	Controlled Action	Completed	In buffer area only
ZeroGen Integrated Gasification Combined Cycle Power Plant and CO2 Capture, Transport and Storage	2009/5195	Controlled Action	Completed	In feature area
Not controlled action				
Blackwater to Emerald Dual Circuit 132kV Powerline, QLD	2012/6480	Not Controlled Action	Completed	In feature area
Development and operation of a new multi-seam underground coal mine with associated on-site infrastr	2011/5811	Not Controlled Action	Completed	In feature area
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Springsure Creek 132kV powerline and switchyards	2012/6385	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
Blackwater to Rolleston 132 kV transmission line	2002/880	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Curragh West Project	2011/6187	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Referral decision				
Proposal for open cut coal mining operation, central QLD	2013/6946	Referral Decision	Completed	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

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

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

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

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

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A.2 Wildlife Online search results

Queensland Government

WildNet species list

Search Criteria: Species List for a Specified Point
Species: All
Type: All
Queensland status: Rare and threatened species
Records: All
Date: All
Latitude: -23.6794
Longitude: 148.8455
Distance: 25
Email: ajensen@emmconsulting.com.au
Date submitted: Tuesday 05 Sep 2023 07:09:06
Date extracted: Tuesday 05 Sep 2023 07:10:02

The number of records retrieved = 30

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Limnodynastidae	*Adelotus brevis*	tusked frog		V		4
animals	birds	Cacatuidae	*Calyptorhynchus lathami*	glossy black-cockatoo		V		2
animals	birds	Cacatuidae	*Calyptorhynchus lathami erebus*	glossy black-cockatoo (northern)		V		11
animals	birds	Columbidae	*Geophaps scripta scripta*	squatter pigeon (southern subspecies)		V	V	4
animals	birds	Meliphagidae	*Grantiella picta*	painted honeyeater		V	V	2
animals	mammals	Petauridae	*Petaurus australis australis*	yellow-bellied glider (southern subspecies)		V	V	3
animals	mammals	Potoroidae	*Bettongia gaimardi gaimardi*	eastern bettong		EX	EX	1
animals	mammals	Pseudocheiridae	*Petauroides armillatus*	central greater glider		E	E	11
animals	mammals	Vespertilionidae	*Chalinolobus dwyeri*	large-eared pied bat		E	V	2
animals	reptiles	Scincidae	*Egernia rugosa*	yakka skink		V	V	1/1
plants	land plants	Apocynaceae	*Cerbera dumicola*			NT		2/2
plants	land plants	Arecaceae	*Livistona fulva*			V		4/4
plants	land plants	Asteraceae	*Rutidosis glandulosa*			NT		7/7
plants	land plants	Byttneriaceae	*Commersonia pearnii*			CR		2/2
plants	land plants	Euphorbiaceae	*Bertya pedicellata*			NT		3
plants	land plants	Lamiaceae	*Coleus blakei*			NT		8/8
plants	land plants	Leguminosae	*Acacia storyi*			NT		4/2
plants	land plants	Leguminosae	*Daviesia discolor*			V	V	4/3
plants	land plants	Leguminosae	*Daviesia quoquoversus*			V		1
plants	land plants	Loganiaceae	*Logania diffusa*			V	V	1
plants	land plants	Myrtaceae	*Baeckea trapeza*			V		3/3
plants	land plants	Myrtaceae	*Homoranthus brevistylis*			CR		1/1
plants	land plants	Myrtaceae	*Melaleuca groveana*			NT		1
plants	land plants	Myrtaceae	*Melaleuca pearsonii*			NT		10/9
plants	land plants	Orchidaceae	*Corunastylis valida*			V		1/1
plants	land plants	Rhamnaceae	*Polianthion minutiflorum*			V	V	2/2
plants	land plants	Solanaceae	*Solanum adenophorum*			E		1
plants	land plants	Solanaceae	*Solanum elachophyllum*			E		6/5
plants	land plants	Surianaceae	*Cadellia pentastylis*	ooline		V	V	1/1
plants	land plants	Zamiaceae	*Macrozamia platyrhachis*			E	E	10/9

CODES

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

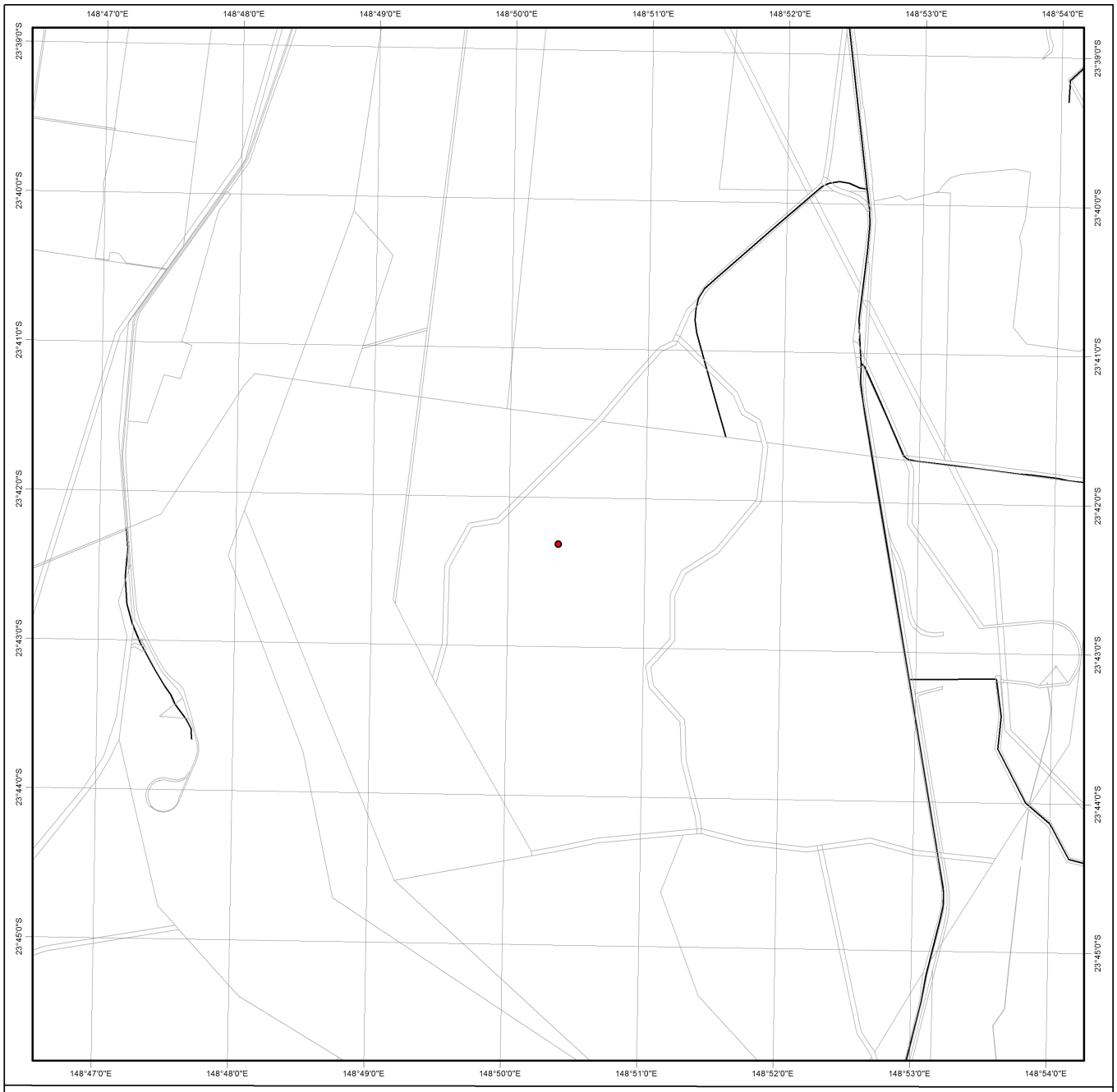
Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.*
The codes are Extinct (EX), Extinct in the Wild (PE), Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern (C).

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

Records - The first number indicates the total number of records of the taxon (wildlife records and species listings for selected areas).
This number is output as 99999 if it equals or exceeds this value. A second number located after a / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

A.3 Protected plant trigger mapping

28/09/2023 14:47:21
Longitude: 148.8394 Latitude: -23.7052

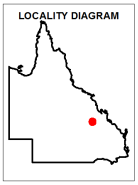


Protected Plants Flora Survey Trigger Map

Legend

- Coordinates
- High risk area
- Other land parcel boundaries
- Freeways / motorways / highways
- Secondary roads / streets

LOCALITY DIAGRAM



N

0 480 960 1,440 1,920 2,400 m

This product is projected into:
GDA 1994 Queensland Albers

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

Land parcel boundaries are provided as locational aid only.

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

For further information or assistance with interpretation of this product, please contact the Department of Environment and Science at palm@des.qld.gov.au

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

Protected plants flora survey trigger map

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

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

Updates to the data informing the flora survey trigger map

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

Species information

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

Appendix B

General habitat assessment results

B.1 General habitat assessment results – part 1-A of form

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
1	NR	NA	Gently undulating plain	Plain	Clay	75	50	50	Absent	None	Absent	None	0
2	NR	NA	Gently undulating plain	Plain	Clay	90	75	25	Absent	None	Absent	None	0
3	NR	NA	Gently undulating plain	Plain	Clay	70	60	40	Absent	None	Absent	None	0
4	NR	NA	Gently undulating plain	Plain	Clay	60	70	30	Absent	None	Absent	None	0
5	NR	NA	Gently undulating plain	Plain	Clay	80	70	30	Absent	None	Absent	None	0
6	NR	NA	Gently undulating plain	Plain	Clay	80	70	30	Absent	None	Absent	None	0
7	NR	NA	Undulating plain	Plain	Clay	85	90	10	Absent	none	Absent	None	0
8	NR	NA	Undulating plain	Plain	Clay	75	75	25	Absent	none	Absent	None	0
9	NR	NA	Undulating plain	Plain	Clay	85	90	10	Absent	none	Absent	None	0
10	NR	NA	Undulating plain	Plain	Clay	90	90	10	Absent	none	Absent	None	0

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
11	NR	NA	Undulating plain	Plain	Clay	80	85	15	Absent	none		None	0
12	NR	NA	Undulating plain	Plain	Clay	99	99	1	Absent	none	Absent	None	0
13	NR	NA	Undulating plain	Plain	Clay	99	99	1	Absent	none	Absent	None	0
14	NR	NA	Undulating plain	Plain	Clay	90	90	10	Absent	none	Absent	None	0
15	NR	NA	Undulating plain	Plain	Clay	99	99	1	Absent	none	Absent	None	0
16	NR	NA	Gently undulating plain	Plain	Clay	50	80	20	Absent	None	Absent	None	0
17	NR	NA	Undulating plain	Plain	Clay loam	70	90	10	Absent	None	Absent	None	0
18	REM	11.3.1	Gently undulating plain	Drainage depression	Clay	80	75	25	Absent	*Eucalyptus melanophloia, Corymbia dallachiana*	Common	*Eucalyptus melanophloia, Corymbia dallachiana*	5
19	RGW	NA	Undulating plain	Drainage depression	Clay	70	70	30	Absent	None	Occasional	None	0
20	RGW	NA	Undulating plain	Drainage depression	Clay	90	85	15	Absent	None	Absent	None	0
21	NR	NA	Undulating plain	Plain	Clay	90	80	20	Absent	None	Absent	None	0
22	RGW	NA	Gently undulating plain	Plain	Sandy loam	80	75	25	Absent	*Eucalyptus melanophloia, E. populnea*	Common	None	0

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
23	REM	11.3.1	Gently undulating plain	Stream bank	Clay	80	70	30	Absent	*Eucalyptus coolabah*	Common	*Eucalyptus coolabah*	15
24	REM	11.3.1/11.3.2	Gently undulating plain	Stream bank	Clay	70	75	20	Absent	*Eucalyptus coolabah, E. populnea*	Absent	*Eucalyptus coolabah*	5
25	REM	11.3.1	Gently undulating plain	Stream bank	Clay	70	75	25	Absent	*Eucalyptus coolabah, Corymbia dallachiana*	Absent	*Eucalyptus coolabah*	5
26	NR	NA	Gently undulating plain	Plain	Clay	80	80	20	Absent	None	Absent	None	0
27	NR	NA	Gently undulating plain	Plain	Clay	80	80	20	Absent	None	Absent	None	0
28	NR	NA	Gently undulating plain	Plain	Clay	70	80	20	Absent	None	Absent	None	0
29	REM	11.3.1	Gently undulating plain	Stream bank	Clay	90	80	20	Absent	None	Absent	None	0

B.2 General habitat assessment results – part 1-B 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	Associated Severity
1		Shallow	Common	Shallow	Occasional	Rare	5%, 5mm	<1	Ephemeral	None	Isolated fragment	Grazing	High
2		Shallow	Common	Shallow	Occasional	Rare	5%, 5mm	<1	Permanent	None	Isolated fragment	Grazing	High
3			Common	Shallow	Common	Occasional	10%, 10mm	<1	Ephemeral	None	Isolated fragment	Grazing	High
4		Shallow	Common	Shallow	Common	Occasional	10%, 10mm	<1	Ephemeral	None	Isolated fragment	Grazing	High
5		Shallow	Common	Shallow	Common	Occasional	5%, 10mm	<1	Ephemeral	None	Isolated fragment	Grazing	High
6		Shallow	Common	Shallow	Common	Occasional	5%, 10mm	<1	Ephemeral	None	Isolated fragment	Grazing	High
7		Shallow	Common	Absent	Absent	Rare	0%, 0	1-3	Permanent	None	Isolated fragment	Grazing	High
8		Shallow	Common	Absent	Absent	Rare	10%, 10mm	1-3	Permanent	None	Isolated fragment	Grazing	High
9		Shallow	Common	Absent	Absent	Rare	0%, 0	1-3	Permanent	None	Isolated fragment	Grazing	High
10		Shallow	Common	Absent	Absent	Rare	0%, 0	1-3	Permanent	None	Isolated fragment	Grazing	High
11		Shallow	Common	Absent	Absent	Occasional	5%, 10m	<1	Ephemeral	None	Isolated fragment	Grazing	High
12		Shallow	Common	Absent	Absent	Rare	0%, 0	1-3	Permanent	None	Isolated fragment	Grazing	High
13		Shallow	Common	Absent	Absent	Rare	0%, 0	1-3	Permanent	None	Isolated fragment	Grazing	High

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	Associated Severity
14		Shallow	Common	Diverse	Common	Rare	2%, 5mm	<1	Ephemeral	None	Isolated fragment	Grazing	High
15		Shallow	Common	Diverse	Occasional	Rare	0%, 0	<1	Ephemeral	None	Isolated fragment	Grazing	High
16			Common	Diverse	Common	Common	15%, 20mm	<1	Ephemeral	None	Isolated fragment	Broadscale clearing	Severe
17		Shallow	Common	Absent	Absent	Rare	2%, 5mm	1-3	Ephemeral	None	Isolated fragment	Grazing	High
18	Large (>20 cm)	Shallow	Common	Absent	Absent	Common	10%, 20mm	<1	Ephemeral	*Eucalyptus melanophloia, Corymbia dallachiana*	Narrow linear patch	Erosion	High
19		Shallow	Abundant	Absent	Absent	Occasional	10%, 20mm	<1	Permanent	None	Narrow linear patch	Grazing	High
20		Shallow	Abundant	Absent	Absent	Occasional	<5%, 5mm	<1	Ephemeral	None	Narrow linear patch	Grazing	High
21		Shallow	Abundant	Diverse	Abundant	Absent	0%, 0mm	<1	Ephemeral	None	Isolated fragment	Grazing	High
22		Absent	Absent	Absent	Absent	Common	10%, 20mm	<1	Ephemeral	*Eucalyptus melanophloia, E. populnea*	Narrow linear patch	Grazing	High
23	Large (>20 cm)	Shallow	Common	Absent	Absent	Occasional	20%, 20mm	<1	Ephemeral	*Eucalyptus coolabah*	Narrow linear patch	Grazing	High
24	Large (>20 cm)	Shallow	Abundant	Absent	Absent	Rare	10%, 20mm	<1	Ephemeral	*Eucalyptus coolabah, E. populnea*	Narrow linear patch	Grazing	High

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	Associated Severity
25	Large (>20 cm)	Shallow	Abundant	Absent	Absent	Common	10%, 20mm	<1	Ephemeral	*Eucalyptus coolabah, Corymbia dallachiana*	Narrow linear patch	Grazing	High
26		Shallow	Common	Absent	Absent	Common	10%, 20mm	<1	Ephemeral	None	Isolated fragment	Broadscale clearing	Severe
27		Shallow	Common	Absent	Absent	Common	10%, 20mm	<1	Ephemeral	None	Isolated fragment	Broadscale clearing	Severe
28		Shallow	Common	Absent	Absent	Common	10%, 20mm	<1	Ephemeral	None	Isolated fragment	Broadscale clearing	Severe
29		Shallow	Common	Absent	Absent	Common	10%, 20mm	<1	Ephemeral	None	Narrow linear patch	Fragmentation	High

B.3 General habitat assessment results – part 2-A of form

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Ground cover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
30	REM	11.3.1	Gently undulating plain	Stream bank	Clay	60	30	70	Absent	*Eucalyptus coolabah*	Occasional	*Eucalyptus coolabah*	10
31	REM	11.3.1	Gently undulating plain	Stream bank	Clay	90	50	50	Absent	*Eucalyptus coolabah*	Occasional	*Eucalyptus coolabah*	10
32	NR	NA	Gently undulating plain	Plain	Clay	80	80	20	Absent	None	Absent	None	0
33	NR	NA	Gently undulating plain	Plain	Clay	80	80	20	Absent	None	Absent	None	0
34	NR	NA	Gently undulating plain	Plain	Clay	80	80	20	Absent	None	Absent	None	0
35	NR	NA	Gently undulating plain	Plain	Clay	80	80	20	Absent	None	Absent	None	0
36	REM	11.3.1	Gently undulating plain	Stream bank	Clay	60	60	40	Absent	*Eucalyptus coolabah*	Occasional	None	0
37	NR	NA	Gently undulating plain	Plain	Clay	95	75	25	Absent	None	Absent	None	0
38	NR	NA	Gently undulating plain	Plain	Sandy loam	95	75	25	Absent	None	Absent	None	0
39	NR	NA	Gently undulating plain	Plain	Clay loam	95	85	15	Absent	None	Absent	None	0
40	NR	NA	Gently undulating plain	Plain	Clay	90	80	20	Absent	None	Absent	None	0
41	REM	11.3.1	Gently undulating plain	Stream bank	Clay	65	40	50	Absent	*Eucalyptus coolabah*	Occasional	*Eucalyptus coolabah*	5

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Ground cover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
42	REM	11.5.3	Undulating plain	Plain	Sandy loam	40	20	80	Absent	*Eucalyptus populnea*	Occasional	None	0
43	REM	11.3.25/11.3.1	Undulating plain	Stream bank	Silty clay	50	40	60	Absent	*Eucalyptus camaldulensis, E. melanophloia, E. populnea, Corymbia tessellaris*	Occasional	*Eucalyptus camaldulensis, E. melanophloia*	20
44	REM	11.3.1/11.3.6	Undulating plain	Plain	Sandy loam	75	25	75	Absent	*Eucalyptus populnea, E. melanophloia, Corymbia clarksoniana*	Occasional	*Eucalyptus melanophloia*	5
45	High Value Regrowth	11.3.1/11.3.6	Rolling low hills	Plain	Sandy clay	80	60	30	Absent	*Eucalyptus melanophloia, E. crebra, Corymbia clarksoniana*	Occasional	*Eucalyptus melanophloia, E. crebra, Corymbia clarksoniana*	20

B.4 General habitat assessment results – part 2-B 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	Koala Food Trees (%)	Connectivity	Presence of Threat	Associated Severity
30	Large (>20 cm)	Shallow	Common	Absent	Absent	Common	20%, 20mm	<1	Ephemeral	*Eucalyptus coolabah*	30	Narrow linear patch	Broadscale clearing	High
31	Large (>20 cm)	Diverse	Common	Absent	Absent	Common	10%, 20mm	<1	Ephemeral	*Eucalyptus coolabah*	30	Narrow linear patch	Pest species	Severe
32		Shallow	Abundant	Absent	Absent	Common	10%, 20mm	<1	Ephemeral	None	0	Isolated fragment	Broadscale clearing	Severe
33		Shallow	Common	Absent	Absent	Common	10%, 20mm	<1	Ephemeral	None	0	Isolated fragment	Broadscale clearing	Severe
34		Shallow	Common	Absent	Absent	Common	10%, 20mm	1-3	Ephemeral	None	0	Isolated fragment	Broadscale clearing	Severe
35		Shallow	Common	Absent	Absent	Common	10%, 20mm	1-3	Ephemeral	None	0	Isolated fragment	Broadscale clearing	Severe
36		Shallow	Common	Absent	Absent	Common	10%, 20mm	<1	Ephemeral	*Eucalyptus coolabah*	10	Isolated fragment	Broadscale clearing	Severe
37		Shallow	Occasional	Shallow	Rare	Absent	0%, 0mm	<1	Ephemeral	None	0	Isolated fragment	Pest species	Severe
38		Absent	Absent	Absent	Absent	Absent	0%, 0mm	<1	Ephemeral	None	0	Isolated fragment	Pest species	Severe
39		Absent	Absent	Absent	Absent	Absent	0%, 0mm	1-3	Ephemeral	None	0	Isolated fragment	Grazing	Severe
40		Shallow	Common	Diverse	Common	Occasional	5%, 10mm	<1	Ephemeral	None	0	Isolated fragment	Grazing	Severe

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	Koala Food Trees (%)	Connectivity	Presence of Threat	Associated Severity
41	Large (>20 cm)	Shallow	Common	Shallow	Occasional	Common	10%, 20mm	<1	Ephemeral	*Eucalyptus coolabah*	20	Narrow linear patch	Broadscale clearing	High
42		Absent	Absent	Absent	Absent	Common	15%, 20mm	<1	Ephemeral	*Eucalyptus populnea*	10	Isolated fragment	Broadscale clearing	High
43	Large (>20 cm)	Shallow	Occasional	Absent	Absent	Occasional	10%, 10mm	<1	Ephemeral	*Eucalyptus camaldulensis, E. melanophloia, E. populnea, Corymbia tessellaris*	50	Narrow linear patch	Fragmentation	High
44	Large (>20 cm)	Absent	Absent	Absent	Absent	Common	15%, 20mm	<1	Ephemeral	*Eucalyptus populnea, E. melanophloia, Corymbia clarksoniana*	10	Isolated fragment	Broadscale clearing	High
45	Large (>20 cm)	Absent	Absent	Absent	Absent	Occasional	20%, 20mm	1-3	Ephemeral	*Eucalyptus melanophloia, E. crebra, Corymbia clarksoniana*	85	Isolated fragment	Grazing	Moderate

B.5 General habitat assessment results June 2023 – part 1-A of form

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
154	NR	NA	Gently undulating plain	Plain	Sandy clay	80	60	40	Absent	*E.camaldulensis, E. tereticornis*	Occasional	None	0
155	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	NR	NR	Absent	None	Occasional	None	0
156	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	NR	NR	Absent	None	Occasional	None	0
157	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	NR	NR	Absent	None	Occasional	None	0
158	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	NR	NR	Absent	None	Absent	None	0
159	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	NR	NR	Absent	None	Absent	None	0
160	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	NR	NR	Absent	None	Occasional	None	0
161	REM	11.3.1	Gently undulating plain	Plain	Sandy clay	80	50	50	Absent	*E. populnea, E. melanophloia*	Occasional	E. populnea, E. melanophloia	5

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
162	REM	11.3.1	Gently undulating plain	Plain	Sandy clay	NR	NR	NR	Absent	*E.populnea*	Absent	Dead stag	3
163	NR	NA	Gently undulating plain	Dam	Sandy clay	NR	NR	NR	Absent	None	Absent	None	0
164	NR	NA	Gently undulating plain	Dam	Sandy clay	NR	NR	NR	Absent	*E.melanophloia, E, tereticornis, E.populnea*	Occasional	None	0
165	REM	11.3.1	Gently undulating plain	Plain	Sandy clay	NR	NR	NR	Absent	*E.melanophloia, E, tereticornis, E.populnea*	Occasional	None	0
166	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	NR	NR	Absent	*E.melanophloia*	Occasional	None	0
167	REM	11.3.1	Gently undulating plain	Plain	Sandy clay	NR	NR	NR	Absent	*E.melanophloia, E, tereticornis*	Occasional	None	0
168	NR	NA	Gently undulating plain	Dam	Sandy clay	NR	NR	NR	Absent	None	Occasional	None	0
169	NR	NA	Gently undulating plain	Dam	Sandy clay	50	80	20	Absent	None	Occasional	None	0
170	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
171	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
172	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
173	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
174	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
175	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
176	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
177	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
178	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
179	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
180	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
181	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
182	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
183	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
184	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
185	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
186	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
187	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
188	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
189	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
190	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
191	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
192	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
193	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
194	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
195	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
196	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
197	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
198	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
199	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
200	NR	NA	Gently undulating plain	Plain	Sandy clay	90	98	2	Absent	None	Absent	None	0
201	NR	NA	Gently undulating plain	Dam	Sandy clay	90	NR	NR	Absent	None	Absent	None	0
202	NR	NA	Gently undulating plain	Plain	Sandy clay	90	90	10	Absent	None	Absent	None	0
203	NR	NA	Gently undulating plain	Plain	Sandy clay	90	90	10	Absent	None	Absent	None	0
204	NR	NA	Gently undulating plain	Plain	Sandy clay	90	80	20	Absent	None	Absent	None	0
205	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0
206	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
207	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0
208	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0
209	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0
210	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0
211	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0
212	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0
213	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0
214	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0
215	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
216	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0
217	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0
218	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0
219	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0
220	NR	NA	Gently undulating plain	Plain	Sandy clay	90	75	25	Absent	None	Absent	None	0
221	NR	NA	Gently undulating plain	Dam	Sandy clay	NR	NR	NR	Absent	None	Absent	None	0
222	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	98	2	Absent	None	Absent	None	0
223	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	75	25	Absent	None	Absent	None	0
224	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	98	2	Absent	None	Absent	None	0

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
225	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	98	2	Absent	None	Absent	None	0
226	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	98	2	Absent	None	Absent	None	0
227	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	98	2	Absent	None	Absent	None	0
228	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	98	2	Absent	None	Absent	None	0
229	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	98	2	Absent	None	Absent	None	0
230	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	98	2	Absent	None	Absent	None	0
231	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	98	2	Absent	None	Absent	None	0
232	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	98	2	Absent	None	Absent	None	0
233	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	98	2	Absent	None	Absent	None	0

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
234	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	98	2	Absent	None	Absent	None	0
235	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	98	2	Absent	None	Absent	None	0
236	NR	NA	Gently undulating plain	Plain	Sandy clay	NR	98	2	Absent	None	Absent	None	0
237	NR	NA	Gently undulating plain	Plain	Silty clay loam	85	80	20	Absent	None	Rare	None	0
238	NR	NA	Gently undulating plain	Plain	Clay loam	85	90	30	Absent	None	Rare	None	0
239	NR	NA	Gently undulating plain	Plain	Clay loam	85	80	20	Absent	None	Rare	None	0
240	NR	NA	Gently undulating plain	Plain	Clay loam	85	70	30	Absent	None	Rare	None	0
241	NR	NA	Gently undulating plain	Plain	Silty clay loam	90	80	20	Absent	None	Absent	None	0
242	NR	NA	Gently undulating plain	Plain	Clay loam	85	70	30	Absent	None	Rare	None	0

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
243	NR	NA	Gently undulating plain	Plain	Sandy loam	60	40	20	Absent	None	Absent	None	0
244	NR	NA	Gently undulating plain	Plain	Sandy loam	80	70	30	Absent	None	Absent	None	0
245	NR	NA	Gently undulating plain	Plain	Clay loam	85	55	40	Absent	None	Absent	None	0
246	NR	NA	Gently undulating plain	Plain	Sandy clay loam	80	70	75	Absent	None	Absent	None	0
247	NR	NA	Gently undulating plain	Plain	Sandy clay loam	30	40	30	Absent	None	Absent	None	0
248	NR	NA	Gently undulating plain	Plain	Sandy clay loam	30	40	30	Absent	None	Absent	None	0
249	NR	NA	Gently undulating plain	Bank (stream bank)	Clay loam	75	30	50	Absent	None	Common	None	0
250	NR	NA	Gently undulating plain	Bank (stream bank)	Clay loam	75	30	50	Absent	None	Common	None	0
251	NR	NA	Gently undulating plain	Plain	Clay loam	80	65	20	Absent	None	Rare	None	0

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
252	NR	NA	Gently undulating plain	Plain	Clay loam	NR	NR	NR	Absent	None	Absent	None	0
253	NR	NA	Gently undulating plain	Plain	Clay loam	20	35	45	Absent	None	Absent	None	0
254	NR	NA	Gently undulating plain	Plain	Clay loam	90	40	50	Absent	None	NR	None	0
255	NR	NA	Gently undulating plain	Plain	Clay loam	90	40	50	Absent	None	NR	None	0
256	NR	NA	Gently undulating plain	Plain	Clay loam	90	40	50	Absent	None	NR	None	0
257	NR	NA	Gently undulating plain	Plain	Clay loam	90	40	50	Absent	None	NR	None	0
258	NR	NA	Gently undulating plain	Plain	Clay loam	95	20	70	Absent	None	NR	None	0
259	NR	NA	Gently undulating plain	Plain	Clay loam	85	40	35	Absent	None	NR	None	0
260	NR	NA	Gently undulating plain	Plain	Clay loam	90	10	80	Absent	None	Absent	None	0

Site	Validated RE Condition	Validated RE Code	Landform Pattern	Landform Element	Soil Texture	Vegetated Groundcover (%)	Exotic Vegetation Cover (%)	Native Vegetation Cover (%)	Flowering Eucalypts	Eucalypt Species	Decorticating Bark	Hollow Bearing Tree Species	Hollow Tree per ha
261	NR	NA	Gently undulating plain	Plain	Clay loam	90	10	80	Absent	None	Absent	None	0
262	HVR	-	Gently undulating plain	Plain	Clay loam	80	85	10	Absent	None	Absent	None	0
263	HVR	11.9.5	Gently undulating plain	Plain	Clay loam	NR	1	30	Absent	None	NR	None	0
264	HVR	11.3.1	Gently undulating plain	Plain	Sandy clay loam	80	40	40	Absent	*E.tesselaris*	Common	None	0
265	HVR	11.3.1	Gently undulating plain	Plain	Sandy loam	80	40	60	Absent	None	Absent	None	0
266	HVR	11.3.1	Gently undulating plain	Plain	Sandy clay loam	80	40	40	Absent	*E.tesselaris*	Common	None	0

B.6 General habitat assessment results June 2023 – part 1-B 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	Koala Food Trees (%)	Connectivity	Presence of Threat	Associated Severity
154	None	Absent	Absent	Absent	Absent	Rare	5%, 20mm	<1	Permanent	*E.camaldulensis, E. tereticornis*	30	Narrow linear patch	Weeds	High
155	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
156	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
157	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
158	None	Deep	Common	Shallow	Common	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
159	None	Absent	Absent	Absent	Absent	Occasional	NR	<1	Permanent	None	0	Narrow linear patch	Broadscale clearing	High
160	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
161	Medium	Absent	Absent	Absent	Absent	Common	NR	<1	Permanent	*E. populnea, E. melanophloia*	5	Narrow linear patch	Weeds	High
162	Medium	Absent	Absent	Absent	Absent	Rare	NR	<1	Permanent	*E.populnea*	NR	Narrow linear patch	Weeds	High
163	None	Absent	Absent	Absent	Absent	Rare	NR	<1	Permanent	None	0	N/A	Broadscale clearing	High
164	None	Absent	Absent	Absent	Absent	Rare	NR	<1	Permanent	*E.melanophloia, E, tereticornis, E.populnea*	2	Narrow linear patch	Grazing	High

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	Koala Food Trees (%)	Connectivity	Presence of Threat	Associated Severity
165	None	Absent	Absent	Absent	Absent	Common	NR	<1	Permanent	*E.melanophloia, E, tereticornis, E.populnea*	2	Narrow linear patch	Grazing	High
166	None	Absent	Absent	Absent	Absent	Common	NR	<1	Permanent	*E.melanophloia*	2	Narrow linear patch	Grazing	High
167	None	Absent	Absent	Absent	Absent	Common	NR	<1	Permanent	*E.melanophloia, E, tereticornis*	10	Narrow linear patch	Grazing	High
168	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
169	None	Absent	Absent	Absent	Absent	Absent	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
170	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
171	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
172	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
173	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
174	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
175	None	Shallow	Occasional	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
176	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High

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	Koala Food Trees (%)	Connectivity	Presence of Threat	Associated Severity
177	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
178	None	Shallow	Occasional	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
179	None	Shallow	Occasional	Shallow	Rare	Rare	0%, 0mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
180	None	Shallow	Occasional	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
181	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
182	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
183	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
184	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
185	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
186	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
187	None	Shallow	Occasional	Absent	Absent	Rare	0%, 0mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
188	None	Shallow	Occasional	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
189	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High

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	Koala Food Trees (%)	Connectivity	Presence of Threat	Associated Severity
190	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
191	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
192	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
193	None	Shallow	Rare	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
194	None	Shallow	Rare	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
195	None	Shallow	Rare	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
196	None	Shallow	Rare	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
197	None	Shallow	Rare	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
198	None	Shallow	Rare	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
199	None	Shallow	Common	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
200	None	Shallow	Rare	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
201	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
202	None	Shallow	Rare	Shallow	Occasional	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High

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	Koala Food Trees (%)	Connectivity	Presence of Threat	Associated Severity
203	None	Shallow	Rare	Shallow	Occasional	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
204	None	Shallow	Rare	Shallow	Occasional	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
205	None	Diverse	Common	Diverse	Occasional	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
206	None	Diverse	Common	Diverse	Occasional	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
207	None	Diverse	Common	Diverse	Occasional	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
208	None	Diverse	Common	Diverse	Occasional	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
209	None	Diverse	Common	Diverse	Occasional	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
210	None	Diverse	Common	Diverse	Occasional	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
211	None	Diverse	Common	Diverse	Occasional	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
212	None	Diverse	Common	Shallow	Common	Rare	0%, 0mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
213	None	Diverse	Common	Shallow	Common	Rare	0%, 0mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
214	None	Diverse	Common	Shallow	Common	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High

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	Koala Food Trees (%)	Connectivity	Presence of Threat	Associated Severity
215	None	Diverse	Common	Shallow	Common	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
216	None	Diverse	Common	Shallow	Common	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
217	None	Diverse	Common	Shallow	Common	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
218	None	Diverse	Common	Shallow	Common	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
219	None	Diverse	Common	Shallow	Common	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
220	None	Diverse	Common	Shallow	Common	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
221	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
222	None	Shallow	Rare	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
223	None	Diverse	Common	Diverse	Occasional	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
224	None	Shallow	Rare	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
225	None	Shallow	Rare	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
226	None	Shallow	Rare	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High

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	Koala Food Trees (%)	Connectivity	Presence of Threat	Associated Severity
227	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
228	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
229	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
230	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
231	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
232	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
233	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
234	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
235	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
236	None	Absent	Absent	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
237	None	Absent	Absent	Absent	Absent	Rare	10%, 3mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
238	None	Shallow	Rare	Absent	Absent	Rare	10%, 3mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
239	None	Shallow	Occasional	Absent	Absent	Rare	10%, 3mm	<1	Permanent	None	0	N/A	Broadscale clearing	High

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	Koala Food Trees (%)	Connectivity	Presence of Threat	Associated Severity
240	None	Shallow	Abundant	Absent	Absent	Rare	10%, 3mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
241	None	Absent	Absent	Absent	Absent	Absent	3%, 2mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
242	None	Shallow	Abundant	Absent	Absent	Rare	10%, 3mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
243	None	Absent	Absent	Absent	Absent	Absent	1%, 1mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
244	None	Shallow	Rare	Absent	Absent	Absent	1%, 1mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
245	None	Diverse	Common	Deep	Common	Absent	10%, 3mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
246	None	Shallow	Occasional	Absent	Absent	Absent	1%, 3mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
247	None	Shallow	Occasional	Absent	Absent	Absent	1%, 1mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
248	None	Shallow	Occasional	Absent	Absent	Absent	1%, 1mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
249	None	Absent	Absent	Absent	Absent	Common	3%, 5mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
250	None	Absent	Absent	Absent	Absent	Common	3%, 5mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
251	None	Shallow	Common	Absent	Absent	Rare	5%, 10mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
252	None	Absent	Absent	Absent	Absent	Absent	0%, 0mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High

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	Koala Food Trees (%)	Connectivity	Presence of Threat	Associated Severity
253	None	Absent	Absent	Absent	Absent	Absent	0%, 0mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
254	None	Shallow	Common	Absent	Absent	Rare	2%, 5mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
255	None	Shallow	Common	Absent	Absent	Rare	2%, 5mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
256	None	Shallow	Common	Absent	Absent	Rare	2%, 5mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
257	None	Shallow	Occasional	Absent	Absent	Rare	2%, 5mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
258	None	Shallow	Common	Absent	Absent	Rare	2%, 5mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
259	None	Shallow	Common	Absent	Absent	Rare	2%, 5mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
260	None	Shallow	Rare	Absent	Absent	Absent	1%, 1mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
261	None	Diverse	Common	Absent	Absent	Absent	1%, 1mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
262	None	Diverse	Common	Absent	Absent	Absent	1%, 1mm	1-3	Permanent	None	0	N/A	Broadscale clearing	High
263	None	Shallow	Occasional	Absent	Absent	Rare	0%, 0mm	<1	Permanent	None	0	N/A	Broadscale clearing	High
264	None	Absent	Absent	Absent	Absent	Common	7%, 50mm	<1	Permanent	*E.tessellaris*	1		Weeds	High

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	Koala Food Trees (%)	Connectivity	Presence of Threat	Associated Severity
265	None	Absent	Absent	Absent	Absent	Absent	10%, 50mm	<1	Permanent	None	0		Broadscale clearing	High
266	None	Absent	Absent	Absent	Absent	Common	7%, 50mm	<1	Permanent	*E.tessellaris*	1		Weeds	High

Appendix C

Consolidated fauna species list

Class	Scientific name	Common name
Amphibia	*Cyclorana alboguttata*	Green-striped Burrowing Frog
	Cyclorana brevipes	Superb Collared Frog
	Cyclorana novaehollandiae	Eastern Snapping Frog
	Cyclorana verrucosa	Rough Collared Frog
	Limnodynastes salmini	Salmon-striped Frog
	Limnodynastes tasmaniensis	Spotted Marsh Frog
	Litoria caerulea	Green Tree Frog
	Litoria fallax	Eastern Sedge Frog
	Litoria inermis	Bumpy Rocket Frog
	Litoria latopalmata	Broad-palmed Rocket Frog
	Litoria rubella	Desert Tree Frog
	Platyplectrum ornatum	Ornate Burrowing Frog
	*Rhinella marina**	Cane Toad*
	Uperoleia rugosa	Chubby Gungan
Aves	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill
	Acanthiza nana	Yellow Thornbill
	Acanthiza reguloides	Buff-rumped Thornbill
	Accipiter cirrocephalus	Collared Sparrowhawk
	*Acridotheres tristis**	Common Myna*
	Acrocephalus australis	Australian Reed-warbler
	Aegotheles cristatus	Australian Owlet-nightjar
	Anas gracilis	Grey Teal
	Anas superciliosa	Pacific Black Duck
	Anhinga novaehollandiae	Australasian Darter
	Anthus novaeseelandiae	Australasian Pipit
	Aprosmictus erythropterus	Red-winged Parrot
	Aquila audax	Wedge-tailed Eagle
	Ardea alba	Great Egret
	Ardea intermedia	Intermediate Egret
	Ardea pacifica	White-necked Heron
	Ardeotis australis	Australian Bustard
	Artamus cinereus	Black-faced Woodswallow
	Artamus leucorynchus	White-breasted Woodswallow
	Artamus superciliosus	White-browed Woodswallow
	Artemus personatus	Masked Woodswallow
	Aviceda subcristata	Pacific Baza
	Aythya australis	Hardhead
	Cacatua galerita	Sulphur-crested Cockatoo
	Cacomantis pallidus	Pallid Cuckoo
	Cacomantis variolosus	Brush Cuckoo

Class	Scientific name	Common name
	Chalcites lucidus	Shining Bronze Cuckoo
	Chalcites osculans	Black-eared Cuckoo
	Chenonetta jubata	Maned Duck
	Chlamydera maculata	Spotted Bowerbird
	Chrysococcyx basalis	Horsfield's Bronze-cuckoo
	Circus assimilis	Spotted Harrier
	Cisticola exilis	Golden-headed Cisticola
	Colluricincla harmonica	Grey Shrikethrush
	Coracina novaehollandiae	Black-faced Cuckooshrike
	Coracina papuensis	White-bellied Cuckooshrike
	Corvus coronoides	Australian Raven
	Corvus orru	Torresian Crow
	Coturnix pectoralis	Stubble Quail
	Coturnix ypsilophora	Brown Quail
	Cracticus nigrogularis	Pied Butcherbird
	Cracticus tibicen	Australian Magpie
	Cracticus torquatus	Grey Butcherbird
	Cygnus atratus	Black Swan
	Dacelo novaeguineae	Laughing Kookaburra
	Daphoenositta chrysoptera	Varied Sittella
	Dendrocygna eytonii	Plumed Whistling Duck
	Dicaeum hirundinaceum	Mistletoebird
	Dicrurus bracteatus	Spangled Drongo
	Egretta novaehollandiae	White-faced Heron
	Elanus axillaris	Black-shouldered Kite
	Elseyornis melanops	Black-fronted Dotterel
	Entomyzon cyanotis	Blue-faced Honeyeater
	Eolophus roseicapilla	Galah
	Eurostopodus mystacalis	White-throated Nightjar
	Eurystomus orientalis	Dollarbird
	Falco berigora	Brown Falcon
	Falco cenchroides	Nankeen Kestrel
	Falco longipennis	Australian Hobby
	Falco subniger	Black Falcon
	Fulica atra	Eurasian Coot
	Galinago hardwickii	Latham's Snipe
	Gallinula tenebrosa	Dusky Moorhen
	Geopelia humeralis	Bar-shouldered Dove
	Geopelia placida	Peaceful Dove
	Geophaps scripta scripta	Squatter Pigeon
	Gerygone albogularis	White-throated Gerygone

Class	Scientific name	Common name
	Gerygone fusca	Western Gerygone
	Grallina cyanoleuca	Magpie-lark
	Grus rubicunda	Brolga
	Haliastur sphenurus	Whistling Kite
	Hieraaetus morphnoides	Little Eagle
	Himantopus leucocephalus	Pied Stilt
	Hirundo neoxena	Welcome Swallow
	Irediparra gallinacea	Comb-crested Jacana
	Lalage tricolor	White-winged Triller
	Lichenostomus chrysops	Yellow-faced Honeyeater
	Lichenostomus virescens	Singing Honeyeater
	Lichmera indistincta	Brown Honeyeater
	Lonchura castaneothorax	Chestnut-breasted Mannikin
	Malurus cyaneus	Superb Fairywren
	Malurus melanocephalus	Red-backed Fairywren
	Manorina flavigula	Yellow-throated Miner
	Megalurus mathewsi	Rufous Songlark
	Melithreptus albogularis	White-throated Honeyeater
	Melopsittacus undulatus	Budgerigar
	Merops ornatus	Rainbow Bee-eater
	Microcarbo melanoleucos	Little Pied Cormorant
	Microeca fascinans	Jacky Winter
	Milvus migrans	Black Kite
	Mirafra javanica	Horsfield's Bushlark
	Myiagra inquieta	Restless Flycatcher
	Myiagra rubecula	Leaden Flycatcher
	Neochmia modesta	Plum-headed Finch
	Nettapus coromandelianus	Cotton Pygmy Goose
	Ninox novaeseelandiae	Southern Boobook
	Nycticorax caledonicus	Nankeen Night Heron
	Nymphicus hollandicus	Cockatiel
	Ocyphaps lophotes	Crested Pigeon
	Pachycephala rufiventris	Rufous Whistler
	Pardalotus striatus	Striated Pardalote
	Pelecanus conspicillatus	Australian Pelican
	Petrochelidon ariel	Fairy Martin
	Petrochelidon nigricans	Tree Martin
	Phalacrocorax sulcirostris	Little Black Cormorant
	Phaps chalcoptera	Common Bronzewing
	Philemon citreogularis	Little Friarbird
	Philemon corniculatus	Noisy Friarbird

Class	Scientific name	Common name
	Platalea flavipes	Yellow-billed Spoonbill
	Platalea regia	Royal Spoonbill
	Platycercus adscitus	Pale-headed Rosella
	Plectorhyncha lanceolata	Striped Honeyeater
	Plegadis falcinellus	Glossy Ibis
	Podargus strigoides	Tawny Frogmouth
	Pomatostomus temporalis	Grey-crowned Babbler
	Porphyrio melanotus	Australasian Swamphen
	Pyrrholaemus sagittatus	Speckled Warbler
	Rhipidura albiscapa	Grey Fantail
	Rhipidura leucophrys	Willie Wagtail
	Rostratula australis	Australian Painted Snipe
	Smicrornis brevirostris	Weebill
	Strepera graculina	Pied Currawong
	Struthidea cinerea	Apostlebird
	Tachybaptus novaehollandiae	Australasian Grebe
	Taeniopygia bichenovii	Double-barred Finch
	Taeniopygia guttata	Zebra Finch
	Threskiornis moluccus	Australian White Ibis
	Todiramphus macleayii	Forest Kingfisher
	Todiramphus pyrrhopygius	Red-backed Kingfisher
	Todiramphus sanctus	Sacred Kingfisher
	Trichoglossus moluccanus	Rainbow Lorikeet
	Turnix pyrrhothorax	Red-chested Buttonquail
	Turnix varius	Painted Buttonquail
	Turnix velox	Little Buttonquail
	Tyto javanica	Eastern Barn Owl
	Vanellus miles	Masked Lapwing
Non-volant mammals	*Aepyprymnus rufescens*	Rufous Bettong
	Canis lupus	Dingo, Domestic Dog
	Hydromys chrysogaster	Water-rat
	Lepus europaeus	Brown Hare*
	Macropus giganteus	Eastern Grey Kangaroo
	Mus musculus	House Mouse*
	Oryctolagus cuniculus	Rabbit*
	Petaurus breviceps	Sugar Glider
	Phascolarctos cinereus	Koala
	Planigale maculata	Common Planigale
	Pseudomys desertor	Desert Mouse
	Sminthopsis macroura	Stripe-faced Dunnart
	Sus scrofa	Pig*

Class	Scientific name	Common name
	Trichosurus vulpecula	Common Brushtail Possum
	Wallabia bicolor	Swamp Wallaby
Reptilia	*Anilios wiedii*	Brown-snouted Blind Snake
	Boiga irregularis	Brown Tree Snake
	Carlia pectoralis	Open-litter Rainbow-skink
	Carlia schmeltzii	Robust Rainbow-skink
	Concinnia sokosoma	Stout Barsided Skink
	Cryptoblepharus pannosus	Ragged Snake-eyed Skink
	Cryptoblepharus pulcher	Elegant Snake-eyed Skink
	Cryptophis boschmai	Carpentaria Snake
	Demansia psammophis	Yellow-faced Whipsnake
	Denisonia maculata	Ornamental Snake
	Diplodactylus platyurus	Eastern Fat-tailed Gecko
	Diplodactylus vittatus	Eastern Stone Gecko
	Diporiphora nobbi	Nobbi Dragon
	Furina diadema	Red-naped Snake
	Gehyra catenata	Chain-backed Dtella
	Gehyra dubia	Dubious Dtella
	Heteronotia binoei	Bynoe's Gecko
	Lerista fragilis	Eastern Mulch-slider
	Lialis burtonis	Burton's Legless Lizard
	Lucasium steindachneri	Box-patterned Gecko
	Menetia greyii	Common Dwarf Skink
	Morethia boulengeri	South-eastern Morethia Skink
	Morethia taeniopleura	Fire-tailed Skink
	Nephrurus asper	Prickly Knob-tailed Gecko
	Oedura monilis	Ocellated Velvet Gecko
	Parasuta dwyeri	Dwyer's Snake
	Pseudonaja textilis	Eastern Brown Snake
	Pygopus schraderi	Eastern Hooded Scaly-Foot
	Tiliqua scincoides	Common Blue-tongued Skink
	Tropidonophis mairii	Keelback
	Varanus tristis	Black-headed monitor
Bats	*Austronomus australis*	White-striped Free-tailed Bat
	Chaerephon jobensis	Northern Freetail Bat
	Chalinolobus gouldii	Gould's Wattled Bat
	Chalinolobus morio	Chocolate Wattled Bat
	Chalinolobus picatus	Little Pied Bat
	Miniopterus orianae oceanensis	Southern Bent-wing Bat
	Ozimops lumsdenae	Northern Free-tailed Bat
	Ozimops ridei	Eastern Free-tailed Bat

Class	Scientific name	Common name
	Pteropus scapulatus	Little Red Flying Fox
	Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat
	Scotorepens balstoni	Western Broad-nosed Bat
	Scotorepens greyii	Little Broad-nosed Bat
	Taphozous troughtoni	Troughton's Sheathtail Bat
	Vespadelus baverstocki	Inland Forest Bat
	Vespadelus troughtoni	Eastern Cave Bat

* - pest fauna species

Appendix D

Anabat results

Microbat Call Interpretation Report

Prepared for ("Client"):	EMM Consulting
Survey location/project name:	Blackwater Mine
Survey dates:	19-26 March & 12-15 April 2019
Client project reference:	
Job no.:	EMM-1901
Report date:	9 May 2019

Methods

Data received

Balance! Environmental received 21 ZCA data files and associated LOG files, recorded using three Anabat Express detectors (Titley Scientific, Brisbane) during two survey periods (19-26 March and 12-15 April 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 3604 ZC files, which contained a total of 3707 identifiable bat-calls.

At least 15 and possibly 16 bat species were recorded during the March-April 2019 surveys at Blackwater Mine (see **Table 1**). Thirteen 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 2093 (56.5%) of the recognised calls. The remainder had mixed or intermediate call characteristics and could only be assigned to 'unresolved species pairs'. Where a species pair was identified for a given detector-night, both species in the pair are listed as "possible" in **Table 1**, unless more diagnostic calls from one or both species in the pair were reliably identified.

Almost two-thirds of the identified calls belonged to just four species: *Chalinolobus gouldii; Ozimops ridei; Saccolaimus flaviventris;* and *Chaerephon jobensis*. *Chalinolobus picatus* and *Scotorepens greyii* together contributed another 16.5% of the total call-count.

Sample spectrograms of call types recorded during the survey are displayed in **Appendix 1**.

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 Mine, March-April 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:	DPM_SN395665						EMM_SN304010					GLE_SN324708								
Date:	19/3	20/3	21/3	22/3	23/3	25/3	20/3	22/3	23/3	25/3	26/3	19/3	20/3	21/3	22/3	25/3	26/3	12/4	14/4	15/4
Chalinolobus gouldii	♦	□	♦	♦	♦		♦	♦	♦	♦	♦	♦	♦	♦	□	♦	♦	♦	♦	♦
Chalinolobus morio									♦	□	□	□		□		♦		♦	□	
Chalinolobus picatus		♦	□	♦		♦	♦	♦	♦	♦	♦	♦	□	♦	♦	♦	♦	□	♦	□
Nyctophilus species										♦	♦					♦	♦	♦		
Scotorepens balstoni	□		□						□	♦	♦		□	□		♦	♦			
Scotorepens greyii		□	♦	♦	♦		♦	♦	♦	♦	♦	♦	♦	♦	□	♦	♦	♦	□	♦
Vespadelus baverstocki	♦	♦		□			♦	□	□	□	♦	♦		♦		♦	♦	□		
Vespadelus troughtoni					♦			♦	♦	□	□	□		♦		□		♦	♦	
Miniopterus orianae oceanensis	♦	♦	♦	♦	♦		♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	
Austronomus australis							♦				♦						♦	♦	♦	
Chaerephon jobensis	♦	♦	♦	♦	♦		♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	□
Ozimops lumsdenae	♦	♦	♦	♦	♦	♦		♦	♦	♦	♦	♦	♦			♦	♦	♦	♦	□
Ozimops ridei	♦	□	□	♦	♦		♦	♦	♦	♦	♦	□	□	♦	□	♦	♦	♦	♦	□
Saccolaimus flaviventris	♦	♦	♦	♦	♦		♦	♦	□	♦	♦	♦	♦	♦	♦	♦	♦	♦	□	♦
Taphozous troughtoni	♦		♦	♦	♦			♦	♦	♦	♦	♦	♦				♦		♦	

Glossary

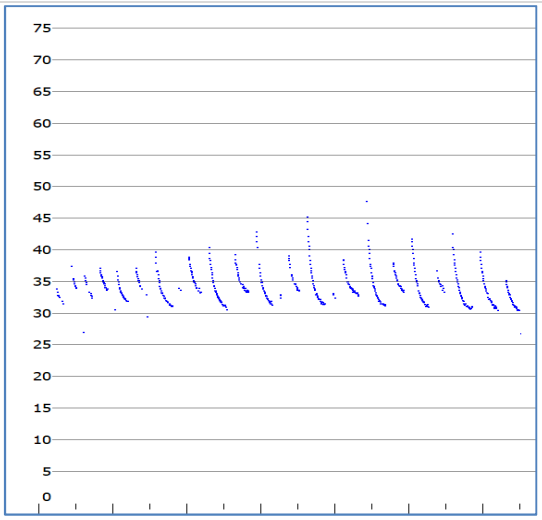
Technical terms used in this report are described in the following table.

Approach phase	The part of a bat *call* emitted as the bat starts to home in on a detected prey item; a transitional series of *pulses* between the *search phase* and *feeding buzz*, that become progressively steeper and shorter in duration.
Call	Refers to a single bat call, made up of a series of individual sound *pulses* in one or more *phases* (*search, approach, feeding buzz*).
CF (=Constant Frequency)	A type of *pulse* in which the dominant component consists of a more-or-less 'pure tone' of sound at a Constant Frequency; with *shape* appearing flat on the sonogram. Often also contains a brief *FM* component at the beginning and/or end of the CF component (*viz.* FM-CF-FM).
Characteristic frequency (Fc)	The frequency of the flattest part of a *pulse*; usually the lowest frequency reached in the *qCF* component of a pulse. This is often the primary diagnostic feature for species identification.
Duration	The time period from the beginning of a *pulse* to the end of the pulse.
Feeding buzz	The terminal part of a *call*, following the *approach phase*, 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 *pulse* in which there is substantial change in frequency from beginning to end; *shape* ranges from almost vertical and linear through varying degrees of curvature.
FC range	Refers to the range of frequencies occupied by the *characteristic frequency* section of *pulses* within a call or set of calls.
Frequency sweep or "band-width"	The range of frequencies through which a *pulse* sweeps from beginning to end; Maximum frequency (Fmax) – minimum frequency (Fmin).
Knee	The transitional part of a *pulse* between the initial (usually steeper) frequency sweep and the *characteristic frequency* 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 *call*; the *shape*, *duration* and *characteristic frequency* of a pulse are the key diagnostic features used to differentiate species.
Pulse body	The part of the *pulse* between the *knee* and *tail* and containing the *characteristic frequency* section.
Pulse shape	The general appearance of a *pulse* on the sonogram, described using relative terms related to features such as slope and degree of curvature. See also *CF, qCF* and *FM*.
qCF (=quasi Constant Frequency)	A type of *pulse* in which there is very little change in frequency from beginning to end; *shape* appears to be almost flat. Some pulses also contain an *FM* component at the beginning and/or end of the qCF component (*viz.* FM-qCF).
Search phase	The part of a bat *call* generally required for reliable species diagnosis. A consistent series of *pulses* 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 *approach phase* and *feeding buzz* pulses.
Sequence	Literally, a sequence of *pulses* that may be from one or more bats; but generally refers to a *call* or part (e.g. *phase*) of a call.
Tail	The final component of a *pulse*, following the *characteristic frequency* section; may consist of a short or long sweep of frequencies either upward or downward from the Fc; or may be absent.

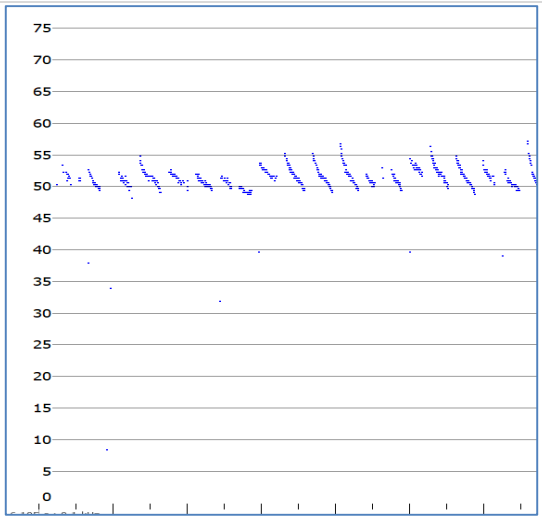
Appendix1 Call-detection rates for bat species recorded at Blackwater Mine, March-April 2019.

Detector:	DPM_SN395665						EMM_SN304010					GLE_SN324708									Species total
Date:	19/3	20/3	21/3	22/3	23/3	25/3	20/3	22/3	23/3	25/3	26/3	19/3	20/3	21/3	22/3	25/3	26/3	12/4	14/4	15/4	
Positively identified calls																					
Chalinolobus gouldii	4		26	10	6		3	13	24	24	106	7	21	13		10	13	26	13	2	321
Chalinolobus morio									1							11		1			13
Chalinolobus picatus		7		1		1	71	4	4	19	13	3		4	1	11	21		6		166
Nyctophilus species										2	2					1	2	1			8
Scotorepens balstoni										15	5					3	3				26
Scotorepens greyii			3	3	3		1	7	3	2	38	1	4	8		9	61	1		1	145
Vespadelus baverstocki	1	2					2				1	1		1		2	15				25
Vespadelus troughtoni					2			1	1					2				5	3		14
Miniopterus orianae oceanensis	2	1	2	11	5		9	95	82	1	5	10	6	13	2	1	1	16	6		268
Austronomus australis							1				2						2	2	1		8
Chaerephon jobensis	4	1	13	27	11		11	37	35	15	111	2	8	28	1	24	215	168	50		761
Ozimops lumsdenae	2	3	18	10	11	3		7	10	33	2	4				1	10	16			130
Ozimops ridei	1			3	1		2	4	1	9	9			1		2	7	5	3		48
Saccolaimus flaviventris	1	4	4	7	3		4	6		57	8	10	4	4	3	11	8	3		1	138
Taphozous troughtoni	1		3	3	1			5	3	1	1	1	1				1		1		22
Unresolved calls																					
C. gouldii / O. ridei	3	4	13	15	6		5	3	11	284	31	19	20	4	327	21	36	19	11	2	834
C. gouldii / S. balstoni	1		2						2	9	4		1	1			1				21
C. picatus / S. greyii		53	6				40	3	4	40	18	13	3	6	1	26	73	2	13	1	302
C. picatus / V. baverstocki										1							7				8
V. baverstocki / M. o. oceanensis				3			3	15	15	5		4		3			1	2			51
V. troughtoni / C. morio									1	2	6	1		1		8		2	1		22
S. flaviventris / C. jobensis	2		2	45	6		3	31	27	12	16	6	2	2	14	13	80	79	14	2	356
S. flaviventris / O. lumsdenae	1			1				1	1	3	3	1					7	1		1	20
Detector-night total	23	75	92	139	55	4	155	232	225	534	381	83	70	91	349	154	564	349	122	10	3707

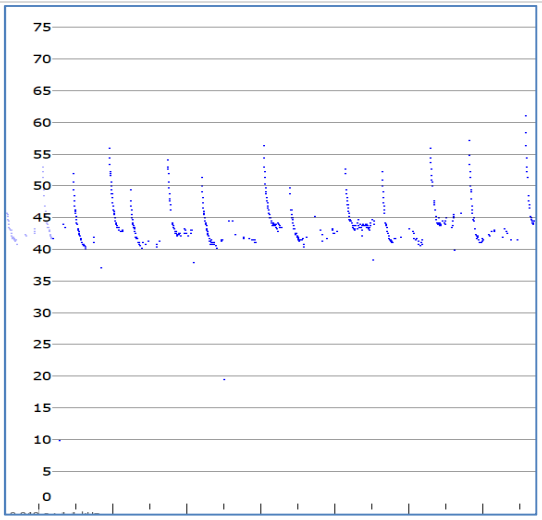
Appendix 2 Representative call sequences from the Blackwater surveys, March-April 2019.
(Scale: 10 msec per tick; time between pulses removed)



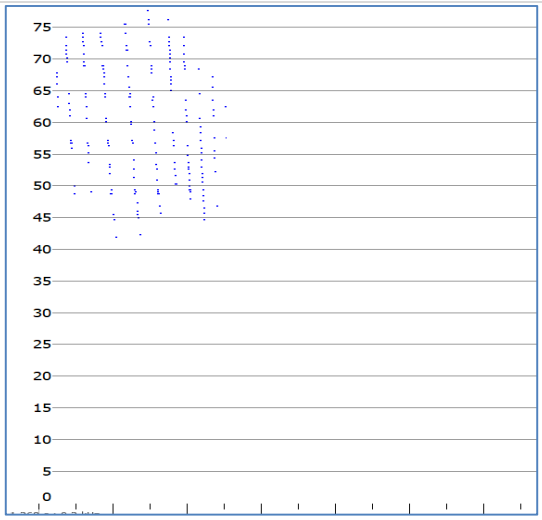
Chalinolobus gouldii



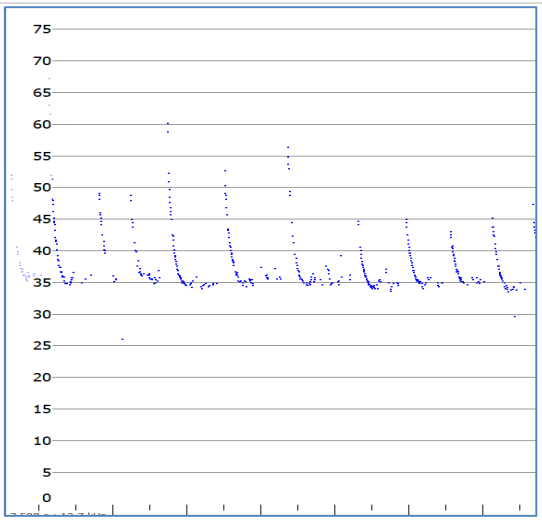
Chalinolobus morio



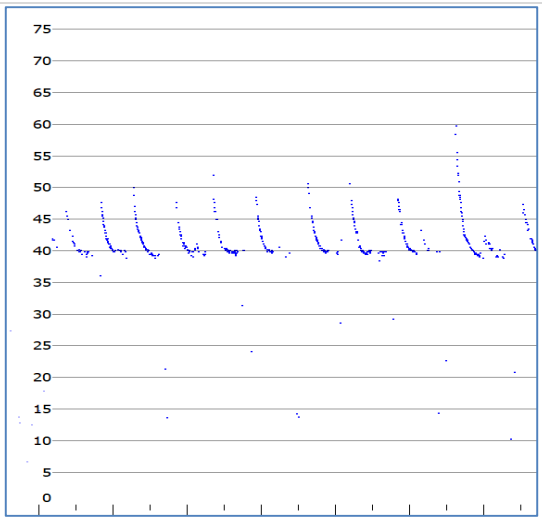
Chalinolobus picatus



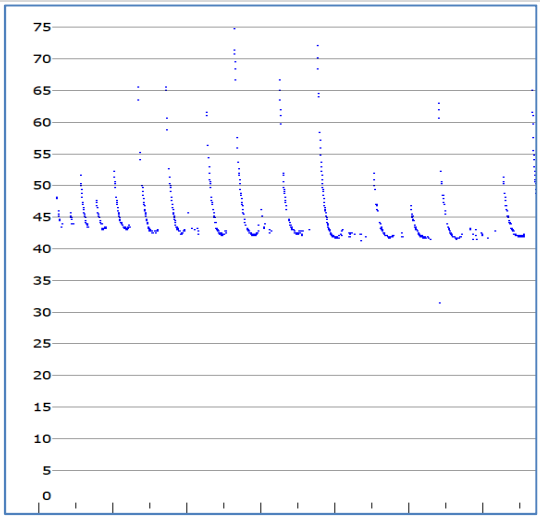
Nyctophilus species



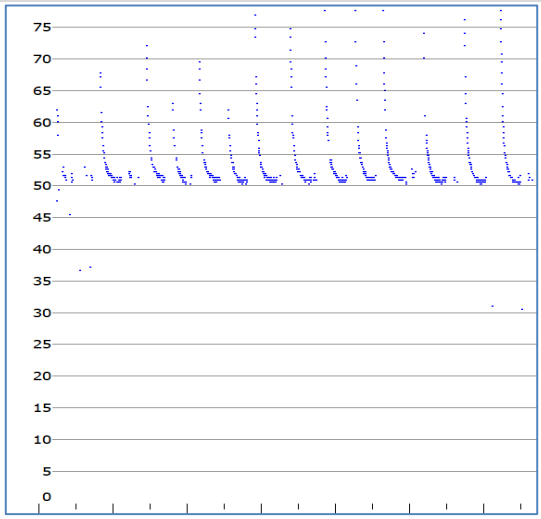
Scotorepens balstoni



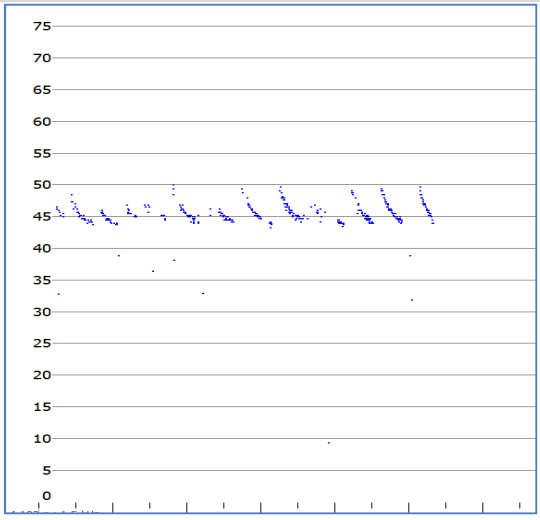
Scotorepens greyii



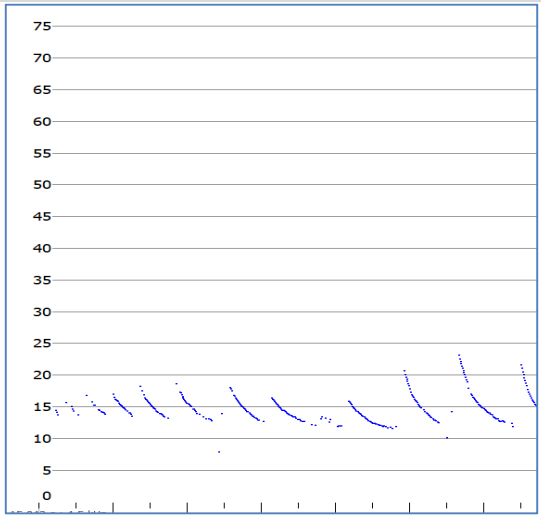
Vespadelus baverstocki



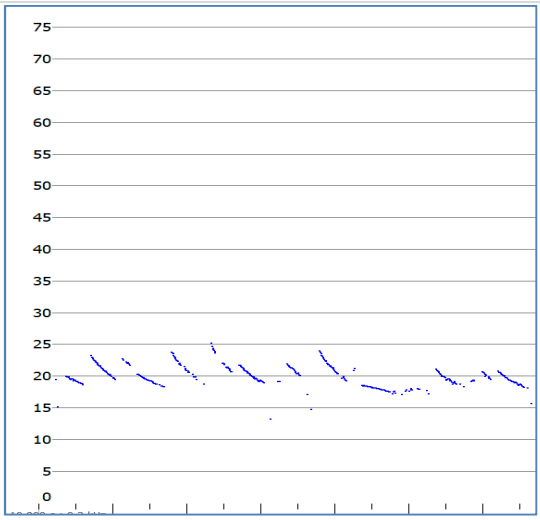
Vespadelus troughtoni



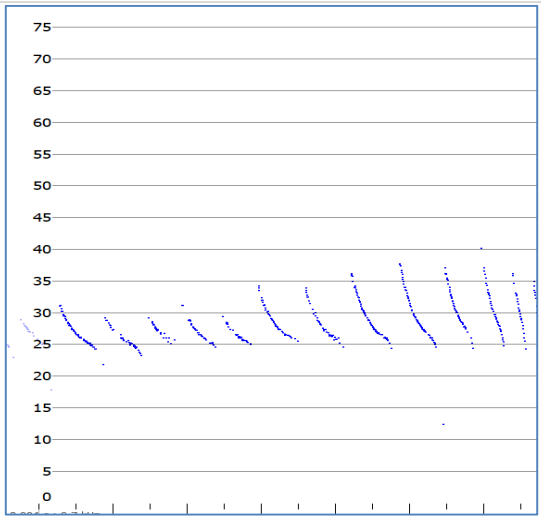
Miniopterus orianae oceanensis



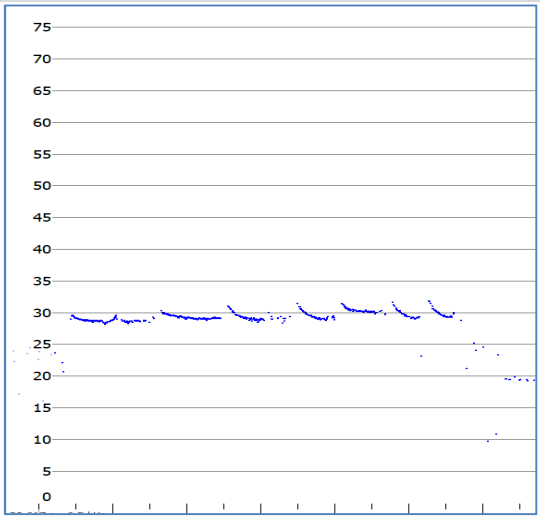
Austronomus australis



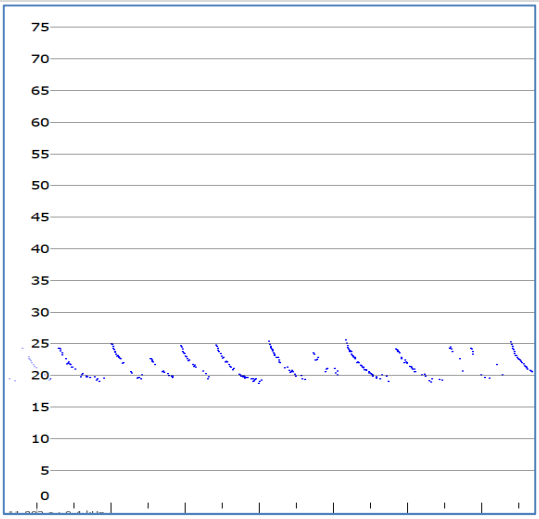
Chaerephon jobensis



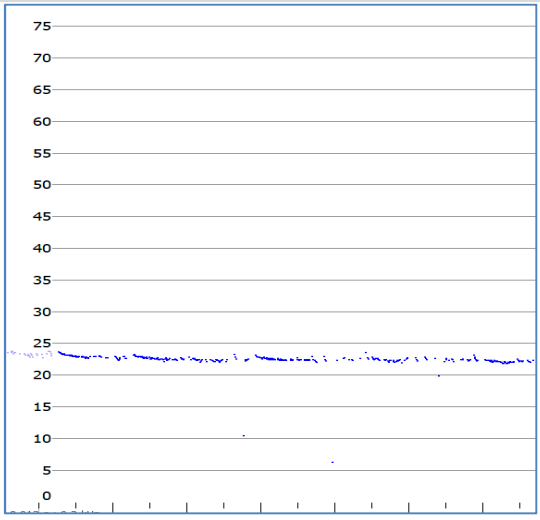
Ozimops lumsdenae



Ozimops ridei



Saccolaimus flaviventris



Taphozous troughtoni

Microbat Call Interpretation Report

Prepared for ("Client"):	EMM Consulting
Survey location/project name:	Blackwater (North)
Survey dates:	September-October 2019
Client project reference:	
Job no.:	EMM-1902A
Report date:	16 December 2019

Methods

Data received

Balance! Environmental received 5 ZCA data files and associated LOG files, recorded using two Anabat Express detectors (Titley Scientific, Brisbane) between 29th September and 2nd October 2019. The dataset included a folder for a third detector ("GLE"), within which the log files indicated deployment overnight on 29th September, but there was no ZCA data file in this folder.

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 337 ZC files, which contained a total of 770 identifiable bat-calls.

At least 13 and possibly 14 bat species were recorded during the Blackwater North spring 2019 survey (see **Table 1**). Twelve 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 540 (70%) 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. 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.

Two-thirds of the positively identified calls belonged to just three species: *Chalinolobus gouldii; Miniopterus orianae oceanensis;* and *Chaerephon jobensis*. Another 24% of the reliably identified calls were contributed by *Scotorepens greyii; Chalinolobus picatus;* and *Ozimops lumsdenae*. Most of the 'unresolved' calls were also attributable to *S. greyii* and/or *C. picatus* (see **Table 2**).

Sample spectrograms of call types recorded during the survey are displayed in **Appendix 2**.

Table 1 Microbat species detected at Blackwater North, 29 September – 2 October 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	
Date:	29-Sep	30-Sep	2-Oct	29-Sep	30-Sep
Chalinolobus gouldii	♦	♦	♦	♦	♦
Chalinolobus morio	♦				
Chalinolobus picatus	♦	♦		□	□
Nyctophilus sp.	♦				
Scotorepens balstoni	♦			♦	
Scotorepens greyii	♦	♦		♦	
Vespadelus baverstocki	□	□		♦	□
Vespadelus troughtoni	♦				
Miniopterus orianae oceanensis	♦	♦	♦	♦	♦
Chaerephon jobensis	♦	♦	♦	♦	♦
Ozimops lumsdenae	♦	♦	♦	♦	♦
Ozimops ridei	□	♦	♦	♦	♦
Saccolaimus flaviventris	♦	♦	□	♦	♦

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.

Glossary

Technical terms used in this report are described in the following table.

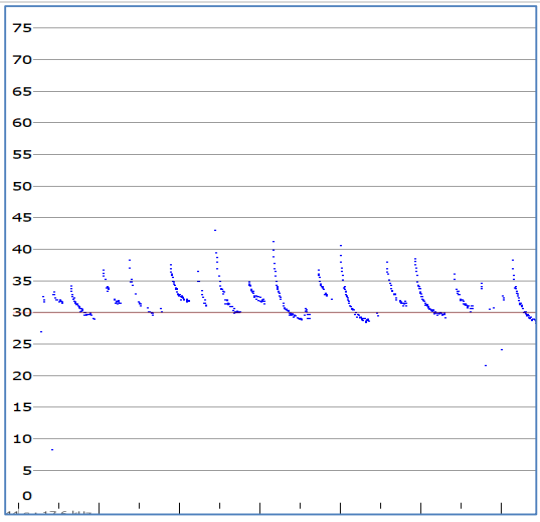
Approach phase	The part of a bat *call* emitted as the bat starts to home in on a detected prey item; a transitional series of *pulses* between the *search phase* and *feeding buzz*, that become progressively steeper and shorter in duration.
Call	Refers to a single bat call, made up of a series of individual sound *pulses* in one or more *phases* (*search, approach, feeding buzz*).
CF (=Constant Frequency)	A type of *pulse* in which the dominant component consists of a more-or-less 'pure tone' of sound at a Constant Frequency; with *shape* appearing flat on the sonogram. Often also contains a brief *FM* component at the beginning and/or end of the CF component (*viz.* FM-CF-FM).
Characteristic frequency (Fc)	The frequency of the flattest part of a *pulse*; usually the lowest frequency reached in the *qCF* component of a pulse. This is often the primary diagnostic feature for species identification.
Duration	The time period from the beginning of a *pulse* to the end of the pulse.
Feeding buzz	The terminal part of a *call*, following the *approach phase*, 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 *pulse* in which there is substantial change in frequency from beginning to end; *shape* ranges from almost vertical and linear through varying degrees of curvature.
FC range	Refers to the range of frequencies occupied by the *characteristic frequency* section of *pulses* within a call or set of calls.
Frequency sweep or "band-width"	The range of frequencies through which a *pulse* sweeps from beginning to end; Maximum frequency (Fmax) – minimum frequency (Fmin).
Knee	The transitional part of a *pulse* between the initial (usually steeper) frequency sweep and the *characteristic frequency* 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 *call*; the *shape*, *duration* and *characteristic frequency* of a pulse are the key diagnostic features used to differentiate species.
Pulse body	The part of the *pulse* between the *knee* and *tail* and containing the *characteristic frequency* section.
Pulse shape	The general appearance of a *pulse* on the sonogram, described using relative terms related to features such as slope and degree of curvature. See also *CF, qCF* and *FM*.
qCF (=quasi Constant Frequency)	A type of *pulse* in which there is very little change in frequency from beginning to end; *shape* appears to be almost flat. Some pulses also contain an *FM* component at the beginning and/or end of the qCF component (*viz.* FM-qCF).
Search phase	The part of a bat *call* generally required for reliable species diagnosis. A consistent series of *pulses* 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 *approach phase* and *feeding buzz* pulses.
Sequence	Literally, a sequence of *pulses* that may be from one or more bats; but generally refers to a *call* or part (e.g. *phase*) of a call.
Tail	The final component of a *pulse*, following the *characteristic frequency* section; may consist of a short or long sweep of frequencies either upward or downward from the Fc; or may be absent.

Appendix1

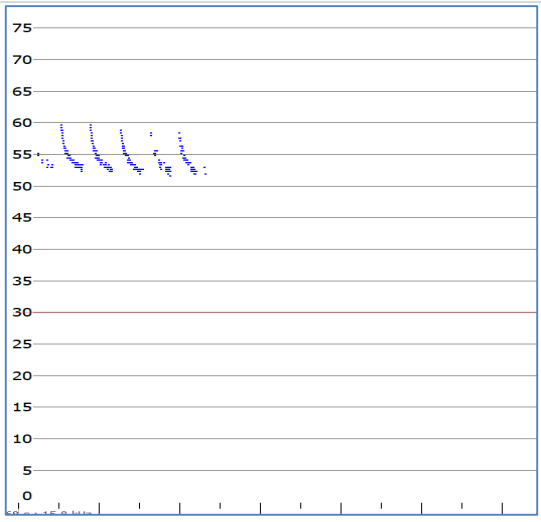
Call-detection rates for bat species recorded at Blackwater North, 29 September – 2 October 2019.

Detector name-Serial No.:	DPM SN395665			EcoSmart SN304010		Species Total
Date:	29-Sep	30-Sep	2-Oct	29-Sep	30-Sep	
Positively identified calls						
Chalinolobus gouldii	51	45	2	1	4	103
Chalinolobus morio	1					1
Chalinolobus picatus	44	5				49
Nyctophilus sp.	1					1
Scotorepens balstoni	7			2		9
Scotorepens greyii	25	10		2		37
Vespadelus baverstocki				1		1
Vespadelus troughtoni	1					1
Miniopterus orianae oceanensis	120	20	4	6	12	162
Chaerephon jobensis	14	25	54	5	2	100
Ozimops lumsdenae	2	26	11	3	2	44
Ozimops ridei		3	1	2	1	7
Saccolaimus flaviventris	9	10		2	4	25
Unresolved calls						
C. gouldii / O. ridei	23	25		7	5	60
C. gouldii / S. balstoni	3			1		4
C. picatus / S. greyii	119	13				132
C. picatus / V. baverstocki	3			2	3	8
V. baverstocki / M. o. oceanensis	6	4		2	1	13
S. flaviventris / C. jobensis	2	4	4		3	13
Detector-night Total	431	190	76	36	37	770

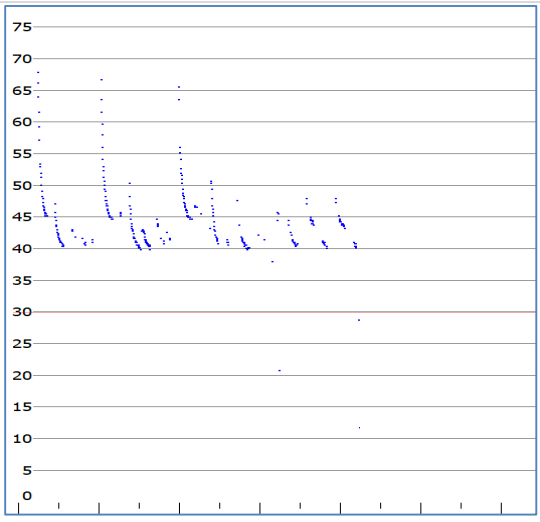
Appendix 2 Representative call sequences from the Blackwater surveys, September-October 2019.
(Scale: 10 msec per tick; time between pulses removed)



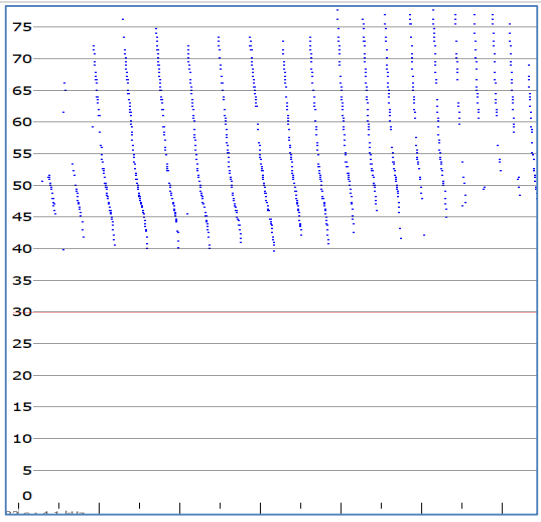
Chalinolobus gouldii



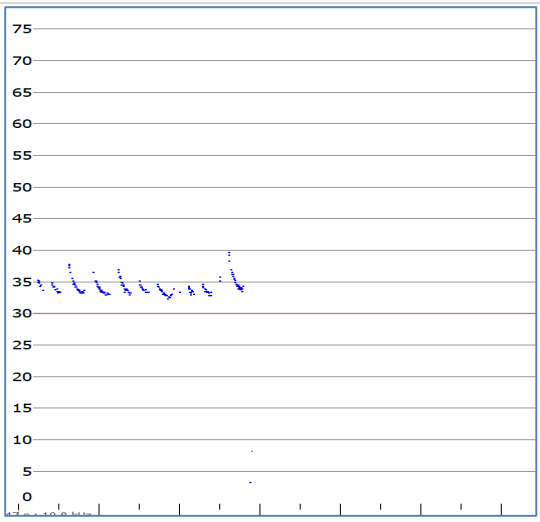
Chalinolobus morio



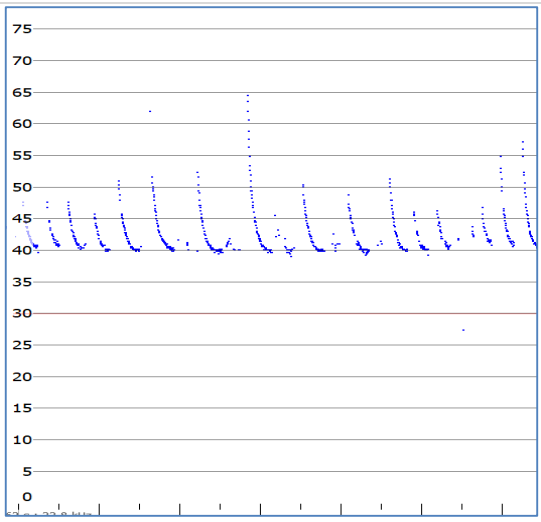
Chalinolobus picatus



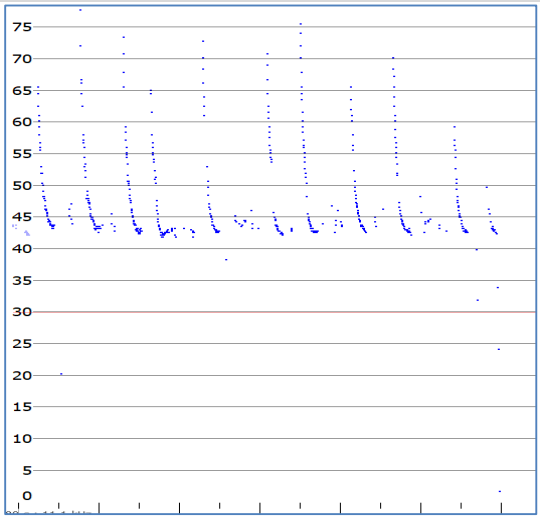
Nyctophilus species



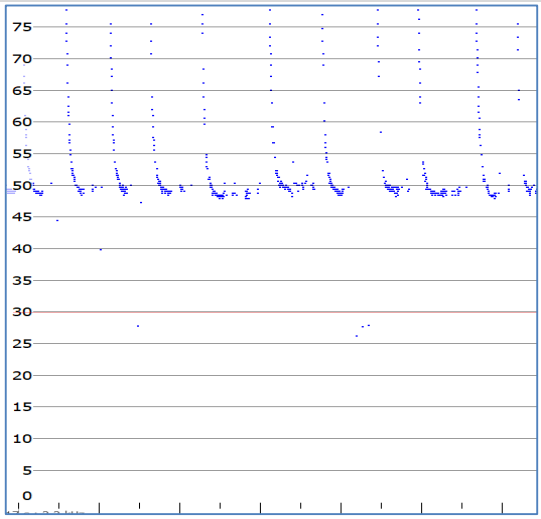
Scotorepens balstoni



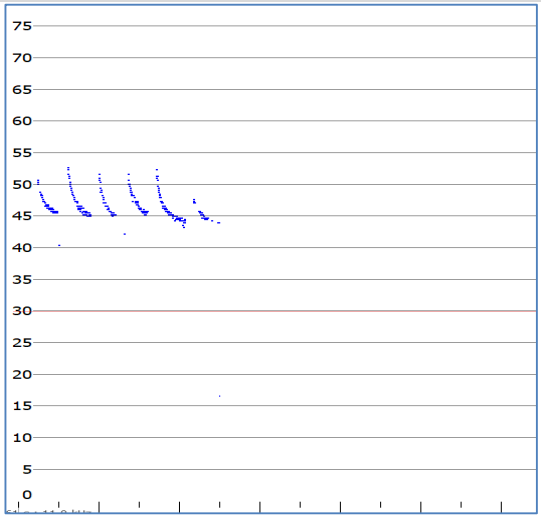
Scotorepens greyii



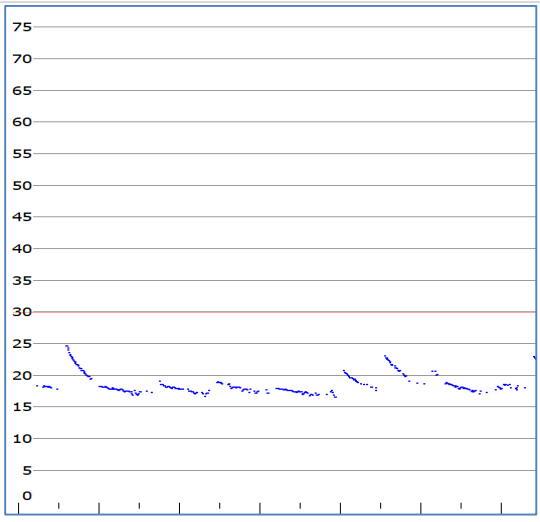
Vespadelus baverstocki



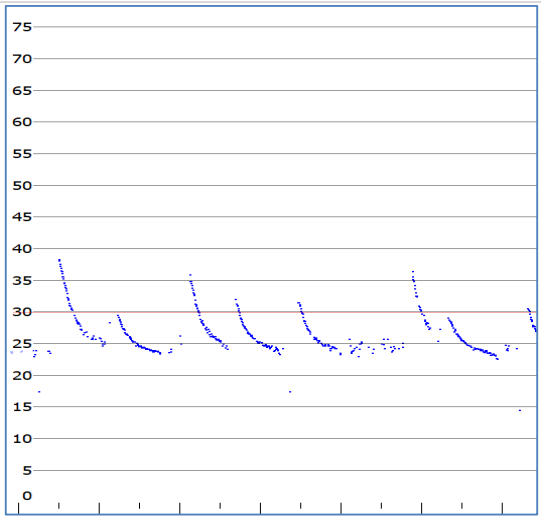
Vespadelus troughtoni



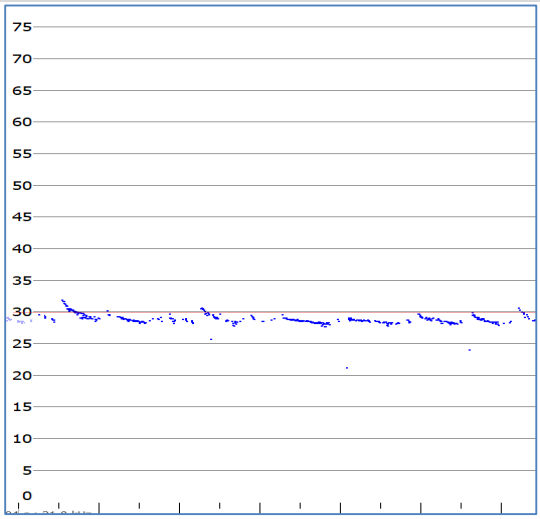
Miniopterus orianae oceanensis



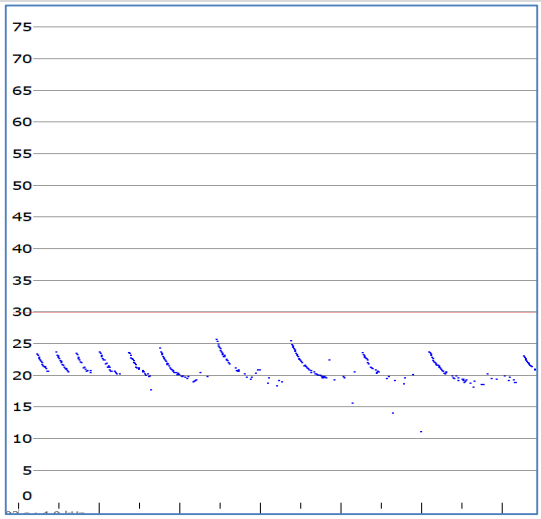
Chaerephon jobensis



Ozimops lumsdenae



Ozimops ridei



Saccolaimus flaviventris

Appendix E

Refined likelihood of occurrence

E.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
Antechinus argentus	Silver-headed Antechinus	P	P	E	V	The Silver-headed Antechinus was first described in 2013 therefore little is known of the species' ecology. Habitats where this species has been recorded consist of wet high altitude open forest (DCCEEW 2023s).	Unlikely	Database searches confirmed records of this species in the Blackdown Tableland National Park to the east of the Study area. Due to the species restriction to high altitudes and wet open forests which don't occur in the Study area, the species is unlikely to occur.
Bidyanus bidyanus	Silver Perch	P	O	CE	LC	Faster-flowing water, including rapids and races, and more open sections of river, throughout the Murray-Darling Basin (MDB) (Clunie and Koehn 2001, cited in TSSC 2013).	Unlikely	Distributional range is naturally in the Murray Darling Basin, although translocated to coast streams in south-east Queensland (and other states). Species or species habitat not detected during field surveys
Calidris ferruginea	Curlew Sandpiper	P	O	CE, Mi	CE	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, dames with bare edges of mud. The species does not breed in Australia (DCCEEW 2023t).	Unlikely	The desktop reviews confirmed no records of this species within the desktop Study area. There is potential for this species to occur during migration but it is not considered likely.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Chalinolobus dwyeri	Large-eared Pied Bat	P	P	V	V	The Large-eared Pied Bat typically roost in caves and other crevices with preferred foraging habitat consisting of fertile eucalypt woodlands or dense riparian corridors (DCCEEW 2023d).	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 Study area. Most records for the species are within several kilometres of cliff lines or rocky terrain (preferred roosting habitat). The Study area does not support preferred roosting habitat such as caves or sandstone escarpments. However, the riparian vegetation could be considered as potential but limited foraging habitat. Preferred foraging habitat comprises open forests and woodlands including riparian zones, foot-slopes and valley floors, within 2.5 km of preferred roosting habitat (Kerswell et al. 2020). The Large-eared Pied Bat requires a combination of sandstone cliffs and fertile woodland valley within close proximity of each other (DCCEEW 2023d). Ultimately, the long distance from preferred roosting habitat and the disjunct and limited forging habitat within the Study area, the species is considered unlikely to occur. Extensive survey effort (see Figure 4.2) failed to record this species. Additionally, the species was not recorded on Anabats in separate surveys in Blackwater southern leases by EMM in 2019-20.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Dasyurus hallucatus	Northern Quoll	P	O	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	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 Study area. Habitat critical to the survival of the Northern Quoll is defined in (DoE 2016) as: • 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. Foraging or dispersal habitat is recognised to be any land comprising predominantly native vegetation in the immediate area (i.e. within 1 km) of shelter habitat. The Study area is unsuitable habitat.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Delma torquata	Collared Delma	P	O	V	V	The Collared Delma is an endemic species to Queensland and one of the smallest members of the *Pygopodidae* family (legless lizards). 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 (DCCEEW 2023u).	Unlikely	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 Study area. Limited information is known about its full distribution in Queensland; however, it has been recorded in isolated populations where microhabitat occurs. The Study area includes eucalypt dominated woodlands on land zone 3 and 9 but these are isolated and limited in extent and therefore the species is considered unlikely to occur. The presence of rocks, logs, bark and other coarse woody debris, and mats of leaf litter (typically 30 to 100 mm thick) appears to be an essential characteristic of the Collared Delma microhabitat and is always present where the species occurs (BBR Workshop 2010). Rocky microhabitats in particular appear to be an essential habitat feature. 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 Study area. Microhabitat features are not present in the Study area and therefore the species 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
Denisonia maculata	Ornamental Snake	P	O	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 (DCCEEW 2023b).	Known	No records of the Ornamental Snake have been confirmed from historical surveys in the surveys area. However, the species is known to occur within the region. Three snakes were found in close proximity to each other in an area of gilgai between Taurus Creek and the Blackwater-Rolleston Road on ML1762 (Figure 6.1). Conditions were good during these surveys, with water in some gilgai and many frogs active. All three were found on drying margins of gilgai in cracking clay soils. This is outside of the project footprint. It is considered potential to occur in other gilgai areas in the study area as it is generally difficult to detect, and suitable albeit degraded gilgai habitat exists within the Study area. Additionally, this species has been recorded by EMM from similar degraded gilgai on southern BWM leases.
Egernia rugosa	Yakka Skink	P	P	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 (DCCEEW 2023v).	Unlikely	The desktop review did not identify any records of species within the desktop Study area; however, it is known to occur in the wider region. There is also an ALA record north-west of the Study area. 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. The desktop review did not identify any records of species within the desktop Study area; however, it is known to occur in the wider region. The Study area does not contain extensive areas of suitable habitat for this species including logs, tree stumps and rocky areas.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Elseya albagula	Southern Snapping Turtle	P	O	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 2019o). 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 desktop Study area. No waterways within the Study area are likely to provide suitable habitat to support the species.
Erythrotriorchis radiatus	Red Goshawk	P	O	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 (DCCEEW 2023w).	Unlikely	The desktop review identified three historical records of the species in the Blackdown Tableland National Park, but no records exist from historical surveys with the BWM leases. The Study 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.
Falco hypoleucos	Grey Falcon	P	O	V	V	The Grey Falcon inhabits woodland, shrubland and grasslands in the arid and semi-arid zones (Menkhorst et al. 2017).	Unlikely	There are no regional records of Grey Falcon and it is mostly restricted to arid habitats. Therefore, the species 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
Furina dunmalli	Dunmall's Snake	P	O	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 (DCCEEW 2023x).	Unlikely	Desktop review did not identify any records of the species within the desktop Study area. The modelled distribution of this species suggests that this species does not occur.
Geophaps scripta scripta	Squatter Pigeon (southern)	P	P	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 (DCCEEW 2023a).	Known	The desktop review indicated that the species has been recorded during historic surveys within the Blackwater mine leases and as recent as 2006 and 2007 in the Terang and South Marshmead areas. The species has also been recorded in adjacent protected areas including Arthurs Bluff State Forest. Although the species was recorded adjacent to dams near Taurus Road on two occasions, in June and August 2023, the species is considered to be scarce in the Study area due to habitat degradation rendering the Study area unsuitable. A significant factor is likely the extensive areas of dense Buffel grass dominating the Study area. Additionally, the Study area is dominated by clay soils, and sandy substrates are not extensive. The habitat is typically unsuitable for the species due to a combination of factors, namely: • Terrain and soils – most of the Study area occurs on clay dominated soils, which differs from the flat alluvial plains and sandy substrates favoured by the species (Squatter Pigeon Workshop, 2011). • Groundcover – much of the Project footprint is dominated by areas of dense grassy groundcover, which differs from

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
								the patchy tussock grassy understories of open woodland favoured by the species. Feeding opportunities are restricted in such dense grassy understoreys, and the potential for predation is increased. • Vegetation communities – the species favours open grassy woodlands and disturbed area. The Study area is dominated by extensive Buffel Grass and communities along creek lines are dense with clay soils. The majority of the Study area comprises extensive areas of dense Buffel Grass cover and clay soils. This species generally requires open forest or scrub on sandy soils, dominated by native grasses, in close association with permanent water (DCCEEW 2023a). 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; DCCEEW 2023a).

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Grantiella picta	Painted Honeyeater	P	P	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, *Melaleuca, Casuarina, Callitris,* and *Acacia* communities. It feeds primarily on Mistletoe (Loranthaceae) fruits and its movements are highly dependent on fruit availability (DCCEEW 2023e).	Potential	Desktop review identified records of the Painted Honeyeater within the desktop 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. 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 *Amyema quandang*. 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 Study 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 Study area. The species retains a low possibility of occurrence on a sporadic basis.
Hemiaspis damelii	Grey Snake	P	O	E	E	Occurs in Brigalow and Belah woodlands on cracking clay soils, often in association with water bodies.	Unlikely	The desktop review did not identify any records of the species within the desktop Study area. The Study area is not within its currently known distribution and is therefore 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
Hirundapus caudacutus	White-throated Needletail	P	O	V	V	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 (DCCEEW 2023q).	Likely	Although this species was not recorded during field surveys, it has been recorded adjacent to the Study area. Additionally, this species has a similar life-cycle and general ecology to the Fork-tailed Swift which was recorded within the Study area.
Lerista allanae	Allan's Lerista	P	O	E	E	This species occurs in a small distribution near Clermont, on black soil. Recent records of the skink were from leaf litter and friable soils beneath trees and shrubs (Borsboom et al. in prep.).	Unlikely	The Study area is outside the known distribution of the species and habitat is unsuitable. Known only from a small area near Clermont/Capella, northwest of the Study area, in open grasslands and grassy woodland, on black and red soil.
Maccullochella peelii	Murray Cod	P	O	V	LC	Deep water with in-stream habitat such as boulders, logs, and overhanging vegetation (Allen et al. 2002). From fast-moving, clear upland streams to slow-flowing, turbid lowland waters. Most individuals stay within 10 km reach of the river (Pusey et al. 2004; Allen et al. 2002).	Unlikely	Outside of natural area of distribution (ALA 2020). Species or species habitat not detected during field surveys.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Macroderma gigas	Ghost Bat	P	O	V	E	The Ghost Bat is Australia's largest micro-bat (microchiropteran) species. 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 desktop Study area. Preferred roosting habitat has not been recorded within the Study area.
Neochmia ruficauda ruficauda	Star Finch	P	O	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 (DCCEEW 2023y).	Unlikely	The desktop review did not identify any records of the species within the desktop Study area. The Study area is not within its currently known distribution and is therefore unlikely to occur.
Nyctophilus corbeni	Corben's Long-eared Bat	P	O	V	V	Corben's Long-eared Bat 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 desktop Study area. The Study 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.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Onychogalea fraenata	Bridled Nail-tail Wallaby	P	O	E	E	The species formally occurred throughout the Brigalow Belt occupying semi-arid environments. Its primary habitat consisted of ecotones between dense acacia shrubland and grassy woodland. Currently, the only naturally occurring population resides in Taunton National Park. A few sightings have also occurred outside the park, but these records are generally within 10 km (DCCEEW 2023z). In the national park the species is known to utilise open grassy woodland dominated by Poplar Box, dense forests dominated by Brigalow and transitional vegetation of very dense Brigalow.	Unlikely	The species has not been recorded in the desktop Study area and they have not been recorded in the Study area. This species is highly unlikely to be found away Taunton National Park situated ~30 km to the east. Additionally, the Study area no longer supports the extensive suitable habitat required for this species.
Petaurus australis australis	Yellow-bellied Glider	P	P	V	V	This species occurs in tall mature eucalypt forest. It feeds primarily on plant and insect exudates. They extract sap by incising into trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. They den in the hollows of large trees and have a large home range.	Unlikely	The desktop review identified records of the species in Blackdown Tableland National Park. However, no records exist from historic surveys within the Study area. The Yellow-bellied Glider favours forests with a diversity of eucalypt species and taller mature trees with abundant hollows and the species requires well connected remnant woodlands. The species is unlikely to occur in the Study area.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Petauroides armillatus	Central Greater Glider	P	P	E	E	The Central Greater Glider is the largest gliding possum in Australia. The species 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).	Unlikely	The desktop review identified records of the species in the Arthurs Bluff State Forest and Blackdown Tableland National Park. However, no records exist from historic surveys within the Study area. The Study area does support potential foraging habitat for the species. This primarily consists of remnant RE11.3.25 riparian vegetation along Taurus Creek, as well as small patches of *E. coolabah* also fringing Taurus Creek. However, the occurrence of this species is likely constrained by the lack of hollow bearing trees and limited and disjointed areas of habitat. The 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 2016) and the species requires well connected remnant woodlands. The species is unlikely to occur in the Study area. In general, there are few large mature trees in the creek lines 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 Taurus Creek and Two Mile Gully. The species is easy to detect and extensive surveys along Taurus Creek and Two Mile Gully 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.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Phascolarctos cinereus	Koala	P	O	E	E	The Koala is an arboreal, medium-sized marsupial. The species inhabits a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by *Eucalyptus* species. It feeds almost exclusively on the foliage of eucalypts and related species including *Corymbia, Lophostemon* and *Melaleuca* (DCCEEW 2023c).	Known	The desktop review identified one record of the Koala within the desktop Study area although this was from surveys undertaken prior to 2008. Database searches also confirmed records of Koalas in Blackdown Tableland National Park east of the Study area. Indirect evidence of this species (tree scratches) were recorded during EMM field surveys. Although they were relatively old, it confirms previous occurrence of this species. Suitable albeit limited habitat exists along Taurus Creek in the form riparian vegetation. However, the area of habitat is rather limited in extent and connectivity to adjacent habitat is poor.
Poephila cincta cincta	Southern Black-throated Finch	P	O	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 (DCCEEW 2023aa).	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 Study area.
Pteropus poliocephalus	Grey-headed Flying Fox	P	O	V	V	This nomadic species roosts in varying habitats including rainforests, *Melaleuca* communities, mangroves, and various riparian communities in both disturbed and undisturbed areas. It is primarily a canopy-feeder that forages on the nectar and fruits of various plant species. Foraging habitat is also highly variable according to food availability and includes rainforests, eucalypt woodlands, *Melaleuca* swamps and *Banksia* woodlands.	Unlikely	No records of this species exist within the desktop Study area. The Study area is on the margins of the geographical range or the species and offers some suitable habitats, although it has not been recorded from nearby Blackdown Tablelands National Park. Analysis of Federal Government roost data from the nearest flying fox camps at Blackwater, Comet, Duaringa and Emerald found that there are no records of Grey-headed Flying Fox from these camps.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Rheodytes leukops	Fitzroy River Turtle	P	O	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 (DCCEEW 2023ab). Preferred areas have high water clarity and are often associated with ribbonweed (*Vallisneria* sp.) (DEE 2020c).	Unlikely	The desktop review did not identify any records of this species within the desktop Study area. Targeted surveys failed to identify any suitable habitat for this species within the Study area.
Rostratula australis	Australian Painted Snipe	P	O	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 (DCCEEW 2023n).	Known	This species was recorded on three occasions by EMM ecologists within the Study area. It was recorded during both dry and wet conditions. Two records were of birds utilising constructed dams with shallow marshy edges, with the remaining record from flooded gilgai during wet conditions. It is likely the artificial dams supply refuge for this species during dry conditions where they exploit year-round suitable habitat and disperse from these areas into gilgai and other temporally flooded habitats during wet conditions. Site inspections indicate no breeding habitat is present in the Study area.
Stagonopleura guttata	Diamond Firetail	P	O	V	V	Diamond Firetail occur in eucalypt, acacia or casuarina woodlands, open forests and other lightly timbered habitats, including farmland and grassland with scattered trees	Unlikely	Desktop review did not identify any records of the species within the desktop Study area. There are no suitable open grassy woodlands present in the Study area.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Turnix melanogaster	Black-breasted Buttonquail	P	O	V	V	The Black-breasted Buttonquail 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 (DCCEEW 2023ac).	Unlikely	The desktop review did not identify any records of this species within the study or Study area. The Study area does not support suitable rainforest or vine thicket communities to support this species.

E.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
Aristida annua	✓	×	V	-	This species is restricted to a relatively small area in central Queensland. It is primarily recorded from *Eucalyptus orgadophila* woodlands on basalt derived black soils. However, other records exist from disturbed environs with exotic grass species such as roadsides (DCCEEW 2023f).	Potential	Although no records occur within the desktop Study area, regional records do exist. No preferred habitat occurs within the Study area; however, due to records of the species from disturbed sites along with low detection rates, this species is considered low 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
Arthraxon hispidus	✓	×	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 Study area, there are records from Blackdown Tableland within the desktop Study area.
Bertya opponens	✓	×	V	-	The species occurs in the region primarily on lateritic 'jump-ups' (Land zone 7) in association with Lancewood (*Acacia shirleyi*) communities (DCCEEW 2023g).	Unlikely	This species has been recorded in high densities just south of the Study area. However, no suitable land zone 7 habitat exists within the Study area.
Cadellia pentastylis	✓	✓	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 (*Eucalyptus albens*) and White Cypress Pine (*Callitris glaucophylla*) (DCCEEW 2023h).	Unlikely	This species has multiple confirmed records south of the desktop Study area and suitable habitat exists within the Study area. However, the population to the south is relatively restricted and is disjunct from any vegetation within the Study area. Additionally, this species is distinctive and usually easy to detect and due to no records, is considered unlikely to occur within the Study area.
Daviesia discolor	✓	✓	V	V	On the Blackdown Tableland, *Daviesia discolor* 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 (*Eucalyptus sphaerocarpa*) and Black Stringybark (*E. nigra*) (DoE 2008a).	Unlikely	Suitable habitat does not exist in the Study area as the elevation is too low therefore the species is unlikely to occur.

Scientific name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Dichanthium queenslandicum	✓	×	E	-	Primarily grows on black cracking soil in natural native grassland.	Potential	A record of this species exists approximately 25 km southwest of the project footprint. However, due to a lack of suitable native grasslands and extensive area of Buffel Grass along with cattle grazing, the species is only considered low potential to occur. This is a conservative approach due to the difficulties in detecting this species.
Dichanthium setosum	✓	×	V	-	The species grows in woodlands associated with rich, high nutrient soils. It is difficult to identify in the field and extremely similar to *D. sericeum* and *D. fecundum* (DCCEEW 2023i).	Potential	Suitable habitat for this species does not occur in the Study area. However, due to the difficulties in the detection and identification of this species, it is considered low potential to occur.
Eucalyptus raveretiana	✓	×	V	-	This species is restricted to woodland communities associated with riparian zones and alluvial flats. It is commonly found in these areas that provide fertile clays, loams, and sands with high moisture content (Halford 1997).	Unlikely	There are no records in the desktop Study area, and the species is unlikely to occur.
Homoranthus decumbens	✓	×	E	-	*Homoranthus decumbens* is restricted to Barakula State Forest near Chinchilla with a population of approximately 50 plants, and Blackdown Tableland. 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 *Goodenia racemosa, Petrophile* spp. (cone bush), *Xanthorrhoea* spp. (grasstree) and *Banksia oblongifolia* (DCCEEW 2023k).	Unlikely	The species is restricted to Blackdown Tableland and unlikely to occur within the Study area.

Scientific name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Logania diffusa	✓	✓	V	V	The species is known only from higher altitudes on the Blackdown Tableland. It occurs on the top of the plateau escarpment in heathland dominated by *Banksia oblongifolia* and *Leptospermum* spp. and in open forest with Eucalyptus spp. and Forest Sheoak (*Allocasuarina torulosa*) in shallow, sandy, often stony soil overlying sandstone (DoE 2008c).	Unlikely	The species is restricted to Blackdown Tableland and unlikely to occur within the Study area.
Macrozamia platyrhachis	✓	✓	E	-	The species is known only from higher altitudes on the Blackdown Tableland and occurs in eucalypt woodland or open forest on sandy soil (Queensland Herbarium 2007).	Unlikely	The species is restricted to Blackdown Tableland and unlikely to occur within the Study area.
Marsdenia brevifolia	✓	×	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 (DCCEEW 2023l).	Unlikely	No records exist within the Study area and it does not appear to support suitable habitat for this species.
Phaius australis	✓	×	E	E	Occurs in coastal wet heath/sedgeland wetlands (Barry 2005), swampy grassland or swampy forest.	Unlikely	In the region, the species is restricted to Blackdown Tableland and unlikely to occur within the Study area.
Polianthion minutiflorum	✓	✓	V	-	The species is primarily restricted to coastal *Melaleuca* swamps with an outlier record from an artesian spring near Blackdown Tableland (DoE 2008b).	Unlikely	Suitable habitat not available within Study area.

Scientific name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Solanum dissectum	✓	×	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 *Eucalyptus thozetiana* communities (TSSC 2016a).	Potential	Although suitable Brigalow dominated communities occur within the Study area, and this species has been recorded by EMM on southern BWM leases, it is considered only low potential to occur as suitable patches of Brigalow communities are limited in extent and quality. Patches of Brigalow communities in the Study area have been well surveyed and the species was not recorded.

E.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								
Cuculus optatus	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 Study area. The Study 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.
Hirundapus caudacutus	White-throated Needletail	✓	✓	V, Mi	V	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, DCCEEW 2023q).	Likely	Although this species was not recorded during field surveys, it has been recorded adjacent to the Study area. This species is likely to occur in airspace over the site sporadically during summer months.

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Monarcha melanopsis	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 (DoE 2015).	Unlikely	The Study area does not contain potential habitat in vine thicket and gullies. As such, this species is considered to be unlikely to occur.
Symposiachrus trivirgatus	Spectacled Monarch	✓	×	Mi	SLC (Mi)	This species occurs in rainforest, dense waterside vegetation and mangrove ecosystems (Menkhorst et al. 2017).	Potential	The Study 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.
Motacilla flava	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.
Myiagra cyanoleuca	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 (DoE 2015, Menkhorst et al. 2017).	Unlikely	The desktop review did not identify records of this species within the Study area. The Study 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.
Rhipidura rufifrons	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 (DoE 2015, Menkhorst et al. 2017).	Potential	The Study 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								
Actitis hypoleucos	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 (DoE 2017).	Unlikely	Suitable coastal or inland waters habitat for this species does not occur within the Study 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
Calidris acuminata	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 (DoE 2017).	Unlikely	Suitable wetland habitat for this species does not occur within the Study area. Therefore, it is considered unlikely to occur.
Calidris ferruginea	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 (DCCEEW 2023t).	Unlikely	Suitable coastal or inland waters habitat for this species does not occur within the Study area. Therefore, it is considered unlikely to occur.
Calidris melanotos	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 (DoE 2017).	Unlikely	Suitable coastal or inland waters habitat for this species does not occur within the Study area. Therefore, it is considered unlikely to occur.
Gallinago hardwickii	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 (DCCEEW 2023o).	Known	The desktop review did not identify records of this species within the Study area. This species favours permanent and ephemeral freshwater wetlands with low, dense vegetation. This species was recorded in the field surveys.
Plegadis falcinellus	Glossy Ibis	×	×	Mi	SLC (Mi)	The species is resident in Australia and favours freshwater wetland habitats (Menkhorst et al. 2017) including farm dams.	Known	This species was recorded once during the autumn surveys on a farm dam in the north of the Study area (outside of the project footprint).

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Refined likelihood of occurrence	Rationale
Pandion haliaetus	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 (DoE 2017).	Unlikely	Suitable wetland habitat for this species does not occur within the Study area. Therefore, it is considered unlikely to occur.
Migratory marine birds								
Apus pacificus	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 (DCCEEW 2023p).	Known	The desktop review did not identify records of this species within the Study area although records occurred in the desktop Study area. As it occurs aerially and over a variety of habitats, the species is likely to be recorded in the Study area. This species was recorded in the field surveys.

E.4 TECs with potential to occur

TECs	EPBC Act status	Potentially Associated ground-truthed regional ecosystems	Refined likelihood of occurrence	Rationale
Brigalow (*Acacia harpophylla* dominant and co-dominant)	Endangered	11.3.1, 11.4.9	Known	The Brigalow TEC associated RE11.3.1 is the most widespread remnant vegetation type within the Study area. However, only one area of brigalow TEC was confirmed as riparian vegetation along Taurus Creek within ML1762. The total area covered 6.34 ha. Remaining areas of 11.3.1 and other brigalow associated regional ecosystems all failed to meet TEC conditional thresholds, primarily due to weed cover and other aspects of disturbance.

TECs	EPBC Act status	Potentially Associated ground-truthed regional ecosystems	Refined likelihood of occurrence	Rationale
Coolibah – Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	-	Unlikely	One associated RE (11.3.3) was originally thought to be present as Coolabah was observed. However, the patch size was too small and had the wrong structure and species composition. The patch was confirmed as RE11.3.1, and description states that Coolabah can be present as an emergent species.
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Endangered	-	Unlikely	No regional ecosystems associated with this TEC were ground-truthed during field surveys. All grassland habitats within the Study area consisted primarily of exotic pasture grass species and exist on atypical soil types for the TEC.
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	-	Unlikely	No regional ecosystems associated with this TEC were ground-truthed during field surveys.
Weeping Myall woodlands	Endangered	11.3.2	Unlikely	One regional ecosystem associated with this TEC was ground-truthed within the Study area. However, this TEC was not recognised as the primary species of *Acacia pendula* is absent within the Study area.
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	11.3.2	Unlikely	Several areas of ground-truthed RE11.3.2 were recorded in the Study area. All areas failed to meet Poplar Box TEC thresholds through excessive weed cover and patch size being too small.

Appendix F

Vegetation community assessment results

F.1 Quaternary assessments

Site	Emergent species dominance	T1 species dominance	T2 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height (m)	EDL cover (%)	Verified RE condition	Verified RE code
1	NA	*Eucalyptus coolabah, Terminalia oblongata, Lysiphyllum carronii, Acacia harpophylla*	*Acacia harpophylla, Terminalia oblongata*	*Terminalia oblongata, Acalypha eremorum, Acacia harpophylla*	NA	*Cenchrus ciliaris*	T1	10	25	Remnant	11.3.1
2	NA	*Eucalyptus populnea, Eucalyptus melanophloia, Acacia harpophylla*	*Lysiphyllum carronii, terminalia oblongata,*	*Terminalia oblongata*	*Acacia harpophylla*	*Cenchrus ciliaris*	T1	17	20	Remnant	11.3.1/11.3.2
3	NA	*Acacia harpophylla*	NA	*Acacia harpophylla*	*Enchylaena tomentosa*	*Cenchrus ciliaris*	T1	3	5	Non-remnant	NA
4	*Eucalyptus populnea*	*Lysiphyllum carronii, Acacia salicina*	*NA*	*Psydrax johnsonii*	NA	*Cenchrus cilliaris*	T1	5	7	Non-remnant	NA
5	NA	*Eucalyptus populnea*	*Lysiphyllum carronii, Lysiphyllum hookeri, Acacia salicina, Acacia harpophylla, Alectryon olefolius*	*Citrus glauca, Eremophila mitchellii, Psydrax johnsonii*	*Carissa ovata*	*Enteropogon acicularis. Aristida* spp., *Cenchrus cilliaris*	T1	11	15	Remnant	11.3.2
6	NA	*Acacia harpophylla, Eucalyptus coolabah*	*Terminalia oblongata, Lysiphyllum hookeri, Acacia harpophylla,*	*Lysiphyllum hookeri, Acacia harpophylla*	NA	*Cenchrus ciliaris, Megathyrsus maxima, Bryophyllum delagoense*	T1	15	45	Remnant	11.3.1/11.3.25
7	NA	NA	NA	*Acacia harpophylla, Terminalia oblongata*	NA	*Cenchrus ciliaris*	S1	1	10	Non-remnant	NA
8	NA	*Eucalyptus populnea*	*Eucalyptus populnea, Acacia excelsa*	*Alectryon oleifolius, Grewia scrabrella*	NA	*Cenchrus ciliaris*	T1	12	29	Remnant	11.3.2

Site	Emergent species dominance	T1 species dominance	T2 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height (m)	EDL cover (%)	Verified RE condition	Verified RE code
9	NA	*Eucalyptus populnea*	*Acacia excelsa, Lysiphyllum carronii*	*Grewia scabrella, Acacia excelsa*	NA	*Aristida ramosa, Enteropogon acicularis, Clenched cilliaris*	T1	15	10	Remnant	11.3.2
10	NA	NA	*NA*	*Acacia harpophylla*	NA	*Cenchrus ciliaris*	S1	1.5	5	Non-remnant	NA
11	NA	*Eucalyptus tereticornis*	*Terminalia oblongata, Lysiphyllum carronii, Acacia harpophylla, Eucalyptus tereticornis*	*Terminalia oblongata, Acalypha eremorum, Lysiphyllum carronii*	*Carissa ovata*	*Cenchrus cilliaris, Abutilon oxycarpum*	T1	10	50	Remnant	11.3.1/11.3.6
12	NA	*Acacia harpophylla*	*Terminalia oblongata*	*Terminalia oblongata*	NA	*Leptochloa digitata*	T1	7	25	Regrowth	NA
13	NA	NA	NA	*Acacia harpophylla, Terminalia oblongata, Lysiphyllum carronii*	NA	*Cenchrus ciliaris*	S1	1	20	Non-remnant	NA
14	NA	NA	NA	*Acacia harpophylla, Citrus glauca*	*Carissa ovata, Sida rhombifolia, Capparis lasiantha, Pterocaulon redolens*	*Cenchrus ciliaris, Evolvulus alsinoides, Parthenium hysterophorus*	G	0.4	60	Non-remnant	NA
15	NA	*Eucalyptus coolabah, Acacia harpophylla, Terminalia oblongata, Brachychiton rupestris*	*Acacia harpophylla, Lysiphyllum hookeri, Terminalia oblongata, Diospyros humilis*	*Atalaya hemiglauca, Alectryon diversifolius, Terminalia oblongata*	NA	*Megathyrsus maximus, Cenchrus ciliaris, Bryophyllum delagoense*	T1	16	50	Remnant	11.3.1
16	NA	*Acacia harpophylla*	NA	*Acacia harpophylla*	*Enchylaena tomentosa*	*Cenchrus ciliaris, Bryophyllum delagoense*	T1	4	15	Non-remnant	NA

Site	Emergent species dominance	T1 species dominance	T2 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height (m)	EDL cover (%)	Verified RE condition	Verified RE code
17	NA	*Acacia harpophylla*	*Acacia harpophylla*	*Carissa ovata*	NA	*Cenchrus ciliaris*	T1	6	10	Non-remnant	NA
18	NA	NA	NA	*Acacia harpophylla, Terminalia oblongata*	NA	*Cenchrus ciliaris*	S1	1	20	Non-remnant	NA
19	NA	*Eucalyptus coolibah, Acacia harpophylla*	*Terminalia oblongata, Lysiphyllum app.*	*Diospyros humilis*	NA	*Cenchrus cilliaris, Bothriochloa bladhii*	T1	12	60	Remnant	11.3.1/11.3.3
20	NA	NA	*NA*	*Lysiphyllum carronii*	NA	*Cenchrus ciliaris*	S1	1.5	5	Non-remnant	NA
21	NA	*Eucalyptus populnea*	*Acacia excelsa, Lysiphyllum carronii, Lysiphyllum hookeri, Terminalia oblongata, Owenia acidula*	*Grewia scabrella, Lysiphyllum carronii, Geijera parvifolia*	*Carissa ovata*	*Cenchrus cilliaris, Enteropogon acicularis*	T1	13	15	Remnant	11.3.2
22	NA	NA	NA	*Apophyllum anomalum*	NA	*Cenchrus ciliaris*	G	0.6	90	Non-remnant	NA
23	NA	*Acacia harpophylla*	*Terminalia oblongata*	*Santalum lanceolatum, Lysiphyllum carronii*	*Terminalia oblongata*	*Cenchrus ciliaris*	T1	6	30	Regrowth	11.4.9
24	NA	NA	NA	*Acacia harpophylla*	NA	*Cenchrus ciliaris*	S1	1	10	Non-remnant	NA
25	NA	*Acacia harpophylla*	*Lysiphyllum hookeri*	*Carissa ovata*	NA	*Cenchrus ciliaris*	T1	14	15	Remnant	11.3.1/11.3.25
26	NA	NA	NA	*Acacia harpophylla, Atalaya hemiglauca*	NA	*Cenchrus ciliaris*	S1	1	10	Non-remnant	NA
27	NA	*Acacia harpophylla*	NA	NA	NA	*Cenchrus ciliaris*	T1	5	20	Non-remnant	NA
28	NA	*Acacia harpophylla*	*Terminalia oblongata*	*Carissa ovata*	NA	*Cenchrus ciliaris*	T1	8	20	Non-remnant	NA

Site	Emergent species dominance	T1 species dominance	T2 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height (m)	EDL cover (%)	Verified RE condition	Verified RE code
29	NA	*Eucalyptus populnea*	*Acacia salicina, Lysiphyllum carronii*	*Citrus glauca, Lysiphyllum cunninghamii*	NA	*Cenchrus cilliaris*	T1	13	20	Remnant	11.3.2
30	NA	*Acacia harpophylla*	NA	*Acacia harpophylla*	*Enchylaena tomentosa*	*Cenchrus ciliaris*	T1	2.5	10	Non-remnant	NA
31	NA	NA	NA	*Acacia harpophylla*	*Capparis lasiantha*	*Cenchrus ciliaris*	G	0.8	95	Non-remnant	NA
32	NA	NA	NA	*Acacia harpophylla*	*Atalaya hemiglauca*	*Cenchrus ciliaris*	G	0.8	40	Non-remnant	NA
33	*Eucalyptus coolabah*	*Eucalyptus coolabah, Acacia harpophylla, Terminalia oblongata, Lysiphyllum carronii*	*Lysiphyllum carronii, terminalia oblongata,*	*Terminalia oblongata*	*Acacia harpophylla*	*Cenchrus ciliaris*	T1	11	20	Remnant	11.3.1
34	NA	*Acacia harpophylla*	*NA*	*Terminalia oblongata*	*Carissa ovata*	NA	T1	4	25	Non-remnant	NA
35	NA	NA	NA	*Citrus glauca*	*Atalaya hemiglauca*	*Cenchrus ciliaris*	G	0.8	80	Non-remnant	NA
36	NA	*Acacia harpophylla*	NA	*Atalaya hemiglauca, Acacia harpophylla*	NA	*Cenchrus ciliaris*	S1	2.5	25	Non-remnant	NA
37	NA	*Acacia harpophylla*	*NA*	*Lysiphyllum carronii*	NA	*Cenchrus ciliaris*	T1	9	15	Non-remnant	NA
38	NA	*Eucalyptus populnea*	*Acacia salicina, Acacia harpophylla, Lysiphyllum carronii*	*Acacia excelsa, Acacia salicina*	NA	*Cenchrus cilliaris*	T1	14	10	Remnant	11.3.2
39	NA	NA	NA	*Acacia harpophylla*	*Capparis lasiantha*	*Cenchrus ciliaris*	G	0.8	95	Non-remnant	NA
40	NA	*Eucalyptus populnea, Corymbia tessellaris*	*Acacia salicina, Lysiphyllum carronii*	*Grewia scabrella*	*Carissa ovata*	*Enteropogon acicularis, Cenchrus cilliaris*	T1	15	15	Remnant	11.3.2
41	NA	*Acacia harpophylla*	NA	*Acacia harpophylla*	*Enchylaena tomentosa*	*Cenchrus ciliaris*	T1	3	5	Non-remnant	NA

Site	Emergent species dominance	T1 species dominance	T2 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height (m)	EDL cover (%)	Verified RE condition	Verified RE code
42	NA	*Eucalyptus coolabah, Acacia harpophylla, Terminalia oblongata*	*Acacia harpophylla, Brachychiton rupestris, Terminalia oblongata, Lysiphyllum carronii*	*Acacia harpophylla, Ventilago criminals, Lysiphyllum cunninghamii*	NA	*Cenchrus cilliaris*	T1	14	50	Remnant	11.3.1
43	NA	*Eucalyptus melanophloia*	*Brachychiton rupestris*	*Lysiphyllum hookeri*	*Carissa ovata*	*Cenchrus ciliaris*	T1	14	30	Remnant	11.3.2/11.4.9
44	*Eucalyptus tereticornis*	*Acacia harpophylla, Terminalia oblongata, Brachychiton rupestris*	*Lysiphyllum carronii, Terminalia oblongata*	*Acalypha eremorum, Erythroxylum australe*	NA	*Cenchrus Bryophyllum*	T1	14	55	Remnant	11.3.1/11.3.6
45	*Eucalyptus coolabah*	*Terminalia oblongata, Lysiphyllum carronii, Acacia harpophylla*	*Citrus glauca, Lysiphyllum carronii, Acacia harpophylla*	*Terminalia oblongata, Acalypha eeemnantorum, Acacia harpophylla*	NA	*Cenchrus ciliaris*	T1	8	25	Remnant	11.3.1
46	NA	*Acacia harpophylla*	*Terminalia oblongata*	*Terminalia oblongata*	*Carissa ovata*	*Cenchrus ciliaris*	T1	12	20	Non-remnant	NA
47	NA	*Acacia harpophylla, Lysiphyllum carronii, Flindersia dissosperma*	NA	*Citrus glauca, Acacia harpophylla*	NA	*Cenchrus ciliaris*	T1	5	10	Non-remnant	NA
48	NA	*Eucalyptus populnea*	*Geijera parvifolia, Acacia excelsa, Eremophila mitchelli, Diospyros humilis*	*Capparis lasiantha, Carissa ovata*	NA	*Cenchrus cilliaris*	T1	16	15	Remnant	11.3.2
49	NA	*Acacia harpophylla*	NA	*Atalaya hemiglauca, Terminalia oblongata, Acacia harpophylla*	NA	*Cenchrus ciliaris*	T1	5	10	Non-remnant	NA
50	NA	*Eucalyptus melanophloia, Eucalyptus populnea*	*Lysiphyllum carronii, Alectryon oleifolius, Eremnantophila mitchellii*	*Eremnantophila mitchellii, Terminalia oblongata, Psydrax oleifolia,*	*Solanum elachophyllum, Carissa ovata,*	*Cenchrus ciliaris, Urochloa mosambicensis*	T1	12	20	Regrowth	11.3.2

Site	Emergent species dominance	T1 species dominance	T2 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height (m)	EDL cover (%)	Verified RE condition	Verified RE code
				Archidendropsis basaltica	*Harissia martinii*						
51	*Eucalyptus chloroclada*	*Acacia harpophylla*	*Lysiphyllum carronii*	*Acacia salicina*	NA	*Cenchrus ciliaris*	T1	12	10	Regrowth	11.3.1
52	NA	NA	NA	*Atalaya hemiglauca, Acacia harpophylla*	NA	*Cenchrus ciliaris*	S1	1.5	10	Non-remnant	NA
53	NA	NA	NA	*Cassia brewsteri, Acacia excelsa, Hovea longipes, Capparis loranthifolia*	*Carissa ovata*	*Cenchrus ciliaris, Evolvulus alsinoides, Parthenium hysterophorus*	G	0.6	90	Non-remnant	NA
54	NA	*Acacia harpophylla*	*NA*	*Lysiphyllum hookeri*	NA	*Cenchrus ciliaris*	T1	11	30	Remnant	11.3.1/11.3.6
55	NA	NA	NA	NA	NA	*Cenchrus ciliaris*	G	0.6	75	Non-remnant	NA
56	NA	NA	NA	*Acacia harpophylla*	*Atalaya hemiglauca*	*Cenchrus ciliaris*	G	0.8	95	Non-remnant	NA
57	NA	*Acacia harpophylla*	NA	*Carissa ovata, Capparis lasiantha, Acacia harpophylla*	NA	*Cenchrus ciliaris*	T1	3.5	5	Non-remnant	NA
58	NA	*Acacia harpophylla*	NA	*Acacia harpophylla*	*Enchylaena tomentosa*	*Cenchrus ciliaris*	T1	3	10	Non-remnant	NA
59	NA	*Acacia harpophylla*	NA	*Atalaya hemiglauca*	NA	*Cenchrus ciliaris*	T1	3.5	10	Non-remnant	NA
60	NA	*Lysiphyllum carronii*	*Acacia harpophylla*	*Carissa ovata*	NA	*Cenchrus ciliaris*	T1	6	15	Non-remnant	NA
61	NA	NA	NA	*Acacia harpophylla, Citrus glauca*	NA	*Cenchrus ciliaris*	S1	1	10	Non-remnant	NA
62	NA	*Eucalyptus coolabah, Acacia harpophylla*	*Acacia harpophylla, Terminalia oblongata, Brachychiton rupestris*	*Lysiphyllum hookeri, Acacia harpophylla, Capparis loranthifolia*	*Carissa ovata*	*Cenchrus ciliaris, Parthenium hysterophorus*	T1	16	30	Remnant	11.3.1

Site	Emergent species dominance	T1 species dominance	T2 species dominance	S1 species dominance	S2 species dominance	Ground species dominance	EDL type	EDL height (m)	EDL cover (%)	Verified RE condition	Verified RE code
63	NA	*Terminalia oblongata, Acacia harpophylla*	*Lysiphyllum carronia T. oblongata*	*Terminalia oblongata, Eremophila mitchelii*	NA	*Enteropogon acicularis, Cenchrus cilliaris, Bryophyllum delegoense*	T1	12	55	Remnant	11.3.1/11.3.3

F.2 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	*Acacia harpophylla*	NA	NA	*Atalaya hemiglauca, Lysiphyllum carronii, Terminalia oblongata*	5.5	16
2	NA	NA	NA	NA	*Acacia harpophylla*	*Terminalia oblongata*	NA	*Eucalyptus melanophloia, Corymbia dallachiana*	14	35
3	NA	NA	NA	NA	*Acacia harpophylla*	NA	*Eucalyptus coolabah*	*Terminalia oblongata*	24	60
4	*Eucalyptus tereticornis*	NA	NA	NA	*Acacia harpophylla*	*Eucalyptus melanophloia*	NA	*Brachychiton rupestris*	14	40
5	NA	NA	NA	NA	*Acacia harpophylla*	*Acacia salicina*	NA	NA	14	40

F.3 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	*Acacia harpophylla*	NA	NA	*Atalaya hemiglauca, Apophyllum anomalum, Terminalia oblongata,*	3	5	NA	NA	NA	NA
2	NA	NA	NA	*Lysiphyllum hookeri, Geijera parviflora, Terminalia oblongata, Santalum lanceolatum, Ventilago viminalis*	8	40	NA	NA	NA	NA
3	*Lysiphyllum hookeri*	NA	NA	*Brachychiton rupestris, Terminalia oblongata*	10	25	NA	NA	NA	NA
4	*Terminalia oblongata*	*Lysiphyllum carronii*	NA	*Acacia salicina, Acacia excelsa*	8	20	NA	NA	NA	NA
5	*Acacia salicina*	*Geijera parvifolia*	NA	*Terminalia oblongata, Lysiphyllum cunninghamii*	7	50	NA	NA	NA	NA

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 A1 (all sites < 5 ha)	
Site ID No	**Patch size (ha)**	**VM Act mapped RE**	**Ground-truthed RE**	**Is RE associated with Poplar Box TEC (based on landform and species composition)**	***Eucalyptus populnea* is the dominant canopy species**	**≥30 native plant species per ha in ground layer**	**≥ 90% of perennial vegetation cover in ground layer1 is native**
Transect 1	0.26	11.3.1/11.3.25/11.3.2	11.3.2	Yes	Yes	No – 19 species	No – 37.5% native groundlayer cover
Transect 2	1.13	11.3.1/11.3.25/11.3.2	11.3.2	Yes	Yes	No – 5 species	No – 50% native groundlayer cover
Transect 3	1.13	11.3.1/11.3.25/11.3.2	11.3.2	Yes	Yes	No – 6 species	No – 55.6% native groundlayer cover
Transect 4	4.79	Non-remnant	11.3.2	Yes	Yes	No – 7 species	Yes – 100% native groundlayer cover

G.2 Brigalow TEC assessment results

Site Information			EPBC TEC Key Diagnostic Criteria			EPBC TEC Condition Thresholds	
Site ID No	**VM Act mapped RE**	**Ground-truthed RE**	**Is RE associated with Brigalow TEC (based on landform and species composition)**	***Acacia harpophylla* 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%**
23	11.3.2/11.3.25/11.3.1	11.3.1	Yes	Yes	Yes	Yes	No – Buffel Grass (*C. ciliaris*) is dominant in the ground layer and >50% cover
25	Non-remnant	11.3.1	Yes	No	Yes	Yes	No – Buffel Grass (*C. ciliaris*) is dominant in the ground layer and >50% cover
30	Non-remnant	11.3.1	Yes	Yes	Yes	Yes	Yes
31	Non-remnant	11.3.1	Yes	Yes	Yes	Yes	No – Buffel Grass (*C. ciliaris*) is dominant in the ground layer and >50% cover

Appendix H

Habitat quality assessment results

Site: 37 (11.3.1) – Endangered	Assessor – Bruce McLennan (Arcadian Ecology)
Property: Mountain View	Date: 05/04/2019
Bioregion: Brigalow Belt	Sub-region: Isaac – Comet Downs
State mapped RE: Non-remnant	Observed RE: 11.3.1
Transect Co-ordinates (GDA 94 Datum)	
0 m (start of transect):	-23.693645; 148.868637
50 m (centre point):	-23.693417; 148.868271
Elevation (mAHD):	194
General Site Description	
Landform	Undulating plain
Soil	Loam
Dominant vegetation observed	Coolabah open woodland on alluvium with dense low tree understory

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)* Number of large Eucalypt trees:	na na
Non-Eucalypt large tree DBH (cm): *(from benchmark document)* Number of large Non-Eucalypt trees:	28 9
Total large trees/ha:	18
Tree canopy (EDL) height (m):	18
Sub-canopy height (m):	8
Emergent height (m):	na
Total tree species richness: *Eucalyptus coolabah, Acacia harpophylla, Terminalia oblongata, Eucalyptus melanophloia, Eremophila mitchellii, Owenia acidula, Brachychiton rupestris, Lysiphyllum hookeri, Diospyros humilis*	9

50 x 10 m area	
Shrub spp. richness: *L. hookeri, Atalaya hemiglauca, Elaeodendron australe, Acalypha eremorum, Backhousia angustifolia, Acacia harpophylla, Ehretia membranifolia, Capparis mitchellii, Capparis lasiantha, Abutilon otocarpum*	10
Grass spp. richness: *Bothriochloa bladhii*	1
Forb spp. richness: *Flaveria australasicus, Cyperus gracilis, Ipomoea sp., Cyperus bifax, Euphorbia drummondii*	5
Other spp.: *Cymbidium canaliculatum,*	1
Weed spp. and cover as % of area: *Cenchrus ciliaris, Megathyrsus maximus, Bryophyllum delagoense, Malvastrum coromandelianum, Malvastrum americanum, Parthenium hysterophorus*	80

Plot attributes (actual)	Unit of measure	Measurement

Tree canopy cover (100 m canopy intercept)	% cover	12.7
Shrub canopy cover (100 m canopy intercept)	% cover	5
Native perennial grass cover (1 m x 1 m plots)	% cover	0
Litter cover (1 m x 1 m plots)	% cover	52.2
Coarse woody debris (from 50 m x 20 m plot)	m / ha	1170
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	5
Grasses	no. species	4
Forbs	no. species	8
Large eucalypts	no. / ha	na
Large non-eucalypts	no. / ha	170
Tree canopy median height	m	14
Tree canopy cover	%	29
Native shrub cover	%	8
Native perennial grass cover	%	8
Organic litter cover	%	34
Coarse woody debris	m / ha	1752

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	2.5	Proximity to Ecological Corridors	6	**6**
Native plant species richness: Forbs	5	3	**Total:**	**26**	13
Tree canopy cover	5	2	**Habitat:**		
Tree canopy height	5	5	Threats	15	**0**
Shrub layer cover	5	5	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	5	Site + landscape	106	60.5
Total	**80**	47.5	**TOTAL SCORE (Site + landscape + habitat (where relevant)**	**156**	60.5

Habitat quality score: 6

Site photos

Start point

Mid-point, facing north

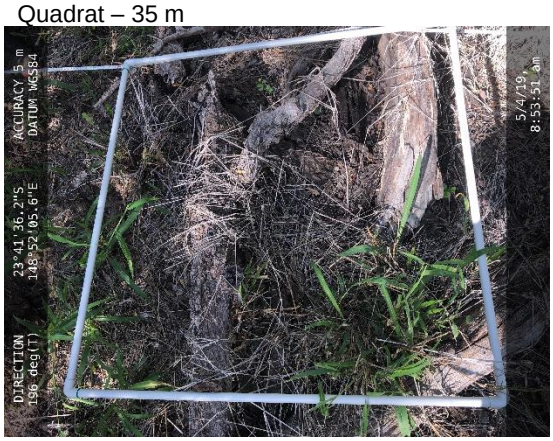
Mid-point, facing east

Mid-point, facing south

Mid-point, facing west

Quadrat – 35 m

Quadrat – 45 m



Quadrat – 55 m

Quadrat – 65 m

Quadrat – 75 m

Site: 41 (11.3.1) – Endangered	Assessor – Bruce McLennan (Arcadian Ecology)
Property: Mountain View	Date: 05/04/2019
Bioregion: Brigalow Belt	Sub-region: Isaac – Comet Downs
State mapped RE: 11.3.1/11.3.25/ 11.3.2	Observed RE: 11.3.1
Transect Co-ordinates (GDA 94 Datum)	
0 m (start of transect):	-23.677538; 148.867355
50 m (centre point):	-23.677725; 148.867065
Elevation (mAHD):	188
General Site Description	
Landform	Undulating plain
Soil	Clay
Dominant vegetation observed	Brigalow and Coolabah woodland on clay alluvium

100 x 50 m area (0.5 ha)	
Dominant canopy or EDL species with evidence of recruitment (%):	**80**
Eucalypt large tree DBH (cm): *(from benchmark document)* Number of large Eucalypt trees:	Na
Non-Eucalypt large tree DBH (cm): *(from benchmark document)* Number of large Non-Eucalypt trees:	28 11
Total large trees/ha:	22
Tree canopy (EDL) height (m):	15
Sub-canopy height (m):	8
Emergent height (m):	na
Total tree species richness: *Eucalyptus coolabah, Acacia harpophylla, Terminalia oblongata, Lysiphyllum carronii, Eremophila mitchellii, Alectryon oleifolius, Brachychiton rupestris, Lysiphyllum hookeri, Acacia oswaldii, Atalaya hemiglauca,*	10
50 x 10 m area	
Shrub spp. richness: *L. hookeri, Atalaya hemiglauca, Acalypha eremorum, Ehretia membranifolia, Capparis loranthifolia, Capparis lasiantha, Unknown, Abutilon otocarpum, Enchylaena tomentosa*	8
Grass spp. richness: *Bothriochloa bladhii*	1
Forb spp. richness: *Flaveria australasica, Sida sp., Portulaca oleracea, Boerhavia sp., Terrestris Tribulus, Cyperus bifax, Crinum flaccidum, Alternanthera nana, Nyssanthes erecta, Pseuderanthemum variabile, Commelina ensifolia*	11
Other spp.: *Clematicissus opaca, Parsonsia sp.,*	2
Weed spp. and cover as % of area: *Cenchrus ciliaris, Megathyrsus maximus, Bryophyllum delagoense, Malvastrum coromandelianum, Malvastrum americanum, Parthenium hysterophorus, Cryptostegia grandiflora, Urochloa mosambicensis, Harrisia martinii, Abutilon guineense,*	70

Plot attributes (actual)	Unit of measure	Measurement
Tree canopy cover (100 m canopy intercept)	% cover	20.4
Shrub canopy cover (100 m canopy intercept)	% cover	1.5
Native perennial grass cover (1 m x 1 m plots)	% cover	0
Litter cover (1 m x 1 m plots)	% cover	33
Coarse woody debris (from 50 m x 20 m plot)	m / ha	1420
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	5
Grasses	no. species	4
Forbs	no. species	8
Large eucalypts	no. / ha	na
Large non-eucalypts	no. / ha	170
Tree canopy median height	m	14
Tree canopy cover	%	29
Native shrub cover	%	8
Native perennial grass cover	%	8
Organic litter cover	%	34
Coarse woody debris	m / ha	1752

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	5	Mobility	10	0
Fallen woody material	5	5	Site location	5	**0**
Weed cover	10	0	**Total**	**50**	0
Litter cover	5	5	Site + landscape	106	64
Total	**80**	51	**TOTAL SCORE (Site + landscape + habitat (where relevant)**	**156**	64

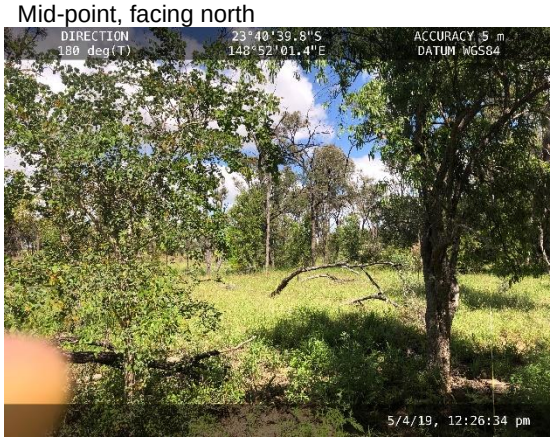
Habitat quality score: 6

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: 44 (11.3.6) – Of concern/Least concern	Assessor – Bruce McLennan (Arcadian Ecology)
Property: Taurus	Date: 06/04/2019
Bioregion: Brigalow Belt	Sub-region: Isaac – Comet Downs
State mapped RE: Non-remnant	Observed RE: 11.3.6
Transect Co-ordinates (GDA 94 Datum)	
0 m (start of transect):	-23.747908; 148.885010
50 m (centre point):	-23.748001; 148.884506
Elevation (mAHD):	210
General Site Description	
Landform	Gently undulating plain
Soil	Sandy loam
Dominant vegetation observed	Silver-leaved ironbark woodland on alluvial creek flat

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)* Number of large Eucalypt trees:	40 2
Non-Eucalypt large tree DBH (cm): *(from benchmark document)* Number of large Non-Eucalypt trees:	na na
Total large trees/ha:	4
Tree canopy (EDL) height (m):	16
Sub-canopy height (m):	8
Emergent height (m):	na
Total tree species richness: *Eucalyptus melanophloia, Terminalia oblongata, Lysiphyllum hookeri, Diospyros humilis, Acacia salicina, Elaeodendron australe, Denhamia oleaster, Brachychiton rupestris*	8
50 x 10 m area	
Shrub spp. richness: *Acalypha eremorum, Carissa ovata, Jasminum didymum subsp. lineare, Atalaya hemiglauca, Archidendropsis basaltica, Geijera parviflora, Acacia excelsa, Enchylaena tomentosa,*	8
Grass spp. richness: *Enteropogon acicularis, Enneapogon avenaceus, Sporobolus actinocladus, Sporobolus caroli, Aristida sp., Chrysopogon fallax, Dactyloctenium radulans, Unident.*	8
Forb spp. richness: *Cyperus gracilis, Brunoniella australis, Glycine tabacina, Glycine sp., Commelina ensifolia, Ipomoea sp., Portulaca oleracea, Boerhavia dominii, Sida trichopoda*	9
Other spp.:	
Weed spp. and cover as % of area: *Cenchrus ciliaris, Urochloa mosambicensis, Megathyrsus maximus, Parthenium hysterophorus, Bryophyllum delagoense, Opuntia tomentosa, Harrisia martinii,*	50

Plot attributes (actual)	Unit of measure	Measurement
Tree canopy cover (100 m canopy intercept)	% cover	11.8
Shrub canopy cover (100 m canopy intercept)	% cover	8.5
Native perennial grass cover (1 m x 1 m plots)	% cover	2
Litter cover (1 m x 1 m plots)	% cover	21
Coarse woody debris (from 50 m x 20 m plot)	m / ha	890
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	3
Grasses	no. species	9
Forbs	no. species	10
Large eucalypts	no. / ha	20
Large non-eucalypts	no. / ha	na
Tree canopy median height	m	20
Tree canopy cover	%	23
Native shrub cover	%	1
Native perennial grass cover	%	40
Organic litter cover	%	35
Coarse woody debris	m / ha	300

Site assessment 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	3	Proximity to Ecological Corridors	6	**6**
Native plant species richness: Forbs	5	3	**Total:**	**26**	8
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	2	Site location	5	**0**
Weed cover	10	3	**Total**	**50**	0
Litter cover	5	5	Site + landscape	106	55
Total	**80**	47	**TOTAL SCORE (Site + landscape + habitat (where relevant)**	**156**	55

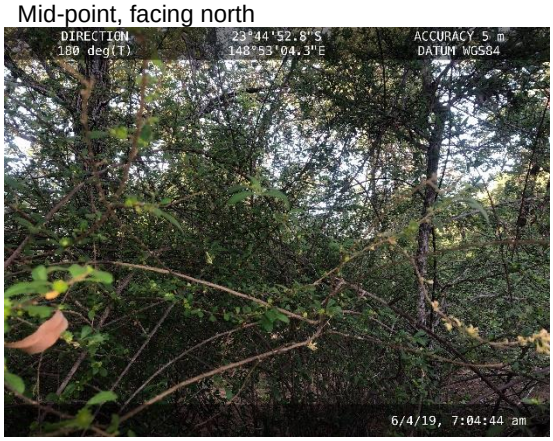
Habitat quality score: 5

Site photos

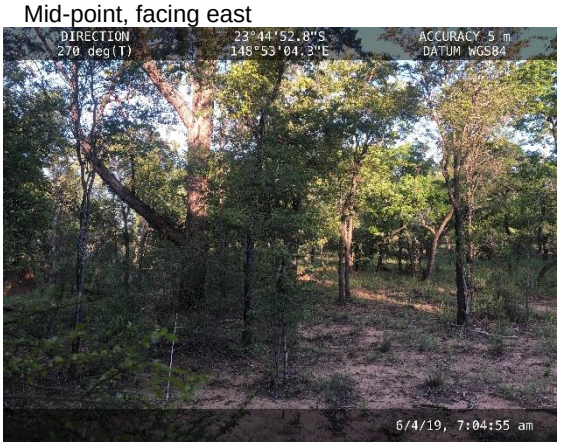
Start point

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: 45 (11.3.1) – Endangered	Assessor – Bruce McLennan (Arcadian Ecology)
Property: Taurus	Date: 06/04/2019
Bioregion: Brigalow Belt	Sub-region: Isaac – Comet Downs
State mapped RE: Non-remnant	Observed RE: 11.3.1
Transect Co-ordinates (GDA 94 Datum)	
0 m (start of transect):	-23.731825; 148.872574
50 m (centre point):	-23.732185; 148.872330
Elevation (mAHD):	203
General Site Description	
Landform	Gently undulating plain
Soil	Sandy loam
Dominant vegetation observed	Disturbed Silver-leaved ironbark woodland with dense Bauhinia sub-canopy on sandy clay alluvium

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)* Number of large Eucalypt trees:	na na
Non-Eucalypt large tree DBH (cm): *(from benchmark document)* Number of large Non-Eucalypt trees:	28 10
Total large trees/ha:	20
Tree canopy (EDL) height (m):	16
Sub-canopy height (m):	7
Emergent height (m):	na
Total tree species richness: *Eucalyptus melanophloia, Terminalia oblongata, Lysiphyllum hookeri, Brachychiton australis, Acacia harpophylla, Lysiphyllum carronii, Santalum lanceolatum, Acacia oswaldii, Capparis mitchellii*	9
50 x 10 m area	
Shrub spp. richness: *Grewia scabrella, Jasminum didymum subsp. lineare, Capparis lasiantha, Abutilon otocarpum, Alectryon oleifolius, Denhamia oleaster, Psydrax oleifolia, Alectryon diversifolius, Atalaya hemiglauca, Sida hackettiana, Sida rohlenae*	11
Grass spp. richness: *Dichanthium sp., Dactyloctenium radulans, Chloris ventricosa, Sporobolus caroli, Enteropogon acicularis*	5
Forb spp. richness: *Cyperus gracilis, Brunoniella australis, Cyperus bifax, Alternanthera nana, Polymeria calycina, Glycine tabacina, Portulaca oleracea, Oxalis perennans, Calotis cuneata, Evolvulus alsinoides, , Boerhavia dominii, Tribulus terrestris, Portulaca australis,*	13
Other spp.:	
Weed spp. and cover as % of area: *Cenchrus ciliaris, Cryptostegia grandiflora, Megathyrsus maximus, Parthenium hysterophorus, Bryophyllum delagoense, Vachellia farnesiana, Harrisia martinii, Gomphrena celosioides, Malvastrum americanum, Trianthema portulacastrum*	60

Plot attributes (actual)	Unit of measure	Measurement
Tree canopy cover (100 m canopy intercept)	% cover	6.8
Shrub canopy cover (100 m canopy intercept)	% cover	9.1
Native perennial grass cover (1 m x 1 m plots)	% cover	3
Litter cover (1 m x 1 m plots)	% cover	24
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	3
Shrubs	no. species	5
Grasses	no. species	4
Forbs	no. species	8
Large eucalypts	no. / ha	na
Large non-eucalypts	no. / ha	170
Tree canopy median height	m	14
Tree canopy cover	%	29
Native shrub cover	%	8
Native perennial grass cover	%	8
Organic litter cover	%	34
Coarse woody debris	m / ha	1752

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	**6**
Native plant species richness: Forbs	5	5	**Total:**	**26**	8
Tree canopy cover	5	2	**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	5	Site location	5	**0**
Weed cover	10	0	**Total**	**50**	0
Litter cover	5	5	Site + landscape	106	59
Total	**80**	51	**TOTAL SCORE (Site + landscape + habitat (where relevant)**	**156**	59

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

Appendix I

Protected plant survey consolidated species list

Scientific Name	Common Name
Abutilon oxycarpum	Lantern Bush
Acacia harpophylla	Brigalow
Aeschynomene indica	Curly indigo
Alternanthera nana	Hairy joyweed
Apophyllum anomalum	Warrior bush
Aristida latifolia	-
Astrebla lappacea	Curly Mitchell grass
Atalaya hemiglauca	Whitewood
Atriplex muelleri	-
Boerhavia dominii	Tarvine
*Bothriochloa pertusa**	Indian couch
Brunionella australis	Blue trumpet
Bryophyllum delagoense	Mother-of-millions
Capparis lasiantha	Nepine
Carissa ovata	Currant bush
*Cenchrus ciliaris**	Buffel grass
Chenopodium desertorum	Desert goose foot
Chloris inflata	Purpletop Rhodes grass
Citrus glauca	Desert lime
Cyperus bifax	Downs nutgrass
Dactyloctenium radulans	Button grass
Dichanthium sericeum	Queensland bluegrass
Dinebra decipiens	-
Diplachne fusca fusca	Brown beetle grass
Dipteracanthus australasicus	-
Einadia nutans subspecies linifolia	Climbing saltbush
Enchylaena tomentosa	Ruby saltbush
Enteropogon acicularis	-
Eragrostis sp.	-
Eremophila maculata	Spotted emu bush
Eriochloa sp.	-
Euphorbia tannensis	-
*Gomphrena celesioides**	Gomphrena weed
*Harrisia martinii**	Harrisia cactus

Scientific Name	Common Name
Hibiscus brachysiphonius	Low hibiscus
Jasminum didymum ssp. lineare	Jasmine
Leptochloa digitata	Umbrella canegrass
Marsdenia viridiflora	Native pear
Marsilea sp.	-
Minuria integerrima	Smooth minuria
*Opuntia tomentosa**	Velvet tree pear
Panicum decompositum	Native millet
Panicum queenslandicus	Coolabah grass
*Parkinsonia aculeata**	Parkinsonia
*Parthenium hysterophorus**	Parthenium
Paspalidium caespitosum	Brigalow grass
Phyllanthus maderaspatensis	-
Portulaca oleracea	Pigweed
Salsola australis	Soft roly-poly
Santalum lanceolatum	Northern sandalwood
Sclerolaena muricata var. semiglabra	Black roly-poly
Sclerolaena tetracuspis	Giant redburr
Sida rohlenae	Shrub sida
Sida trichopoda	Hairy sida
Solanum nemophilum	-
Sporobolus actinocladus	Katoora grass
Sporobolus caroli	Fairy grass
Sporobolus mitchellii	Rat's tail couch
Tribulus terrestris	Caltrop
*Urochloa mosambicensis**	Sabi grass

*Introduced species

Appendix J

Curricula vitae

Andrew Jensen

Associate Environmental Scientist

Curriculum vitae

EMM
creating opportunities

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

Carmichael Coal Mine, Secondment to Adani Mining, Brisbane (Adani Mining)

- Andrew was seconded to Adani Mining for five months to assist in their pre-commencement compliance reviews and completing tasks relating to pre-commencement conditions. Adani then requested Andrew return for a further three months following commencement to assist in further compliance reviews and early works tasks.
- Undertook a review of all conditions of approval, as well as commitments made in compliance documents and plans, and highlighted tasks requiring action before Project could commence.
- Assisted in completing outstanding pre-commencement tasks such as updates to the Species Management Plan and the Groundwater Dependent Ecosystems Management Plan.
- Assisted in developing scopes of work for further baseline monitoring and surveys relating to MNES and weeds and pests.

Queensland Oil Refinery, Ecological Surveys (Queensland Oil Refinery)

- Andrew undertook an ecological constraints survey (fauna) of the proposed refinery site including habitat assessments, and scoping for further targeted surveys.

Mount Fox Windfarm, Ecological Constraints Report (Windlab)

- Andrew prepared a desktop ecological review of the project area ecology, including risks to development and recommendations for scoping future field surveys for the proposed windfarm.

Blackwater Mine, Ecological Surveys, Blackwater (BHP)

- Andrew undertook ecological surveys (fauna) of the proposed expansion area including habitat assessments, trapping and active searches in late-wet surveys.
- Surveys were consistent with EPBC guidelines for relevant species, and Queensland Vertebrate Fauna Survey Guidelines.

McPhillamys Gold Mine, Ecological Surveys and Biodiversity Assessment Report, Blayney NSW (Regis Resources)

- Andrew undertook ecological surveys of the proposed mine targeting listed fauna species on the site, including habitat assessments, trapping and active searches.
- Contributing author to BAR, including assessment under bilateral agreement of EPBC impacts (and corresponding EPBC referral and impact assessment).

Tipton West Dalby Pipeline, Ecological Surveys, Dalby (APA Group)

- Andrew undertook ecology surveys of the site area (desktop and field survey of ecological constraints) to inform an EA Application for the Project, and prepared an environmental constraints report, including MNES and MSES significance assessment.

Rugby Run Solar Farm, Secondment to Adani Renewables, Brisbane/Moranbah (Adani Renewables)

- Andrew was seconded to Adani Renewables from CDM Smith for six months to work on the Rugby Run Solar Farm Project.
- Developed Construction Environmental Management Plan for the project, and assisted in development of Tier 2 plans and procedures.
- Assisted in Development Approvals, and other Council and State approvals (e.g. protected plant clearing permit, waterway barrier works applications) for the Project.
- Worked in environmental and regulatory team, assisting management of the contractor working on construction. Role included preparing induction materials, review of environmental reporting, site checklists, site compliance reporting and monitoring requirements.

Reedy Creek Wallumbilla Pipeline, Ecological Surveys, Reedy Creek (APA Group)

- Andrew undertook ecology surveys of the alignment targeting animal breeding places (Golden-tailed Gecko, Echidna) to inform a high-risk Species Management Program for the Project.
- Managed weed surveys and mapping along the Project alignment.

Styx Coal Mine, Supplementary Ecological Surveys, Marlborough (Waratah Coal)

- Andrew undertook supplementary ecology surveys of the proposed mine site, including MNES (Red Goshawk, Koala, Painted Snipe, Ornamental Snake).
- Assisted in SEIS update (update of MNES, ecology and offsets chapters) to address DotEE and DES comments.Prepared initial draft of Construction EMP and Species Management

Bauxite Hills Mine, Ecological Surveys, north of Weipa (Metro Mining)

- Undertook survey of proposed haul road corridors targeting potential MNES species on the site.
- Undertook and supervised surveys, including developing method to meet DotEE approval targeting potential key species on site. Surveys included active searches for Red Goshawk nests, and survey for near threatened Cape York subspecies of Rufous Owl, as well as hollow surveys to inform habitat assessment for the Bare-rumped Sheathtail Bat.
- Prepared summary report for submission to DotEE, including analysis of key species present at the site.

Williamtown Airport – expansions, Newcastle (Defence Australia)

- Project managed post approvals ecology issues relating to the EPBC Assessment, following the project being declared a controlled action. Liaison with Department of Defence on site and key consultees over operational impacts and proposed monitoring for migratory shorebirds, Gould's Petrel and bats.

Elk Antelope gas field, Preparation of ESIA, Papua New Guinea (Total E&P PNG Limited)

- Project managed production of ESIA report for an appraisal well in the Elk-Antelope gas field, including preparation of the draft construction management plan.
- Co-ordinated relevant technical desktop studies and collation of report.

Cape River Substation, Vegetation clearing permit, Pentland (Windlab)

- Project manager for vegetation clearing permit for a transmission line easement.
- Prepared supporting information for application including findings of surveys undertaken at the site. Prepared Vegetation Management Plan for the project.

Frieda River Project, Aquatic Ecology Impact Assessment, Papua New Guinea (PanAust)

- Contributing author to aquatic ecology impact assessment for copper-gold mine in Papua New Guinea including assessment of downstream impacts.

Kennedy Energy Park, Ecological assessment and EPBC referral, Hughenden (Windlab)

- Project manager for ecological assessment of renewable energy park.
- Undertook ecological surveys of proposed solar farm and windfarm site and prepared baseline reporting.
- Undertook MNES assessment and EPBC referral for the project, resulting in a 'not a controlled action' decision.

Chifley Road upgrade, Review of Environmental Factors, Chifley NSW (Roads and Maritime)

- Project manager and author of the REF report for a road upgrade in the Blue Mountains. Included preparation of basis for Construction Management Plan.
- Technical report reviewer for heritage, noise and ecology studies.
- Author of submissions report.

Granville Platform Upgrade, Review of Environmental Factors, Granville NSW (Sydney Trains)

- Contributing author of REF report.
- Assessed impacts on threatened species and ecological communities at both a Commonwealth and state level.

Erskineville platform upgrade, Review of Environmental Factors, Erskinville NSW (Sydney Trains)

- Contributing author of REF report.
- Assessed impacts on threatened species and ecological communities at both a Commonwealth and state level.

Menangle Park gas pipeline, Review of Environmental Factors, Menangle Park NSW (Jemena)

- Reviewed and assessed ecological, heritage and water quality impacts for the REF for with the installation of a gas pipeline at Menangle Park, NSW.
- Assessed impacts on threatened species and ecological communities at both a Commonwealth and state level.

Riverwood Bridge upgrade, Review of Environmental Factors, Riverwood NSW (Sydney Trains)

- Contributing author of the REF report
- Assessed impacts on threatened species and communities at Commonwealth and state level.

P'nyang Project appraisal well, Preparation of ESIA, Papua New Guinea (Oil Search)

- Co-ordinated field surveys and production of an ESIA for an appraisal well in Western Province.
- Assisted in development of Environmental and Social Management Plan and stakeholder engagement plan and for the project.

P'nyang Project, Preparation of EIS, Papua New Guinea (Esso PNG P'nyang Ltd)

- Project manager for EIS submission.
- Contributing author of relevant chapters and Construction and Operation Management Plans.
- Undertook and supervised terrestrial biodiversity surveys.
- Technical studies management of biodiversity and ecological studies.
- Assisted in development forum process logistics, and stakeholder engagement.

Former Mary Kathleen uranium mine, Environmental Condition and Rehabilitation Assessment, near Mount Isa (Queensland Government)

- Contributing author of report on existing environment at the site, and risk assessment of the site for rehabilitation prior to release of the site for future land use options.
- Developed scoping section for approvals and impact assessment required for any future activities at the site.

Sarsfield Gold Mine Expansion Project Supplementary Report to the EIS, Ravenswood (Carpentaria Gold)

- Contributing author of chapters for terrestrial ecology and traffic and transport.
- Contributing author of Environmental Management Plan.
- Contributing author of submission responses.
- Developed approach to offsets consistent with State and Federal guidelines.

PNG LNG Pipeline Project, Preconstruction Environmental Surveys, Papua New Guinea (Spiecapag)

- Reviewed and analysed survey reports for pipeline right of way social, environmental and cultural heritage preconstruction surveys. The programme addressed IFC Performance Standards for the project.
- Preconstruction surveys were used to update the project Environmental Management Plan.

PNG LNG Project, Secondment to ExxonMobil, Papua New Guinea (ExxonMobil)

- Seconded to ExxonMobil from Coffey for nine months to work on the upstream elements of the PNG LNG Project.
- Worked in environmental and regulatory team, assisting management of the contractor working on construction of Komo airfield in the Highlands of PNG. Role included assisting in preparation of management plans, induction materials, review of environmental reporting, site checklists, site compliance reporting and monitoring requirements.
- Assisted in the implementation by the contractor of Environmental and Social Management Plans produced by ExxonMobil, and worked with the contractor to produce their own site specific plans.
- Assisted with management and reporting of environmental issues on site (e.g. spills reporting, environmental incidents etc).

Moura Pipeline, Ecological Assessment and EPBC Referral, Moura (Queensland Nitrates)

- Prepared ecological baseline reporting and impact assessment for gas pipeline in central Queensland.
- Prepared MNES assessment and EPBC referral for project.

Hillalong Project, Ecological Surveys for reassignment of vegetation mapping, Glenden (Shandong Energy)

- Carried out ecological surveys of the site, to assist in reassigning incorrectly mapped vegetation at the site, and identifying additional ecological constraints.
- Prepared report for submission to Queensland Government to allow client to continue with exploratory drilling in a buffer zone of a mapped endangered RE.

Surat Gas Project, Supplementary Report to the EIS, Brisbane/Surat Basin (Arrow Energy)

- Contributing author of relevant chapters and Environmental Management Plans.
- Developed processes to address concerns around aquatic and terrestrial ecology.
- Contributing author of submission responses.
- Undertook and supervised terrestrial biodiversity surveys (using standard and targeted trapping methods and flora BioCondition assessment).
- Contributing author of environmental offset strategies and requirements.
- Contributing author of MNES assessment, including liaison with DoE in Canberra.

Arrow LNG Plant, Supplementary Report to the EIS, Brisbane/Gladstone (Arrow Energy)

- Author of relevant chapters and Environmental Management Plans for terrestrial ecology and shorebirds.

- Contributing author of submission responses.
- Author of environmental offset strategies and requirements.
- Contributing author of matters of national environmental significance, liaising with SEWPaC on the development of these documents and application of the EPBC Act guidelines.

Moranbah Gas Project, Threatened Species Management Plan, Brisbane (Arrow Energy)

- Contributing author of Threatened Species Management Plan.

Arrow LNG Plant, Preparation of EIS, Brisbane/Gladstone (Arrow Energy)

- Contributing author of relevant chapters and Environmental Management Plan.
- Contributing author of MNES assessment, liaising with SEWPaC on the development of these documents and application of the EPBC Act.

Pagham Harbour Coastal Defence Scheme, Preparation of EIS, Pagham UK (Environment Agency)

- Produced ornithology section of EIS for the coastal defence scheme at important designated site, involving shingle recharge of areas of the site.
- Assessed existing baseline based on ornithological data and the impacts of the proposed scheme on the ornithology of the site.

QE2 Teesport Berth Development, Preparation of EIS, Teesport UK (PD Teesport)

- Contributing author of relevant section of EIS assessing impacts on ornithological matters in the designated site and proposed management measures.

Round 3 Offshore Windfarms, Review of Ecological Constraints, Edinburgh UK (Airtricity)

- Identified likely constraints with regard to ornithology in potential zones of development based on ecological factors. Identified areas of the zones in which development should be avoided.
- Assisted in developing survey methodologies for boat based surveys of likely offshore windfarm zones in British territorial waters. Survey methodology targeted likely key species within each zone.

Onshore Windfarm bird survey methodology design, Edinburgh UK (Enertrag)

- Identified likely key issues with regard to ornithology around potential sites close to SPAs.
- Assisted in developing survey methodologies for each site based upon these likely issues.

Dover Harbour Terminal 2 Development, Preparation of EIS, Dover UK (Dover Harbour Board)

- Reviewed the existing ornithological data and analysed the surveys undertaken.
- Contributing author to ornithology section of the EIS assessing impacts on ornithological matters in the site and proposed management measures.
- Designed methodology for further wintering shorebird surveys and breeding bird surveys around the site.

Dudgeon Offshore Windfarm, Preparation of EIS, Edinburgh UK (Dudgeon Offshore Wind)

- Reviewed existing ornithological data and analysed surveys undertaken.
- Proposed methodology for further surveys and statistical analysis (offshore boat based bird surveys).
- Contributing author to ornithology section of the EIS assessing impacts on ornithological matters in the site and proposed management measures.

Elgin Flood Alleviation Scheme, Ecological Surveys, Elgin UK (Moray Council)

- Assisted with production of Controlled Activities Regulations (CAR) licence applications to SEPA for the Elgin Flood Alleviation Scheme.
- Liaised with design team to establish which scheme elements need licensing, and with SEPA to see which licence each scheme element fell under.
- Produced landownership maps for the area and gathered data on sensitive receptors in the downstream area to carry out a flood damage assessment.
- Carried out ecological surveys of the site.

Seaham Harbour Redevelopment, Preparation of EIS, Seaham UK (Durham Council)

- Contributing author to ecology section of EIS for a harbour redevelopment next to Durham Coast SPA.
- Analysed baseline of birds in the designated site.

Titchwell Managed Realignment, Preparation of EIS, Norfolk UK (Royal Society for the Protection of Birds)

- Contributing author to ornithology section of EIS, assessing the impacts on internationally important populations of rare birds at the site.
- Produced a mitigation plan to assist in replacement of lost habitat.

Forres (River Findhorn) Flood Alleviation Scheme, Ecological Surveys and Preparation of EIS, Elgin UK (Moray Council)

- Assisted with environmental input into design of the scheme throughout its development embedded in client's office.
- Produced an Environmental Opportunities and Constraints Report.
- Assisted in the environmental and sustainability assessment of the options, as part of the scoping process.
- Carried out ecological surveys of the site.
- Contributing author to the EIS for this scheme, in particular terrestrial ecology and introductory chapters and management plans.

Helix Project Phase II, Ecological Surveys, Grangemouth UK (British Waterways)

- Managed environmental input into regeneration of green space area, and prepared ecological opportunities and constraints report.
- Liaised with regulatory authorities on behalf of client.
- Organised and managed protected species surveys undertaken by sub-contractors. Analysed survey information to inform scheme design.
- Undertook Phase 1 habitat survey, including proposal for habitat enhancement measures which could be incorporated into scheme design.

Forres (River Findhorn) Flood Alleviation Scheme, Ecological Surveys, Elgin UK (Moray Council)

- Assisted with production of CAR licence applications to SEPA for the Forres (River Findhorn) Flood Alleviation Scheme.
- Carried out ecological surveys of the site.

Proposed Firth of Forth Windfarm, Review of Constraints, Edinburgh UK (Airtricity)

- Identified likely constraints with regard to ornithology in potential zones of development based on ecological factors. Identified areas of the zones in which development should be avoided.
- Assisted in developing survey methodologies for boat based surveys of likely offshore windfarm zones in British territorial waters. Survey methodology targeted likely key species within each zone.

Seahouses seawall upgrade, Ecological Surveys, Seahouses UK (Northumbria Council)

- Developed survey methodology to monitor disturbance of shorebirds to allow construction to continue. Natural England had previously stated that no construction should take place during the winter months due to shorebirds.

Thames Estuary Maintenance Dredging, Review of Ecological Data, London UK (Port of London Authority)

- Analysed Wetland Bird Survey data for sites around the Thames Estuary in London.
- Assessed trends in populations of shorebirds near the proposed dredging sites.

BERR Offshore Energy Strategic Assessment, Review of Survey Method, Edinburgh UK (BERR)

- Assessed the adequacy of the bird aerial survey methodology proposal provided by WWT to survey offshore areas around UK.

Bo'ness Harbour Development, Wintering Bird Management Plan, Bo'ness UK (ING Estate)

- Produced a wintering bird management plan which identified potential impacts on wintering shorebirds on the Firth of Forth, and proposed management measures.

Brent Decommissioning, Sensitivity Assessment and Environmental Risk, Edinburgh UK (Shell)

- Contributed to the provision of biological information on key ornithological receptor groups encountered in the Brent field and wider area.
- Assessed sensitivity relevant to specific hazards and activities likely to result from decommissioning and remediation activities of platforms in the oil field.

Canvey Biodiesel Plant, Preparation of EIS Addendum, Canvey UK (Sure Green Fuels)

- Produced an addendum to the EIS with regard to potential objections from statutory consultees.
- Liaised with consultees to develop mitigation measures and a monitoring programme to assess the possible impact of the development on ornithology.

Barrow Waterfront Harbour Revision Order, Preparation of EIS, Barrow UK (West Lakes Renaissance)

- Contributing author to ecology section of EIS for £100million+ regeneration scheme, next to internationally protected site.

Trow Quarry Remediation Project, Ecological Surveys and Preparation of EIS, Trow UK (South Tyneside Council)

- Analysed baseline populations of birds present near works within designated sites.
- Carried out ecological surveys of the site.
- Contributing author to ornithology section of EIS assessing impacts on ornithological matters in the designated site.

Isle of Grain Windfarm, Review of Ecological Data, Isle of Grain UK (British Petroleum)

- Reviewed additional ecological survey data to that collected as part of the original EIS.
- Assisted in developing a methodology for post-construction monitoring on site

Newhaven Desalination Plant, Preparation of EIS, Newhaven UK (Clarity Ltd)

- Reviewed the existing ornithological data and analysed the surveys undertaken.
- Contributing author to ornithology section of the EIS assessing impacts on ornithological matters in the site and proposed management measures.

Strangford Lough Marine Current Turbine, Preparation of EIS, Strangford UK (SeaGen Ltd)

- Reviewed ornithological data gathered as part of the monitoring work for marine mammals.
- Contributing author to ornithology section of the EIS assessing impacts on ornithological matters in the site and proposed management measures.

Thanet Offshore Windfarm, Preparation of EIS Addendum, Thanet UK (Warwick Energy)

- Produced an addendum to ecology section of the existing EIS based on additional bird survey data for both boat and aerial surveys.

River Carron Forth Gateway Project, Ecological Surveys, Grangemouth UK (British Waterways)

- Managed assessment of environmental opportunities and constraints. Consulted with SEPA/SNH on behalf of client.
- Organised and undertook wintering shorebird surveys.

creating opportunities

Servicing projects throughout Australia and internationally

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Curriculum vitae

Ben Nottidge

Senior Ecologist

Ben is an experienced fauna ecologist with over 15 years experience. Ben has completed a large number of fauna surveys for proposed developments in Queensland including seasonal surveys that meet Qld and Commonwealth survey guidelines for EIS projects. Recent examples include Olive Downs coal mine, Bruce Highway upgrade on Sunshine Coast, Arrow Bowen Pipeline, Australia Pacific LNG Project, Moranbah South coal mine, Foxleigh coal mine and Valeria and Winchester South coal mines.

Ben has an in-depth knowledge of fauna survey techniques and tailoring them to suit a development site and meet survey guidelines. Ben also has highly developed skills in data capture and interpretation; ensuring highest standards of data collection are maintained.

Qualifications and memberships

- Bachelor of Applied Science – Protected Area Management, University of Queensland, 2001.
- First Class Honours, University of Queensland, Dispersal patterns of translocated and rehabilitated koalas in South-east Queensland, 2002.
- Current Rehabilitation Permit (Wildlife Spotter-catcher) – DEHP.
- Blue Card (now White Card)– Construction industry #129922, 2004
- Coal board Medical
- Current Senior Fird Aid and CPR Certificate
- Manual Liscence and 4WD Driver Certificate
- Generic Coal Surface Induction (S11)

Career

- Principal Ecologist, GreenLeaf Ecology, 2011 – Present.
- Manager/Senior Ecologist, Ecological Services Unit, Australia Zoo Wildlife Warriors Worldwide Ltd, 2007 – 2011.
- Environmental Scientist, James Warren & Associates, 2003 – 2007.

Representative Experience

- Foxleigh Proposed Coalmine – EIS fauna survey, Middlemount, Anglo American, QLD.
- Moranbah South proposed Coalmine – EIS fauna survey, Moranbah, Anglo American, QLD.
- Valeria Proposed Coalmine – EIS fauna survey, Capella, Rio Tinto Group, QLD.
- Winchester South proposed Coalmine – EIS fauna survey, Moranbah, Rio Tinto Group, QLD.
- Hail Creek Coalmine – EIS fauna surveys including targeted koala surveys and wildlife spotter-catching, Nebo, Rio Tinto Group, QLD.
- Arrow Bowen Pipeline – EIS fauna survey (pre and post wet season), Arrow Energy Pty Ltd, QLD.
- Pentland proposed Coalmine – EIS ecological (fauna) surveys (pre and post wet season), MDL 361, Pentland, Great Northern Energy Pty Ltd, QLD.
- Olive Downs South and Willunga Coal Project – EIS ecological (fauna) surveys (pre and post wet season and offset sites), Coppabella, Pembroke Resources Pty Ltd., QLD.

Curriculum vitae

Bruce McLennan

Senior Ecologist

Bruce is an experienced ecologist with over 10 years working on a range of projects in Queensland and Northern NSW. This experience includes protected plant surveys, pre-clearance vegetation surveys and mapping regional ecosystems. Having worked as a Vegetation Planning Officer with Greening Australia for a number of years, Bruce has a wide knowledge of property planning, vegetation management and rehabilitation techniques at a property scale. Bruce has particular experience undertaking BioCondition assessments.

Qualifications

- Bachelor of Business, Rural Management, University of Queensland, Gatton, Queensland, Australia
- Master of Sustainability Science, University of Southern Queensland, Toowoomba, Queensland, Australia

Relevant training and endorsements

- 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
- Approved NSW BioBanking, BioCertification & Framework for Biodiversity Assessment Assessor (December 2015) (Assessor number: 189)

Career

- Senior Ecologist, EMM Consulting, 2017 – Present
- Senior Ecologist (Unidel was purchased by AMEC in mid-2013), 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

Representative Experiences

- Rolleston Coal Mine - Expansion Offsets, Rolleston, Queensland, Australia, Glencore/Xstrata Coal, QLD.
- Walton Coal Project – Environmental Offsets Advice, Aquila Resources, QLD.
- Bowen Gas Pipeline and Bowen Gas Project – Environmental Offsets, Arrow Energy Pty Ltd, QLD.
- Wiggins Island Coal Export Terminal (WICET) – environmental offsets monitoring, Greening Australia Queensland, QLD.
- Carmichael Rail project – ecology/weed surveys for the 450km proposed rail corridor, Carmichael Rail Pty Ltd., QLD.
- Pembroke Resources – Olive Downs Linear Infrastructure, & Olive Downs/Willunga Project Terrestrial Ecology Surveys, QLD.

Curriculum vitae

Bruce McLennan

Curriculum vitae


Chagi Weerasena

Ecologist

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 and well developed communication skills.

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

- Ecologist, EMM Consulting, September 2017 – present.
- Contract Environmental Scientist, Amec Foster Wheeler (currently Wood Group), January 2017 – July 2017.
- Undergraduate GIS Analyst, Healthy Waterways (currently Healthy Land & Water), 2015.
- Marine Conservation and Education Intern, Oceans Campus South Africa, 2014.

Representative Experience

- Carmichael Coal Mine – contaminated land and ecology field surveys, and desktop reporting, Adani, QLD.
- Quorn Park Solar Farm – flora field surveys, Quorn Park Solar Farm, NSW.
- SunCoast Palmview – flora field surveys, Energex, QLD.
- Inland Rail Geotechnical Investigations – Matters of National Environmental Significance reporting, Protected Plants reporting, EPBC online referral, Australian Rail Track Corporation, QLD.
- Snowy Hydro 2.0 – Field surveys including koala surveys, vegetation plots, threatened flora transects and preclearance surveys, Review of Environmental Factors reporting, Snowy Hydro, NSW.
- Lady Annie Mine – National Greenhouse and Energy Reporting and National Pollution Inventory reports, CST Minerals, QLD.
- Harlaxton Quarry – National Greenhouse and Energy Reporting and National Pollution Inventory reports, Quarry Products Toowoomba, QLD.
- San Jorge Nickel Mine – contributing to EIS, Axiom Mining, Solomon Islands.

Curriculum vitae

Gus Daly

Ecologist

Gus is an ecologist based in Brisbane, with experience in flora and fauna identification, report writing and result presentation for varying audiences. He also has experience in data collection, analysis and knowledge of OH&S principles. Gus is a particularly knowledgeable and enthusiastic ornithologist.

Gus' recent professional work has involved assisting in the undertaking protected plants surveys for the geotechnical support as a part of ARTC inland rail project's feasibility studies as well as weed surveys for FYFE in Condabri Central, near Miles airport.

Qualifications

- Bachelor of Science with Honours Shorebird feeding ecology using stable isotope analysis, 2017
- Bachelor of Environmental Science, Southern Cross University, Lismore, Majoring in Coastal Management, 2015

Career

- EMM Consulting –Ecologist, 2018
- Australian Broadcasting Corporation Fauna data logging, 2018
- Logan City Council Mammal and Avifauna surveys, 2018
- Southern Cross University, School of Environmental Science & Engineering, Lismore, Demonstrator/Tutor, 2016

Representative Experience/skills

- Experience in flora and fauna identification (particularly avifauna).
- ARTC Inland Rail Geotechnical Support – Protected plant surveys and protected plant reports, Australian Rail Track Corporation, QLD.
- Cottage Creek weed surveys – 800 hectares of weed surveys in the lots comprising Cottage Creek, south of Reedy creek gas processing facilities, FYFE, QLD.

Lui Weber

Senior botanist

Curriculum vitae

Lui is a senior botanist based in EMM's Brisbane office. Lui has vast experience undertaking vegetation surveys and mapping, weed management, vegetation rehabilitation and conservation, and environmental monitoring.

Lui has advanced skills in data collection and analysis, and flora identification utilised across a broad range of geographical areas. He is also highly skilled at generating reports and management plans

Qualifications

- Bachelor of Science (Ecology and Botany) – University of Queensland 2004
- Bachelor of Science Honours (Botany) (Class 1) University of Queensland 2011

Career

- Principal Botanist Montane Ecological Solutions, April 2014 - Present
- Senior Botanist, Aspect Ecology, April 2014 - Present
- Senior Botanist, BAAM Pty Ltd, Sep 2011 - April 2014
- Senior Botanist, Sinclair Knight Merz (Now Jacobs), Australia, November 2008 - September 2011
- Vegetation survey and mapping officer, Moreton Bay Regional Council, QLD, 2004 - 2008
- Sub-consultant, Northern Rivers Catchment Management Authority (CMA), NSW, 2008
- Sub-consultant, NSW Nature Conservation Trust, 2005 - 2008
- Sub-consultant, Ecos Environmental Pty Ltd, 2005 - 2008
- Plant Physiology Research Assistant, University of Queensland (School of Biological Sciences (Schmidt Plant Physiology Lab)), 2003 - 2004

Representative experience

Heading if applicable

- Hunter Valley Operations Offset Assessment, flora and fauna surveys, Belford NSW (HVO)
- Saving our Species Euphrasia bella and Gaultheria viridicarpa cliff flora survey of Limpinwood NR – NSW Government Department of Environment and Heritage
- Saving our Species Zieria adenodonta and Ozothamnus vagans cliff flora survey of Wollumbin NP – NSW Government Department of Environment and Heritage
- Bli Bli Quarry Regional Ecosystem and threatened flora mapping – Holcim
- Waisoi Namosi Vegetation Mapping Fiji – Phalaris

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- Wollert Power Station Vegetation Mapping, Victoria – APA Group
- Brolga and Canoona Mine Projects flora and vegetation survey – QLD Nickel.
- Wolffdene Quarry threatened flora survey - Hanson.
- QGC Wandoan Gas Project, Vegetation Mapping and threatened flora survey.
- Kin Kin Quarry threatened flora survey and Vegetation Mapping - Neilsen's
- Ballina to Woodburn Pacific Highway Upgrade Threatened Flora, Lowland Rainforest and Coastal Cypress Pine EEC Mapping – SKM/Jacobs.
- Cooroy to Curra Bruce Highway Upgrade – SKM/Jacobs, Regional Ecosystem Mapping and Threatened flora Survey for section C.
- Togara North EIS – Xstrata Coal Regional Ecosystem Mapping and Threatened flora Survey
- Pacific Highway Upgrade (Wells Crossing to Glenugie) – Threatened flora surveys, mapping.
- National Broadband Network, Visionstream – Optic Fibre Alignment Flora and Habitat Assessments, Queensland and Western Australia.
- Aquila Resources Washpool EIS – Vegetation Mapping
- BHP Mitsubishi Alliance (BMA) Ward's Well Vegetation Constraints Analysis
- Rio Tinto Hail Creek Mine Vegetation Mapping and Survey
- QLD Department of Main Roads, Multimodal Transport Corridor - Flora Survey and Vegetation mapping for Stages 1,2,3 & 5.
- SEQ Water, Hinze Dam Stage 3 – Threatened Flora Surveys.
- BMA, Seraji East Coal Project, Seismic Lines Drilling & Exploration - Endangered RE Mapping and Flora Survey.
- New Hope Coal, New Acland Stage 3 Rail Spur - Baseline and Threatened Flora Survey.
- Linkwater, Southern Regional Water Pipeline – Baseline flora surveys, vegetation survey and mapping.
- Tugun Bypass Project – Baseline flora surveys, vegetation mapping, threatened species translocation (including seed collection).
- QLD Environmental Protection Agency, Flora of North Stradbroke Island – Flora survey, photography and collection of specimens.
- Pacific Highway Upgrade (Brunswick Heads Bypass) – Baseline flora surveys, vegetation survey, mapping and seed collection.
- Pacific Highway Upgrade (Woodburn to Iluka) - Baseline flora surveys, vegetation survey and mapping.
- Pacific Highway Upgrade (Bonville Bypass) - Baseline flora surveys, vegetation survey and mapping, threatened species translocation (including seed collection).
- Department of Environment and Conservation NSW, Comprehensive Coastal Assessment – 150 detailed vegetation plots including floristic and structural data and new records of threatened species.
- Department of Environment and Conservation NSW, Threatened Species Survey – Brunswick Heads Nature Reserve.
- Northern Rivers Catchment Management Authority (CMA) Bush Recovery Round 3, property vegetation survey and vegetation mapping, Arcview GIS.
- Saving our Species Ozothamnus vagans Weed Mapping Limpinwood NR and Wollumbin NP – NSW Office of Environment and Heritage
- Wollert Power Station Weed Mapping, Victoria – APA Group
- QGC Wandoan Gas Project, Weed Mapping.
- National Broadband Network, Visionstream – Optic Fibre Alignment Weed Mapping
- Rio Tinto Hail Creek Mine Weed Mapping.
- Queensland Water Infrastructure, Traveston Crossing Dam Pilot Revegetation Project - Weed Mapping.
- Gold Coast City Council, Nerang River Health Study – Weed Mapping and Management Priorities.
- Weed Management Plans for Moreton Bay Regional Council Reserves – Lagoon Creek and Godwin Beech Environment Parks, Campbell's Pocket Rd Council VCA.
- NSW Nature Conservation Trust – Weed Management plans for 10 Conservation Covenant Properties in Northern NSW.
- Northern Rivers Catchment Management Authority (CMA) Bush Recovery Round 3, property weed survey and management planning.
- NSW Department of Environment and Conservation – Monitoring of the success of Bitou Bush control measures and impacts on native vegetation in Bundjalung National Park.
- Vegetation Condition (Biocondition) Assessment Lower Mooloola River Environmental Reserve – QLD Department of Transport and Main Roads.
- Hinze Dam Stage 3 SEQWater – Regeneration area selection regeneration species selection and planting design
- RAAF, Amberley Wildlife Management Strategy – Regeneration area selection, wildlife corridor design, regeneration species selection and planting design.

- Queensland Water Infrastructure, Traveston Crossing Dam Pilot Revegetation Project – Regeneration species selection and planting design.
- Ormeau Bottle Tree Translocation Wolffdene Quarry – Hansen
- Background Report to the National Recovery Plan for Littoral Rainforests and Coastal Vine Thickets of Eastern Australia - DeSEWPAC.
- Cunningham's Gap Clayton's Gully Grass Tree and Orchid translocation - Fulton Hogan.
- SEQ Water Hinze Dam Stage 3 – Propagation and Translocation Plan and Seed/Cutting Collection for EPBC Listed Flora Species.
- Queensland Water Infrastructure Traveston Crossing Dam Habitat Restoration Strategy - Threatened Flora and Endangered Ecosystems.
- New Hope Coal, Jeebropilly Environmental Offsets – Desktop Assessment of Conservation Values and Environmental Offset Planning.
- NSW Nature Conservation Trust – Flora surveys of proposed covenant areas on private property and assessment of rolling fund properties in North Coast and Nandewar Bioregions.
- Moreton Bay Regional Council – Assessment of properties under Voluntary Conservation Agreements – Flora surveys, landholder consultation, weed monitoring and regeneration planning.
- Moreton Bay Regional Council – Assessment of properties under MBRC Land for Wildlife schemes – Flora surveys, landholder consultation, weed monitoring and regeneration planning.
- Biodiversity Back on Track SEQ Catchments. Represented Moreton Bay Regional Council, attended conference as a as Threatened Flora Expert to provide conservation advice for flora species.
- Northern Rivers Catchment Management Authority (CMA) Bush Recovery Round 3, scoring of property conservation values, landholder liaison and conservation management planning.
- Parsons Brinkerhoff, Orchid Management and Translocation Plan for the Bulahdelah Bypass – Translocation and research plan for three threatened orchid species.
- Ecos Environmental – Successful Nomination for Coastal Cypress Pine Forest in The NSW North Coast as an Endangered Ecological Community.
- 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. Provides a list of plant species suitable for revegetation and predicted to have been present on any land parcel in the regional council area. Species lists are based on EPA pre-clearing RE mapping and species recorded from the shire within each RE.
- Caboolture Shire Council, Regeneration Database – Development of a regeneration database for Caboolture Shire Council. The Database provides a list of plant species suitable for revegetation and predicted to have been present on any land parcel in the shire. Species lists are based on EPA pre-clearing Regional Ecosystem mapping and species field data recorded from the shire within each RE.
- Linkwater, Southern Regional Water Pipeline - Regeneration plan planting species selection and densities for each regional ecosystem along the 100km alignment.
- Regeneration plans for Moreton Bay Regional Council Reserves – Lagoon Creek and Godwin Beach Environmental Parks, Campbell's Pocket Rd Council VCA.
- Threatened Invertebrate (Atlas Ground Beetle and Pink Underwing Moth) Monitoring Woodburn to Ballina Pacific Highway Upgrade – Jacobs and NSW Roads and Maritime Services.
- Threatened Flora Monitoring Ballina to Woolgoolga Pacific Highway Upgrade – NSW Roads and Maritime Services.
- Weipa and Andoom Annual Rehabilitation Monitoring 2014 – 2018 Rio Tinto Alcan
- Eighteen Mile Swamp Base of Escarpment Vegetation Condition Monitoring including hemispherical canopy photography – Sibelco
- Trevally Trial and QC Alumina mine rehabilitation monitoring, Weipa – Rio Tinto
- Vance Sand Mining Rehabilitation and Analogue site monitoring, North Stradbroke Island – Sibelco
- Acid Frog habitat monitoring, North Stradbroke Island – Sibelco
- Bribie Island Groundwater Project – SEQWater Ecological (Flora and Frog) Monitoring of Groundwater Dependent Wallum Ecosystems.
- Rio Tinto Clermont Mine Creek Diversion Monitoring Using Index of Diversion Condition, ACARP Methodology.
- Rio Tinto Hail Creek Mine Biodiversity Monitoring Using Corveg and Biocondition Methodologies.
- Wesfarmers Curragh Blackwater Creek Diversion – Revegetation Monitoring and Professional Oversight.
- Traveston Crossing Dam Pilot Revegetation Project – Regeneration Baseline Monitoring Data and Target Ecosystem Reference Sites, including carbon accounting, Rainforest CRC methodology.
- Gold Coast City Council, Nerang River Health Study - Stream Condition and Riparian Vegetation Monitoring.

- Envite Environmental Training – Author of MERV plant database of all plant species by habitat type within the NSW North Coast and Northern Tablelands Bioregion including 4200 species over 9 broad habitat types. Database developed for use in ecological monitoring on palmtop computers in the field.
- NSW Department of Environment and Conservation – Monitoring of the impacts of Bitou Bush control measures on native vegetation in Bundjalung National Park.
- Brisbane Aquifer Project - Ecological Monitoring, Water Extraction, baseline ecological studies.
- Redlands Shire Council, Feral Pig Monitoring Project – Monitoring ecological impacts of feral animals.

Publications

Yun Kit Yeoh, Paul Dennis, Chanyarat Paungfoo-Lonhienne, **Lui Weber,** Richard Brackin, Mark Ragan, Susanne Schmidt, and Philip Hugenholtz (2017) Evolutionary conservation of a core root microbiome across plant phyla along a tropical soil chronosequence. ***Nature Communications*** (8, Article number: 215 (2017). doi:10.1038/s41467-017-00262-8

Low Tim and **Weber Lui** (2017) Chapter: Seed Dispersal in the Big Scrub In: Greenfields S. Ed. The Big Scrub Rainforest: a Journey Through Time. Big Scrub Landcare and Rous County Council. Everbest China. 175pp.

Lui C. Weber, Jeremy VanDerWal, Susanne Schmidt, William J. F. McDonald, Luke P. Shoo (2014) Patterns of rain forest plant endemism in subtropical Australia relate to stable mesic refugia and species dispersal limitations. *Journal of Biogeography* **41**:2, 222-238.

Shoo L. P., O'Mara J., Perhans K., Rhodes J. R., Runting R., Schmidt S.,Traill L. W., **Weber L. C.**, Wilson K. A., Lovelock C. E.. (2012) Moving beyond the conceptual: specificity in regional climate change adaptation actions for biodiversity in South East Queensland, Australia. *Regional Environmental Change*. Online Dec 2012.

Price R., **Weber L**., Weber E., Latansio-Aidar S. & Hagger V. (2010) Chapter 3: Rainforests in South East Queensland, **In**: Lovelock C., Skilleter G. & Schmidt S. *South East Queensland Climate Adaptation Research Initiative, Biodiversity* - Vulnerability of Focal Habitats to Climate Change: Milestone Report, April 2010, pp. 29-91, School of Biological Science, University of Queensland, St Lucia.

Weber, L. (2013). Plants that Miss the Megafauna. *Wildlife Australia*, Vol. 50, No. 3, Spring 2013: 22-25.

Weber L. C. (2009) A new population of Minyon Quandong (*Elaeocarpus sedentarius*) from northern New South Wales. *Australasian Plant Conservation* Vol. 17 No. 4 pp. 20-21.

Sheringham, P.R., Dr. Benwell, A., Gilmour, P., Graham, M.S., 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 by the Department of Environment and Climate Change 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 ISBN: 0 9756823 1 8. Includes Interactive DVD by Lui Weber and Robert Price.

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