



Karara Wind Farm

**MNES Assessment Report (EPBC
2020/8755)**

ACCIONA Energy Australia Global Pty Ltd

9 September 2021

→ **The Power of Commitment**



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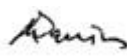
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Executive summary

Overview

The Karara Wind Farm Project (the Project), proposed by CleanCo Queensland (CleanCo), in partnership with ACCIONA Energy Australia Global Pty Ltd (ACCIONA), will include the construction and operation of a wind farm comprising up to 20 wind turbines and ancillary infrastructure including access tracks, overhead 33 kV electrical reticulation, underground 33 kV electrical reticulation, one substation, site amenities, and laydown areas.

The Project is located approximately 40 km south-west of the township of Warwick and 70 km south west of Toowoomba. The Project is proposed over one State Forest and four freehold lots, totalling approximately 4,633 ha and is located within Goondiwindi Regional Council and Southern Downs Regional Council Local Government Areas. The Project footprint within the Project area is approximately 338 ha in extent.

This report has been prepared to identify and assess matters of national environmental significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) which are likely to be impacted by the proposed action.

Potential impacts and mitigation measures

Wherever practicable, the Project footprint has been sited within areas of relatively low local ecological value. The Project footprint intersects a landscape that has been subject to extensive historical land clearing and decades of intensive sheep grazing. Despite this, the Project footprint retains areas of remnant vegetation with high ecological values for native flora and fauna.

The construction and operation of the Project will result in the removal of vegetation, and disturbance of existing ground conditions on either a temporary or permanent basis. The assessment of impacts to MNES determined that the following impacting processes are those most likely to result in a significant impact to a MNES:

- Loss of habitat
- Injury or mortality
- Fragmentation of habitat and loss of connectivity
- Disturbance to habitat from noise, light, and vibration
- Habitat degradation and increased erosion
- Spread of invasive species.

Pre-clearance surveys will be undertaken to provide small-scale information on key sensitive ecological receptors. These will allow opportunities for avoidance of breeding places and other key habitat values through localised re-alignments during construction and adaptive management during the operation phase.

Mitigation and management measures are proposed, including a Construction Management Plan, Fauna Management Plan, Vegetation Management Plan and Bird and Bat Adaptive Management Plan.

Significant impact assessment

A significance of impacts assessment was undertaken of the Project's potential impacts on MNES that have been confirmed present or are considered likely to occur within the Project area. The assessment was made against the EPBC Act Significant Impact Guidelines 1.1 (DotE 2013) and determined that the Project is likely to result in significant impacts on the following listed species:

- Koala (*Phascolarctos cinereus*) (Vulnerable) – due to the impact on habitat critical to the survival of the species and potential for injury or mortality during construction
- Central greater glider (*Petauroides armillatus*) (formerly the greater glider (*Petauroides volans*)) (Vulnerable) – due to the impact on habitat critical to the survival of the species
- Grey-headed flying-fox (*Pteropus poliocephalus*) (Vulnerable) – due to the impact on habitat critical to the survival of the species
- Squatter pigeon (southern) (*Geophaps scripta scripta*) (Vulnerable) – due to the impact on habitat critical to the survival of the species
- Regent honeyeater (*Anthochaera Phrygia*) – due to the impact on habitat critical to the survival of the species.

Where impacts are unavoidable and significant, land-based offsets are proposed.

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Abbreviations and acronyms

Acronym	Definition
ACCIONA	ACCIONA Energy Australia Global Pty Ltd
ACT	Australian Capital Territory
ALA	Atlas of Living Australia
AOO	Area of occupancy
CleanCo	CleanCo Queensland
cm	Centimetres
CMP	Construction Management Plan
BACI	Before-After-Control-Impact
BBAMP	Bird and Bat Adaptive Management Plan
CMP	Construction Management Plan
DAF	Queensland Department of Agriculture and Fisheries
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DBH	Diameter at breast height
DES	Queensland Department of Environment and Science
DEWHA	Department of the Environment, Water, Heritage and the Arts
DNRME	Former Queensland Department of Natural Resources, Mines and Energy, now Department of Resources
DoR	Queensland Department of Resources
EOO	Extent of occupancy
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESCP	Erosion and Sediment Control Plan
Ha	Hectares
IUCN	International Union for the Conservation of Nature
Km	Kilometres
Km/hr	Kilometres per hour
LGA	Local government areas
M	Metres
mm	Millimetres
MNES	Matters of National Environmental Significance
MSES	Matters of State Environmental Significance
MV	Medium voltage
MW	Megawatt
N/A	Not applicable
NC Act	Queensland <i>Nature Conservation Act 1992</i>
NSW	New South Wales
OHTL	Overhead transmission line
PMST	Protected Matters Search Tool
RE	Regional Ecosystem
RSA	Rotor Swept Area
SAT	Spot Assessment Technique

Acronym	Definition
SMP	Species Management Plan
SPRAT	Species Profiles and Threats
TEC	Threatened Ecological Community
The Project	Karara Wind Farm Project
TSSC	Threatened Species Scientific Committee

1. Introduction

1.1 Proposed action

1.1.1 Overview

CleanCo Queensland (CleanCo), in partnership with ACCIONA Energy Australia Global Pty Ltd (ACCIONA), propose to develop the Karara Wind Farm (the Project) (EPBC 2020/8755) with up to 20 wind turbines that are anticipated to generate approximately 114 MW of renewable energy to contribute to the national electricity grid, together with associated ancillary infrastructure including:

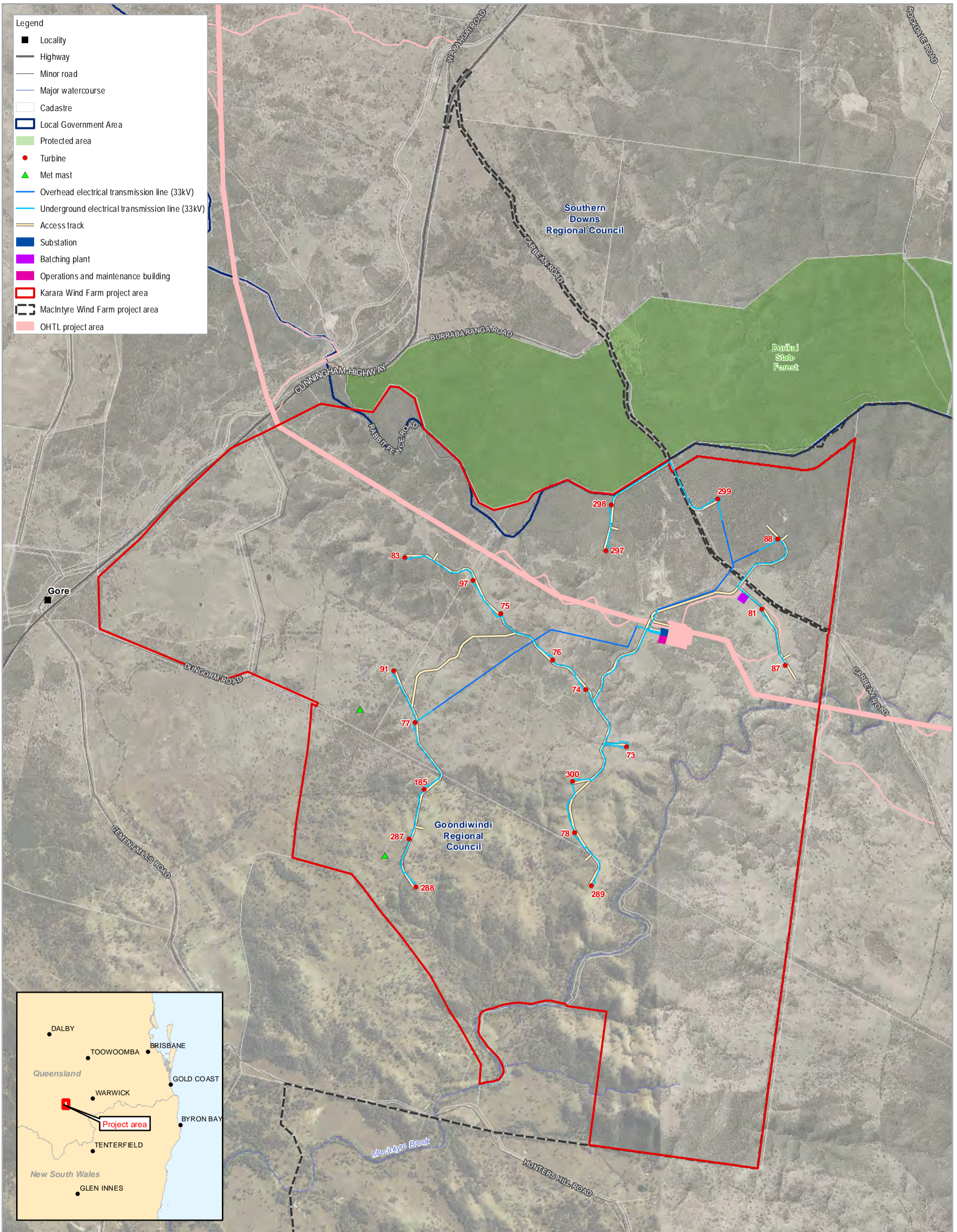
- Wind turbine foundations and hardstand areas
- Access tracks
- Overhead 33 kV electrical reticulation
- Underground 33 kV electrical reticulation
- One substation
- Two meteorological masts
- One construction compound
- One laydown area
- One operations and maintenance facility.

The Project is located approximately 40 km south-west of the township of Warwick and 70 km southwest of Toowoomba in Queensland. The Project is proposed over one State Forest and four freehold lots, totalling approximately 4,633 ha (defined as the 'Project area') and is located within Goondiwindi Regional Council and Southern Downs Regional Council Local Government Areas. The Project footprint within the Project area is approximately 113.5 ha in extent.

The Project is related to the proposed MacIntyre Wind Farm Project (EPBC 2020/8756) and a proposed overhead transmission line (OHTL) Project (2020/8759) that collectively comprise the MacIntyre Wind Energy Precinct. The proposed projects have been referred separately under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The MacIntyre Wind Farm Project proposes the development of up to 169 wind turbines, six meteorological masts, site access and access tracks, underground and overhead 33 kV medium voltage electrical reticulation, control facilities, ancillary works and site amenities supporting construction and operation phases. The proposed OHTL Project proposes the development of 64 km of 330 kV OHTL that traverses both the Project and proposed MacIntyre Wind Farm in the south within a 60 m wide easement.

The proposed Project will connect into Powerlink's transmission network via the OHTL Project cutting into the Powerlink Millmerran – Middle Ridge OHTL further north at Tummaville.

The Project locality and area are shown in Figure 1.1.

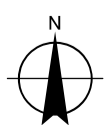


- Legend**
- Locality
 - Highway
 - Minor road
 - Major watercourse
 - Cadastre
 - ▭ Local Government Area
 - ▭ Protected area
 - Turbine
 - ▲ Met mast
 - Overhead electrical transmission line (33kV)
 - Underground electrical transmission line (33kV)
 - Access track
 - Substation
 - Batching plant
 - Operations and maintenance building
 - ▭ Karara Wind Farm project area
 - ▭ MacIntyre Wind Farm project area
 - ▭ OHTL project area



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 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



Acciona Energy Australia Global Pty Ltd
 MNES Assessment Report

Project location,
 area and infrastructure

Project No. 12525037
 Revision No. 0
 Date 09/08/2021

Figure 1-1

1.1.2 Layout development

The Project layout has been based on maximising exposure to the available wind energy resource in areas approved by landholders whilst minimising potential environmental and amenity impacts as described in sections below.

The Project (development) footprint presented in the EPBC Referral (EPBC 2020/8755) assumed a worst case scenario with an area of 338 ha in extent estimated to be required to accommodate Project infrastructure, including wind turbines, access tracks, overhead and underground cables and other associated infrastructure. In the absence of geotechnical survey to inform design and to provide flexibility for micro-sitting, infrastructure was located within broad corridors up to 100 m in width and within areas of 3 ha at turbine locations.

During development of the Preliminary Documentation, Project design has been advanced and the Project footprint refined accordingly such that the adopted layout as presented in Figure 1.1 has sought to further avoid sensitive environmental values and reduce the overall area required to accommodate Project infrastructure such that the Project footprint is 113.5 ha in extent. Access track corridors have largely been reduced to 30 m widths, notwithstanding that some areas retain a wider width to accommodate terrain. Turbine hardstand areas have been reduced to the smallest footprint practicable to accommodate safe work practices.

It is noted that final footprints are likely to be reduced further as a result of design and ability to rehabilitate and reinstate work areas. However, as these areas are not yet defined, the Project footprint, based on an extent of 113.5 ha as shown in Figure 1.1 is used for the purposes of assessment.

1.1.2.1 Alternative strategies, plans and measures to avoid and minimise impacts

A hierarchical approach of avoiding then minimising vegetation clearing was adopted in the design of the Project in response to ecological constraints. Ecological assessments identified the following areas that helped to inform the design:

- No-go areas: High-value regrowth vegetation (categorised as Category C vegetation under Queensland legislation, for which no mechanism to clear vegetation for a wind farm was available under the *Planning Act 2016* and the *Vegetation Management Act 1999* during formative Project design phases)
- High impact areas: high priority areas to avoid as far as practicable; particularly for temporary works, on the basis that the areas contain one or more of the following:
 - High value habitat for listed threatened species comprising of breeding, nesting or roosting habitat
 - Values for a large number of species and/or species habitat collectively
 - Endangered Regional Ecosystems (REs)
 - A threatened ecological community (TEC)
 - Non-fragmented parcels of good quality vegetation.
- Low impact areas: low priority areas to avoid on the basis that they contain:
 - Moderate to low value listed threatened species habitat and/or foraging and general use habitat
 - Smaller, fragmented areas of habitat
 - Of Concern or Least Concern RE.

Following the constraints assessment, an iterative design process was adopted with the aim being to avoid areas identified as no-go, high impact, and low impact, where practicable. Design development and progression has further enabled the avoidance of impacts to species and communities through avoiding habitat and minimizing the disturbance footprint within habitat areas. The Project footprint has been reduced to a total of 113.5 ha (reduced from 338 ha presented in EPBC 2020/8755).

To the extent possible, infrastructure is located within areas of non-remnant vegetation or within existing cleared areas and restricted to within the adopted Project footprint (Figure 1.1).

Structures have been sited within Least Concern RE where practicable, before being placed in Of Concern or Endangered RE. Infrastructure has also been sited to avoid essential habitat to the greatest extent practicable; however, these areas have not been fully avoided.

In some cases, the identified constrained areas could not be avoided due to the need to site turbines within good wind resource areas, and in consideration of landowner farming constraints. Constraining terrain and topography across the site also influenced the locations of turbines, specifically in relation to access required for the blade transport vehicle (noting the blades are likely to be in excess of 80 m length). These factors are discussed in further detail below.

1.1.2.2 Wind resource

The regional wind resource has informed the selection of the Project area. The local wind resource has been measured and confirmed that the Project area is suitable for the establishment of a wind farm. Considerations to the wind resource, natural environment, physical environment, constructability, grid proximity, procurement and the detailed design of the Project will inform the Project's final layout. A 1,500 m setback from existing or approved non-host sensitive land uses has been applied to the development of the layout, and infrastructure has been positioned to avoid and minimise ecological impacts as far as practicable.

Some areas of the Project footprint, particularly along the northern and eastern border of the Project area, have been identified as having high wind energy potential. This results in some low and high impact areas being within the Action area. Whilst these areas are implicated in the design, through utilising the high wind resource in this area, the Project requires fewer turbines overall; in turn, resulting in less clearing impact. Utilising these areas also allows for the generation of more renewable energy which is ultimately realised by the end user.

1.1.2.3 Topography

The topography of the site was a constraint in the selection of locations for a number of the access tracks and hard stand areas. Where practicable and topography allowed, access tracks and hardstand areas are proposed in areas of non-remnant vegetation. However, in some instances, this is not practicable as topography was beyond the design capacity of typical construction vehicles and steep and difficult terrain would make transportation of turbine blades (80 m plus in length) to hardstand areas impossible.

To allow for the safety of the construction team and the transport of equipment, some of the infrastructure is required to be located outside of non-remnant vegetation areas.

1.1.2.4 Landowners

The proposed location and placement of infrastructure, both temporary and permanent, required consent and approval from the relevant landholder. Site selection was therefore limited to areas approved by landowners as part of the overall Project design.

Where avoidance is not practicable, measures to minimise the impacts were adopted including:

- Restriction of land clearing to the minimum required for the safe construction of the wind farm. Detailed design, geotechnical and land surveys will inform micro-siting of infrastructure with consideration of further reducing the extent of clearing required. As such, the expected area of clearing is likely to be significantly less than that currently proposed.
- Use of existing farming tracks as access tracks and widening these to meet the needs of construction. This will result in some vegetation clearing but tracks in existing disturbance areas will be used as much as practicable to minimise new disturbance and fragmentation of habitat.
- Site offices, construction stockpiles and other temporary activities will be placed in previously disturbed areas where practicable.

- Where temporary construction activities cannot be placed in previously disturbed or cleared areas, rehabilitation of the areas will be undertaken as soon as practicable after the facilities are no longer required.
- Where infrastructure crosses watercourses, areas of existing disturbance (i.e. existing farming tracks) have been selected. Where there is not practicable, the Project footprint has been minimised and large habitat trees have been avoided where practicable.
- Habitat enhancement features (e.g. salvaged hollows and nesting boxes) will be established outside of the clearing area within suitable habitat and in accordance with management plans and legislative requirements.
- Access tracks and overhead transmission lines have been designed using direct routes where practicable, to minimise the total amount of clearing required.

Additional measures to avoid impacts that have been incorporated into the design of the Project include the use of infrastructure elements that do not preclude fauna movement. There will be limited new permanent fences constructed (except around the substation) and turbines will not have any external lighting; this will reduce potential impacts to birds and bats.

1.2 Purpose of this report

The Project was determined to be a controlled action requiring assessment and approval under the EPBC Act before it can proceed for the following relevant controlling provisions:

- Listed threatened species and ecological communities (sections 18 and 18A)
- Listed migratory species (section 20 and 20A).

The Project is being assessed by preliminary documentation.

This report has been prepared to:

- Identify and assess matters of national environmental significance (MNES) under the EPBC Act which are likely to be impacted by the proposed action (EPBC 2020/8755)
- Respond to the request for additional information required for the preliminary documentation, in particular addressing:
 - Item 3 Description of the environment and Matters of National Environmental Significance (being listed threatened species and ecological communities and listed migratory species)
 - Item 4 Quantification of impacts (on MNES and MNES habitat)
 - Item 5 Avoidance and mitigation.

Specifically, this report presents the findings of desktop and field-based ecological assessments undertaken to demonstrate that the development of the Project can avoid, minimise or mitigate impacts on flora, fauna and ecological processes and included:

- Identifying the ecological values of the Project area, including vegetation communities and terrestrial and aquatic flora and fauna through desktop and field-based methods
- Assessing the potential impacts of the Project on ecological values protected under the EPBC Act
- Identifying mitigation and management actions to minimise impacts.

Where impacts are predicted on MNES a significance of impact assessment was undertaken in accordance with the Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DotE 2013). As necessary and applicable offsets are proposed and reported the EPBC Act Environmental Offsets Policy and reported in the MacIntyre Wind Farm Project Environmental Offsets Strategy (Attexo 2021).

The desktop assessment (Section 2.2) field assessments (Section 2.3) and likelihood of occurrence assessment (Section 2.4) for the Project area returned the following results for listed threatened species and ecological communities and listed migratory species:

- Confirmed present within Project area:
 - One TEC - white box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC (Critically Endangered)
 - One flora species – *Vincetoxicum forsteri* (syn. *Tylophora linearis*) (Endangered)
 - Two mammals – koala (*Phascolarctos cinereus*) (Vulnerable) and central greater glider (*Petauroides armillatus*) (Vulnerable)
- Likely to occur (based on the proximity to recent historical records and the presence of suitable habitat):
 - Seven bird species – regent honeyeater (*Anthochaera phrygia*) (Critically Endangered), squatter pigeon (southern) (*Geophaps scripta scripta*) (Vulnerable), painted honeyeater (*Grantiella picta*) (Vulnerable), white-throated needletail (*Hirundapus caudacutus*) (Vulnerable, Migratory), swift parrot (*Lathamus discolor*) (Critically Endangered), fork-tailed swift (*Apus pacificus*) (Migratory), and rufous fantail (*Rhipidura rufifrons*) (Migratory)
 - One mammal species – grey-headed flying-fox (*Pteropus poliocephalus*) (Vulnerable).
- Confirmed absent:
 - Two flora species – *Eucalyptus infera* (Durikai mallee) (Vulnerable) and *Macrozamia conferta* (Vulnerable)

The Department of Agriculture, Water and Environment (DAWE) in its request for additional information to the preliminary documentation considers that there is a real chance or possibility that significant impacts may arise in relation to the following additional species that are addressed in this report for completeness and included in Appendix A:

- Border thick-tailed gecko (*Uvidicolus sphyrurus*) (Vulnerable)
- Austral Cornflower (*Rhaponticum australe*) (Vulnerable)
- Austral Toadflax (*Thesium australe*) (Vulnerable)
- Bluegrass (*Dichanthium setosum*) (Vulnerable)
- *Callistemon pungens* (Vulnerable)
- *Macrozamia machinii* (Vulnerable)
- *Macrozamia pauli-guilielmi* (Pineapple zamia) (Endangered).

This report is supported by the following technical documents provided as standalone report:

- EPBC Act threatened birds – habitat and regional assessment and targeted surveys (Report No. 20033 (14.3)) (Nature Advisory 2021c)
- Bird Utilisation Survey Baseline Report (Report No. 20033 (18.1) March 2021) (Nature Advisory 2021a)
- Bird and Bat Adaptive Management Plan (Report No. 20033 (3.3) April 2021) (Nature Advisory 2021b) (BBAMP)
- Construction Management Plan (12525037-REP-MWF-09) (GHD 2020a)
- Preliminary Vegetation Management Plan (12525037-REP-MWF-014) (GHD 2020c)
- Preliminary Fauna Management Plan (GHD 2020) (12525037-REP-MWF-013) (GHD 2020b).

1.3 Assessment of alternatives

There are no feasible alternatives to undertaking the Project. As a renewable energy wind farm project, the Project contributes to meeting State and Commonwealth Government renewable targets and satisfies State and Commonwealth Policy requirements.

CleanCo is a Government Owned Corporation established under the Queensland Government's Powering Queensland Plan and has a target to support 1,000 MW of new renewable energy generation by 2025. CleanCo will build, own and operate the Project to:

- Diversify Queensland's electricity generation sources
- Support system security and reliability
- Provide opportunities for local businesses and employment.

The proposed Project layout and footprint was determined following a constraints analysis process that sought to avoid, and where avoidance was not practicable, minimise impacts, to determine the best and most appropriate locations for Project infrastructure with consideration of wind resource, environmental sensitivities and landholder requirements.

1.4 Scope and limitations

This report has been prepared by GHD for ACCIONA Energy Australia Global Pty Ltd and may only be used and relied on by ACCIONA Energy Australia Global Pty Ltd for the purpose agreed between GHD and ACCIONA Energy Australia Global Pty Ltd as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than ACCIONA Energy Australia Global Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered at specific sample points and information reviewed at the date of preparation of the report. Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of construction activities, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change. Species presence, distribution and detectability can change over time in response to seasonal and annual variations in environmental conditions. Extensive survey effort has been commissioned within and adjoining the Project area over a ten-year period. Surveys have spanned a range of seasons, with most surveys coinciding with periods of high fauna activity in spring, summer and autumn. The survey effort is therefore considered sufficient to provide a reliable basis for understanding the existing environment and assessing potential impacts on species and their habitats.

GHD has prepared this report on the basis of information provided by ACCIONA and its appointed consultants and contractors, and others (including Government authorities). GHD has not independently verified or checked this information beyond the agreed scope of work. GHD does not accept liability in connection with unverified information from those reports, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Methodology

2.1 Approach and terminology

The ecological assessment for the Project included a desktop review of environmental databases, mapping layers and previous field survey reports, and a field assessment of the terrestrial flora and fauna ecological values within the Project area and surrounding landscapes as applicable. The desktop and field methodologies are detailed separately in sections 2.2 and 2.3 respectively.

The term 'Project area' refers to the broader properties within which the Karara Wind Farm Project is proposed.

The term 'footprint' refers to the area of proposed impact.

The proposed Karara Wind Farm is related to the proposed OHTL Project (EPBC 2020/8759), a portion of which traverses through the centre of the Project area.

The proposed Karara Wind Farm is related to the proposed MacIntyre Wind Farm Project (EPBC 2020/8756) that is located directly adjacent on the eastern side of the Project area.

2.2 Desktop assessment

A desktop review was undertaken to identify and collate existing information on the ecological values with the Project area and surrounding landscape. Desktop searches were undertaken for the Project to provide location-specific information on the conservation significant species, TECs and vegetation communities (represented in Queensland by REs) with potential to occur. For most database sources, the desktop search extent encompassed areas within a 20 km buffer of the approximate centre of the wind farm, to provide context about potential presence of mobile or cryptic species that are known to occur in similar habitats within the region. The desktop assessment used the information referenced below.

2.2.1 Protected Matters Search Tool

The DAWE Protected Matters Search Tool (PMST) was used to identify TECs and conservation significant flora and fauna, listed under the EPBC Act (MNES) that have the potential to occur within the vicinity of the Project area. The search was undertaken within a 20 km radius of the approximate centre of the wind farm (-28.3997, 151.5989) (Appendix B).

2.2.2 Wildlife Online database

The Queensland Department of Environment and Science (DES) Wildlife Online database was searched to retrieve historical records of flora and fauna species previously recorded within the vicinity of the Project area. The search was undertaken for a 20 km radius of the approximate centre of the wind farm (-28.3997, 151.5989).

2.2.3 Species Profile Search database

The DES Species Profile Search was undertaken to obtain spatial data records for conservation significant species responsible for generating high risk trigger areas intersecting the Project area. The search was also undertaken to gain an understanding of the location and collection date of any protected plant records in proximity to the Project area.

2.2.4 Atlas of Living Australia database

The Atlas of Living Australia (ALA) database was searched to retrieve historical records of flora and fauna species previously observed within a 20 km radius of the approximate centre of the wind farm.

2.2.5 Biomaps

This mapping tool was used to review specific locations, collection date and details of records of species of conservation significance within a 20 km radius of the approximate centre of the wind farm.

2.2.6 Regulated Vegetation Mapping

The Queensland Department of Resources (DoR) (formerly Department of Natural Resources, Mines and Energy (DNRME)) Vegetation Management Regional Ecosystem and Remnant Map spatial layer (version 11) was viewed to determine the extent and type of REs mapped within the Project area. This data layer was prepared in 2018 and is the most recent available version of the spatial information; it was used to determine the extent and type of REs mapped within the Project area that may correspond to areas of TEC.

2.2.7 Essential Habitat Mapping

The DES Essential Habitat Map spatial layer (version 4.29) was viewed to determine if vegetation within the Project area has been identified as essential habitat for a conservation significant species of wildlife listed under provisions of the *Nature Conservation Act 1992* (NC Act).

2.2.8 Protected Plants Flora Survey Trigger Map

The DES Protected Plants Flora Survey Trigger Map spatial layer was viewed to identify the location of any high risk trigger areas occur within the Project area, indicating previous records of conservation significant flora species.

2.2.9 State Planning Policy Mapping

State Planning Policy mapping was reviewed to identify Matters of State Environmental Significance (MSES) that occur within a 20 km radius of the approximate centre of the wind farm.

2.2.10 Koala Habitat Assessment Tool

The MNES value of koala habitat was assessed using the koala habitat assessment toolkit in the EPBC referral guidelines for the vulnerable koala (DotE, 2014) (Section 5.1.6)

2.2.11 Literature review

The following ecological assessment reports were reviewed as part of this assessment:

- AECOM 2012 MacIntyre Wind Farm - Flora and Fauna Characteristics Report – March 2012
- AECOM 2012 MacIntyre Wind Farm – Bird Utilisation Assessment Report – March 2012
- AECOM 2012 MacIntyre Wind Farm – Bat Utilisation Assessment Report – March 2012
- AECOM 2013 MacIntyre Wind Farm – Additional Flora and Fauna Studies – March 2013
- EHP 2018 – Spring Flora and Fauna Assessment Report for the Proposed MacIntyre Wind Farm, Cement Mills, Queensland
- Nature Advisory 2020 MacIntyre Wind Farm – Threatened Bird Habitat Assessment – Interim Results.

Feasibility assessments for the Project have been ongoing for almost a decade. Over this period, ACCIONA has evolved the proposed Project design to respond to constraints and opportunities – both ecological and otherwise. The initial ecological assessments undertaken by AECOM and EHP for the Project were based on iterations of a smaller and less defined arrangement for the Project. However, the temporal coverage of these assessments makes them useful and relevant for consideration within this report, as they provide additional ecological datasets directly relevant to the wind farm project footprint. Subsequent survey undertaken by GHD provided coverage of an expanded Project area. Nature Advisory were commissioned to undertake specialist surveys for conservation significant bird species, namely regent honeyeater, painted honeyeater and swift parrot within the wind farm Project area.

2.3 Field assessment

2.3.1 Summary of survey effort

Ecological surveys have been undertaken for the Project between 2011 and 2021, with surveys undertaken by AECOM (2011 – 2012), EHP (2017 – 2018), GHD (2018 – 2021) and Nature Advisory (2020). The field ecology surveys were undertaken collectively for the Project together with the separately proposed MacIntyre Wind Farm and the OHTL projects. As such the Project area surveyed is generally wider than the Project area. In addition, Nature Advisory were commissioned by ACCIONA to undertake seasonal surveys for the period 22 – 30 May 2020, 15 – 19 June 2020 and 21 – 24 July 2020 to target habitat characterisation and assessment for bird species: regent honeyeater, painted honeyeater, swift parrot and white-throated needletail (Nature Advisory, 2021a)). Nature Advisory has further undertaken seasonal bird utilisation surveys for the periods 23 to 30 May 2020 (early dry season), 22 September to 2 October 2020 (late dry season), 3 to 8 December 2020 (early wet season) and 1 to 6 February 2021 (late wet season) (Nature Advisory, 2021b)).

Flora and fauna survey effort is shown in Figure 2.1 and Figure 2.2, respectively, as applicable. EHP survey data points are not available for inclusion on mapping. Species-specific survey is addressed in Sections 3, 4 and 5 for TECs, flora and fauna, respectively.

Survey periods, effort and methods are summarised in Table 2-1.

The flora and fauna survey methods employed by GHD and Nature Advisory are further described in Section 2.3.3 and Section 2.3.4, respectively. Surveys were undertaken at representative locations across the Project area to provide appropriate survey coverage within each vegetation community, habitat and geographic location present. Areas of high ecological value corresponding with areas of mapped remnant vegetation, waterways and waterbodies were subject to more intensive survey effort.

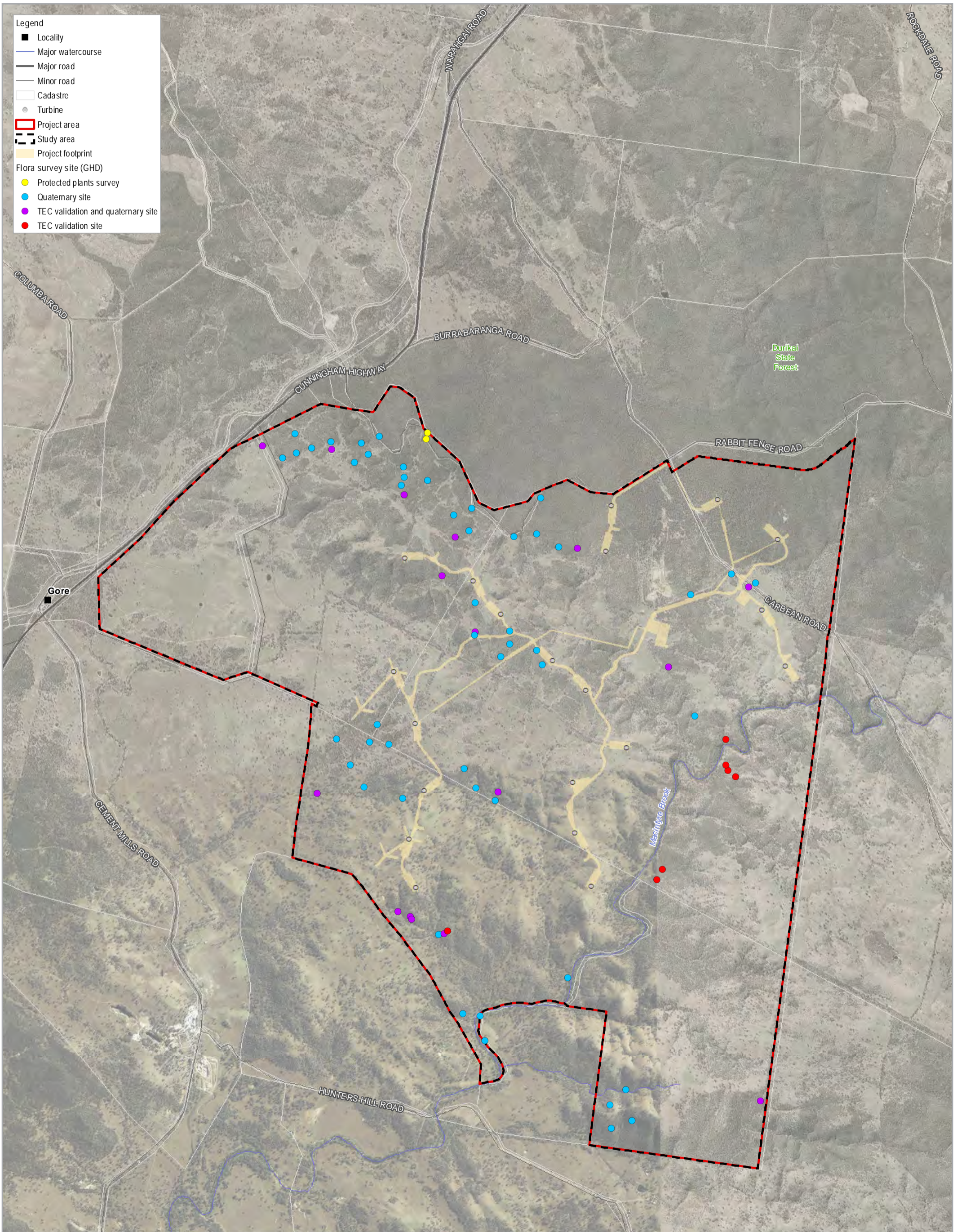
2.3.2 Survey guidelines

Fauna surveys were designed to meet the assessment requirements of the Queensland State Code 23 for Wind Farm Development (DILGP 2017), the National Wind Farm Development Guidelines Draft (EPHC 2010) and as detailed in the following guidelines:

- Queensland Terrestrial Vertebrate Fauna Survey Guidelines (Eyre et al 2018)
- Survey guidelines for Australia's threatened bats (DEWHA 2010a)
- Survey guidelines for Australia's threatened birds (DEWHA 2010b)
- Survey guidelines for Australia's threatened mammals (DSEWPaC 2011a)
- Survey guidelines for Australia's threatened reptiles (DSEWPaC 2011b).

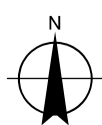
Pre-construction surveys in relation to threatened birds were based on the standards for assessing the risks to birds from wind farms in Australia, outlined in the 'Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia' (Clean Energy Council 2018).

Survey methods used for koala are consistent with methods recommended in Section 5 of the Referral guidelines for the vulnerable koala (DoE 2014).



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 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56

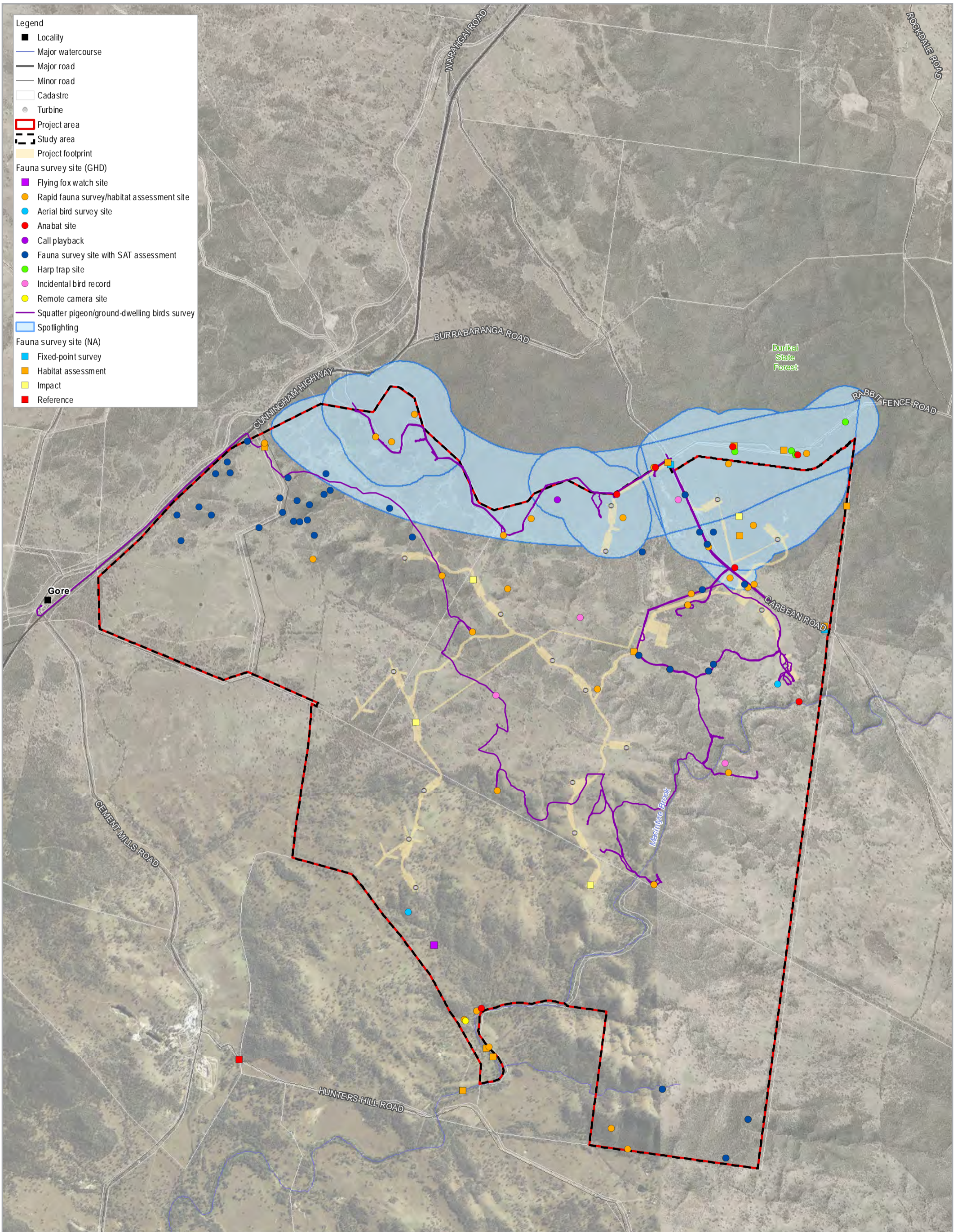


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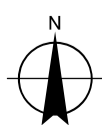
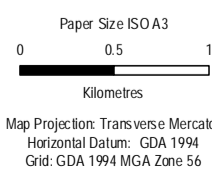
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Distribution of flora survey effort

FIGURE 2-1



Based on or contains data provided by the State of Queensland 2021.
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Distribution of fauna survey effort

FIGURE 2-2

Table 2-1 Summary of ecological survey effort and methodology

Survey dates	Ecologists	Days	Targets	Methodology and survey effort
GHD 2018 - 2020				
26 Oct – 1 Nov 2018 Spring	2 flora 4 fauna	7	Baseline flora and fauna – these surveys assessed areas not previously surveyed by AECOM or EHP. Target species: <i>Eucalyptus infera</i> , <i>Macrozamia conferta</i> , koala, central greater glider, glossy black-cockatoo, powerful owl, grey-headed flying-fox, painted honeyeater, regent honeyeater and border thick-tailed gecko	Quaternary RE vegetation assessments – 70 TEC verification assessments – 20 Habitat assessments/rapid survey – 92 - Bird census (20 mins) - Active search for reptiles (20 mins) - Active search for wildlife traces (20 mins) Searches for koala faecal pellets – 48 Aerial bird surveys – 2
10 – 14 Dec 2018 Summer	3 flora	5	TEC presence, extent and status, and verify RE status of areas mapped as Category C High Value Regrowth at the time of the survey	Spotlighting nights – 10 nights (equating to minimum 60 observer hours) Anabat sites – 5 Harp trap sites - 4 Call playback sites – 1
14 – 18 Jan 2019 Summer	2 flora 2 fauna	5	Baseline flora and fauna Bird and bat utilisation surveys	Remote camera sites – 1 Flying fox watch site – 1
21 – 25 Jan 2019 Summer	2 flora 2 fauna	5	Bird and bat utilisation surveys	
4 – 8 Feb 2019 Summer	2 fauna	5	Bat utilisation surveys	
30 March – 3 April 2020 Autumn	1 flora 1 fauna	5	Flora and fauna baseline	
14-15 December 2020 Summer	2 fauna	2	Fauna baseline	
Nature Advisory 2020				
22 May – 30 May 2020 Autumn	2 fauna	9	Regent honeyeater, painted honeyeater, swift parrot	Targeted bird and habitat surveys within the wind farm Project area – Nature Advisory – 2020 (regent honeyeater, painted honeyeater, swift parrot) Targeted habitat assessments – 11
15 – 19 June 2020 Winter		5		
21 – 24 July 2020 Winter		4		
23 – 30 May 2020 Autumn	2 fauna	8	White-throated needletail	Targeted bird and habitat surveys within the wind farm Project area – Nature Advisory – 2020 (white-throated needletail) Fixed-point count method
22 September – 2 October 2020 Spring		10		

Survey dates	Ecologists	Days	Targets	Methodology and survey effort
3 – 8 December 2020 Summer		5		During early dry season – eight surveys at two survey points During late dry, early wet and late wet season – five survey points Aerial bird surveys – 22 sites
1 – 6 February 2021 Summer		5		

2.3.3 Description of terrestrial flora survey methods

Flora surveys undertaken by GHD between 2018 and 2020 involved a combination of quaternary vegetation assessments and targeted surveys for conservation significant species. Quaternary vegetation assessments were undertaken at 70 sites across the Project area. At these sites, one or more of the survey methods described below were applied.

2.3.3.1 TEC assessments

Remnant vegetation was assessed for TEC status on the basis that in Queensland ecological communities are primary components of REs as defined in listing advice and/or recovery plans.

Based on the PMST results, DAWE mapping and RE communities mapped across the site, the only TEC with potential to occur within the Project area was the white box-yellow box-Blakely's red gum grassy woodland and derived native grassland. Within analogous RE communities, the condition of vegetation was assessed against the respective diagnostic and condition criteria detailed in the relevant listing advice (DECCW 2010, DoE 2019a). Verification of REs was used to refine habitat mapping for MNES and confirm the presence/absence of TECs.

2.3.3.2 RE verification

Verification of mapped RE communities was undertaken using Quaternary level assessments in accordance with the methods detailed in Neldner et al. 2017. Data collected included species and structural composition along with geology and landscape attributes.

2.3.3.3 Targeted searches for threatened flora

Targeted searches for EPBC Act threatened flora species were undertaken in areas where previous records were documented or suitable habitat for a threatened flora species was identified. Species identified as being most likely to be recorded included *Eucalyptus infera*, *Macrozamia conferta*, *Diuris parvipetala* and *Pomaderris coomingalensis*, all of which have previously been recorded within or in proximity to the Project area. Where relevant, surveys were undertaken to coincide with recorded flowering periods of local occurrences. Samples were submitted to the Queensland Herbarium for positive identification.

2.3.3.4 Recording of invasive species

Prohibited or restricted invasive species as defined under the *Biosecurity Act 2014* were recorded. Where relevant, the surveys recorded densities and extent of presence.

2.3.4 Description of terrestrial fauna survey methods

Fauna surveys undertaken by GHD between 2018 and 2020 involved a combination of habitat assessments and rapid survey techniques. Nature Advisory undertook additional targeted surveys in 2020 and 2021 in relation to woodland birds and white-throated needletail. Fauna survey methods described below were applied. Further detail is provided per species in Section 5 and in supporting technical documentation included in EPBC Act threatened birds – habitat and regional assessment and targeted surveys (Nature Advisory, 2021) and Bird Utilisation Survey Baseline Report (Nature Advisory 2021).

Fauna species identified during field surveys are provided in Appendix B.

2.3.4.1 Habitat assessment surveys

At most of the rapid survey sites, habitat assessments were undertaken by GHD to document the value of habitats for birds, reptiles, mammals and amphibians, based on the presence of key resources and microhabitats – as determined by the structural complexity of vegetation and the presence of features such as tree hollows, burrows, rocky outcrops, caves, leaf litter and woody debris. Key habitat features important for conservation significant species were recorded.

For threatened birds known or predicted to occur, Nature Advisory undertook a total of 11 habitat assessments within remnant vegetation and areas where larger trees were present based on a review of aerial and satellite imagery. Habitat characteristics were mapped based on criteria derived from the conservation advice for regent honeyeater (DoE, 2015a), painted honeyeater (DoE, 2015b) and swift parrot (TSSC, 2016) and the national recovery plans for regent honeyeater (DoE, 2016) and swift parrot (Birds Australia 2011).

2.3.4.2 Targeted searches for traces of threatened species

Within suitable habitat, targeted searches were undertaken to detect characteristic traces of threatened wildlife. This included searching eucalypt woodland for koala and central greater glider faecal pellets and scratches, searching rocky outcrops for latrine sites of the spotted-tailed quoll (*Dasyurus maculatus maculatus*), searching beneath Allocasuarinas for evidence of feeding by glossy black-cockatoos (*Calyptorhynchus lathami*) and searching vegetated gullies for nest and roost sites of the powerful owl (*Ninox strenua*).

2.3.4.3 Spot Assessment Technique

Searches for koala faecal pellets were undertaken at 48 sites within the study area using the Spot Assessment Technique (SAT) (Phillips and Callaghan 2011). Based on the results, assessments of habitat quality were undertaken using the koala habitat assessment toolkit detailed in the EPBC Referral guidelines for the vulnerable koala.

2.3.4.4 Bird census surveys

To survey the existing passerine bird assemblage, fixed-point bird surveys were undertaken by GHD for 12 hours within the Project area using the Birds Australia census technique (Loyn 1986). This involved undertaking a 20-minute survey of a 2 ha area recording all birds seen or heard calling. Rapid fixed-point bird surveys and habitat assessment surveys were also completed.

2.3.4.5 Active searches for reptiles and frogs

At 22 survey sites within the study area, a 20-minute active search was undertaken to detect reptile and amphibian species by actively searching beneath rocks, logs, bark, leaf litter and other microhabitats. Species targeted included the border thick-tailed gecko, yakka skink (*Egernia rugosa*), collared delma (*Delma torquata*) and Dunmall's snake (*Furina dunmalli*).

2.3.4.6 Nocturnal active searches and spotlighting

Nocturnal active searches and spotlighting were undertaken over two nights within the Project area. Nocturnal surveys involved a combination of vehicle-based spotlighting transects and nocturnal active-searches with head-torches. These targeted key habitats for conservation significant species including the spotted-tailed quoll, central greater glider, koala, powerful owl, grey-headed flying-fox (*Pteropus poliocephalus*), Dunmall's snake and border thick-tailed gecko.

2.3.4.7 Call-playback for nocturnal species

Call playback was undertaken at one site within the Project area to detect frogs, owls and nightjars. This method targeted the powerful owl.

2.3.4.8 Driving/flushing surveys

Driving/flushing surveys were undertaken to detect the squatter pigeon (southern) and other small ground-dwelling birds. A minimum of 542 km was driven over the course of the surveys.

2.3.4.9 Opportunistic searches for wildlife and traces

All incidental records of fauna observed during surveys were recorded. Bones, feathers, skulls, sloughed skins, faecal pellets, tracks, burrows, scratchings and other indirect wildlife traces were also recorded.

2.3.4.10 Deployment of remote surveillance cameras

A baited remote surveillance camera (Plate 2-1) was deployed at one location within the Project area. The camera was left in situ for three days and nights. The remote camera was deployed in representative vegetation type to target conservation significant species such as the spotted-tailed quoll and brush-tailed rock-wallaby.

2.3.4.11 Deployment of anabats

Anabats were set at seven sites throughout the Project area to record the echolocations of microbat species. Anabat detectors (Plate 2-1) were set at between 1 m and 2 m off the ground in suitable flyways (i.e. watercourses, waterbodies and vegetated areas) within areas of optimal bat habitat, with a local abundance of roosting sites (i.e. hollow trees and foraging habitat). Each Anabat was left in situ overnight for a total of 14 nights. Recorded calls were analysed by specialist sub-consultant Greg Ford. Where possible, calls were identified to species. Where calls could not be identified to species, as a result of poor quality or call overlap between species, calls were identified to a species complex.



Plate 2-1 Anabat detector (left), remote surveillance camera (right)

2.3.4.12 Harp trapping

Harp trapping was undertaken in suitable habitat for Corben's long-eared bat (*Nyctophilus corbeni*) within the Project area. Harp traps (Plate 2-2) were deployed for four nights each at four sites as shown in Plate 2. Traps were set in suitable flyways before dusk and checked every two hours until midnight and checked again at dawn.



Plate 2-2 *Harp traps used in bat utilisation assessments*

2.3.5 Pre-construction bird utilisation surveys

Bird utilisation surveys undertaken by Nature Advisory (2021b) were undertaken based on the 'Best Practice guidelines for the Implementation of Wind Energy Projects in Australia (Clean Energy Council 2018).

The bird utilisation survey is the most commonly used method for generating quantitative data on bird use at a proposed wind farm site. The results of bird utilisation survey provide a ranked abundance of species use of the site at varying heights, including wind turbine rotor swept area (RSA) height. The method provides the following information:

- Bird species (diversity) utilising the Project area
- The relative frequency of activity and density of birds on site
- Flight patterns and heights in relation to wind turbine heights
- The broad distribution of bird species across the wind farm site.

Four pre-construction bird utilisation surveys were undertaken by experienced zoologists from Nature Advisory (2021b) during 2020 and 2021 across the dry and wet seasons, with two in each season to account for seasonal differences in bird activity and migration as detailed below:

- Early dry season: 23 - 30 May 2020
- Late dry season: 22 September - 2 October 2020
- Early wet season: 3 - 8 December 2020
- Late wet season: 1 - 6 February 2021.

The fixed-point count method involved an observer stationed at a survey point for 15 minutes. The adequacy of using 15 minutes as an interval to record the presence of birds during bird utilisation survey was investigated in an earlier study at another wind farm site by Nature Advisory. This showed that 82 to 100 percent (average 88 percent) of species actually seen in one hour of surveying were seen in the initial 15 minutes of observation. Based on this result, the period of 15 minutes adopted in the BUS was considered adequate to generate representative data on the bird species in the area during the surveys.

During the 15 minutes, all bird species and numbers of individual birds observed within 200 metres were recorded. The species, the number of birds and the height of the bird when first observed was documented. For species of concern (threatened species, raptors and waterbirds), the minimum and maximum heights were recorded.

Flight height is then categorised as below, at or above RSA height.

Surveys are undertaken at impact points and reference points. Impact points are located near proposed turbines and distributed across Project area as far as possible. Reference points are located at least 500 m away from proposed turbines and outside of the Project area.

2.3.6 Animal ethics and legislative permits

GHD field surveys were conducted in accordance with the following permits and approvals:

- Department of Employment, Economic Development and Innovation Scientific Users Registration Certificate (Registration Number 132)
- DES Scientific Purposes Permit (permit number WISP15723315)
- Animal Researcher Authority issued by the accredited GHD Animal Ethics Committee (SUR000132).

2.4 Likelihood of occurrence assessment

An assessment was conducted to attribute a 'likelihood of occurrence' to TECs and conservation significant species (i.e. species listed under the EPBC Act and/or NC Act) that have been previously recorded or predicted to occur within the desktop search extent. The likelihood of occurrence assessment was based on a review of species distributions and habitat requirements, historical records for the region, and the results of habitat assessments and field surveys conducted within the Project area. The likelihood of occurrence ranking was based on the following framework:

- **Confirmed present:** TECs and/or species recorded during the field survey.
- **Likely to occur:** TECS and/or species has been recorded in the desktop search extent and suitable habitat is present in the study area.
- **May occur:** TECs and/or species distribution incorporates the study area but only marginal habitat is present or the species has not been recorded in the desktop extent. This includes transient, vagrant or cryptic species that have a reduced likelihood of occurrence but cannot be entirely discounted. Species within this category were not subject to further impact assessment.
- **Unlikely to occur:** Species has not been previously recorded in the desktop search extent and/or current known distribution does not encompass study area and/or suitable habitat is generally lacking from the study area. Species within this category were not subject to further impact assessment.

It is noted that the desktop search extent for the likelihood of occurrence assessment encompassed Durikai State Forest, which has a significant number of historical records of conservation significant species, indicating a high level of survey effort has been historically undertaken for within the desktop search extent. This provides increased confidence for assigning may occur and unlikely to occur ratings based on the absence of nearby historical records, when considered in conjunction with on-site observations of habitat quality. The likelihood of occurrence assessment for TECs and conservation significant species is provided in Appendix D.

2.5 Habitat for conservation significant species

For species confirmed present or considered likely to occur, the distribution of predicted habitat was mapped based on criteria consistent with the habitat requirements specified in the Commonwealth listing advice, recovery plans and/or Species Profile and Threats (SPRAT) profile provided by DAWE. More details are provided in Section 3, Section 4 and Section 5 in relation to specific TECs, flora and fauna, respectively. Given these descriptions are often necessarily broad to apply at a national scale and use definitions that are generally not spatially defined, further definition of the habitat criteria was required to explain how they have been mapped at a local scale and included essential habitat factors listed for each species in the Queensland essential habitat mapping database, relying on factors including RE vegetation communities, elevation and soil type. Where relevant, these were adapted to reflect variations in on-site conditions identified via field surveys. Reasons for any minor deviations from the Commonwealth habitat descriptions are explained. For each species, habitat critical to the survival of the species has been defined for the Project and reported per species in sections below.

Using the RE system as a basis has the additional advantage of allowing for an assessment of the context of habitat loss, by comparing the proportional loss of habitat within the Project area against the area of predicted habitat present within the surrounding landscape. As the RE system has a defined spatial basis, the approach also provides a clear understanding of the spatial resolution at which mapping has been extrapolated. This approach to mapping predicted habitat has been used by GHD in many other Commonwealth impact assessments.

Mapping of predicted habitat for woodland birds, the regent honeyeater, painted honeyeater and swift parrot, was undertaken based on:

- Fauna baseline surveys undertaken by GHD (2018 – 2020)
- Targeted surveys undertaken by Nature Advisory (2020 - 2021) and criteria derived from the DAWE conservation listing advice as detailed in EPBC Act threatened birds – habitat and regional assessment and targeted surveys (Nature Advisory, 2021a) and summarised in Section 5.6, Section 5.7 and Section 5.8, for regent honeyeater, painted honeyeater and swift parrot, respectively. Nature Advisory has extensive experience in undertaking assessments of these species for DAWE under the EPBC Act. The habitat mapping and associated impact assessments are therefore consistent with contemporary DAWE expectations for the species.

To identify and map habitats for woodland birds, habitat was first characterised. This characterisation was based on a combination of literature review and inspection of known past sites used by the species within the proposed Project area. This was followed by field surveys and on-site assessment of the available habitat for the species.

Habitat features at each site were noted, including tree composition and characteristics (e.g. canopy crown cover, tree flowering, presence of mistletoe, tree age – see below) as well as proximity to water (where possible) and degrading influences. For flowering trees, the extent of flowering (light flowering to very heavy flowering) was also recorded. Areas with all characteristics consistent with the habitat requirements of the targeted species were identified as high-quality habitats while those that had some characteristics were classed as potential habitat.

Once high quality and potential habitat was identified, it was assessed for its extent and the limits of its occurrence were mapped. In addition to the habitat assessment, in identified high quality and potential habitats, targeted species surveys were conducted for regent honeyeater, swift parrot and painted honeyeater, based on a series of five-minutes point observations, during which all species of birds and the number of individuals present were recorded. In particular, any nectivorous birds that were feeding, the number of individuals, and the tree species utilised were recorded. The presence of despotic species (e.g. noisy miner) that may reduce the likelihood of target species breeding and feeding activities was also recorded.

2.6 Assessment of potential impacts

Potential impacts associated with the construction and operation of the Project were assessed in relation to the ecological values of the existing environment. During the construction phase the Project is expected to result in localised losses of habitat, predominantly due to clearing for access tracks, turbine pads and transmission line towers, and temporary disturbance of wildlife through construction light, noise, vibration and increased vehicle movements, as well as the potential for erosion and sedimentation.

During the operational phase, the Project is unlikely to have any substantial impact for most environmental matters. Nevertheless, the Project will pose an ongoing operational risk of collision for a small number of high-flying bird and bat species. Bird and bat collision risk is addressed and informed by utilisation surveys undertaken by Nature Advisory (2021b). Mitigation and management actions in relation to bird and bat collision risk is addressed in Bird and Bat Adaptive Management Plan (Report No. 20033 (3.3)) developed by specialists, Nature Advisory (2021c).

For each potential impact identified for the MNES, mitigation measures have been detailed and an assessment of the significance of impact undertaken. Consistent with the EPBC referral, mitigation and management measures as reported are informed by the Construction Management Plan (CMP) (GHD, 2020a), a Preliminary Vegetation Management Plan (GHD, 2020c) and a Preliminary Fauna Management Plan (GHD, 2020b).

2.7 Significance of impacts assessment

A significance of impacts assessment was undertaken of the Project's potential impacts on MNES that have been confirmed present or are considered likely to occur within the Project area.

The assessment was made against the EPBC Act Significant Impact Guidelines 1.1 (DoE 2013) for the following TECs and listed species:

- TEC
 - White box-yellow box-Blakely's red gum grassy woodland and derived native grassland
- Threatened flora species
 - *Macrozamia conferta*
 - *Eucalyptus infera*
 - *Tylophora linearis*
- Threatened fauna species
 - Koala
 - Squatter pigeon (southern)
 - Swift parrot
 - Painted honeyeater
 - Regent honeyeater
 - Central greater glider
 - Grey-headed flying-fox
 - White-throated needletail
 - Rufous fantail
 - Fork-tailed swift.

Where, despite avoidance and the implementation of mitigation and management measures a significant impact remains likely, compensatory measures and offsets are proposed in accordance with the EPBC Act Environmental Offsets Policy as detailed in Section 6 of the Response to the Request for Additional Information Report.

Species not recorded present and not considered likely to occur are included in the likelihood of occurrence assessment (Appendix D) with additional information provided as requested in Appendix A.

3. Threatened Ecological Communities

3.1 White box-yellow box-Blakely's red gum grassy woodland and derived native grassland

3.1.1 Conservation status and documentation

The white box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC (box-gum woodlands and derived grasslands) is listed as Critically Endangered under the EPBC Act. Box gum woodlands and derived grasslands can occur as either woodland or derived native grassland (i.e. grassland where the overstorey of trees has been removed). It occurs in areas where rainfall is between 400 and 1,200 mm per annum, on moderate to highly fertile soils at altitudes of 170 m to 1,200 m (NSW Scientific Committee, 2002).

The box-gum woodlands and derived grasslands TEC is characterised by a species-rich understory of native tussock grasses, herbs and scattered shrubs, where the shrub cover comprises less than 30 percent cover, and is dominated or was previously dominated by white box (*Eucalyptus albens*) and/or yellow box (*E. melliodora*) and/or Blakely's red gum (*E. blakelyi*) trees. Tree coverage is discontinuous and consists of widely-spaced trees (TSSC, 2006). Other co-dominant or associated tree species may include drooping she-oak (*Allocasuarina verticillata*), kurrajong (*Brachychiton populneus*), black cypress pine (*Callitris endlicheri*), white cypress pine (*C. glaucophylla*), apple box (*Eucalyptus bridgesiana*), argyle apple (*E. cinerea*), New England stringybark (*E. caliginosa*), fuzzy box (*E. conica*), long-leaved box (*E. goniocalyx*), red stringybark (*E. macrorhyncha*), brittle gum (*E. mannifera*), western grey box (*E. microcarpa*), coastal grey box (*E. moluccana*), red box (*E. polyanthemos*) and candlebark (*E. rubida*) (Beadle, 1981; Austin et al., 2002 in DECCW, 2010).

The composition of the understory varies due to the wide geographic distribution of the box-gum woodlands and derived grasslands TEC, in response to changes in climate from north to south (Prober, 1996 in DECCW, 2010). The ground layer is characterised by open swards of kangaroo grass (*Themeda triandra*), snow grass (*Poa sieberiana*) and/or river tussock (*P. labillardieri*), interspersed with a diversity of forbs and other grasses.

The box-gum woodlands and derived grasslands TEC is a geographically widespread but now highly fragmented community. It is known to occur along the western slopes and tablelands of the Great Dividing Range from southern Queensland through to New South Wales and the ACT to central Victoria (TSSC, 2006). It is associated with several bioregions in Queensland including Brigalow Belt South, Nandewar, New England Tablelands, and South-eastern Queensland. A loss of more than 90 percent of pre-European distribution is estimated, with estimates indicating that only 405,000 ha of the TEC in various condition states remains (DECCW, 2010).

The box-gum woodlands and derived grasslands TEC is likely to have significantly declined in the local landscape primarily as a result of agricultural practices, such that the remaining areas of the TEC within the Project area are of notable importance. Indeed, the recovery plan for this TEC (DECCW, 2010) estimates that less than five percent of the original extent of the TEC remains of sufficient condition and size to be included in the listed ecological community.

A variety of fauna species depend upon the habitat of this TEC for foraging, roosting, nesting, raising young, dispersal, movement and/or migration, including birds, arboreal and ground-dwelling mammals, reptiles, amphibians, and invertebrates.

3.1.2 Survey effort

A summary of ecological survey effort and methods is provided in Table 3-1 and shown in Figure 2.1.

Table 3-1 Summary of flora survey effort

Survey dates	Ecologists	Days	Targets	Methodology and survey effort
26 Oct – 1 Nov 2018 Spring	2 flora	7	Baseline flora	Quaternary RE vegetation assessments – 70 TEC verification assessments – 20
10 – 14 Dec 2018 Summer	3 flora	5	TEC and High Value Regrowth	
14 – 18 Jan 2019 Summer	2 flora	5	Baseline flora	
21 – 25 Jan 2019 Summer	2 flora	5	Baseline flora	
30 March – 3 April 2020 Autumn	1 flora	5	Baseline flora	

The presence and extent of the white box-yellow box-Blakely’s red gum grassy woodland and derived native grassland TEC within the Project area was quantified over five field surveys between 2018 and 2020:

- A total of 54 survey days (based on combined individual effort per person)
- TEC verification was undertaken at 20 sites across the Project area
- Quaternary assessments were undertaken at 70 sites across the Project area. TEC validation sites were distributed throughout the investigation area and were primarily selected to target mapped areas of the REs that are analogous to the TEC (Section 3.1.2).

The TEC survey methodology involved assessment of the vegetation against the diagnostic and condition criteria for the white box - yellow box - Blakely’s red gum grassy woodland and derived native grassland TEC (TSSC, 2006).

The following information was recorded at each TEC validation site:

- Identification of the ecologically dominant layer
- Structural category (dense, mid-dense, sparse)
- Height range and median height for each layer
- Flora species composition and relative dominance of each layer, with specific focus on:
 - Assessing the canopy layer composition against the characteristic species specified by the diagnostic criteria for this TEC (TSSC, 2006)
 - Counts of native ground layer species as required by the diagnostic criteria for this TEC (TSSC, 2006)
 - Noting the presence of ‘important species specified by the diagnostic criteria for this TEC (TSSC, 2006)
- Soils, geology, slope, aspect and landform
- Condition and disturbances.

3.1.3 Criteria used to map box gum woodlands and derived grasslands TEC

No survey guidelines have been developed by DAWE for TECs. Within analogous RE communities, the condition of vegetation was assessed against all key diagnostic and condition criteria detailed in the Commonwealth listing advice for this TEC (TSSC, 2006). This methodology is considered sufficient for this TEC as it is these criteria that determine whether or not a particular area of vegetation constitutes this TEC.

The process for mapping the box-gum woodlands and derived grasslands TEC within the Project area included vegetation community (RE) analysis and aerial photography interpretation, together with ground-truthing to assess the on-ground vegetation against the key diagnostic and condition criteria detailed in the Commonwealth listing advice for this TEC (TSSC, 2006) to confirm the on-ground TEC extents. In Queensland the box-gum woodlands and derived grasslands TEC is a primary component of the following REs: 11.8.2a, 11.8.8, 11.9.9a, 13.3.1, 13.11.8, 13.12.8 and 13.12.9. It can also be a smaller component of the following REs: 11.3.23, 12.8.16 (only at the far western edge of the bioregion), 13.3.4, 13.11.3 and 13.11.4. REs present within the Project area are shown in Figure 3.1.

In order for an area to be included in the listed ecological community, a patch must meet the condition criteria specified by the Commonwealth listing advice for this TEC (TSSC, 2006). Table 3-2 provides a summary of the assessment against the diagnostic and condition criteria.

3.1.4 Desktop results

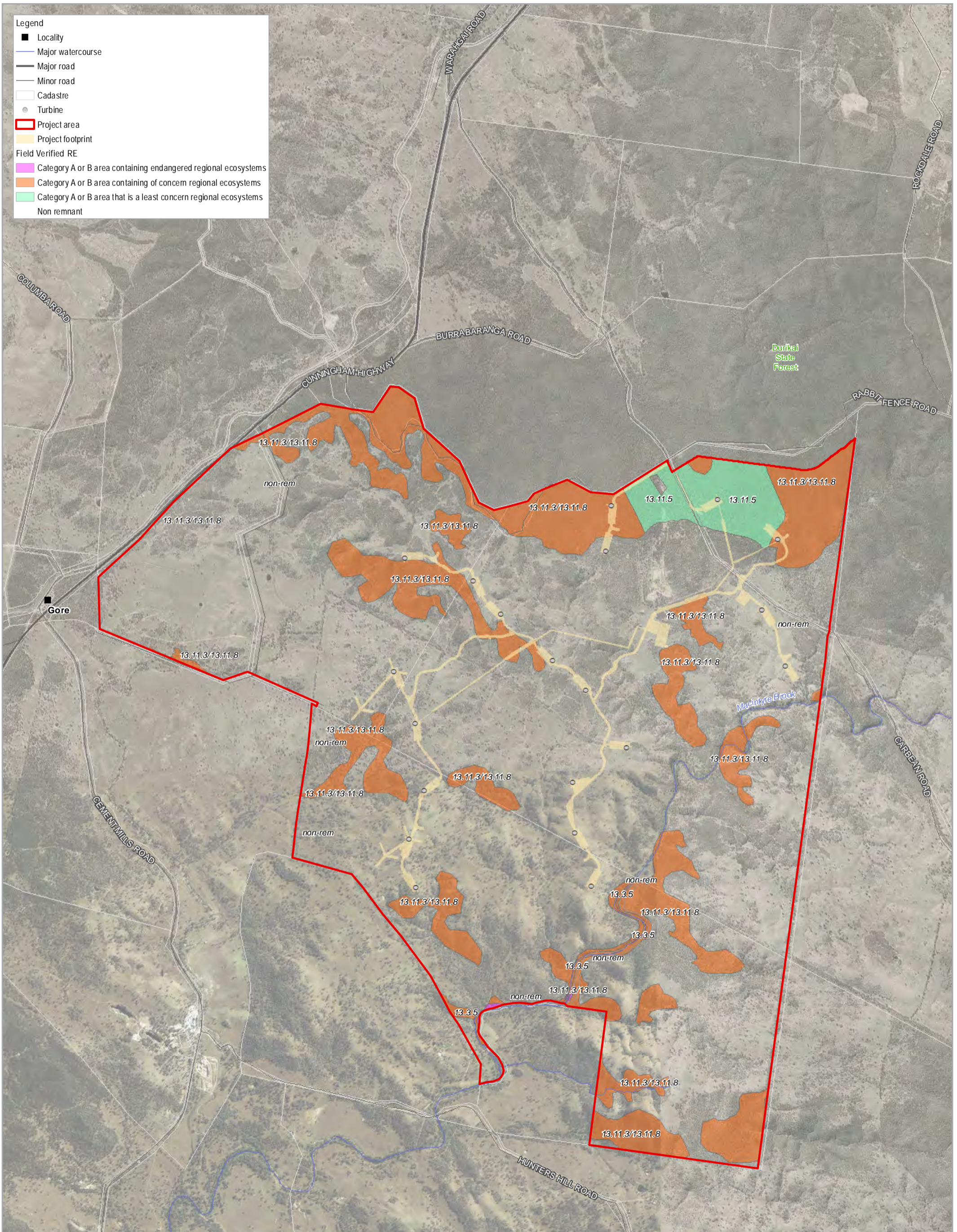
The white box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC was identified within the PMST (Appendix B) as being likely to occur within a 20 km radius from a central point within the Project area. An estimated extent of 117.94 ha of this TEC is mapped within 5 km surrounding the Project footprint as shown in Figure 3.2.

The DoR Vegetation Management Regional Ecosystem and Remnant Map spatial layer (version 11) was the desktop information source of primary importance to the TEC assessment. This data layer was prepared in 2018 and is the most recent available version of the spatial information; it was used to determine the extent and type of REs mapped within the Project area that may correspond to areas of TEC.

3.1.5 Survey results

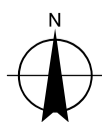
The box-gum woodland and derived native grassland TEC was confirmed present at three locations within the Project area during field ecological surveys as shown in Figure 3.3. A total of 18.75 ha of the TEC is mapped within the Project area, none of which is proposed to be impacted by the Project. The 39.05 ha of TEC referenced in the EPBC 2020/8755 was in relation to TEC predicted within 1 km of Project area. The extent of TEC mapped within the Project area has not changed.

The original assessment covered an area within 1 km of the Project area. The assessment area has been expanded to 5 km of the Project footprint, as outlined below. No confirmed data concerning known extent of the box-gum woodlands and derived grasslands TEC within the surrounding landscape is available. However, RE mapping was used to estimate the extent of this TEC within the Project footprint.



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Paper Size ISO A3
 0 0.5 1
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56






Acciona Energy Australia Global Pty Ltd
 MNES Assessment Report



Vegetation communities
 (regional ecosystems)

Project No. 12525037
 Revision No. 0
 Date 09/08/2021

FIGURE 3-1

Table 3-2 Diagnostic features of the identified TEC

Criteria	Key diagnostic features	Photo
<p>Is, or was previously, at least one of the most common overstorey species <i>Eucalyptus albens</i>, <i>E. melliodora</i>, <i>E. blakelyi</i>, <i>E. microcarpa</i> or <i>E. moluccana</i>?</p>	<p><i>Eucalyptus albens</i>, <i>E. melliodora</i>, or <i>E. moluccana</i>. was dominant within each TEC patch</p>	
<p>Does the patch ¹ have a predominantly native ground layer ²?</p>	<p>Despite past grazing pressures, the ground layer within TEC patches was dominated by native perennial species. Common species included <i>Dysphania pumilo</i>, <i>Aristida</i> spp., <i>Brunoniella australis</i>, <i>Ancistrachne uncinulata</i>, <i>Entolasia stricta</i>, <i>Fimbristylis dichotoma</i>, <i>Carex inversa</i> and <i>Cheilanthes sieberi</i></p>	
<p>Is the patch 0.1 ha or greater in size?</p>	<p>TEC patches exceeded the 0.1 ha threshold with the smallest mapped patch covering approximately 0.15 ha</p>	

Criteria	Key diagnostic features	Photo
<p>Excluding grasses there are 12 or more native understorey species, including one important species?</p>	<p>Patches identified all had 12 or more native understorey species, with at least one important species present. <i>Calotis</i> spp., <i>Laxmannia gracilis</i> and <i>Chrysocephalum apiculatum</i> were the most common important species recorded.</p>	
<p>If patch does not meet the above criteria (4), is the patch 2 ha or greater in size and have an average of 20 or more mature trees ³ per ha, or is there natural regeneration of the dominant overstorey eucalypts ⁴?</p>	<p>Rarely identified as most areas that did not meet criteria 4 had predominantly introduced understorey species, therefore not meeting criteria².</p>	

1 Patch - a patch is a continuous area containing the ecological community (areas of other ecological communities such as woodlands dominated by other species are not included in a patch). In determining patch size it is important to know what is, and is not, included within any individual patch. The patch is the larger of:

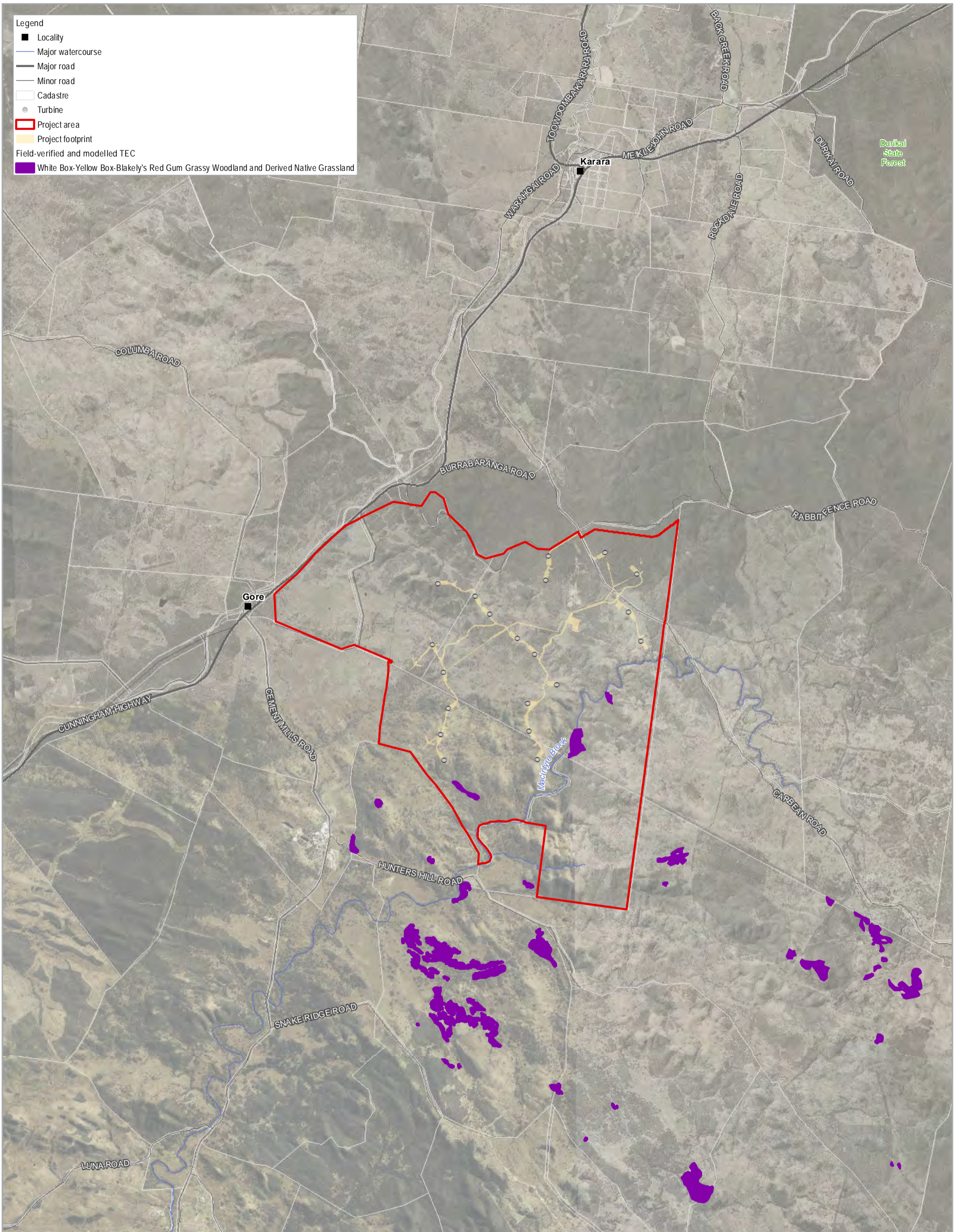
- an area that contains five or more trees in which no tree is greater than 75 m from another tree, or
- the area over which the understorey is predominantly native.

Patches must be assessed at a scale of 0.1 ha (1,000 m²) or greater.

2 A predominantly native ground layer is one where at least 50 per cent of the perennial vegetation cover in the ground layer is made up of native species. The best time of the year to determine this is late autumn when the annual species have died back and have not yet started to regrow. (At other times of the year, you can determine whether something is perennial or not is if it is difficult to pull out of the soil. Annual species pull out very easily.)

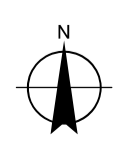
3 Mature trees are trees with a circumference of at least 125 cm at 130 cm above the ground.

4 Natural regeneration of the dominant overstorey eucalypts when there are mature trees plus regenerating trees of at least 15 cm circumference at 130 cm above the ground.



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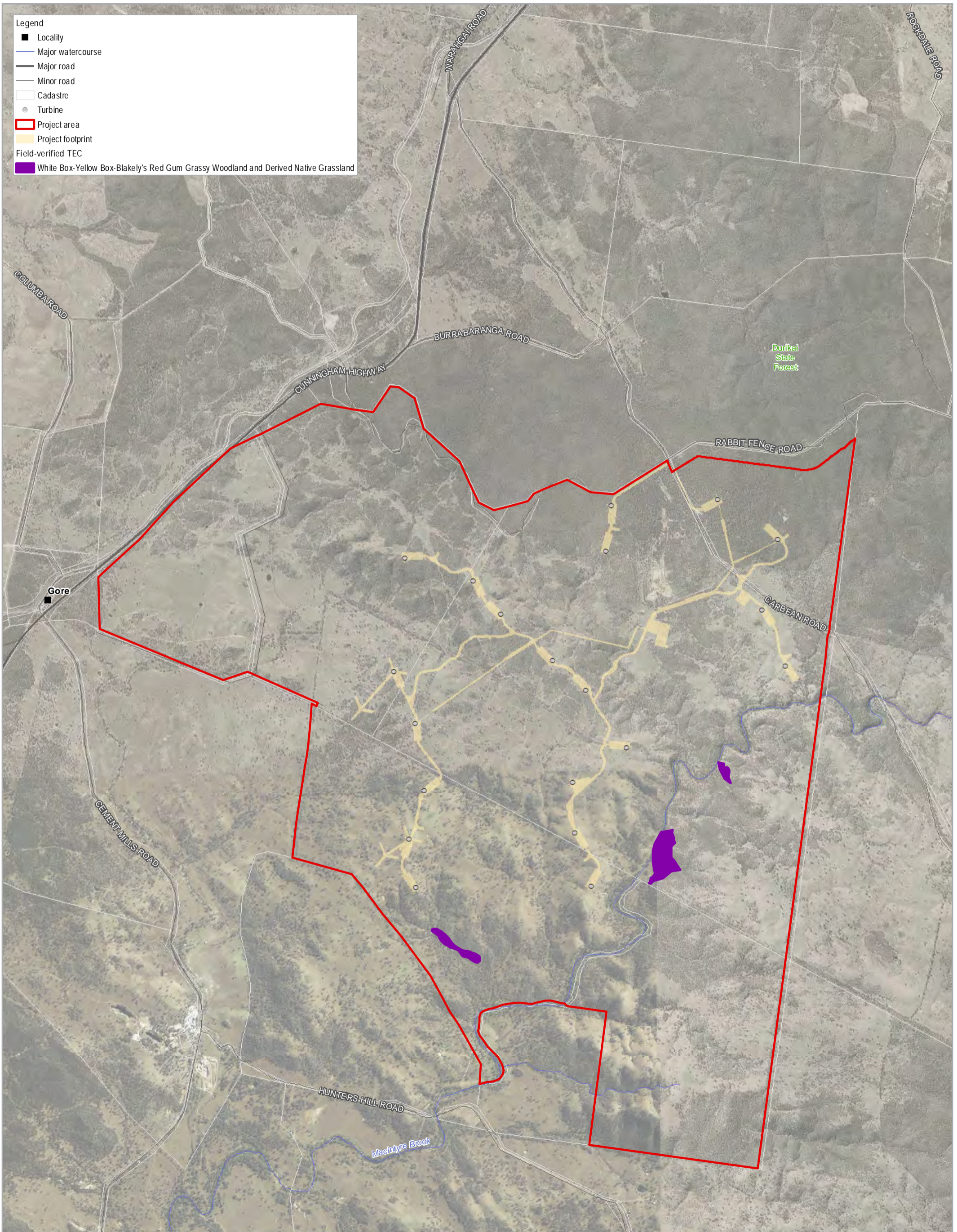
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 Extent of box-gum woodlands
 and derived grasslands TEC within
 and surrounding the project area

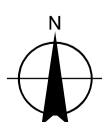
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FIGURE 3-2



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**Extent of box-gum woodlands
 and derived grasslands TEC
 within the project area**

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FIGURE 3-3

An estimated extent of 117.94 ha of this TEC is mapped within 5 km surrounding the footprint, such that the extent within the Project area is equivalent to 15.90 percent. The extent of the TEC within the Project area and immediately adjoining landscape is shown in Figure 3.2.

Where areas of vegetation met the TEC condition criteria (Table 3-2), levels of weed infestation were typically low and the ground layers within the TEC patches were dominated by perennial native species. Common species included *Dysphania pumilo*, *Aristida* spp., *Brunoniella australis*, *Ancistrachne uncinulata*, *Entolasia stricta*, *Fimbristylis dichotoma*, *Carex inversa* and *Cheilanthes sieberi*. Where areas of vegetation did not meet the TEC diagnostic and condition criteria, this was typically attributed to a low diversity of ground layer species as a result of grazing pressures.

The TEC was principally located within vegetation depicted as RE 13.11.3/13.11.8. Each TEC patch had either *Eucalyptus albens*, *E. moluccana* or *E. melliodora* as the most common overstorey species and a predominantly native understorey.

All identified TEC patches were greater than 0.1 ha in size; had a predominantly native ground layer; and had 12 or more native understorey species present (excluding grasses), with at least one of those listed in the associated EPBC Act policy statement 3.5 species list (DEH, 2006).

Most patches of the box-gum woodlands and derived grasslands TEC within the Project area were recorded on lower slopes and flats adjacent to watercourses. Due to this position within the landscape being preferential for grazing practices, the areas of TEC remaining within the Project area are highly fragmented as a result of historic clearing to facilitate grazing.

Ground-truthing and predictive modelling of the box-gum woodlands and derived grasslands TEC for the Project was focussed on assessment of remnant vegetation. Additional areas of the box-gum woodlands and derived grasslands TEC have the potential to exist within the Project area beyond the areas that were subject to ground-truthing. However, based on observations recorded within non-remnant vegetation during the field surveys, the TEC is considered unlikely to occur in non-remnant areas due to the intensity of grazing and the associated reduction in native ground layer species. The Commonwealth listing advice (TSSC, 2006) confirms this approach and states the following:

The Committee considers that areas in which an overstorey exists without a substantially native understorey are degraded and are no longer a viable part of the ecological community. Although some native species may remain, in most of these areas the native understorey is effectively irretrievable.

On a similar note, EHP (2018) concluded that native ground layer diversity was insufficient for vegetation to constitute the TEC at all assessment sites at the time of their survey, confirming GHD's conclusion that ground layer composition is the limiting factor for the presence of this TEC.

Based on the above, degraded areas of box-gum woodland within the Project area do not represent habitat critical to the survival of the TEC.

3.1.6 Significance of project area

This section assesses the significance of white box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC habitats within the Project area in terms of whether the mapped areas constitute habitat critical to the survival of the species.

The recovery plan for the box-gum woodlands and derived grasslands TEC (DECCW, 2010) states that given the currently highly fragmented and degraded state of this ecological community, all areas of this TEC that meet the minimum condition criteria should be considered critical to the survival of this ecological community. Accordingly, all areas of the box-gum woodlands and derived grasslands TEC mapped within the Project area constitute habitat critical to survival of the TEC.

The recovery plan for this TEC (DECCW, 2010) also states that degraded woodland areas not considered part of the listed ecological community may also be essential to the long-term conservation and recovery of the TEC by virtue of their landscape setting (e.g. providing connectivity) or remaining flora/fauna habitat features (e.g. occurrence of rare or threatened species, tree hollows), and should also be considered as potential habitat critical to the survival of this ecological community. The importance of degraded areas to the survival of the listed ecological community require assessment

on a site-by-site basis. In this regard, degraded box-gum woodlands in the Project area do not support notable ecological values, with the following characteristics of the degraded box-gum woodlands noted:

- Critical components of the TEC are largely absent from the degraded box-gum woodlands. In particular, tree canopy cover is notably sparse and the understorey and ground layer species are predominantly non-native.
- Ecological processes critical to the survival of the TEC are not facilitated by the degraded areas of box-gum woodlands. In particular, as a result of the notably sparse tree layer and the predominantly non-native understorey and ground layers, the areas of degraded box-gum woodlands do not provide a significant seed source to the areas of TEC. Similarly, habitat connectivity processes are impaired as a result of the sparse vegetation cover.
- Owing to the long-history and continued pressures of grazing practices, the native understorey is effectively irretrievable such that these areas are highly unlikely to recover to a condition in the future such that the TEC criteria can be met. Indeed, the level of ecosystem alteration is such that it is unlikely that areas of degraded box-gum woodland can be restored to a level at which landscape function of the TEC is enhanced.
- The areas of degraded box-gum woodlands do not provide habitat for significant fauna species. The only exception to this is koala given that koala habitat is mapped across the entire Project area but noting however that the areas of degraded box-gum woodlands provide amongst the lowest value koala habitat within the Project area (refer Section 5.1).

Consequently, degraded areas of box-gum woodland within the Project area do not support ecological values and do not meet the condition criteria for the TEC and are not representative of habitat critical to the survival of the TEC.

An estimated extent of 117.94 ha of this TEC is mapped within 5 km surrounding the Project footprint. No TEC is proposed to be impacted by the Project as the areas of TEC within the Project area have been avoided through project design. The extent of this TEC within the Project area and immediately adjoining landscape is shown in Figure 3.2.

3.1.7 Threatening processes

Threatening processes for the white box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC include:

- Clearing of vegetation and fragmentation
- Grazing of livestock
- Weed invasion
- Salinity and nutrient enrichment
- Altered fire regimes (TSSC 2006).

3.1.8 Potential impacts

The Commonwealth Listing Advice on White box - Yellow box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland (TSSC, 2006) was the primary reference document for assessment of this TEC within the Project area. No expert consultation was undertaken or considered necessary for assessment of this TEC.

The Project footprint has been sited to avoid direct impacts to the TEC. No clearing is proposed within patches of TEC.

Potential indirect impacts on the white box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC within the Project area include:

- Habitat degradation by increased dust run-off and sedimentation
- Introduction and spread of invasive species.

3.1.8.1 Habitat degradation by increased dust, run-off and sedimentation

The quality of TEC areas has the potential to be indirectly impacted by construction activities that generate localised dust, erosion, run-off and sedimentation through increased vehicle movements, clearance of vegetation and earthworks.

The receiving environment has already been subject to high levels of erosion and sedimentation as a result of existing land-clearing and grazing activities. Nevertheless, sensitive ecological receptors including areas of the TEC will be protected through the implementation of sediment and erosion control measures (during construction, together with management of air quality, particularly dust. Adjacent areas of TEC habitat are not likely to be subject to intensification of ongoing impacts once the Project is operational.

3.1.8.2 Introduction and spread of invasive species

Construction activities have the potential to introduce and spread weeds throughout the Project area. This occurs predominantly via the movement of contaminated vehicles, fill and vegetative material. This can undermine the ecological integrity of bushland remnants by competitively excluding native plant species.

Given the Project is located within a predominantly agricultural landscape, the risks of weed introductions carry heightened consequences. Clearance of native vegetation creates areas of disturbance that are naturally susceptible to colonisation by invasive weed species. These can form a local source of future weed infestations within the surrounding landscape. Two species listed as restricted plants under the *Queensland Biosecurity Act 2014* were recorded in the Project area:

- *Opuntia tomentosa* (velvety tree pear)
- *O. stricta* (prickly pear).

Both species have the potential to be spread into new areas as a result of construction activities. Appropriate treatment and disposal of *Opuntia* spp. will be undertaken in accordance with the requirements of the CMP (GHD, 2020a) and the *Biosecurity Act 2014*.

3.1.9 Measures to avoid, reduce or mitigate impacts

3.1.9.1 Habitat degradation by dust, run-off and sedimentation

The following mitigation measures will be used to minimise the impacts of dust, run off and sedimentation during construction of the Project:

- Erosion and sediment controls have been developed as part of the CMP.
- Routine dust suppression and monitoring will be undertaken throughout construction and operation.
- Erosion and sediment control measures will be installed where in-stream disturbance must be undertaken during flow conditions.
- Areas subject to clearing will be stabilised as soon as practicable.
- All vehicle movement will be restricted to designated tracks located within the Project footprint
- Weather conditions will be monitored during the construction stage and temporary controls will be established during extreme weather events.
- Construction activities will cease during adverse weather conditions (e.g. high wind/high rainfall) that have the potential to significantly distribute dust or increase run off and sedimentation.
- Rehabilitation of temporary construction areas will be undertaken as soon as practicable after clearing.

3.1.9.2 Introduction and spread of invasive species

The following measures will be implemented to minimise the introduction and spread of weeds:

- Weed management actions are included in the CMP and include:
 - Hygiene protocols restricting the movement of vegetation and soil between impacted areas and areas of significantly lower weed infestation.
 - Protocols for monitoring and management of weeds to identify and appropriately respond to significant changes in weed distribution and density.
- Vehicles / equipment travelling from a declared restricted place or quarantine area will be required to wash down and possess a current weed hygiene inspection certificate before moving to a weed free area.
- All machinery and equipment will undertake washdown prior to accessing site and possess a current weed hygiene inspection certificate from an inspector who is deemed competent and is certified in line with Queensland Department of Agriculture and Fisheries (DAF) requirements.
- Vehicle access will be restricted to the Project footprint and existing roads and tracks
- Preliminary weed mapping will be undertaken. This will provide a baseline of existing weed infestation across the Project area to inform weed management.

3.1.10 Significance of impact assessment

An assessment against the Significant Impact Guidelines 1.1 (DoE 2013) with regards to white box-yellow-box - Blakely's red gum grassy woodland and derived native grassland TEC was undertaken and the outcomes provided in Table 3-3.

Table 3-3 Significance of impact on the white box-yellow box-Blakely's red gum woodland and derived native grassland

Impact criteria	Potential to occur
Reduce the extent of an ecological community.	Unlikely Several areas of the TEC were identified within the Project area (18.75 ha,) but none are recorded within the Project footprint. The Project footprint has been designed to avoid all verified TEC patches, with the closest patch approximately 400 m away from the Project footprint.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.	Unlikely No TEC patches occur within approximately 400 m of the Project footprint. The Project will not result in the fragmentation of any TEC patches.
Adversely affect habitat critical to the survival of an ecological community.	Unlikely The recovery plan for the TEC states that any patch that meets the minimum condition criteria should be considered critical habitat for its survival (DECCW 2010). No TEC patches occur within 400 m of the Project footprint. Accordingly, no habitat critical to the survival of the TEC will be adversely affected. Furthermore, no woodland areas providing connectivity between TEC patches will be impacted.
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.	Unlikely No TEC patches occur within 400 m of the Project footprint. The landscape is not proposed to be altered in a way that will impact the abiotic features necessary for the TEC. Where practicable existing tracks will be used within the Project area. Additionally, much on the proposed impact will occur on elevated areas whereas the TEC occurs in low lying areas.

Impact criteria	Potential to occur
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.	<p>Unlikely</p> <p>No significant change in the species composition is expected. The introduction of a weed control program through the CMP is likely to result in the overall reduction of invasive species across the Project area. Equipment and personnel will be subject to weed hygiene requirements and are unlikely to contribute to the introduction of additional invasive species to the site.</p>
<p>Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:</p> <p>Assisting invasive species, that are harmful to the listed ecological community, to become established, or</p> <p>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, or</p>	<p>Unlikely</p> <p>The introduction of a weed control program through the CMP is likely to result in the overall reduction of invasive species across the Project area. Equipment and personnel will be subject to weed hygiene conditions and are unlikely to contribute to the introduction of additional invasive species to the site.</p>
Interfere with the recovery of an ecological community	<p>Unlikely</p> <p>No TEC patches occur within 400 m of the Project footprint. Consequently, no clearing of vegetation within a TEC is proposed for the establishment of the windfarm. Large areas of historically cleared land will also remain available for the regeneration of the TEC.</p>

3.1.11 Conclusion

The Project is **unlikely** to have a direct or indirect impact on the white box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC as a result of the placement of the Project footprint to avoid all areas of impact on the TEC and implementation of appropriate controls in relation to dust, erosion and weed management.

4. Threatened flora species

4.1 *Macrozamia conferta*

4.1.1 Conservation status and documentation

Macrozamia conferta is listed as Vulnerable under the EPBC Act.

4.1.1.1 Ecology

M. conferta is a small cycad with a branching subterranean trunk that forms up to twelve crowns per plant (Forster, 2009). The crown has one to five frond-like leaves that are each 35 to 60 cm long and hairless except for light fawn wool at the base (Forster, 2009). The leaves are characteristically stiff and spirally twisted with 50 to 90 closely crowded light green leaflets with inrolled margins (DEWHA, 2008b; Forster, 2009) (Plate 4-1). Male and female cones occur on separate plants. Mature cones have been recorded in October and November, and ripe seeds have been recorded in February and March (Forster, 2009). Cones may not be produced annually when conditions are unfavourable (Halford, 1997).



Plate 4-1 *Macrozamia conferta* located within MWF Project area

Macrozamia species are 'grove forming' plants – that is, they tend to occur in relatively dense clumps or clusters but are often completely absent from areas of apparently suitable habitat located in the vicinity. It has been argued that grove forming plants derive ecological benefit from this distribution pattern, which is described as 'patchy' rather than random. Studies conducted into *Macrozamia miquelii*, which is a similar cycad with a subterranean trunk, found most seeds do not travel more than one metre from the parent plant (Hall and Walter, 2013).

4.1.1.2 Abundance and distribution

The Conservation Advice (DEWHA, 2008b) for *M. conferta* states there are three known populations located in, or adjacent to, three State Forests (Durikai State Forest, Talgai State Forest and Bringalilly State Forest) west of Warwick in Queensland, with a total of approximately 10,000 individuals and an extent of occurrence of 25 km².

These state forests are:

- SF 444 on plan FTY1516, known as Durikai State Forest, located immediately north of the boundary of the Project area

- SF 595 on plan FTY658, known as Talgai State Forest and located approximately 20 km north-north-east of the Project area
- SF 341 on plan FTY1214, known as Bringalily State Forest and located approximately 25 km west of the Project area.

A search of online herbarium records (AVH, 2021) did not identify supplementary information of any real value in determining the size of these known populations. Where abundance information has been included, records from all three populations state that the species is 'common', 'very common' or 'locally frequent'. One record from Durikai State Forest claimed the population 'extends for approximately two kilometres along fire break' (BRIAQ0834050 in AVH, 2021). The full extent of these populations has not been documented. An online herbarium search (AVH, 2021) found no additional populations have been identified since the publication of the conservation advice (DEWHA, 2008b).

No Area of Occupancy (AOO) is nominated in the Conservation Advice. Extent of occupancy (EOO) and AOO is further discussed in Section 4.1.5.

Surveys (Section 4.1.5) conducted within the adjoining proposed MacIntyre Wind Farm and associated OHTL project areas indicate a re-evaluation of this advice is required, finding:

- 14,293 individual *M. conferta* were recorded within the MacIntyre Wind Farm and OHTL project areas, within an estimated 2,417 ha of critical habitat (critical habitat contains all known records of the species from these areas).
- Projections based on area of suitable habitat and recorded densities/ha estimate the total population in the Durikai State Forest, proposed MacIntyre Wind Farm and OHTL project areas to be in the order of 106,000 plants.
- The AOO for this species is located over three populations with an area of between 156 km² and 208 km². This was determined according to IUCN methodology (IUCN Standards and Petitions Committee, 2019), using historical records from AVH (2021), records from the 2021 GHD surveys for *M. conferta*, and Queensland vegetation (RE) mapping.
- The EOO is estimated to be 1,325 km². This was determined according to IUCN methodology (IUCN Standards and Petitions Committee, 2019) by drawing a boundary around the grid squares used to calculate AOO.

4.1.1.3 Habitat preference

M. conferta records are from open forest communities dominated by *Corymbia citriodora* var. *variegata*, *Eucalyptus fibrosa* subsp. *nubilis*, *E. melliodora*, *E. crebra* and *E. moluccana* (DEWHA, 2008b).

Vegetation communities present in the Project area (as represented by REs in Queensland and mapped in Figure 3.1) that are dominated/sub-dominated by one or more of the aforementioned species include:

- 13.11.3 – *E. crebra* woodland on metamorphics
- 13.11.5 – *E. sideroxylon*, *E. fibrosa* subsp. *nubilis* open forest on metamorphics
- 13.11.6 – *C. citriodora* subsp. *variegata* open forest on metamorphics
- 13.11.8 – *E. melliodora* and/or *E. microcarpa*/*E. moluccana* woodland on metamorphics.

Within the Project area, these REs form two main alliances, often mapped as heterogenous (mixed) polygons in RE mapping – 13.11.3/13.11.8 and 13.11.5/13.11.6.

4.1.2 Survey effort

4.1.2.1 Field survey method

Field ecology surveys undertaken between 2018 and 2020 were composed primarily of quaternary vegetation assessments (in the order of 77 sites and using the methodology outlined in Neldner et al,

2019) (Table 2-1; Figure 2.1) and included targeted searches for *M. conferta* in areas where previous records were documented or suitable habitat was identified as shown in Figure 4.1.

M. conferta was not recorded within the Project area, despite vegetation communities being present for which *M. conferta* is known and within which *M. conferta* is recorded in the adjacent proposed MacIntyre Wind Farm (EPBC 2020/8756) It is considered that in those areas dense or significant populations are highly unlikely to be present.

4.1.2.2 Adequacy of survey

Results from GHD surveys conducted from 2018 to 2020 were used to assess and quantify the presence or absence of *M. conferta* within the Project area.

Between 2018 and 2020, quaternary and protected plant surveys were conducted within the Project area. The species was not detected during any of the surveys. These surveys were considered adequate to discount the presence of *M. conferta* (with the possible exception of minor, scattered populations). The species is generally readily observed when it is present in moderate to high densities, and it is considered highly unlikely that populations of any significance occur within the Project area.

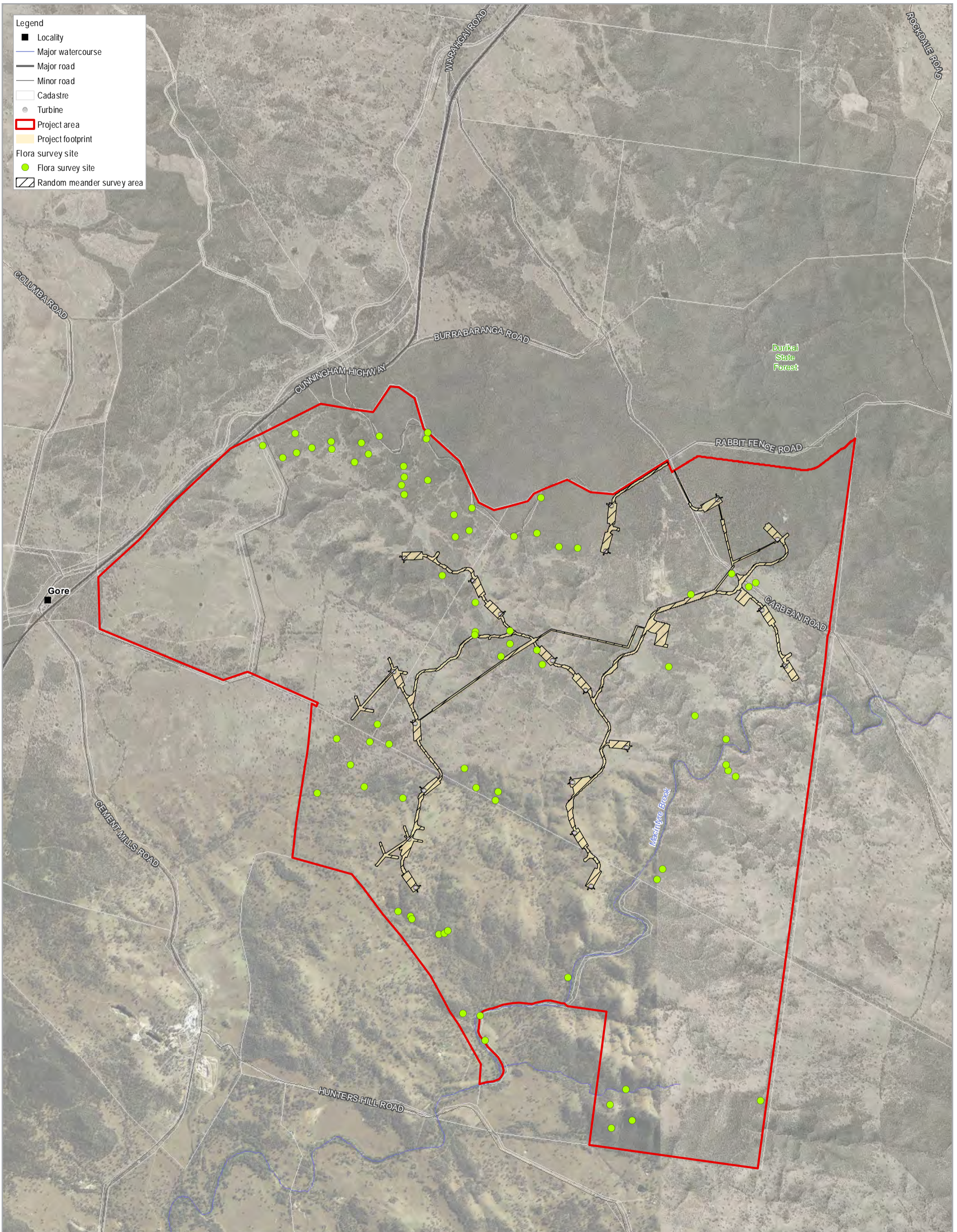
A total distance of 15.5 km was traversed during random meander methods (Figure 4.1).

M. conferta is not a cryptic species and is generally relatively easy to observe, although individuals with damaged leaves, or that do not have live leaves at that particular time, or are located within dense ground cover, can be difficult to spot.

There are no recommended survey guidelines for this species, or for cycads in general. The draft survey guidelines for orchids (DoE, 2013) were consulted during the design phase of this survey. Terrestrial orchids can have similar patterns of local distribution but are generally more cryptic than *M. conferta*. This survey reflects recommendations made in those guidelines, including:

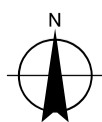
- Stratification – the survey was targeted at areas in which the species had been recorded and surrounding areas of suitable habitat up to one kilometre from those records. Areas in which previous quaternary surveys had not detected the species were not surveyed.
- Meanders used to detect clusters – the survey approach used random and stratified meanders to detect clusters, then a comprehensive survey method to map and count individuals.

Therefore, based on the absence of records from 70 quaternary sites undertaken in suitable habitat across the Project area, it is considered that these surveys were sufficient to conclude that the species has a low potential to occur within the Project footprint. If present, it is likely to occur in as small clusters only.



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 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



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 MNES Assessment Report

Macrozamia conferta
 survey effort

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FIGURE 4-1

4.1.3 Criteria used to define *Macrozamia conferta* habitat

Listing advice and/or conservation advice does not provide a definition of habitat critical to the survival of *M. conferta*. Therefore GHD has adopted the following definition for the purpose of this assessment in consideration of the general description provided in the MNES Significant impact guidelines 1.1 as to what constitutes habitat critical to the survival of a species:

- All habitat hosting *M. conferta* is taken to be habitat critical to the survival of the species based on the presence of individuals and includes the area located within 100 m of those records, regardless of remnant/non-remnant status or RE type.

4.1.4 Desktop results

M. conferta was identified within the PMST (Appendix B) as having potential to occur within a 20 km radius from a central point within the Project area as shown in Figure 4.2.

4.1.5 Survey results

M. conferta was not recorded within the Project area, despite vegetation communities being present for which *M. conferta* is known and within which *M. conferta* is recorded in the adjacent proposed MacIntyre Wind Farm (EPBC 2020/8756) Project area and proposed OHTL (EPBC 2020/8759) Project area as shown in Figure 4.2. No habitat for the species (mapped in accordance with the definition provided in Section 4.1.3) is present within the Project area.

4.1.6 Significance of Project area

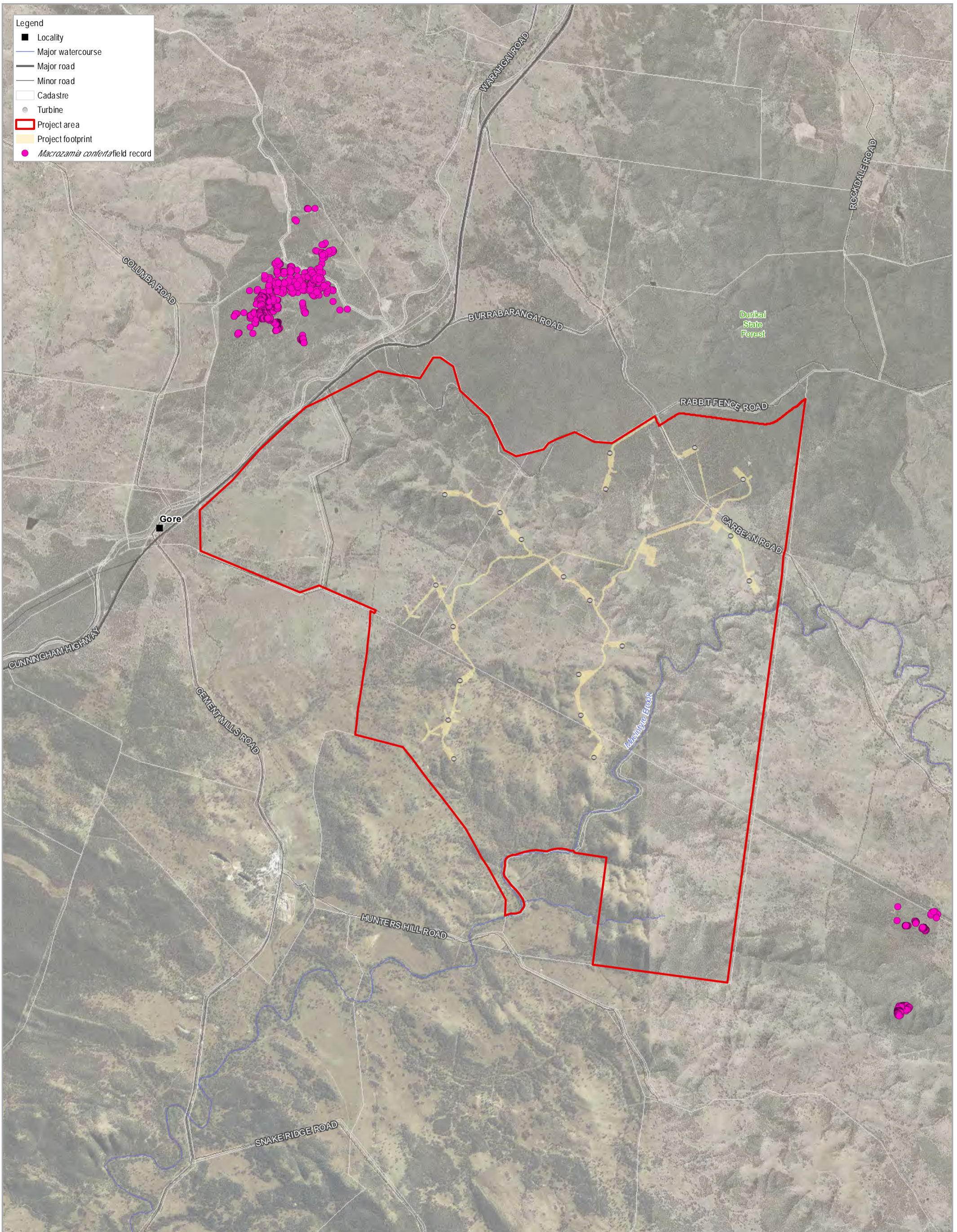
Land use in the Project area and surrounding vicinity is primarily sheep grazing, with some forestry (both in State forests and on private land). Sheep grazing has likely had the greatest impact on the landscape within which *M. conferta* has the potential occur in the locale, with the majority of the Project area having been cleared for pasture.

Within the northern section of the Project area, adjacent to Durikai State Forest, evidence of ongoing selective timber harvesting is present with the species *C. citriodora*, *E. fibrosa* and *E. sideroxylon* appearing to be targeted. This area correlates to where RE 13.11.5 is present (Figure 3.1).

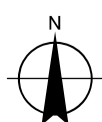
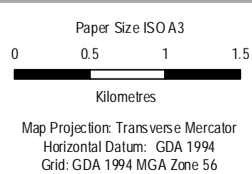
Observations made from areas in the vicinity of the Project area suggest *M. conferta* is relatively resilient to impacts from selective logging. Evidence from old tracks, relict equipment and cut stumps suggests that this activity has been occurring in these forests for decades at least.

The Project area contains 923 ha of remnant vegetation that meets the habitat requirements for *M. conferta* (Figure 3.1). The heterogeneous polygon RE 13.11.3/13.11.8 is mapped across much of the Project area, either as small discrete patches or part of larger patches connected to Durikai State Forest. RE 13.11.5 is mapped as part of a larger patch extending into Durikai State Forest. Two small patches of RE 13.11.6 are mapped along Carbean Road. However, despite extensive survey effort within relevant vegetation communities across 77 survey sites and within approximately 15.5 km of random meanders (the latter targeting *T. linearis*) no individual of *M. conferta* was recorded within the Project area and consequently habitat is considered to be absent from within the Project area.

The Conservation Advice states there are three populations comprising a total of approximately 10,000 plants are known from locations within State forests outside of the Project area. Surveys undertaken adjacent to the Project area, within the proposed MacIntyre Wind Farm (EPBC 2020/8756) Project area to the east and a localized area within the proposed OHTL (EPBC 2020/8759) Project area to the north-west, recorded in the order of 14,293 individuals as shown on Figure 4.2.



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Macrozamia conferta
 survey results

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FIGURE 4-2

Consistent with the Conservation Advice (DEWHA 2008b), plants within the adjacent proposed MacIntyre Wind Farm (EPBC 2020/8756) and OHTL (EPBC 2020/8759) project areas were found within vegetation communities represented in Queensland by RE 13.11.3, RE 13.11.5, RE 13.11.6 and RE 13.11.8. Within the proposed MacIntyre Wind Farm (EPBC 2020/8756) and OHTL project areas, these REs form two main alliances of heterogenous (mixed) polygons, namely RE 13.11.3/13.11.8 and RE 13.11.5/13.11.6. Survey results for *M. conferta* from the proposed MacIntyre Wind Farm (EPBC 2020/8756) and OHTL (EPBC 2020/8759) project areas found a generally consistent difference in the density of populations between these alliances. On average, across nearly 1,000 ha of surveyed area the recorded density/ha was 11.5 times greater in RE 13.11.5/13.11.6 habitat (23.6 plants/ha) than in RE 13.11.3/13.11.8 habitat (2.06 plants/ha), with occasional exceptions.

Projections based on area of suitable habitat and recorded densities (plants/ha) estimate the total population within the Durikai State Forest and proposed MacIntyre Wind Farm (EPBC 2020/8756) and OHTL (EPBC 2020/8759) project areas to be in the order of 106,000 plants.

To estimate the size of the entire species population (as the current estimate is clearly grossly incorrect), Area of Occupancy (AOO) was calculated. Area of Occupancy is a useful unit to use in the estimate of populations to determine their approximate size. The basic unit is relatively coarse (4 km²) but can allow an assessment of the relative proportion of habitat at a landscape scale. This is particularly useful for a species, such as *M. conferta*, whose habitat is relatively common but within which the species occurs patchily. The revised AOO for *M. conferta* was calculated reasonably accurately as described below.

Known records contribute 104 km² as follows:

- The 'adjacent proposed MacIntyre Wind Farm (EPBC 2020/8756) and OHTL project areas AOO' constitutes:
 - MacIntyre Wind Farm (EPBC 2020/8756) Project area records occupy 15 grid squares of 4 km² = 60 km²
 - OHTL (EPBC 2020/8759) records occupy 4 grid squares = 16 km²
- Other records (generalised and clumped together, so this figure may be lower than the reality) occupy 7 grid squares = 28 km².

Based on survey observations, the generalised records and vegetation (RE) mapping, it is considered possible that a further 104 km² can be attributed as follows:

- Durikai State Forest - 13 grid squares = 52 km² (this estimate is considered likely to be accurate)
- Bringalily State Forest - 3 grid squares = 12 km² (the situation in this state forest is not known and this assumption is considered possible only)
- Talgai State Forest - 10 grid squares = 40 km² (the situation in this state forest is not known and this assumption is considered possible only).

Therefore, the revised known AOO for *M. conferta* is predicted to be at least 104 km² (encompassing records from the proposed MacIntyre Wind Farm (EPBC 2020/8756) Project area, the proposed OHTL (EPBC 2020/8759) Project area and other known records). However, the likely AOO for the species (based on availability of suitable habitat in the vicinity of known records) is estimated to be in the order of 156 km² (by incorporating Durikai State Forest areas only) and up to 208 km² (by adding additional areas of Bringalily State Forest and Talgai State Forest habitat to the total).

Given there is little accurate information available on the extent of populations of this species in the state forests in which it has been recorded, EOO is difficult to determine with confidence. However, there are at least two possible scenarios for the EOO for this species:

1. By using the outer extent of the grid squares generated to calculate the AOO, an estimated EOO of 1,325 km² is obtained.
2. If the EOO is drawn around the records as they appear in AVH (2021) and records from the GHD survey in January 2021, an overall area of 836 km² is obtained.

It is considered most likely that the upper estimate of 1,325 km² is closest to the true EOO.

The predicted AOO and EOO for *M. conferta* are shown on Figure 4.3.

Survey work conducted within the adjacent proposed MacIntyre Wind Farm (EPBC 2020/8756) and OHTL (EPBC 2020/8759) project areas recorded a total of 14,293 plants. This figure is nearly 50 percent larger than the current estimate for the entire species of 10,000 plants (DEWHA 2008b). When population densities recorded during these surveys are projected for identified habitat areas, a total estimated population of 108,109 plants is obtained within the proposed MacIntyre Wind Farm (EPBC 2020/8756) and OHTL (EPBC 2020/8759) project areas and areas located in the immediate vicinity including Durikai State Forest.

Consequently, an overall estimate of population for the species can be predicted as follows:

- The estimated AOO calculations for *M. conferta* (as outlined above) found that the MacIntyre Wind Farm (EPBC 2020/8756) Project area and OHTL (EPBC 2020/8759) Project area combined constitutes 76 km² of AOO, which is 37 percent of the upper AOO estimate outlined above, and 49 percent of the lower AOO estimate.
- Therefore, by applying the density of 105, 942 plants within an AOO of 76 km² to the other estimated AOOs, the total population could be in the order of between 216,000 and 286,000 plants overall. Of these, the upper AOO estimate is thought to be more likely.

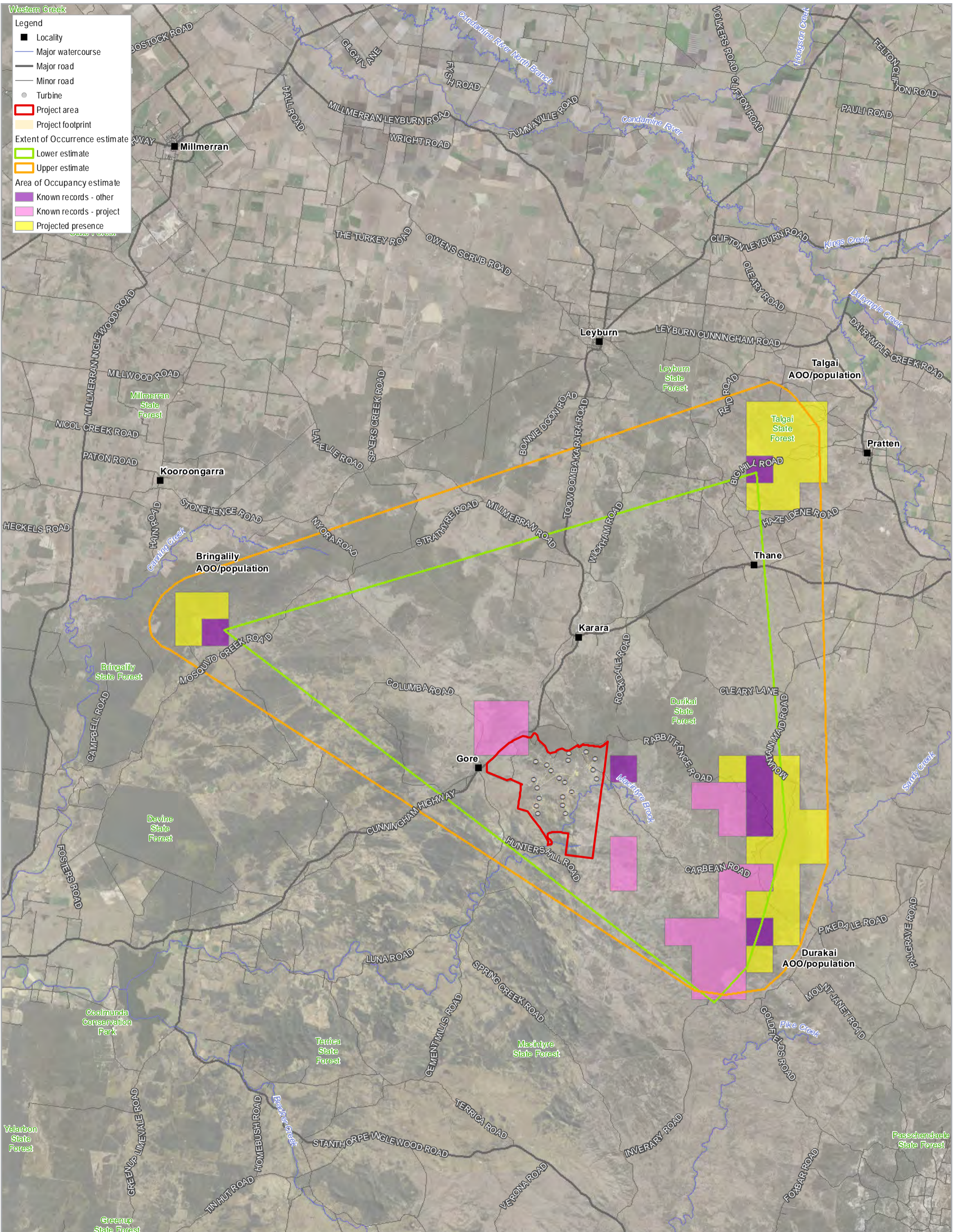
Therefore, based on likely AOO for the species, the overall species population for *M. conferta* is considered likely to be in the order of between 216, 000 and 286, 000 plants.

However, the Project area and specifically the Project footprint contains only REs that meet the requirements for the species – *M. conferta* itself has not been recorded.

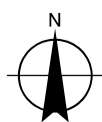
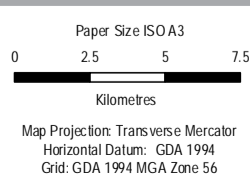
4.1.7 Threatening processes

Threatening processes (DEWHA 2008a) for *M. conferta* include:

- Loss and damage through timber harvesting
- Inappropriate fire regimes
- Failure of insect pollination mutualism
- Vulnerability to illegal collecting of both seed and whole of plant.



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Macrozamia conferta area of occupancy and extent of occurrence

FIGURE 4-3

4.1.8 Potential impacts and mitigation measures

No *M. conferta* individuals have been recorded from within the Project area and consequently habitat for the species is not considered to be present.

Records and habitat critical to the survival of the species are located outside of the Project area to the north-west and east. Potential indirect disturbance impacts associated with clearing for infrastructure will be managed:

- Pre-clearance surveys will be undertaken to confirm that no individuals of *M.conferta* will be cleared.
- Land clearing will be restricted to the minimal amount necessary for the construction of the Project and will not extend outside of the Project footprint.
- The extent of vegetation clearing (and no-go areas) will be clearly identified on construction plans and in the field using high visibility fencing or flagging in the vicinity of high conservation significant areas. Clearing extent will be communicated to construction supervisors. If fencing or flagging is in poor condition, it will be replaced as soon as possible to reduce the potential of accidental clearing
- No clearing or translocation of threatened plants is to occur without appropriate permits in place for their removal.
- A CMP has been prepared to inform actions with regard to managing weed hygiene, erosion, fuels and hazardous substances, fire, etc. and includes erosion and sediment control measures
- All construction personnel shall attend environmental training as part of the site induction process prior to entering the work site. As part of this training, all personnel will be instructed on their obligations in regard to vegetation clearing protocols. Areas identified for vegetation clearance will be clearly defined and detailed in site inductions
- Erosion and sediment controls have been developed as part of the CMP.
- Routine dust suppression and monitoring will be undertaken throughout construction and operation.
- Erosion and sediment control measures will be installed where in-stream disturbance must be undertaken during flow conditions.
- All vehicle movement will be restricted to designated tracks located within the Project footprint.
- Weed management actions are included in the CMP and include:
 - Hygiene protocols restricting the movement of vegetation and soil between impacted areas and areas of significantly lower weed infestation.
 - Protocols for monitoring and management of weeds to identify and appropriately respond to significant changes in weed distribution and density
- All machinery and equipment initially entering the site must possess a current weed hygiene inspection certificate from an inspector who is deemed competent (and certified) in line with DAF requirements.
- All construction vehicles/equipment travelling from declared restricted place or quarantine area will undertake a wash down and possess a current weed hygiene inspection certificate from an accredited inspection station that is required to carry as evidence of quarantine clearance.
- Resources sought from outside the Project area (e.g. fill for access tracks) will be required to hold weed free declarations.
- Restrict vehicle access to existing roads and tracks.
- Preliminary weed mapping will be undertaken. This will provide a baseline of existing weed infestation across the Project area to inform weed management.

4.1.9 Significance of impact assessment

An assessment against the Significant Impact Guidelines 1.1 (DoE 2013) with regards to *M. conferta* was undertaken and the outcomes provided in Table 4-1.

Table 4-1 Significance of impacts on *Macrozamia conferta*

Impact criteria	Potential to occur
Lead to a long-term decrease in the size of an important population of the species.	<p>Unlikely</p> <p>No important populations have been formally recognised although three populations are mentioned in the approved conservation advice for the species (DEWHA 2008a), the closest being Durikai State Forest which abuts the northern extent of the Project area. Due to the restricted distribution and limited occurrences, this State Forest population is likely to be important as it is near the limit of the species range and is likely to be a key source population for breeding and dispersal (DoE 2013). Despite the proximity to Durikai State Forest, no occurrences have been recorded in the Project area. As such, the Project is not expected to result in a long-term decrease in the size of an important population of the species.</p>
Reduce the area of occupancy of an important population.	<p>Unlikely</p> <p>No <i>M. conferta</i> individuals are known to occur in the Project area. The closest confirmed occurrence is 2.5 km east of the Project area boundary. Accordingly, the Project will not result in the loss of the species from a 2 km x 2 km area, such that it would not reduce the area of occupancy of the species (as defined by the Guidelines for Using the IUCN Red List Categories and Criteria Version 12 (IUCN 2016) and cited in the Guidelines for assessing the conservation status of native species according to the EPBC Act and <i>Environment Protection and Biodiversity Conservation Regulations 2000</i>.</p>
Fragment an existing important population into two or more populations.	<p>Unlikely</p> <p>The areas of disturbance are not considered to fragment an existing population. No plants are known to occur within the Project area and the operational works and resulting infrastructure are unlikely to impact the insect pollinators of this species, which are likely to be weevils and thrips (Terry et al. 2005).</p>
Adversely affect habitat critical to the survival of a species.	<p>Unlikely</p> <p>No habitat critical to survival of the species has been mapped within the Project area.</p>
Disrupt the breeding cycle of an important population.	<p>Unlikely</p> <p>No individuals were recorded in the Project area. The closest confirmed occurrence is 2.5 km east of the Project area boundary. Operational works are unlikely to impact the insect pollinators for this species. Dispersal of this species is very limited (Hall and Walter 2013). Operational works undertaken even within relatively close proximity to fertile female plants are unlikely to impact seedling germination. Other abiotic impacts such as erosion and sediment transport that have potential to disrupt the breeding cycle of <i>M. conferta</i> will be managed under a CMP.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	<p>Unlikely</p> <p>No individuals were recorded in the Project area. The closest confirmed occurrence is 2.5 km east of the Project area boundary. The Project will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p>
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species habitat.	<p>Unlikely</p> <p>The introduction of a weed control program through the CMP may result in a slight reduction of invasive species across the Project area. Equipment and personnel will be subject to weed hygiene conditions and are unlikely to contribute to the introduction of additional invasive species within the site.</p>

Impact criteria	Potential to occur
Introduce disease that may cause the species to decline.	Unlikely Disease is not considered to be a key threat to <i>M. conferta</i> (DEWHA, 2008); however, hygiene management measures will be utilised during the construction phase.
Interfere substantially with the recovery of the species	Unlikely No individuals were recorded in the Project area. As there is no expected degradation in the dispersal of the species, the Project will not prevent the existing occurrences from expanding their range. Consequently, the recovery of the species is expected to be unaffected by the Project.

4.1.10 Conclusion

The Project is **unlikely** to have a significant impact on *M. conferta* as no known occurrences of the species is expected to occur within the Project area.

4.2 *Eucalyptus infera*

4.2.1 Conservation status and documentation

Eucalyptus infera is listed as Vulnerable under the EPBC Act and is known only from an area west of Warwick, Queensland with the main population at the southern end of the Durikai State Forest, with an estimated 1,000 individuals (DEWHA 2008b)

E. infera is a mallee or rarely a small tree to 8 m tall that forms a lignotuber. It is restricted to a small part of Queensland, south west of Warwick (EUCLID 2015). This species grows on sandy duplex soils derived from metamorphosed sediments in small drainage lines associated with *E. moluccana*, *E. fibrosa* subsp. *fibrosa* and *Corymbia citriodora* subsp. *variegata* in undulating terrain (DEWHA 2008b).

4.2.2 Survey effort

E. infera can be identified year-round based on vegetative features. Accordingly, all field surveys within the Project area (Figure 2.1) were undertaken at a time suitable for detection of this species, equivalent to 54 survey days (based on combined individual effort per person) as follows and summarised in Table 2-1:

- October/November 2018
- December 2018
- January 2019
- March/April 2020.

Intensive search effort was afforded to detection of threatened flora with targeted searches at the quaternary assessment sites and TEC verification sites (Figure 2.1). These sites were distributed across the diversity of habitat types represented within the Project area, with a total of 70 quaternary sites and 20 TEC verification sites assessed by GHD between 2018 and 2020 during appropriate seasonality for this species.

4.2.3 Criteria used to define *Eucalyptus infera* habitat

The Commonwealth conservation advice identifies that *E. infera* grows on sandy duplex soils derived from metamorphosed sediments in small drainage lines associated with *E. moluccana*, *E. fibrosa* subsp. *fibrosa* and *Corymbia citriodora* subsp. *variegata* in undulating terrain (DEWHA, 2008a). In this regard, woodlands on metamorphosed sediments within the Project area provide potentially suitable habitat for this species.

REs present in the Project area that contain one or more of these species include RE 13.11.5 and RE 13.11.6 (Figure 3.1). REs 13.11.3 and 13.11.8 were also included as habitat as these additional REs

are listed as mandatory habitat factors for the species in the Queensland Essential Habitat database. Local drainage lines supporting known occurrences of *E. infera* were either stream orders 1 or 2 on the Queensland Vegetation Management Watercourse Map.

There is no formal definition of habitat critical to the survival of *E. infera* in the Commonwealth guidelines. Given the species' restricted distribution, it is likely to include all areas of habitat within proximity to known records.

Therefore, habitat hosting *E. infera* is taken to be habitat critical to the survival of the species given the species' restricted distribution, as follows:

- Lower slopes and flats around minor watercourses including the watercourses themselves (stream order 1 -3) in RE 13.11.6, 13.11.5, 13.11.3 or 13.11.8 (or heterogeneous polygons thereof); and
- Within 1 km of confirmed record (including historical records).

4.2.4 Desktop results

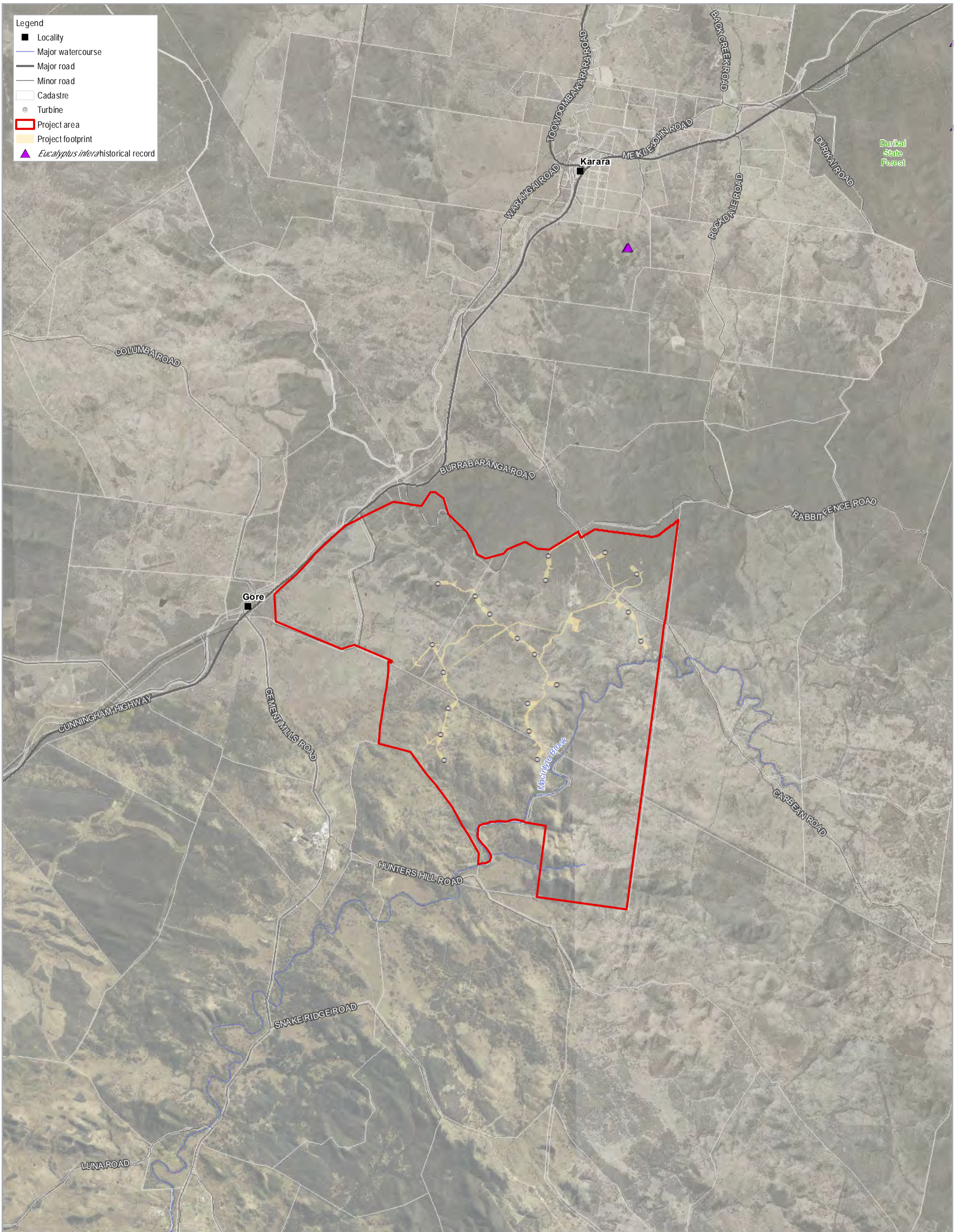
E. infera was identified within the PMST (Appendix B) as having potential to occur within a 20 km radius from a central point within the Project area.

There are several historical records of *E. infera* within a 20 km radius of the Project area. A WildNet search identified a number of historic records in the local landscape to the north and east of the Project area within Durikai State Forest, none of which occur within the Project area. The closest record is approximately 3 km to the north-east and is from 1971. Other records in the local landscape are restricted to areas of State Forest and are located in a cluster approximately 13 km to the north-east of the Project area and another cluster approximately 10 km to the east, as shown on Figure 4.4.

A likelihood of occurrence assessment (Appendix D) determined that this species was 'likely to occur' within the Project area.

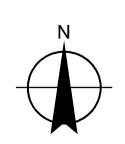
4.2.5 Survey results

No individuals have been recorded within the Project area. Given its distinctive bark and leaf morphology, this species is unlikely to have been overlooked during the field surveys and it can be concluded with a high degree of confidence that it is not present. Two individuals were recorded within Durikai State Forest during the 2019 GHD survey, approximately 11.5 km east of the Project area (Figure 4.4). A Wildlife Online record for the species from 1971 also exists approximately 7 km north of the Project area.



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Paper Size ISO A3
 0 0.5 1 1.5
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



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 Distribution of *Eucalyptus infera* records within and adjacent to the project area

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FIGURE 4-4

4.2.6 Significance of Project area

Although the species was not recorded in the Project area, the presence of suitable habitat along minor watercourses containing *E. moluccana*, *E. fibrosa* subsp. *fibrosa* and *C. citriodora* subsp. *variegata* in undulating terrain on metamorphosed sediments as per the Conservation Advice (DEWHA 2008b) combined with the proximity of historic and recent records resulted in *E. infera* being mapped as having the potential to occur within areas as shown on Figure 4.4. Habitat for *E. infera* is not predicted within in the Project area.

While the Conservation Advice indicates that the distribution of *E. infera* overlaps with the white box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC, no individuals were identified within areas confirmed for the TEC (Section 3.1).

4.2.7 Threatening processes

Threatening processes for *E. infera* include:

- Vegetation clearing
- Timber harvesting
- Habitat degradation due to erosion and inappropriate grazing regimes (DEWHA, 2008b).

4.2.8 Potential impacts and mitigation measures

E. infera is absent from the Project area and will not be impacted.

Records and habitat critical to the survival of the species are located more than 12 km distant from the Project area's eastern boundary. Potential indirect disturbance impacts associated with clearing for infrastructure will be managed as follows:

- Pre-clearance surveys will be undertaken to confirm that no individuals of *E. infera* will be cleared.
- Land clearing will be restricted to the minimal amount necessary for the construction of the Project and will not extend outside of the Project footprint.
- The extent of vegetation clearing (and no-go areas) will be clearly identified on construction plans and in the field using high visibility fencing or flagging in the vicinity of high conservation significant areas. Clearing extent will be communicated to construction supervisors. If fencing or flagging is in poor condition, it will be replaced as soon as possible to reduce the potential of accidental clearing.
- No clearing or translocation of threatened plants is to occur without appropriate permits in place for their removal.
- A CMP has been prepared to inform actions with regard to managing weed hygiene, erosion, fuels and hazardous substances, fire, etc. and includes erosion and sediment control measures
- All construction personnel shall attend environmental training as part of the site induction process prior to entering the work site. As part of this training, all personnel will be instructed on their obligations in regard to vegetation clearing protocols. Areas identified for vegetation clearance will be clearly defined and detailed in site inductions
- Erosion and sediment controls have been developed as part of the CMP.
- Routine dust suppression and monitoring will be undertaken throughout construction and operation.
- Erosion and sediment control measures will be installed where in-stream disturbance must be undertaken during flow conditions.

All vehicle movement will be restricted to designated tracks located within the Project footprint.

- Weed management actions are included in the CMP and include:
 - Hygiene protocols restricting the movement of vegetation and soil between impacted areas and areas of significantly lower weed infestation.

- Protocols for monitoring and management of weeds to identify and appropriately respond to significant changes in weed distribution and density
- All construction vehicles/equipment travelling from declared weed areas will undertake a wash down and possess a current weed hygiene inspection certificate from an accredited inspection station that is required to carry as evidence of quarantine clearance.
- Resources sought from outside the Project area (e.g. fill for access tracks) will be required to hold weed free declarations.
- Restrict vehicle access to within the Project footprint and/or existing roads and tracks.
- Preliminary weed mapping will be undertaken. This will provide a baseline of existing weed infestation across the Project area to inform weed management.

4.2.9 Significance of impact assessment

An assessment against the Significant Impact Guidelines 1.1 (DoE 2013) with regards to *E. infera* was undertaken and the outcomes provided in Table 4-2.

Table 4-2 Significance of impacts on *Eucalyptus infera*

Impact criteria	Potential to occur
Lead to a long-term decrease in the size of an important population of the species.	Unlikely No direct or indirect impacts to the species are anticipated as a result of the proposed works. On ground assessments did not record the presence of this species within the Project area. The closest known record is approximately 7 km north of the Project area. This occurrence will not be impacted by the Project. Furthermore, no populations considered to be important populations occur within 10 km of the Project area.
Reduce the area of occupancy of an important population.	Unlikely No <i>E. infera</i> individuals are known to occur and no habitat for <i>E. infera</i> is mapped within the Project area. The closest known record is approximately 7 km north of the Project area. Accordingly, the Project will not result in the loss of the species from a 2 km x 2 km area, such that it would not reduce the area of occupancy of the species (as defined by the Guidelines for Using the IUCN Red List Categories and Criteria Version 12 (IUCN 2016) and cited in the Guidelines for assessing the conservation status of native species according to the EPBC Act and <i>Environment Protection and Biodiversity Conservation Regulations 2000</i> .
Fragment an existing important population into two or more populations.	Unlikely No known individuals have been recorded from within the Project area. The proposed impact is not expected to fragment an existing population.
Adversely affect habitat critical to the survival of a species.	Unlikely The closest known record is approximately 7 km north of the Project area. Supporting habitat for this distant occurrence will not be impacted by the Project. The Project will not affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population.	Unlikely The closest known record is approximately 7 km north of the Project area. Works within the Project area will not disrupt the breeding cycles of this distant occurrence. The species is likely to be pollinated by insects and possibly flying-foxes, and the Project is not likely to prevent pollination from occurring. The dispersal of the species is through localised seed drop and subsequent water dispersal, which will not be impacted to an extent that would disrupt the breeding cycle of an important population located in Durikai State Forest.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Unlikely No <i>E. infera</i> individuals or predicted habitat for the species has been identified within the Project area. Accordingly, the Project is not expected to result in the decline of the species.

Impact criteria	Potential to occur
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species habitat.	Unlikely The introduction of a weed control program through the CMP is likely to result in a minor reduction of invasive species across the Project area. Equipment and personnel will be subject to weed hygiene requirements and are unlikely to contribute to the introduction of additional invasive species to the site.
Introduce disease that may cause the species to decline.	Unlikely Disease is not considered to be a key threat to <i>E. infera</i> (DEWHA 2008); however, hygiene management measures will be utilised during the construction phase.
Interfere substantially with the recovery of the species	Unlikely No individuals were recorded in the Project area. As there is no expected degradation in the dispersal of the species, the Project will not prevent the existing occurrences from expanding their range. Consequently, the recovery of the species is expected to be unaffected by the Project.

4.2.10 Conclusion

The Project is **unlikely** to have a significant impact *E. infera*, as no direct impacts to known occurrences of the species is expected to occur.

4.3 *Tylophora linearis*

4.3.1 Conservation status and documentation

Tylophora linearis is listed as Endangered under the EPBC Act. It is an herbaceous climber with clear latex that grows to about 2 m long. It grows in dry scrub, open forest and woodlands associated with *Melaleuca uncinata*, *Eucalyptus fibrosa*, *E. sideroxylon*, *E. albens*, *Callitris endlicheri*, *C. glaucophylla*, *Allocasuarina luehmannii*, *Acacia hakeoides*, *A. lineata*, *Myoporum* spp., and *Casuarina* spp. (DEWHA 2008b).

It has rarely been collected and is known from eight localities from Glenmorgan in Queensland to Temora in New South Wales. Most records are from New South Wales in the Dubbo region with scattered populations also recorded in the Baradine and Barraba districts (OEH 2020). The total number of individuals recorded across ten known populations is estimated to be less than 1,000 (TSSC 2019).

4.3.2 Survey effort

T. linearis flowers in spring, with fruiting occurring two to three months later (OEH, 2021). Accordingly and as summarised in Table 2-1, the following field surveys within the Project area were undertaken at a time optimal for detection of this species, equivalent to 49 survey days (based on combined individual effort per person):

- October/November 2018
- December 2018
- January 2019.

Targeted meander searches were undertaken for *T. linearis*, noting that no Commonwealth survey guidelines are available for this species. Intensive search effort was afforded to detection of threatened flora species at the protected plant survey sites shown in Figure 2.1, and were supplemented with targeted searches at the quaternary assessment sites and TEC verification sites. These sites were distributed across the diversity of habitat types represented within the Project area, with a total of 40 quaternary sites and 15 TEC verification sites assessed by GHD between 2018 and 2020 at a time suitable for detection of *T. linearis*.

While it is acknowledged quaternary assessments represent a rapid method intended for validation of habitat, quaternary surveys can identify conservation significant species that are abundant and widely distributed. Based on the absence of records from quaternary sites undertaken in suitable habitat as defined in accordance with the listing advice (DEWHA, 2008c) it is considered that these surveys are sufficient to conclude that if the species has a low potential to occur within the Project footprint, it would do so only very sporadically.

4.3.3 Criteria used to map *Tylophora linearis* habitat

T. linearis grows in dry scrub, open forest and woodlands associated with *Melaleuca uncinata*, *Eucalyptus fibrosa*, *E. sideroxylon*, *E. albens*, *Callitris endlicheri*, *C. glaucophylla*, *Allocasuarina luehmannii*, *Acacia hakeoides*, *A. lineata*, *Myoporum* spp. and *Casuarina* spp. (DEWHA, 2008c). In this regard, suitable habitat within the Project area includes woodlands on metamorphosed sediments. Specifically, REs present in the Project area (Figure 3.1) which meet the structural characteristics of the habitat described and contain one or more of the aforementioned species included the following:

- RE 13.11.3 – *Eucalyptus crebra* woodlands on metamorphics
- RE 13.11.3b – *Eucalyptus caleyi* subsp. *caleyi* woodland
- RE 13.11.5 – *Eucalyptus sideroxylon*, *E. fibrosa* subsp. *nubilis* open forest on metamorphics
- RE 13.11.8 – *Eucalyptus melliodora* and/or *E. macrocarpa* / *E. moluccana* woodland on metamorphics

Additionally, the following RE was considered as habitat as it commonly contains as it commonly contains *E. crebra* which was recorded growing in association with *T. linearis* at the Cumbil and Eura State Forest populations (Forster et al., 2004):

- RE 13.11.6 – *Corymbia citriodora* subsp. *variegata* open forest on metamorphics

Species specific habitat critical to the survival of *T. linearis* has not been defined by DAWE. Essential habitat for *T. linearis* has been mapped by the DoR over all remnant vegetation within 1 km of a confirmed record located at the northern boundary of the Project area. All remnant vegetation within this radial distance is depicted in DoR mapping as comprising RE 13.11.3/13.11.8. This same mapped extent has been used to delineate *T. linearis* habitat for the purposes of assessing the Project's impacts against the EPBC Act Significant Impact Guidelines 1.1 (DoE, 2013).

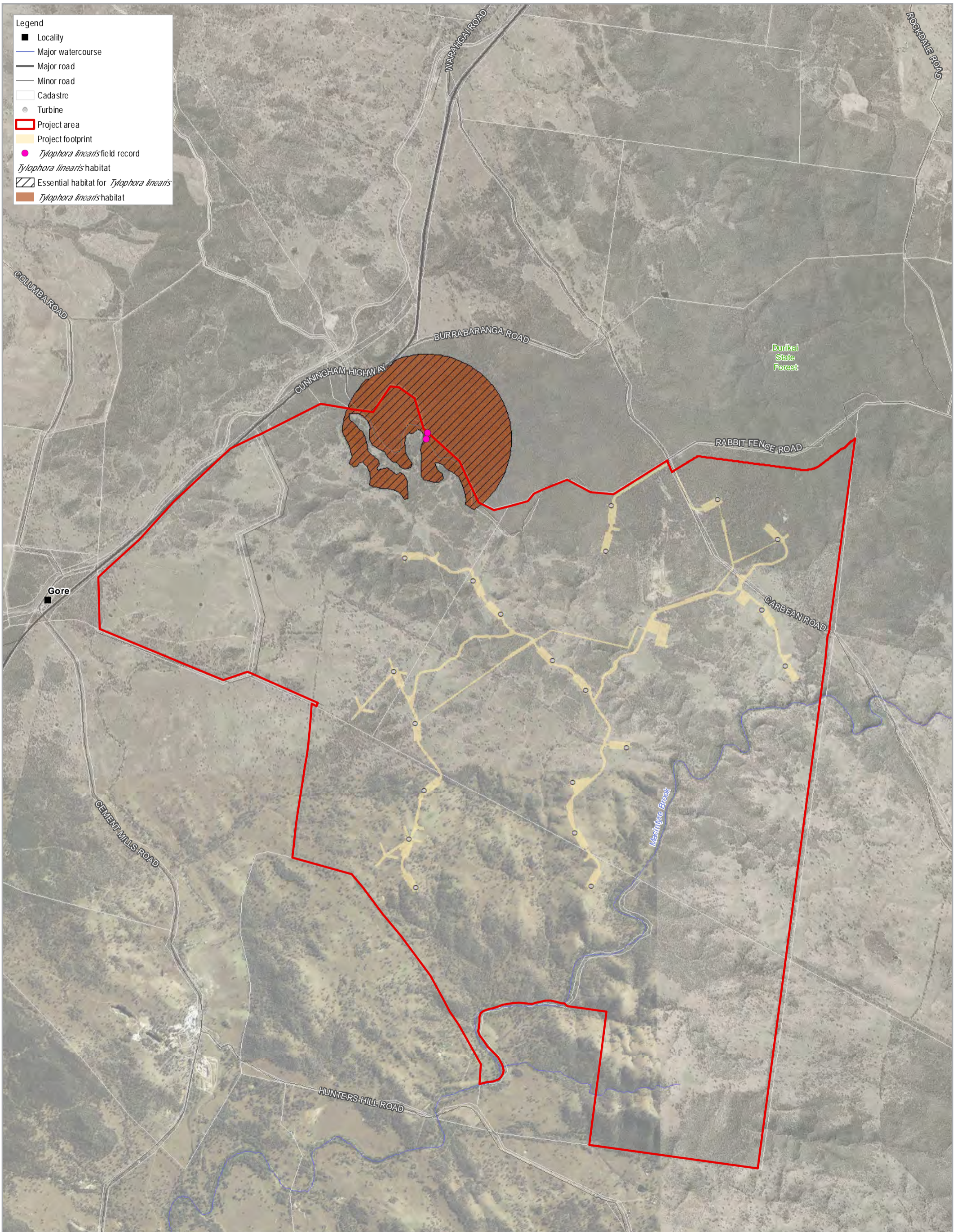
While the Conservation Advice indicates that the distribution of *T. linearis* overlaps with the white box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC, no individuals were identified within areas confirmed for the TEC (Section 3.1).

4.3.4 Desktop results

The location from which the species is known in Queensland is from Myall Park at Glenmorgan, some 300 km plus north-west of Karara.

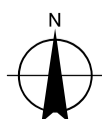
The Species Profile Search (DES, 2021) identified one record for *T. linearis*, which is a record collected in 2018 during a field survey by GHD for the Project, with two *T. linearis* individuals observed approximately 60 m apart as shown in Figure 4.5.

Essential habitat for *T. linearis* is mapped under the *Vegetation Management Act 1999* in proximity to the existing record (Figure 4.5) to provide context for the potential extent of habitat within the Project area.



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Paper Size ISO A3
 0 0.5 1
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



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 MNES Assessment Report
 Distribution of habitat and confirmed records of *Tylophora linearis* within the project area

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FIGURE 4-5

4.3.5 Survey results

T. linearis was confirmed present from the Project area during surveys undertaken by GHD in October 2018. A total of two individuals were recorded within an area less than 0.2 ha at the northern boundary of the Project area, adjacent to Durikai State Forest (Figure 4.5). One individual was found climbing on the rabbit proof fence and was in good health and full flower (Plate 4-2). The second individual was found approximately 60 m away, in good health but not flowering. Samples and photographs were submitted to the Queensland Herbarium for verification and confirmed as *T. linearis*.



Plate 4-2 *Tylophora linearis* recorded near the Project area

A series of meander searches were undertaken within 200 m of the individuals immediately following detection of the occurrence. No additional individuals were recorded within the search radius. The time of flowering coincided with the spring flowering period reported in the *T. linearis* by the NSW Office of Environment and Heritage's fact sheet (OEH 2020). The conditions were also considered to be favourable for detecting the species with above average rainfall received in the two months preceding the survey (i.e. 132.4 mm recorded at Warwick compared to the two-month (August-October) average rainfall of 105.5 mm recorded for the area (source: Bureau of Meteorology Station No. 41525). Forster et. al. (2004) reports that flowering cues for the species are unknown but may be partly related to rainfall.

Attempts to locate the known occurrence during surveys in March 2020 were unsuccessful. This may be a result of the above ground material being shed in dry conditions rather than the loss of the plant as it known to regenerate from a thickened root stock in more favourable conditions. Targeted searches for *T. linearis* were also undertaken in September 2019 in areas of potential habitat within the extent of the proposed OHTL Project (plus a 100 m buffer) in areas of suitable habitat within 2 km of the known occurrence. No individuals were located during these targeted searches. Opportunistic searches for the species were also undertaken during the course of extensive RE and TEC verification surveys in areas of suitable habitat. Field ecologists were familiar with the species, suitable habitat characteristics and similar species (e.g. *Rhyncharrhena* and *Marsdenia* spp.) and found no additional individuals.

Habitat for the species was typically in reasonable condition within the Project area, although introduced grasses formed a notable presence within the ground layer at some locations.

Distribution of flora survey effort within the Project area is shown in Figure 2.1. Distribution of *T. linearis* habitat and records within and adjacent to the Project are shown in Figure 4.5.

4.3.6 Significance of Project area

A population consisting of two individuals was recorded along the northern boundary of the Project area in October 2018. Locations of individuals detected as well as habitat considered critical to the survival of the species (Section 4.3.3) is shown in Figure 4.5.

The Project footprint has been sited to avoid impacts to the population and habitat, with the closest works at least 1.2 km from the nearest individual. Nevertheless, the Project area is considered significant for the species as it supports a newly reported occurrence between two distant populations. The nearest known record in New South Wales is approximately 90 km south-west of the Project area (ALA 2019), whilst the closest confirmed Queensland record is 225 km to the north-west of the Project area.

An extent of 83.39 ha of *T. linearis* habitat is present within the Project area. An extent of 233.95 ha of *T. linearis* habitat is mapped within 5 km of the Project footprint, such that the habitat within the Project area represents 35.64 percent.

4.3.7 Threatening processes

Threatening processes (DEWHA 2008b) for *T. linearis* include

- Forestry activities
- Disturbances such as grazing and fire
- Invasion of habitat by introduced weeds.

4.3.8 Potential impacts

No *T. linearis* individuals or habitat will be impacted.

The Project footprint has been sited to avoid impacts to the known population and habitat, with the closest works at least 1.2 km from the nearest individual. Nevertheless, the Project area is considered significant for the species as it supports a newly reported occurrence between two distant populations. The nearest known record in New South Wales is approximately 90 km southwest of the Project area (ALA 2019), whilst the closest confirmed Queensland record is 225 km to the northwest of the Project area.

4.3.9 Measures to avoid, reduce or mitigate impacts

The Project footprint has been sited to avoid impacts to the population with the closest works at least 1.2 km from the nearest recorded individual. Potential direct and indirect disturbance impacts associated with clearing for infrastructure will be managed through the following:

- Pre-clearance surveys will be undertaken to confirm that no individuals of *T. linearis* will be cleared.
- Land clearing will be restricted to the minimal amount necessary for the construction of the Project and will not extend outside of the Project footprint.
- The extent of vegetation clearing (and no-go areas) will be clearly identified on construction plans and in the field using high visibility fencing or flagging in the vicinity of high conservation significant areas. Clearing extent will be communicated to construction supervisors. If fencing or flagging is in poor condition, it will be replaced as soon as possible to reduce the potential of accidental clearing.
- A CMP has been prepared to inform actions with regard to managing weed hygiene, erosion, fuels and hazardous substances, fire, etc. and includes erosion and sediment control measures
- All construction personnel shall attend environmental training as part of the site induction process prior to entering the work site. As part of this training, all personnel will be instructed on their obligations in regard to vegetation clearing protocols. Areas identified for vegetation clearance will be clearly defined and detailed in site inductions
- Erosion and sediment controls have been developed as part of the CMP.

- Routine dust suppression and monitoring will be undertaken throughout construction and operation.
- Erosion and sediment control measures will be installed where in-stream disturbance must be undertaken during flow conditions.
All vehicle movement will be restricted to designated tracks located within the Project footprint.
- Weed management actions are included in the CMP and include:
 - Hygiene protocols restricting the movement of vegetation and soil between impacted areas and areas of significantly lower weed infestation.
 - Protocols for monitoring and management of weeds to identify and appropriately respond to significant changes in weed distribution and density
- All construction vehicles/equipment travelling from declared weed areas will undertake a wash down and possess a current weed hygiene inspection certificate from an accredited inspection station that is required to carry as evidence of quarantine clearance.
- Resources sought from outside the Project area (e.g. fill for access tracks) will be required to hold weed free declarations.
- Restrict vehicle access to existing roads and tracks.
- Preliminary weed mapping will be undertaken. This will provide a baseline of existing weed infestation across the Project area to inform weed management.

4.3.10 Significance of impact assessment

An assessment against the Significant Impact Guidelines 1.1 (DoE 2013) for *T. linearis* was undertaken and is provided in Table 4-3.

Table 4-3 Significance of impacts on *Tylophora linearis*

Impact criteria	Potential to occur
Lead to a long-term decrease in the size of a population of the species.	Unlikely The Project footprint avoids impacts to known populations and <i>T. linearis</i> individuals. Pre-clearance surveys will be conducted within the Project footprint prior to vegetation clearing. Any individuals detected will be avoided such that there will not be a long-term decrease of an important population.
Reduce the area of occupancy of the species.	Unlikely The Project footprint has been designed such that complete avoidance of <i>T. linearis</i> individuals can be achieved. Accordingly, the Project will not result in the loss of the species from a 2 km x 2 km area, such that it would not reduce the area of occupancy of the species (as defined by the Guidelines for Using the IUCN Red List Categories and Criteria Version 12 (ICUN 2016) and cited in the Guidelines for assessing the conservation status of native species according to the <i>Environment Protection and Biodiversity Conservation Act 1999</i> and <i>Environment Protection and Biodiversity Conservation Regulations 2000</i> .
Fragment an existing population into two or more populations.	Unlikely The Project footprint has been designed such that complete avoidance of <i>T. linearis</i> individuals can be achieved. Accordingly, the Project will not fragment an existing population.
Adversely affect habitat critical to the survival of a species.	Unlikely Clearing will avoid direct impact on individuals and to habitat within the Project area. Pre-clearance surveys will be conducted within the Project footprint prior to vegetation clearing. Any individuals detected will be avoided.

Impact criteria	Potential to occur
Disrupt the breeding cycle of a population.	<p>Unlikely</p> <p>No impact to <i>T. linearis</i> individuals will occur such that no implications on the breeding cycle will occur via processes such as reduced genetic diversity or population size. Furthermore, no impacts on insect presence or movement in the local landscape are anticipated to occur as a result of the project (<i>T. linearis</i> is likely to be insect pollinated), and the Project is not expected to affect wind conditions (seeds are dispersed by wind), such that no impact on the breeding cycle of the population in the broader landscape is expected to occur.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	<p>Unlikely</p> <p>The Project footprint has been designed such that complete avoidance of <i>T. linearis</i> individuals and habitat can be achieved. Accordingly, the Project is not expected to result in the decline of the species.</p>
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat.	<p>Unlikely</p> <p>The implementation of a weed control program is likely to result in an overall reduction of invasive species across the Project area. Equipment and personnel will be subject to weed hygiene conditions and are unlikely to contribute to the introduction of additional invasive species to the Project area.</p>
Introduce disease that may cause the species to decline.	<p>Unlikely</p> <p>Disease is not considered to be a key threat to <i>T. linearis</i> (DEWHA, 2008b). Nevertheless, hygiene management measures will be utilised during the construction phase to avoid introduction of any diseases.</p>
Interfere substantially with the recovery of the species	<p>Unlikely</p> <p>No loss of <i>T. linearis</i> individuals will occur as a result of the Project. Therefore, the recovery of the species is expected to be unaffected.</p>

4.3.11 Conclusion

The Project is **unlikely** to have a significant impact on *T. linearis*. No direct impacts to known occurrences of the species is expected to occur.

5. Threatened Fauna Species

5.1 Koala

5.1.1 Conservation status and documentation

The koala is listed as vulnerable under the EPBC Act.

The species is known to occur from north-eastern Queensland to the south-east corner of South Australia and is widespread in coastal and inland areas (DSEWPC 2012). The species has a specialist diet, feeding on the leaves of select species of *Eucalyptus*, *Lophostemon*, *Corymbia*, *Angophora* and occasionally *Melaleuca* and *Leptospermum* (Martin and Handasyde 1999; Moore and Foley 2000). Consequently, koalas are reliant on access to stands of forest and woodland that support those key food-tree species. Shelter (non-food) tree species are also used to rest and assist in thermoregulation (Crowther et al. 2013; Briscoe et al 2015).

Within the inland context (applicable to the Project area), the Commonwealth listing advice describes koala habitat as eucalypt forests and woodlands, as well as acacia woodlands (with emergent food trees) in both riparian and non-riparian environments (DoE 2014). Inland koala habitat also includes small, patchy or sparsely distributed woodlands, shrublands and forest in highly modified, agricultural-grazing landscapes (DoE 2014). Utilisation of koala habitat is determined largely by food quality, which is heavily reliant on rainfall, soil moisture and fertility levels, with koalas typically occurring in highest densities in nutrient-rich alluvial clay soils (DAWE 2021a).

The way in which koalas move through the landscape also influences their use of habitat. In general, koalas are relatively sedentary, typically changing trees only a few times each day (DAWE 2021a). Koala movement increases in spring when young dispersing males move distances of up to 10 km in urban south-east Queensland (Dique et al. 2014) and 16 km in rural south-east Queensland (White 1999). For the rest of the year koalas move relatively slowly within home ranges that vary between 8 ha and 135 ha (Ellis et al. 2002; Goldingay and Dobner 2014). Home range size generally increases with distance from the coast, as inland koalas need to move more widely to encounter sufficient sources of food and water (Davies et al 2013).

In the assessment of habitat quantity and quality, the Draft National Recovery Plan for the koala (DAWE 2021b) highlights the importance of considering landscape patch size, form and spatial configuration within the context of the wider landscape, which can vary among landscapes and varies regionally (DAWE 2021b). Research has shown that koalas move very differently through different landscapes, depending on the level of habitat connectivity that has been retained (Rus et al 2020). In contiguous landscapes with high connectivity, koalas follow tortuous pathways, moving slowly between koala habitat trees along vegetated watercourses, roadsides and other areas of functional connectivity. This increases their energetic efficiency and reduces their susceptibility to predation (Rus et al 2020). In more fragmented landscapes, koalas follow more direct movement pathways and demonstrate an increased willingness to cross open areas at ground level to move between isolated patches of vegetation (Rus et al 2020) albeit their safety is at risk and the open and exposed landscape proves to be a hostile environment (DAWE 2021b). In the context of a contiguous landscape, where high levels of linear habitat connectivity are retained along watercourses, vegetated roadsides and fence lines and where dog attacks on livestock have been reported by local landholders, large open paddocks are expected to receive low levels of utilisation by koalas. While the Referral guidelines for the vulnerable koala state that koalas can move through treeless areas to a distance of up to 2 km (DoE 2014), in the current context, open areas would experience significantly lower levels of koala movement than areas of functional connectivity.

5.1.2 Survey effort

Surveys for the koala were undertaken using methods recommended in Section 5 of the Referral guidelines for the vulnerable koala (DoE 2014). A summary of ecological survey effort is provided in Table 2-1 and shown in Figure 5.1.

Targeted surveys for the koala were based on:

- Spotlighting across the Project area, undertaken on 10 nights over three surveys in Spring 2018 and Spring 2020 (GHD) and Autumn 2020 (GHD). This equates to a minimum of 60 observer hours of spotlighting, with spotlighting undertaken by two ecologists over three hours per night.
- Targeted searches for faecal pellets using the SAT technique (Phillips and Callaghan 2011). This was undertaken at 48 locations across the Project area over three 4- 5-day surveys.
- Assessments of koala habitat value undertaken at 92 rapid fauna sites and 70 RE confirmation sites within the Project area.

Surveys in 2017, 2018 and Autumn 2020 targeted areas of koala habitat predominantly in remnant woodland. The Spring 2020 survey, undertaken by two ecologists over three days targeted koala habitat in cleared and modified areas including regrowth shrubland and patchy or sparsely distributed non-remnant woodland vegetation.

5.1.3 Criteria used to map koala habitat

5.1.3.1 Commonwealth habitat definition

Referral guidelines for the vulnerable koala (DoE 2014)

Habitat for the koala has been mapped for the Project area using criteria outlined within the Referral guidelines for the vulnerable koala (DoE 2014). As the Project area is located in a contiguous landscape (i.e. ≥ 500 ha) within the inland context (i.e. < 800 mm annual rainfall), the definition of inland koala habitat has been used.

The inland koala habitat definition in the Referral guidelines for the vulnerable koala (DoE 2014) includes '*Any forest or woodland containing species that are known koala food trees, or shrubland with emergent food trees. In the inland context, this can include small, patchy and sparsely distributed woodlands, shrubland and forest in highly modified landscapes.*' (DoE 2014). This relies on the Specht (1970) definitions of forest, woodland, shrubland and sparsely distributed woodland.

National Recovery Plan for the vulnerable koala (DAWE 2021b)

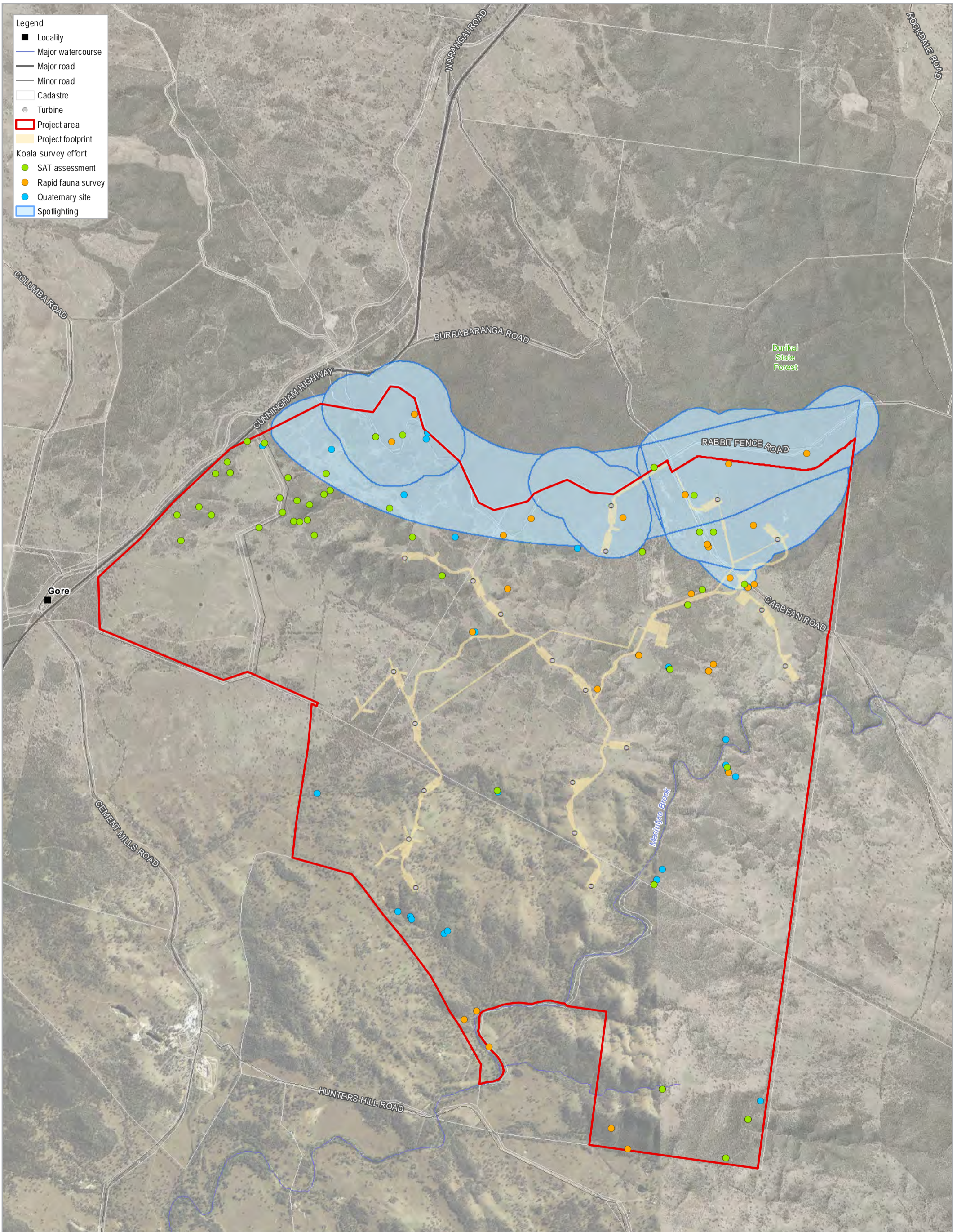
In assessing the habitat values, consideration has also been given to the description of koala habitat currently presented within the Draft National Recovery Plan for the koala (DAWE 2021b), which was released for public comment in June 2021 and may therefore be subject to change.

The definition of koala habitat presented in the Recovery Plan for the vulnerable koala (DAWE 2021b) includes: '*Forests or woodlands; roadside and railway vegetation and paddock trees; safe intervening ground matrix for travelling between trees and patches to forage and shelter and reproduce; and access to vegetated corridors or paddock trees to facilitate movement between patches*'.

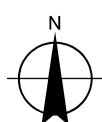
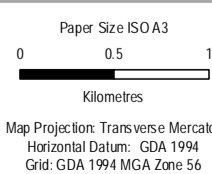
5.1.3.2 Criteria used to map koala habitat within the Project area

Consistent with the inland koala habitat definition outlined in the Referral guidelines for the vulnerable koala (DoE 2014), habitat was mapped according to the following habitat types:

- Remnant and non-remnant forest and woodland
- Patchy and sparsely distributed woodland (including scattered trees along linear corridors)
- Shrubland with emergent koala food trees



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Koala survey effort

FIGURE 5-1

Within the remaining contiguous landscape, isolated paddock trees occur in very low densities (i.e. between 0.25 and 2.7 trees / ha) and may be utilised by koalas from time to time. While isolated food trees are only included in the Commonwealth's definition of koala habitat within the coastal context, a conservative approach has been taken and these have been included in the current assessment to account for all isolated koala food or shelter trees in areas of non-remnant vegetation that could be utilised by koalas on an infrequent basis for dispersal purposes.

Areas of *very sparsely distributed woodland* using the Specht (1970) definition (i.e. areas of woodland with < 10% foliage cover of the tallest plant layer) are not included in the definition of inland koala habitat in the Referral guidelines for the vulnerable koala (DoE 2014). Expanses of open ground within sheep grazing paddocks that would fall within the definition of *very sparsely distributed woodland* do not constitute koala habitat and have not been mapped on that basis.

The mapping criteria further considers koala habitats described in the Draft National Recovery Plan for the Koala (DAWE 2021b) including forests or woodlands; roadside vegetation and paddock trees; safe intervening ground matrix for travelling between trees and patches to forage and shelter and reproduce; and access to vegetated corridors or paddock trees to facilitate movement between patches. Vegetated corridors and areas of safe intervening ground matrix (i.e. where trees or refugial vegetation are less than 50 m apart and located less than 300 m from watercourses and vegetated fence lines) providing for travelling between trees and patches to forage and shelter and reproduce have been incorporated within the 'patchy and sparsely distributed woodlands' category. Individual, isolated paddock trees are included for completeness.

Areas of open ground within the remaining contiguous landscape that occur more than 300 m from vegetated corridors have not been mapped. These 'balance' areas do not provide a safe passage (intervening ground matrix) for travelling between trees in the context of the local landscape, where there is a high incidence of dog attacks on sheep and an abundance of linear corridors that offer safe pathways for koala movement through the landscape. While dispersing male koalas may move through these inhospitable areas, the Project will not impact on koalas' capacity to disperse through those areas for the following reasons:

- Access tracks developed will be similar in nature to farm tracks and roads already traversing the Project area
- The Project will impose no fencing or other physical barriers to koala movement
- Vegetation clearing in these areas will be limited to clearing of pasture grass
- There will be no increase in vehicular traffic from current levels during the operation phase and appropriate controls established during construction.

Areas of open ground within the contiguous landscape are not considered further.


Criteria used to map koala habitat is presented in Table 5-1.



This approach and methodology has been progressed from the koala habitat definition in EPBC 2020/8755 based on further targeted surveys (Section 5.1.2), discussions with DAWE and review and specialist advice from Dr David Dique.


Dr Dique was commissioned to independently review the ecological assessments, undertake a site visit and engage with DAWE in order to provide advice and recommendations with regard to defining koala habitat within the Project area. Dr Dique's recommendations have been adopted as presented herein.

Dr Dique is a Principal Ecologist and a recognised specialist in koala ecology, research, conservation and management planning and has played key roles on expert panels for State and Federal Governments in koala management policy, including developing the Queensland koala habitat mapping, participation as an invited expert on a panel for the review of the status of koalas in Australia and contributing as an invited expert to the development of the EPBC Act koala referral guidelines.

Table 5-1 Criteria used to map koala habitat within the Project area

Habitat type	Definition and mapping criteria	Representative vegetation
<p>Remnant and non-remnant forest and woodland</p>	<p>All vegetation meeting the Specht (1970) definition of forest, woodland or open woodland that contains koala food trees including <i>Eucalyptus tereticornis</i>, <i>E. populnea</i>, <i>E. crebra</i>, <i>E. chlorochlada</i>, <i>E. sideroxylon</i>, <i>E. fibrosa</i> subsp. <i>nubilis</i>, <i>E. conica</i>, <i>E. macrocarpa</i>, <i>E. moluccana</i>, <i>E. meliodora</i>, <i>E. camaldulensis</i>, <i>E. dealbata</i>, <i>E. albens</i>, <i>Angophora leiocarpa</i> or <i>Corymbia citriodora</i> subsp. <i>variegata</i>.</p> <p>Mapping was based on field verified RE mapping, verified at 70 locations, mapping all remnant and high value regrowth for the following RE communities which contain the koala food trees listed above as a diagnostic criteria: 11.3.2, 11.5.1, 11.5.4, 11.7.7, 13.3.4, 13.3.5, 13.11.3, 13.11.5, 13.11.6, 13.11.8 and field-based observations at quaternary sites and rapid fauna sites and interpretation of aerial imagery.</p> <p>To assist in understanding the way that koalas utilise the Project area, areas of remnant woodland were differentiated into high, moderate and low value koala habitat based on the results of faecal pellet searches using the Spot Assessment Technique (SAT) (Phillips and Callaghan 2011) where:</p> <p>High value habitat: Connected polygons of koala habitat within 2 km of a SAT search where koala pellets were found beneath >10 percent of trees searched</p> <p>Moderate value habitat: Connected polygons of koala habitat within 2 km of a SAT search where koala pellets were found beneath 3-10 percent of trees searched</p> <p>Low value habitat: Remnant woodland koala habitat with no koala scats found in SAT searches within 2 km.</p>	

Habitat type	Definition and mapping criteria	Representative vegetation
<p>Patchy, sparsely distributed or non-remnant woodland</p>	<p>Areas mapped included advanced regrowth (non-remnant) vegetation meeting the Specht (1970) definition of forest, woodland or open woodland that contained koala food trees listed for remnant woodland above.</p> <p>The Specht (1970) definition of woodland applied to sparsely distributed woodland (i.e. where the foliage cover of the tallest plant layer is between 10 -30 percent).</p> <p>This category also included and mapped areas of isolated koala habitat trees that occur:</p> <ul style="list-style-type: none"> - Within 50 m of one another (i.e. approximately 4 trees per ha) with a minimum patch size of 1 ha. This included both mature and juvenile koala food trees - Along lines of landscape connectivity (i.e. within 300 m of watercourses or along vegetated fenclines). <p>Habitat was mapped from field-based observations at 654 quaternary sites and 574 rapid fauna sites and interpretation of aerial imagery.</p>	
<p>Shrubland with emergent koala habitat trees</p>	<p>Vegetation meeting the Specht (1970) definition of shrubland, dominated by regrowth <i>Eucalypt</i> or mature <i>Acacia/Callitris</i> that contained at least one emergent koala food tree per hectare.</p> <p>Emergent trees were considered to be trees that are higher than the maximum height range of the dominant canopy tree layer.</p> <p>Shrubland areas were mapped to a minimum resolution of 1 ha. This was undertaken from field observations at 70 quaternary sites and 92 rapid fauna sites and interpretation of aerial imagery.</p>	

Habitat type	Definition and mapping criteria	Representative vegetation
<p>Isolated koala trees within the contiguous landscape</p>	<p>The remaining balance area represents cleared sheep-grazing land, located more than 300 m from watercourses and other points of landscape connectivity (i.e. fence lines or koala habitat) where isolated koala trees occur at very low densities. These areas align with the Specht (1970) definition of <i>very sparsely distributed woodland</i>, where trees account for < 10 percent of foliage cover.</p> <p>While isolated trees are not included in the inland definition of koala habitat outlined in the Referral guideline for the vulnerable koala (DoE 2014), a conservative approach has been adopted and isolated koala trees that could be utilised by transient koalas and would be considered non-juvenile koala habitat trees (i.e. a tree more than 4 m high or with a trunk circumference of more than 31.5 cm at 1.3 m above the ground) (Queensland Environmental Offsets Regulation 2014) are identified.</p> <p>These isolated trees could be utilised by koalas that would move through the area from time to time. While impact on paddock trees can generally be avoided, a conservative approach has been taken and an estimated loss of paddock trees based on their density in the landscape has been calculated.</p> <p>The density of non-juvenile koala trees was estimated using visual inspection of high-resolution aerial imagery, with tree densities estimated from ten randomly selected 1.5 km² plots. While the average tree density was 1.35 trees/ha, the maximum tree density in any single plot (2.70 trees/ha) was used to calculate the number of non-juvenile koala food trees. In order to derive an estimated area of koala habitat (paddock trees) within the Project area and Project footprint, an accepted area of 0.004 ha (40m²) is attributed per tree as the total area of impact for a single non-juvenile koala habitat tree. This is based on the average tree density of 250 trees per hectare for koala bushland habitat in Southeast Queensland as reported in the Queensland Environmental Offsets Policy (DES 2020).</p>	

5.1.4 Desktop results

The koala was identified within the PMST (Appendix B) as known to occur within a 20 km radius from a central point within the Project area.

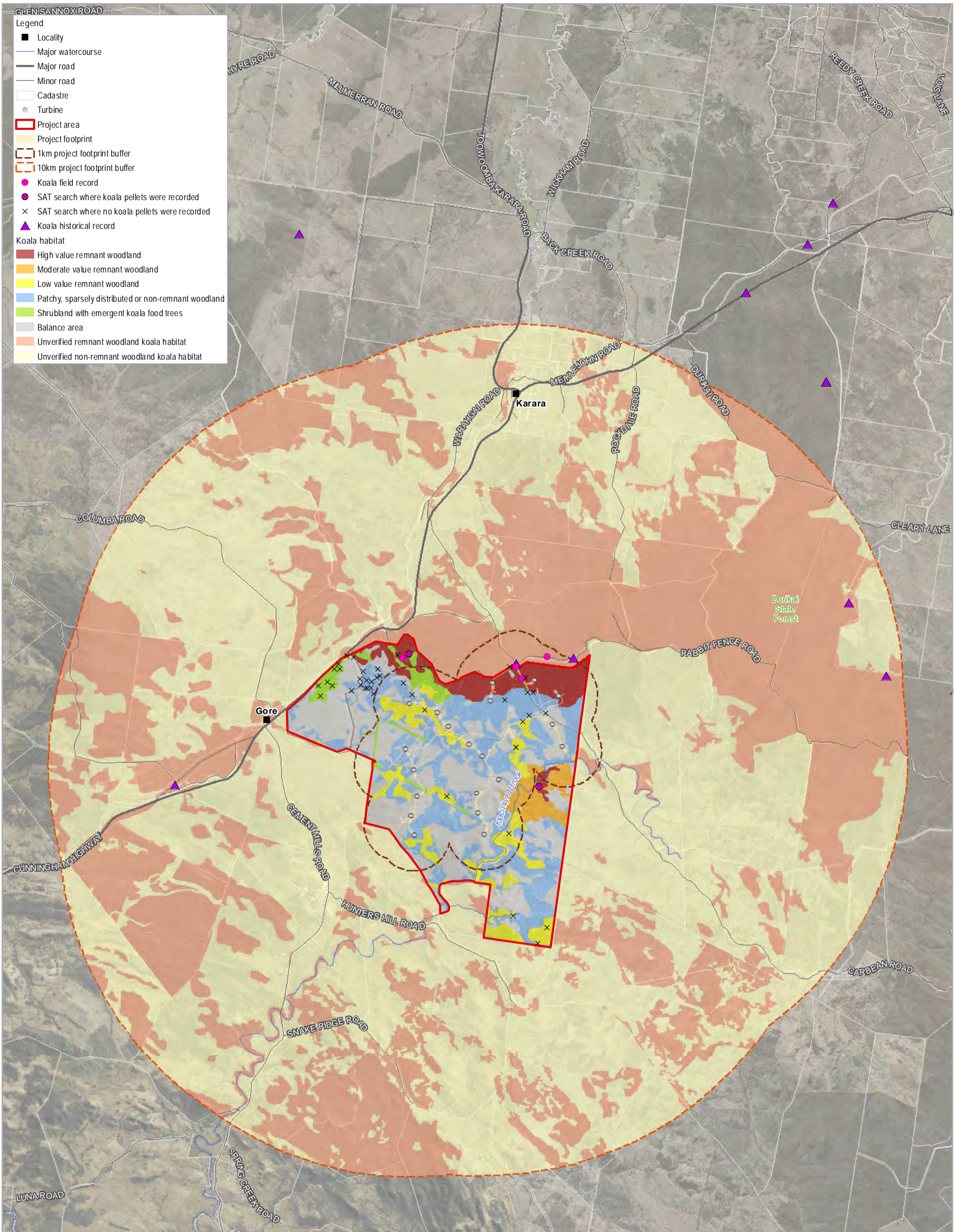
The distribution of historical koala records and DoR mapped essential habitat for the koala on and adjacent to the Project area is mapped in Figure 5.2. Two polygons of essential habitat for the koala area mapped within the Project area. These are buffered around historical koala records on the northern boundary adjacent to Durikai State Forest.

There are 20 historical records of koalas from Durikai State Forest (Wildlife Online). These are all relatively recent records dating between 1994 and 2013. These records are located within remnant woodland in RE 13.11.5, 13.11.6 and 13.11.8; among three RE communities used to map remnant koala habitat within the Project area (Table 5-1). While the population size is unknown and there is insufficient data on local changes in koala numbers over time to assess population stability, the extent and connectivity of habitat and the relative abundance of records and observations during this assessment suggest it is likely to be a healthy and viable population. Given the high level of agricultural land clearing within the broader landscape, Durikai State Forest is likely to have high values for the koala. Based on the abundance of records, remnant woodland habitat in both the Project area and surrounding landscape is considered important for the recovery of the species.

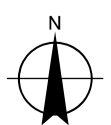
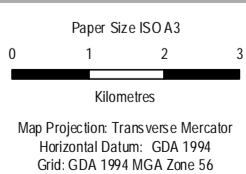
5.1.5 Survey results

5.1.5.1 Koala records

The koala was confirmed present from six locations within or immediately adjacent to the Project area as shown in Figure 5.3. Koalas were recorded from five locations along the northern boundary of the Project area within mature box ironbark woodland, adjacent to Durikai State Forest (Plate 5-1), this included three koala sightings and two locations with fresh koala faecal pellets (Plate 5-2). Fresh koala pellets were also observed from woodland fringing Macintyre Brook. A koala carcass was observed along Carbean Road, 1 km north of the Project area in an area fringed by remnant box-ironbark woodland in Durikai State Forest.



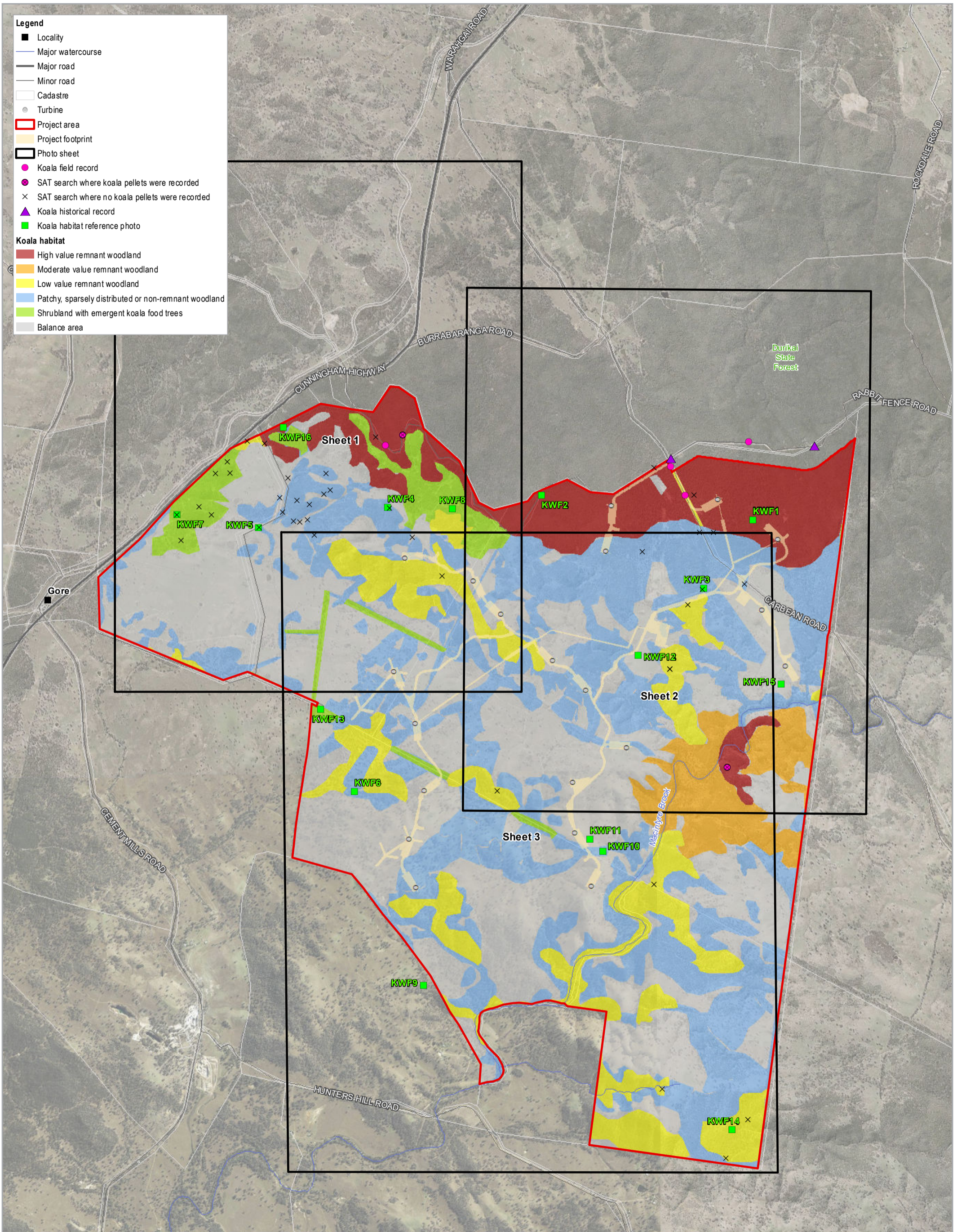
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 In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.



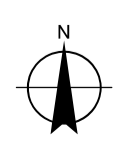
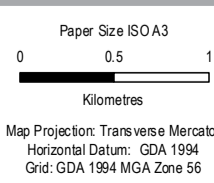
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 MNES Assessment Report
Distribution of koala habitat and records adjacent to the project area

Project No. 12525037
 Revision No. 0
 Date 09/08/2021

FIGURE 5-2



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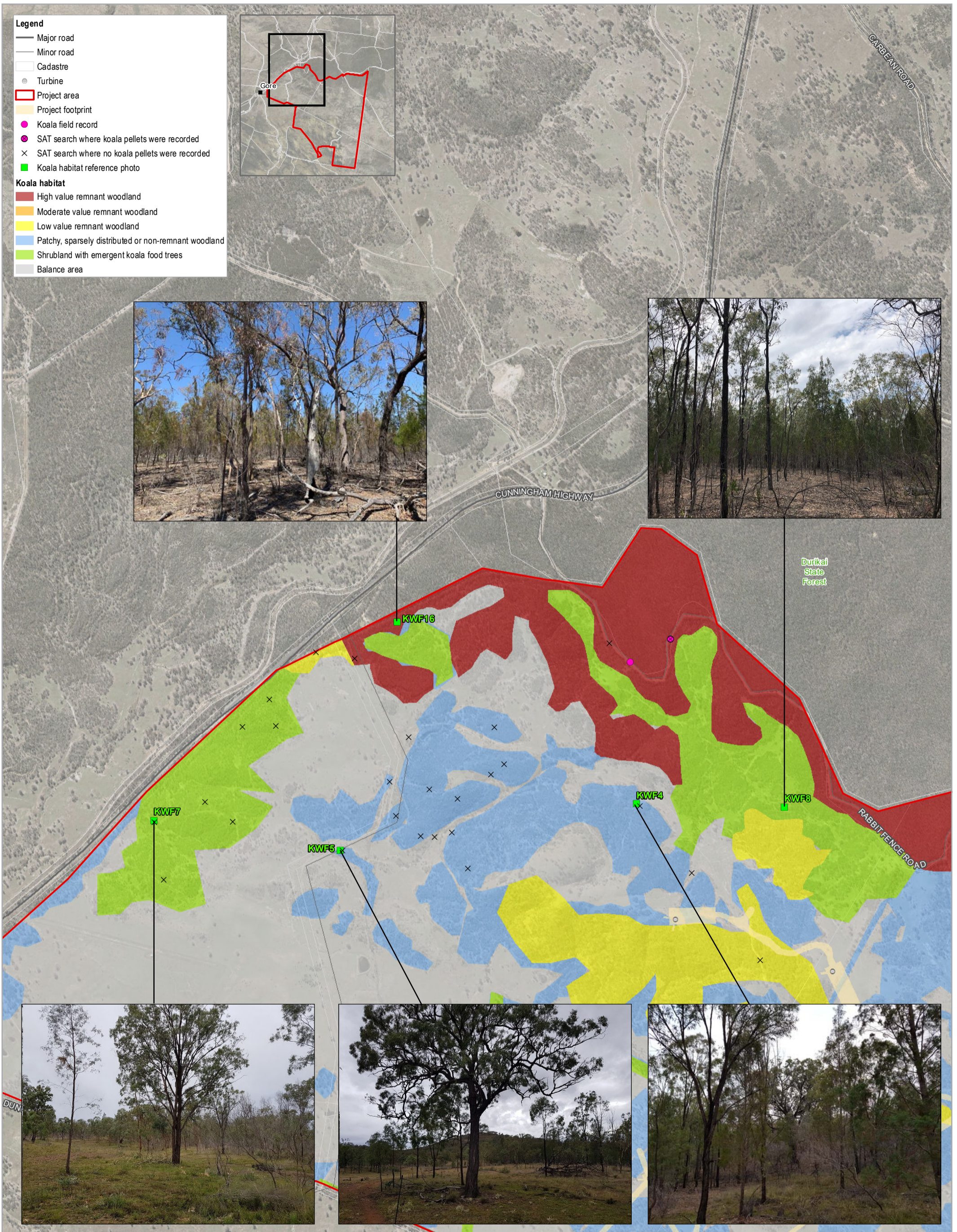


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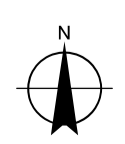
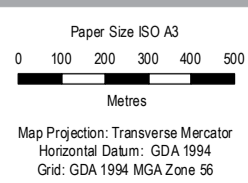
**Distribution of koala habitat
 and confirmed records for koala
 within the project area**

Project No. 12525037
 Revision No. 0
 Date 09/08/2021

FIGURE 5-3



Based on or contains data provided by the State of Queensland 2021.
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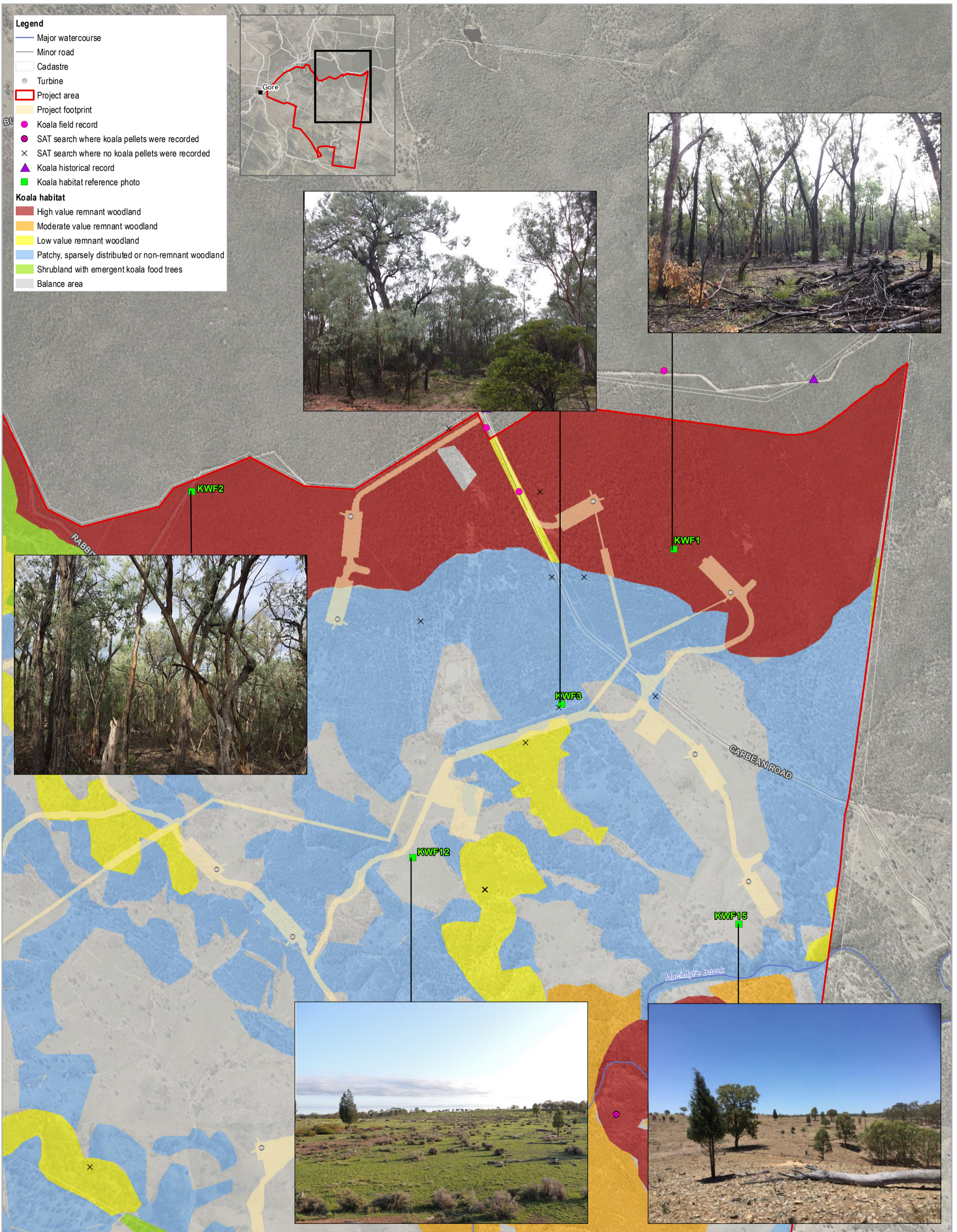


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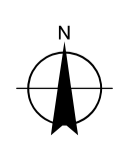
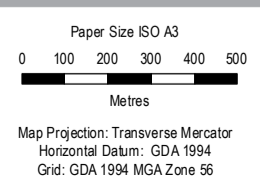
Distribution of predicted habitat and confirmed records of the koala within the project area

Project No. 12525037
 Revision No. 0
 Date 3/08/2021

Sheet 1
FIGURE 5-3



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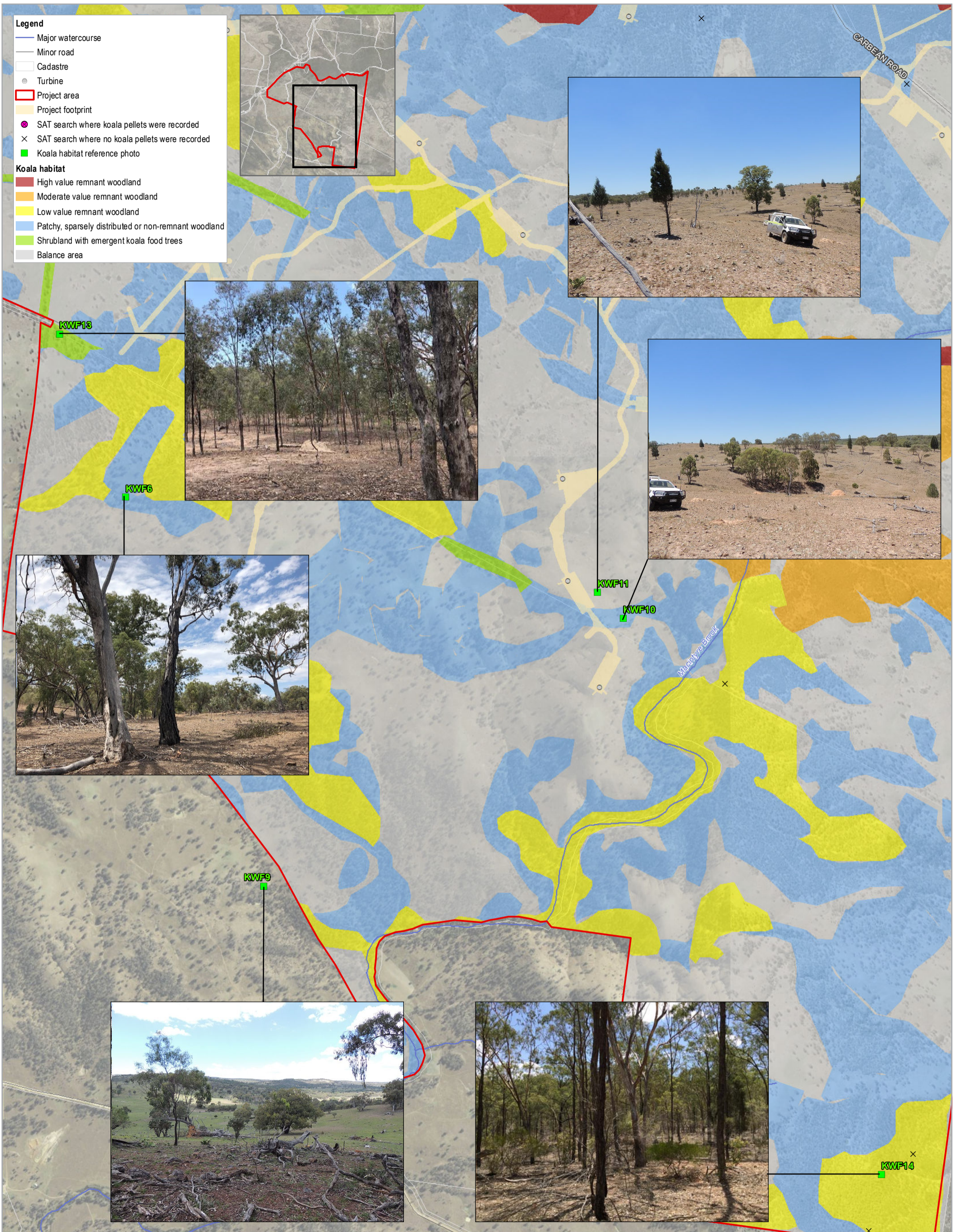


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 MNES Assessment Report

Distribution of predicted habitat and confirmed records of the koala within the project area

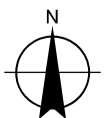
Project No. 12525037
 Revision No. 0
 Date 9/08/2021

Sheet 2
FIGURE 5-3



Based on or contains data provided by the State of Queensland 2021.
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Paper Size ISO A3
 0 100 200 300 400 500
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



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 MNES Assessment Report
Distribution of predicted habitat and confirmed records of the koala within the project area

Project No. 12525037
 Revision No. 0
 Date 9/08/2021

Sheet 3
FIGURE 5-3



Plate 5-1 *Koalas observed within the Project area*



Plate 5-2 *Koala faecal pellets observed within the Project area*

5.1.5.2 Distribution of koala habitat within the Project area

Suitable koala habitat is broadly mapped across the Project area. High and moderate value remnant woodland koala habitat occurs in patches along the north of the Project area, adjacent to Durikai State Forest and along Macintyre Brook. Small patches of regrowth at the north-west of the Project area were mapped as shrubland with emergent koala habitat trees. A large number of scattered polygons of patchy, sparsely or non-remnant woodland koala habitat occur throughout the Project area providing east-west habitat connectivity across the mid-north of the Project area and north-south connectivity along Macintyre Brook.

Although the Project area has been subject to substantial historical vegetation clearing for sheep grazing, substantial functional connectivity has been retained along MacIntyre Brook, Muckingboy Creek and other watercourses, some fence lines and between some patches of woodland. Research has shown that in such environments, koalas typically move along convoluted pathways through areas of functional connectivity, as this reduces their energetic costs and predation risks (Rus et al 2020). Patches of sparsely distributed non-remnant woodland along fence lines and watercourses have been identified across the Project area, in areas of cleared land that occur between areas of higher quality habitat, which provide lines of functional connectivity. These areas are considered important for facilitating koala movement. Along these linear corridors, areas of open ground that provide safe passage between patches of vegetation are likely to be important for koala movement.

Open paddocks within the remaining contiguous landscape retain isolated koala trees in very low densities. While koalas are capable of moving large distances across open ground, and could technically reach isolated trees in open paddocks, the findings of Rus et al (2020) suggest that koalas typically only do this in very fragmented environments where there is no alternative movement pathway. Given local landholders have reported sheep attacks by wild dogs and vegetated corridors are widely available within the Project area, koala movement across open ground would represent a rare occurrence likely related to dispersal of male koalas. Male koala dispersal is a fundamentally dangerous activity that takes koalas through inhospitable terrain, typically resulting in increased mortality rates (Dique et al 2003; Dexter et al 2018). While koalas can move through inhospitable areas, they do not provide habitat and perform no other function at other times of the year.

The distribution of koala habitat (as defined in Section 5.1.3) within the Project area is shown in Figure 5.3. Representative photos of each habitat type are shown in Plate 5-3 to Plate 5-7.



Plate 5-3 *Remnant koala woodland koala habitat*



Plate 5-4 *Non remnant woodland koala habitat*



Plate 5-5 *Patchy, sparsely distributed woodland koala habitat*



Plate 5-6 Shrubland with emergent koala food trees



Plate 5-7 Isolated koala trees within the contiguous landscape

5.1.6 Significance of project footprint

This section assesses the significance of koala habitats within the Project area, whether they constitute habitat critical to the survival of the species, their importance in the context of the local population and whether the local population is important at a national level.

5.1.6.1 Status as an important population

The concept of ‘important populations’ has not been applied to the koala, given the lack of sufficient information on regional population status throughout its national range (DoE 2014a). Nevertheless, the densities of koalas and koala habitat within the Project area would suggest the local population is likely to have regional significance in sustaining koala numbers.

5.1.6.2 Status as habitat critical to the survival of the species

The definition of habitat critical to the survival of the koala is formally defined in the Referral guidelines for the vulnerable koala (DoE 2014) as habitat scoring five or more using the habitat assessment toolkit.

Koala habitat mapped within the Project area scored nine and represents habitat critical to the survival of the koala based on the following assessment as shown in Table 5-2. It should be noted that there is variation in the condition and utilisation of koala habitat across the Project area, as shown in the areas of low, moderate and high value habitat mapped in Figure 5.3. As the Referral guidelines for the vulnerable koala (DoE 2014) state that one habitat assessment score should be applied to a Project area, all habitat including low, moderate and high value areas has been scored as +9 and all mapped habitat consequently represents habitat critical to the survival of the koala.

Table 5-2 Koala habitat assessment score

Criteria	Score	Description
Koala occurrence	+2	Evidence of one or more koalas within the last year
Vegetation composition	+2	Forest, woodland or shrubland with emerging trees with two or more known koala food tree species present
Habitat connectivity	+2	Area is part of a contiguous landscape \geq 1000 ha
Key existing threats	+1	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack in areas that score one or two for koala occurrence
Recovery value	+2	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context
Total	9	

In total, 2,769.41 ha of koala habitat, representing habitat critical to the survival of the species is mapped across the Project area comprising:

- 1,151.62 ha remnant and non-remnant forest and woodland
- 446.81 ha of high-value remnant and non-remnant forest and woodland habitat
- 207.94 ha of moderate remnant and non-remnant forest and woodland habitat
- 496.87 ha of low value remnant and non-remnant forest and woodland habitat
- 1,427.89 ha of patchy, sparsely distributed or non-remnant woodlands
- 170.07 ha of shrubland with emergent koala food trees
- 19.83 ha of isolated koala trees in the contiguous landscape.

5.1.6.3 Context of the local koala population

The koala population within the Project area and adjoining Durikai State Forest is likely to have high regional importance. As shown on Figure 5.2, large areas of intact koala habitat occur within Durikai State Forest immediately north of the Project area. Mature box-ironbark woodland occurs within the northern boundary of the Project area providing habitat for the koala. While habitat within the Project area (Figure 5.3) has been extensively cleared for sheep grazing, substantial functional connectivity has been retained. Macintyre Brook, Muckingboy Creek and a number of smaller watercourses retain riparian woodland that provide habitat and functional connectivity for koala movement. The Project area is located in a contiguous landscape (i.e. > 500 ha). Areas of cleared rural land with few trees that would act as natural barriers to koala movement occur approximately 30 km north and west and 10 km east and south of the Project area.

Based on the relative abundance of recent historical records from within Durikai State Forest and the quality of vegetation, this habitat is likely to be important for the recovery of the species. While the population size is unknown and there is insufficient data on local changes in koala numbers over time to assess population stability, the extent and connectivity of habitat and the relative abundance of records and observations during this assessment suggest it is likely to be a healthy and viable population, important for the persistence of the species in a region that has been heavily impacted by historical land clearing for agriculture.

5.1.7 Threatening processes

Koala populations within eastern Australia have suffered decline due to a number of threats, these include (DAWE 2012):

- Habitat loss, fragmentation and degradation
- Mortality from vehicles strikes and dog attacks
- Spread of disease
- Drought impacts.

5.1.8 Potential impacts

Potential impacts on koala populations and koala habitat (as defined in Section 5.1.3) within the Project area include:

- Loss of habitat
- Barrier effects and restriction of koala movement
- Injury and mortality
- Habitat degradation by increased dust run-off and sedimentation
- Introduction and spread of pest fauna species

Potential impacts are discussed in sections below. Mitigation and management control measures are provided in Section 5.1.9.

5.1.8.1 Loss of habitat

Clearing within the Project footprint will result in the loss of in the order of 52.40 ha of koala habitat. This is as a result of the cumulative loss of discrete localised and/or narrow linear clearing footprints dispersed over a broad area. All defined koala habitat in the Project area is habitat critical to the survival of the koala. The loss of habitat represents 1.89 percent of koala habitat within the Project area and comprises:

- 18.68 ha of remnant and non-remnant forest and woodland habitat
- 12.86 ha of high value remnant and non-remnant forest and woodland habitat representing 2.88 percent of that in the Project area
- 5.82 ha of low value remnant and non-remnant forest and woodland representing 1.17 percent of that in the Project area
- 32.65 ha of patchy, sparsely distributed or non-remnant woodland representing 2.29 percent of that in the Project area
- 0.40 ha of shrubland with emergent koala food trees representing 0.24 percent of that in the Project area.
- 0.67 ha of isolated koala trees within the contiguous landscape.

5.1.8.2 Barrier effect and restriction of koala movement

Habitat loss within the Project area is not expected to impact connectivity with surrounding koala habitat as the habitat losses will be localised and from a dispersed area and will not create new large gaps that present new barriers to koala movement. The Project area is located within a contiguous landscape which despite having high levels of existing land-clearing for agriculture, maintains high functional connectivity along vegetated watercourses, fence lines and scattered patches of woodland habitat. Given the dispersed nature of the infrastructure and the absence of fencing and other potential barriers, the Project is unlikely to restrict koala movement.

Large areas of habitat within Durikai State Forest, and vegetation corridors to the north that connect the Project area to regional koala populations, will not be impacted. Adjacent areas of habitat are not likely to be subject to intensification of ongoing impacts. Impacts from increased levels of dust, runoff or sedimentation are likely to be localised at the Project footprint and will be managed through the proposed mitigation and management measures as contained in the CMP (GHD, 2020a). No new perimeter or internal fencing is proposed that would restrict koala movement. Access tracks have as far as possible been located within existing cleared areas or in alignment with existing farm tracks. New and augmented access will be functionally similar in nature to farm tracks that traverse the landscape and do not impede koala movement.

5.1.8.3 Injury and mortality

Vegetation clearance during construction of the Project has the potential to cause injury and mortality to koalas. The koala has a heightened risk of injury or mortality as a result of its local abundance and relatively slow movement. Entrapment within excavations poses an additional threat to the koala. These risks can be effectively mitigated by implementing strict controls during construction.

Construction related activities have the potential to attract dogs (and other pests) (Section 5.1.8.5). Construction of new access tracks may provide pathways for movement for dogs in particular within and across the Project area. However, the presence of farm tracks and cleared areas are already extensive and dogs are prevalent within the Project area. Loss of habitat could increase exposure to mortality by increasing gaps (albeit narrow) between patches of koala habitat. Koalas would already face a high threat of dog attack when moving through cleared grazing land areas due to the distance from refugial habitat. Proposed predator controls have the potential to reduce the incidence of dog attacks on koalas.

Increased traffic movements during construction have the potential to impact on koala through injury and mortality. Appropriate practices and controls are proposed. The Project is unlikely to cause any substantial injury or mortality of koalas during the operation phase or restrict koala movement between habitat patches in and adjacent to the Project area given the minimal vehicle movements required during the operational phase of the project (i.e. estimated average of one to two vehicle movements on any given access track per day). For areas in the contiguous landscape, impacts attributed to permanent and temporary infrastructure have been assessed together due to similarity in the responses.

5.1.8.4 Habitat degradation by increased dust, run-off and sedimentation

Construction activities have the potential to generate localised dust, erosion, run-off and sedimentation through increased vehicle movements, clearance of vegetation and earthworks. This can reduce the abundance and diversity of adjacent terrestrial and aquatic habitats by physically smothering vegetation, changing nutrient levels, impeding the growth and germination of plant species, encouraging weed incursions and altering the movement and behaviour of fauna species. Impacts from increased levels of dust, runoff, or sedimentation are likely to be localised at the Project footprint and can be managed through the proposed mitigation and management measures.

The Project will have no substantial impact on hydrology that could degrade the quality of koala habitat. The Project footprint is generally located in elevated areas, away from watercourses and will require minimal loss of riparian vegetation. Watercourse crossings for access tracks will utilise existing tracks wherever possible to minimise impact to watercourses. With the exception of Macintyre Brook, all watercourses are ephemeral and only experience flow following rain events. All works within the vicinity of watercourses or in areas with potential for run-off will be subject to routine erosion and sediment control measures.

5.1.8.5 Introduction and spread of pest fauna species

Injury and mortality from dog attacks is a key threat to the koala (DoE 2014). Dogs are known to attack sheep in the local area and would also present an existing threat to the local koala population. While construction activities can facilitate an increase in dog numbers through inappropriate waste disposal and the construction of new tracks which can facilitate increased local dog movement, the risks can be mitigated through routine control measures. As part of predator management, the Project will implement ongoing feral predator control and monitoring. This has the capacity to reduce the incidence of dog attacks on local koalas.

5.1.9 Measures to avoid, reduce or mitigate impacts

5.1.9.1 Loss of habitat

During the planning stage, a number of measures were employed to avoid and reduce the direct loss of habitat, including for the koala (Section 1.1.2). A preliminary ecological constraints assessment was undertaken to identify and avoid areas of high ecological value wherever possible. Key outcomes included:

- Avoiding large remnants of established woodland within Durikai State Forest
- Utilising existing tracks wherever possible and locating proposed new access tracks within previously disturbed areas wherever possible to avoid or minimise disturbance to vegetation and habitat.

The following measures will be implemented during construction to reduce the loss of vegetation and koala habitat:

- Land clearing will be restricted to the minimal amount necessary for the construction of the Project and will not extend outside of the Project footprint.
- The extent of vegetation clearing (and no-go areas) will be clearly identified on construction plans and in the field using high visibility fencing or flagging in the vicinity of high conservation significant areas. Clearing extent will be communicated to construction supervisors. If fencing or flagging is in poor condition, it will be replaced as soon as practicable to reduce the potential of accidental clearing
- Consistent with the Preliminary Fauna Management Plan prepare a Fauna Management Plan to establish the environmental management framework for managing impacts on fauna and fauna habitat.
- Where infrastructure must cross waterways, areas of existing disturbance (i.e. existing tracks) have been selected. Where this is not practicable, the Project footprint will be minimised and large habitat trees will be preferentially retained. Clearing will not extend outside of the Project footprint.
- Site offices, construction stockpiles and laydown/storage areas will be located within existing cleared or disturbed areas.
- Rehabilitation of temporary construction areas will be undertaken sequentially and as soon as practicable after clearing.
- Rehabilitation of temporary laydown areas, stockpiles, site offices and areas will be undertaken as soon as practicable after these facilities are no longer required.
- A CMP has been prepared to inform actions with regard to managing weed hygiene, erosion, fuels and hazardous substances, fire, etc. and includes erosion and sediment control measures
- All construction personnel shall attend environmental training as part of the site induction process prior to entering the work site. As part of this training, all personnel will be instructed on their obligations in regard to vegetation clearing protocols. Areas identified for vegetation clearance are to be clearly defined and detailed in site inductions.

5.1.9.2 Barrier effects and restriction of koala movement

The following measures will be implemented to minimise barrier effect and restriction of koala movement during construction of the Project:

- Weed management actions are included in the CMP and include:
 - Hygiene protocols restricting the movement of vegetation and soil between impacted areas and areas of significantly lower weed infestation.
 - Protocols for monitoring and management of weeds to identify and appropriately respond to significant changes in weed distribution and density
- All construction vehicles/equipment travelling from declared weed areas will undertake a wash down and possess a current weed hygiene inspection certificate from an accredited inspection station that is required to carry as evidence of quarantine clearance.

- Land clearing will be restricted to the minimal amount necessary for the construction of the Project and will not extend outside of the Project footprint.
- Removal of all temporary fencing after works
- Location of temporary infrastructure located outside areas of linear connectivity where koalas are likely to move to avoid any barrier effects
- Construction laydown areas and stockpiles are limited to areas that have previously been cleared to minimise unnecessary clearing
- Temporary construction areas will be rehabilitated as soon as practicable after the completion of construction works to reconnect fragmented habitats.

Impacts on koala during operations are negligible. Fencing is not proposed outside of small, localised areas housing sub-stations and as required to protect koala from entrapment. Access tracks and other linear infrastructure will not preclude movement. Operational activities are limited to one to two utility movements daily; activities that are consistent with current farming activities undertaken within the Project area.

Management of pest fauna is discussed in Section 5.1.9.5 below.

5.1.9.3 Injury and mortality

The following measures will be implemented to minimise injury and mortality during construction:

- Pre-clearance surveys will be undertaken to mark the locations of predicted koala habitat trees and will target specific areas of known and predicted habitat.
- All clearing will be supervised by suitably qualified and experienced fauna spotter-catchers. This will involve searching trees prior to clearing and relocating any resident koalas to the nearest suitable, safe habitat outside the clearing footprint.
- Temporary exclusion fencing will be established around cleared areas in locations of high ecological sensitivity to prevent koalas from returning to work areas where deemed appropriate by the fauna spotter-catcher.
- Employment of sequential clearing practices and use of suitably qualified koala spotters in accordance with the Queensland Nature Conservation (Koala) Conservation Plan 2017 for reducing impact on koalas, including:
 - Clearing of koala habitat trees is carried out in a way that ensures koalas in the area being cleared have enough time to move out of the clearing site without human intervention, including, in particular, for clearing sites with an area of more than 3 ha, by carrying out the clearing in stages; and ensuring not more than the following is cleared in any one stage:
 - For a clearing site with an area of 6 ha or less – 50 percent of the site's area
 - For a clearing site with an area of more than 6 ha – 3 ha or three percent of the site's area, whichever is the greater
 - Ensuring that between each stage and the next there is at least one period of 12 hours starting at 6 p.m. on a day and ending at 6 a.m. on the following day during which no trees are cleared on the site
 - Clearing of the koala habitat trees is carried out in a way that ensures, while the clearing is carried out, appropriate habitat links are maintained within the clearing site and between the site and its adjacent area, to allow koalas living on the site to move out of the site
 - No koala habitat tree in which a koala is present, and no koala habitat tree with a crown overlapping a tree in which a koala is present, is cleared.
- Restricting clearing to daylight hours only during the koala breeding season (September – November)
- Establishing no-go areas
- Restricting vehicle movements to designated areas within the Project footprint
- Establishing and enforcing speed limits. Vehicles to be restricted to 40 km/hr along access tracks.
- Signage in koala habitat areas

- Adverse incident response procedures will be developed to detail actions to be taken in the event of wildlife injury or mortality during clearing.
- A Traffic Management Plan, consistent with objectives and controls described in the transport and road network mitigation measures of the CMP, will be developed for the Project with designated access routes, speed limits and identified sensitive ecological areas
- The CMP includes protocols to limit injury and mortality to the koala, including management of risks associated with open excavations, trenching, waterbodies and responses and reporting for roadkill and adverse incident protocols.

The following measures will be implemented to minimise injury and mortality to the koala during operation of the Project:

- A Traffic Management Plan, consistent with objectives and controls described in the transport and road network mitigation measures of the CMP, will be developed for the Project with designated access routes, established and enforced speed limits and identified sensitive ecological areas and no-go areas
- Prepare and implement a pest (feral animal) management plan, including wild dog abatement plan in consultation with landholders
- Erecting koala-proof fencing around localised danger points, such as sub-stations.

5.1.9.4 Habitat degradation by dust, run-off and sedimentation

The following mitigation measures will be used to minimise the impacts of dust, run off and sedimentation for the Project:

- Erosion and sediment controls have been developed as part of the CMP.
- Routine dust suppression and monitoring will be undertaken throughout construction and operation.
- Erosion and sediment control measures will be installed where in-stream disturbance must be undertaken during flow conditions.
- Areas subject to clearing will be stabilised as soon as practicable.
- All vehicle movement will be restricted to designated tracks located within the Project footprint.
- Weather conditions will be monitored during the construction stage and temporary controls will be established during extreme weather events.
- Construction activities during adverse weather conditions will be managed in accordance with construction the CMP
- Duration of in-stream works will be minimised wherever practicable to reduce the potential for sedimentation.
- Rehabilitation of temporary construction areas will be undertaken as soon as practicable after clearing once these facilities are no longer required (subject to agreement with the landowner). While commitment is made to rehabilitation in keeping with good practice and will be undertake, given the outcomes of rehabilitation cannot be confirmed or guaranteed at this time and are subject to detailed design and construction planning, conservatively, all koala habitat within the Project footprint is for the purpose of the assessment taken to be a loss.

5.1.9.5 Introduction and spread of pest fauna species

The following mitigation measures will be used to minimise the introduction and spread of pest fauna species for the Project:

- Responsible waste management practices (e.g. not leaving out food waste and not feeding wildlife) will be implemented and followed by all construction personnel. All waste will be stored in secure temporary holding containers and transported off site.
- Waste management actions are included in the CMP and include:
 - Requirements for details on the location and specifications for disposal and removal of waste from the construction site.

- All putrescible waste to be stored in secure temporary holding containers and transported off site.
- Implement a pest (feral animal) management plan, including wild dog abatement plan in consultation with landholders
- Sightings or evidence of pest animals will be recorded during construction within a pest register. If increased densities of pest animals are observed, or new pest animals are identified, humane pest controls will be implemented to manage numbers.
- Construction staff will not bring domestic animals into the Project area.
- All construction personnel shall attend environmental training as part of site inductions. As part of this training, all personnel will be instructed on their responsibilities related to avoiding and minimising the introduction/attraction to the construction site of feral animals.

5.1.9.6 Summary of residual impacts on koalas

A summary of the Project's residual impacts on the koala is detailed in Table 5-3. Most Project impacts will be effectively mitigated to low or negligible levels for all habitat types. The risk ratings are presented in Appendix E. A residual impact remains for the clearance of 52.40 ha of vegetation (representing 1.89 percent of habitat within the Project area) within the following habitat types:

- 12.86 ha of high value remnant and non-remnant forest and woodland habitat representing 2.88 percent of that in the Project area
- 5.82 ha of low value remnant and non-remnant forest and woodland representing 1.17 percent of that in the Project area
- 32.65 ha of patchy, sparsely distributed or non-remnant woodland representing 2.29 percent of that in the Project area
- 0.40 ha of shrubland with emergent koala food trees representing 0.24 percent of that in the Project area
- 0.67 ha of isolated koala trees within the contiguous landscape

Despite the magnitude of loss, the nature of the Project and the dispersed distribution of higher-value habitat loss means that substantial consequences for the koala population on and adjacent to the Project area are largely avoided.

Direct impacts on grassland areas within the contiguous landscape will not adversely impact the ecological function of those areas for koalas, as they will not present a physical barrier to koala movement or increase risks to koalas during operation of the Project. Based on the low levels of noise and light and other potential sources of disturbance, the proposed infrastructure is unlikely to present an indirect deterrent to koala movement through the contiguous landscape. Temporary infrastructure will be located in open areas as far as practicable. Localised infrastructure will be predominantly located outside of linear habitat areas to avoid any barrier effects.

Table 5-3 Assessment of impacts on koalas and koala habitat imposed by each infrastructure type

Habitat type	Infrastructure type	Potential impacts	Risk rating	Mitigation measure	Residual impact	Residual risk rating
Remnant woodland Non remnant woodland Patchy and sparsely distributed koala trees Shrubland with emergent koala habitat trees	Permanent localised footprints Wind turbines Sub-station Met masts Operation/maintenance facility	Permanent loss of habitat <ul style="list-style-type: none"> – Turbine footprint (20 x 3.8 ha) – Sub-station (1 x 4 ha) – Met mast footprint (2 x 0.09 ha) – Operation/maintenance facility (1 x 1 ha) 	Extreme	Clearing limits restricted to within the Project footprint	Permanent loss of 26.99 ha of koala habitat from permanent localised infrastructure	High
		Injury/mortality during construction: <ul style="list-style-type: none"> – Construction vehicle movements – Vegetation clearing – Entrapment/entanglement 	High	Clearing supervised by spotter-catchers – at-risk koalas relocated before clearing Sequential clearing Restricting clearing to daylight hours only during the koala breeding season (September – November) Establishing no-go areas Restricting vehicle movements to designated areas Establishing and enforcing speed limits Signage in koala habitat areas	Low residual impact – injury/mortality of individual koalas expected to be avoided entirely or very rare	Low
		Injury/mortality during operation due to: <ul style="list-style-type: none"> – Vehicle movements (on average 1-2 per day) – Entrapment in infrastructure 	Moderate	Establishing no-go areas Establishing and enforcing speed limits Erecting koala-proof fencing around localised danger points	Low residual impact – injury/mortality of individual koalas expected to be very rare	Low

Habitat type	Infrastructure type	Potential impacts	Risk rating	Mitigation measure	Residual impact	Residual risk rating
		Increase in dog attacks during the operation phase Creation of new roads/tracks has the potential to attract dogs. However as tracks are already extensive and dogs are prevalent within the Project area, the Project is unlikely to exacerbate that threat. Loss of habitat could increase exposure to mortality by increasing gaps between patches of koala habitat.	Moderate	Utilise existing tracks wherever possible as included in the Project footprint Implement pest (feral animal) management plan, including wild dog abatement plan in consultation with landholders Waste management plan	Low residual risk of dog attack	Low
		Barrier effects – localised restriction of koala movement	Low	Limiting fencing to small areas of operation and maintenance infrastructure	No restriction on koala movement	Negligible
		Introduction and spread of disease: The Project is unlikely to cause an increase in the incidence or transmission of Phytophthora that can degrade koala habitat in some regions. The Project is unlikely to result in any increase in Chlamydia among koalas	Low	Vehicle hygiene protocols implemented during construction	Negligible impact due to disease transmission	Negligible
		Introduction and spread of weeds Movement of construction vehicles has the potential to introduce and spread weeds that could restrict koala movement and degrade the quality of future habitat	Moderate	Vehicle hygiene protocols implemented during construction	Low residual risk of weed transmission	Low
Remnant woodland Non remnant woodland	Permanent linear footprints Access tracks	Permanent loss of habitat Access tracks (10 m width) Overhead Medium Voltage (MV) (40 m width) Underground MV (10 m width)	High	Clearing limits restricted to within the Project footprint	Permanent loss of 25.39 ha of koala habitat from permanent linear infrastructure	High

Habitat type	Infrastructure type	Potential impacts	Risk rating	Mitigation measure	Residual impact	Residual risk rating
Patchy and sparsely distributed koala trees Shrubland with emergent koala habitat trees	Overhead MV electrical reticulation Underground MV electrical reticulation	Injury/mortality during construction: <ul style="list-style-type: none"> – Construction vehicle movements – Vegetation clearing – Entrapment/entanglement 	High	<p>Clearing supervised by spotter-catchers – at-risk koalas relocated prior to clearing</p> <p>Sequential clearing</p> <p>Restricting clearing to daylight hours only during the koala breeding season (September – November)</p> <p>Establishing no-go areas</p> <p>Restricting vehicle movements to designated areas within the Project footprint</p> <p>Establishing and enforcing speed limits</p> <p>Signage in koala habitat areas</p>	Low residual impact – injury/mortality of individual koalas expected to be avoided entirely or very rare	Low
		Injury and mortality of koalas during operation associated with Vehicle movements (on average 1-2 per day) Entrapment in infrastructure	Moderate	<p>Establishing no-go areas</p> <p>Establishing and enforcing speed limits</p> <p>Vehicle movements restricted to daylight hours</p>	Low residual impact potential for very rare injury/mortality of individual koalas	Low
		Increase in dog attacks during operation phase Creation of new roads/tracks has the potential to attract dogs. However, as tracks are already extensive and dogs are prevalent within the Project area, the Project is unlikely to exacerbate that threat. Loss of habitat could increase exposure to mortality by increasing gaps between patches of koala habitat.	Moderate	<p>Utilise existing tracks as far as possible, as included in the Project footprint</p> <p>Develop pest (feral animal) management plan, including wild dog abatement plan in consultation with landholders</p> <p>Waste management plan</p>	Low residual risk of dog attack	Low

Habitat type	Infrastructure type	Potential impacts	Risk rating	Mitigation measure	Residual impact	Residual risk rating
		Barrier effects – localised and permanent restriction of koala movement	Low	Clearing limits restricted to within the Project footprint No fencing of linear infrastructure	No permanent restriction on koala movement	Negligible
		Introduction and spread of disease: The Project is unlikely to cause an increase in the incidence or transmission of Phytophthora that can degrade koala habitat in some regions. The Project is unlikely to result in any increase in Chlamydia among koalas	Low	Vehicle hygiene protocols implemented during construction	Negligible impact due to disease transmission	Negligible
		Introduction and spread of weeds Movement of construction vehicles has the potential to introduce and spread weeds that could restrict koala movement and degrade the quality of future habitat	Moderate	Vehicle hygiene protocols implemented during construction	Low residual risk of weed transmission	Low
Remnant woodland Non remnant woodland	Temporary localised footprints Construction compound Laydown area	Temporary loss of habitat Construction compound (1 x 1 ha) Laydown area (10 ha)	Moderate	Clearing limits restricted to within the Project footprint Reinstating areas used/disturbed by construction.	Loss of 0.02 ha of koala habitat for temporary infrastructure	Low

Habitat type	Infrastructure type	Potential impacts	Risk rating	Mitigation measure	Residual impact	Residual risk rating
Patchy and sparsely distributed koala trees Shrubland with emergent koala habitat trees		Injury/mortality during construction: <ul style="list-style-type: none"> – Construction vehicle movements – Vegetation clearing – Entrapment/entanglement 	High	Clearing supervised by spotter-catchers – at-risk koalas relocated prior to clearing Sequential clearing Restricting clearing to koala breeding season (September – November) Establishing no-go areas Restricting vehicle movements to designated areas Establishing and enforcing speed limits Signage near koala habitat areas	Low residual impact – potential for very rare injury/mortality of individual koalas	Low
		Injury/mortality during operation due to: Entrapment/entanglement in infrastructure if left in situ	Low	Removal and remediation of all temporary structures/exclusion fencing and excavations	Negligible residual impact	Negligible
		Barrier effects – localised temporary restriction of koala movement	Low	Clearing limits restricted to within the Project footprint Minimising fencing Removal of all temporary fencing after works	No restriction on koala movement	Negligible
		Introduction and spread of disease: The Project is unlikely to cause an increase in the incidence or transmission of Phytophthora that can degrade koala habitat in some regions. The Project is unlikely to result in any increase in Chlamydia among koalas	Low	Vehicle hygiene protocols implemented during construction	Negligible impact on disease transmission	Negligible

Habitat type	Infrastructure type	Potential impacts	Risk rating	Mitigation measure	Residual impact	Residual risk rating
		Introduction and spread of weeds Movement of construction vehicles has the potential to introduce and spread weeds that could restrict koala movement and degrade the quality of future habitat	Moderate	Vehicle hygiene protocols implemented during construction	Low residual risk of weed transmission	Low
Isolated trees within the contiguous landscape	Permanent localised footprints Wind turbines Sub-station Met masts Operation/maintenance facility	Minor loss of koala food trees that are likely to functionally isolated from normal koala movement areas	Negligible	Clearing limits restricted to within the Project footprint	Negligible loss of koala food trees and shelter habitat	Negligible
	Permanent linear footprints Access tracks Overhead MV electrical reticulation Underground MV electrical reticulation	Injury/mortality during construction: – Construction vehicle movements – Vegetation clearing – Entrapment/entanglement	Low	Clearing supervised by spotter-catchers – at-risk koalas relocated prior to clearing Establishing no-go areas Restricting vehicle movements to designated areas Establishing and enforcing speed limits Signage in koala traverse areas	Negligible impact	Negligible
	Temporary localised footprints Construction compound Laydown area	Injury/mortality during operation due to: Entrapment in infrastructure	Low	Establishing no-go areas Establishing and enforcing speed limits Vehicle movements restricted to daylight hours Erecting exclusion fencing around localised active works areas that present a heightened risk of injury	Negligible residual impact due to injury of koalas	Negligible

Habitat type	Infrastructure type	Potential impacts	Risk rating	Mitigation measure	Residual impact	Residual risk rating
		Increase in dog attacks during the operation phase Koalas would already face a high threat of dog attack when moving through low value traverse areas due to the distance from refugial habitat. Construction of local infrastructure in these areas will not have any measurable increase in susceptibility to dog attack	Negligible	Implement pest (feral animal) management plan, including wild dog abatement plan in consultation with landholders Waste management plan	The Project has the potential to reduce the risk of dog attack and the need for koalas to move through these isolated areas	Negligible
		Barrier effects – localised restriction of koala movement	Negligible	Clearing limits restricted to within the Project footprint Minimising fencing Removal of all temporary fencing after works	No restriction on koala movement	Negligible
		Introduction and spread of disease: The Project is unlikely to cause an increase in the incidence or transmission of Phytophthora that can degrade koala habitat in some regions. The Project is unlikely to result in any increase in Chlamydia among koalas	Low	Vehicle hygiene protocols implemented during construction	Negligible impact on disease transmission	Negligible
		Introduction and spread of weeds Low value koala traverse areas already have high levels of disturbance and limited habitat value.	Low	Vehicle hygiene protocols implemented during construction	Negligible residual risk of weed transmission	Negligible

5.1.10 Significance of impact assessment

The significance of the Project's impacts on the koala has been assessed against the Significant Impact Guidelines 1.1 (DoE 2013), using the framework detailed in the Referral guidelines to the vulnerable koala (DoE 2014) and presented in Table 5-4.

Table 5-4 Significance of impact on koalas

Impact criteria	Potential to occur
Lead to a long-term decrease in the size of an important population of the species.	<p>Unlikely</p> <p>The concept of 'important populations' has not been applied to the koala, given the lack of sufficient information on regional population status throughout its national range (DoE 2014). Nevertheless, the distribution and density of koalas and koala habitat within the Project area would suggest the local population is likely to have regional significance in sustaining koala numbers. The Project will result in loss of 52.40 ha of koala habitat, representing 1.89% of habitat within the Project area. Although this area is above the threshold at which a significant impact is triggered due to loss of habitat critical to the survival of the species, the loss is experienced in numerous small areas over a relatively large local geographic area. The loss of habitat alone is therefore unlikely to lead to a long-term decrease in the size of the local population.</p> <p>Vegetation clearing for the Project carries the risks of koala injury and mortality. However, these risks will be mitigated through the use of sequential clearing under the supervision of suitably trained and qualified fauna spotter-catchers. Risks of mortality and injury due to collision with construction vehicles will be mitigated through the implementation of a Traffic Management Plan. The Project is otherwise unlikely to have any substantial impact in terms of its expected impact on koalas, with no anticipated increase in dog attacks or vehicle collision risks and no restrictions to koala movements.</p> <p>Unmitigated, the Project has the potential to lead to a long-term reduction in the size of the local koala population, due largely to construction impacts. Provided construction controls to mitigate impact on koalas are implemented, the Project is unlikely to lead to a long-term decrease in the size of the local koala population.</p>
Reduce the area of occupancy of an important population.	<p>Unlikely</p> <p>As detailed above, the concept of 'important populations' has not been applied to the koala (DoE 2014). Habitat losses within the Project footprint are not expected to result in the displacement or disappearance of koalas from any individual area at a spatial scale that relates directly to the scale at which area of occupancy is measured (i.e. 2 km x 2 km). While the Project will result in a loss of 52.40 ha of koala habitat, this will occur in small areas across a relatively broad geographic area and will not result in the complete loss of habitat within any given area. Given the ongoing risks to koalas are also relatively minor, the Project is not expected to reduce the area of occupancy of the species or of an important population.</p>
Fragment an existing important population into two or more populations.	<p>Unlikely</p> <p>As detailed above, the concept of 'important populations' has not been applied to the koala (DoE 2014a). The majority of proposed infrastructure is located within previously cleared grazing land where fragmentation impacts already exist. The Project will result in a loss of 52.40 ha of koala habitat critical to the survival of the species. Habitat loss will be from numerous discrete areas across a broader area and will not create large gaps that present barriers to koala movement. No fencing is proposed for turbine foundations or internal access tracks. These areas will therefore not restrict local koala movement or limit gene flow between populations. While substations and operation and maintenance facilities will be fenced, these are localised features that have limited influence on local koala movement. Large areas of high-value habitat within Durikai State Forest, and vegetation corridors (to the north and west) that connect the Project area to regional populations, will not be impacted. No important populations have been defined for the species. As such, the Project will not fragment an existing important population into two or more populations.</p>

Impact criteria	Potential to occur
Adversely affect habitat critical to the survival of a species.	<p>Likely</p> <p>The Project will result in the loss of 52.40 ha of habitat critical to the survival of the koala. Based on the Referral guidelines for the vulnerable koala (DoE 2014) this exceeds the threshold level and will constitute a significant impact due to loss of habitat.</p>
Disrupt the breeding cycle of an important population.	<p>Unlikely</p> <p>As detailed above, the concept of 'important populations' has not been applied to the koala (DoE 2014). The koala mating season is generally between September and March, with females giving birth to a single young between October and May. It is unlikely that the construction and operation of the Project will disrupt the breeding cycle of the local koala population. During the breeding season, males actively seek female koalas and koala movements across the landscape are typically more extensive. Without mitigation, the Project could lead to an increased risk of vehicle strike. Traffic volume, speed and visibility influence koala collision rates. Prevett et al. (1995) found that road kills occurred where vehicle speeds exceeded 80 km/hr and where wider habitat corridors or linear forests occurred on both sides of the road. Potential impacts will be mitigated through implementation of on-site speed limits, signage in higher-value koala habitat areas, and standard best practice sequential clearing using koala spotters. Clearing within koala habitat areas will be limited to daylight hours only during the peak breeding season (September – November).</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	<p>Unlikely</p> <p>The Project will result in a loss of 52.40 ha of koala habitat. This accounts for only a small proportion of suitable habitat in the broader landscape, i.e. 1.89 % of habitat within the Project area. Although clearing will cause minor additional fragmentation of habitat and reduce the area of available habitat, the extent of habitat disturbance is not likely to decrease the availability or quality of habitat available to the local population to the extent that the species will decline.</p>
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species habitat.	<p>Unlikely</p> <p>Wild dogs represent a key threat to koalas as a species and particularly within the local district. Wild dogs are already present in the locality, and baiting is being undertaken on an ad hoc basis to reduce impacts on local sheep stock. A wild dog control program will be undertaken as part of the operation of the Project. This will have substantial benefits for the local koala population. Creation of new tracks can facilitate dog movements into new areas. However, as the existing environment already has an extensive network of farm tracks, the Project is unlikely to exacerbate the existing dog situation. Any risks to koalas are expected to be outweighed by a formal commitment to wild dog control as part of a comprehensive, adaptive pest management plan.</p> <p>Unmitigated, the Project has the potential to introduce or spread weeds, some of which (e.g. <i>Lantana camara</i>) could inhibit local koala movement. This potential will be mitigated by the implementation of a Weed Management Plan governing construction and operation of the Project. The Project therefore poses low risks to the local koala population via introduction and spread of invasive species.</p>
Introduce disease that may cause the species to decline.	<p>Unlikely</p> <p>The Project is not anticipated to introduce new diseases that may cause the species to decline. Stress may lead to an increase in the expression of chlamydia in koalas, however the implementation of mitigation measures such as sequential clearing will reduce disturbance-related stress and risk of disease.</p>

Impact criteria	Potential to occur
Interfere substantially with the recovery of the species	<p>Unlikely</p> <p>As detailed above, the Project is unlikely to substantially interfere with the recovery of the species. Localised loss of habitat will be experienced over a broad geographic area, representing a small proportion of the habitat present locally. The Project is unlikely to have any substantial impact in the operation phase, with no substantial long-term increase in mortality or any substantial barrier effects due to loss of habitat connectivity. All impacts are expected to be localised. Accordingly, the Project is unlikely to substantially interfere with the recovery of the species.</p>

5.1.10.1 Significance of impact due to loss of habitat critical to the survival of the koala

The Project will result in the direct loss of 52.40 ha of habitat critical to the survival of the koala. Based on the flowchart detailed in Table 2 of the Referral guidelines for the vulnerable koala (DoE 2014a) any loss of more than 20 ha of habitat critical to the survival of the koala constitutes a significant impact under the EPBC Act. Accordingly, the Project is **likely** to have a significant impact on the koala due to the loss of habitat critical to the species.

5.1.10.2 Significance of impact due to interference with the recovery of the species

The Project is unlikely to significantly interfere with the recovery of the koala.

As detailed in the Referral guidelines for the vulnerable koala (DoE, 2014), for all areas of koala habitat scoring ≥ 5 on the koala habitat assessment toolkit, an assessment of the potential interference with the recovery of the species must be undertaken considering the following factors:

Will the project increase fatalities due to dog attacks to a level that is likely to result in multiple, ongoing fatalities? The Project is not expected to result in any change in the abundance of wild dogs. The Project will result in the creation of new maintenance access tracks that will facilitate local movement of wild dogs but will also assist the farmers in accessing land more readily for control. However, the site already has a large number of farm tracks existing in the landscape that are already utilised by wild dogs for movement. Accordingly, the introduction of additional access tracks is not expected to have a measurable impact on local dog numbers or the subsequent frequency of dog attacks on koalas. Wild dog baiting will likely continue within the district (and accessing the site will be easier for the landowners once access tracks are constructed). This will reduce or at least maintain current risks of dog attacks for koalas.

Will the project increase koala fatalities due to vehicle strikes to a level that is likely to result in multiple ongoing fatalities? The Project will result in a large increase in vehicle movements during the construction period. This carries a risk of increased vehicle strike but will be mitigated through standard controls such as speed limits. The risks of ongoing mortality from vehicle strikes is low, given the Project will only result in occasional movements of maintenance vehicles during the Project's operation phase.

Will the project facilitate the introduction or spread of pathogens such as Chlamydia or *Phytophthora cinnamomi* that are likely to significantly reduce the reproductive output or the carrying capacity of the habitat? The use of standard hygiene protocols in vehicle movements during construction means that the potential for introduction of *Phytophthora* is relatively limited. The Project is unlikely to have any substantial impact during the operational phase and is unlikely to have any impact on levels of Chlamydia in the local koala population.

Will the project create a barrier to movement between or within habitat critical to the survival of the koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the koala? The Project will result in minor localised fragmentation of habitat. However, this will pose no barrier to the movement of koalas, as the wind farm will not be fenced.

Will the project change hydrology which degrades habitat critical to the survival of the koala to the extent that the carrying capacity of the habitat is reduced in the long-term? The Project will have no substantial impact on hydrology that could degrade the quality of koala habitat.

5.1.11 Conclusion

The Project is **likely** to have a significant impact on the koala as the Project results in the clearance of 52.40 ha of habitat. Based on the Referral guidelines for the vulnerable koala (DoE 2014), this exceeds the threshold level and will constitute a significant impact due to loss of habitat critical to the survival of the species.

Offsets are proposed and described in the Karara Wind Farm Project Environmental Offsets Strategy (Attexo 2021).

5.2 Central greater glider

5.2.1 Conservation status and documentation

The central greater glider is listed as Vulnerable under the EPBC Act. This species was formerly known as the greater glider (*Petauroides volans*).

The species is restricted to mature eucalypt forests and woodlands with an abundance of mature, hollow bearing trees (Andrews et al. 1994; Kavanagh 2000; Eyre 2004; Van der Ree et al. 2004; Vanderduys et al. 2012). The species has a specialist folivorous diet and displays seasonal food preferences (Kehl and Borsboom 1984; Kavanagh and Lambert 1990). As a result, the species requires access to forests with a diversity of tree species to provide a consistent food source throughout the year (Kavanagh 1984).

The species dens in large hollows in mature trees (Henry 1984; Lindenmayer et al. 1991; Goldingay 2012). The availability and abundance of mature, hollow-bearing denning trees is a limiting factor. In south-east Queensland, the species requires at least two to four live, hollow-bearing trees for every 2 ha of suitable forest habitat (Eyre 2002). The species has been found to be absent from forests with fewer than six hollow-bearing trees per ha (ARCS 1999). The species has a relatively small home range, typically 1 – 4 ha (Henry 1984; Comport et al. 1996; Gibbons and Lindenmayer 2002). Given the species' limited capacity for dispersal, and reluctance to cross vegetation gaps, it is sensitive to habitat fragmentation (McCarthy and Lindenmayer 1999).

5.2.2 Survey effort

As described in Section 2.3 and summarised in Table 2-1, targeted searches of suitable habitat were undertaken to detect characteristic traces including faecal pellets and scratches. Nocturnal active searches and spotlighting were also undertaken targeting key habitats for conservation significant species. Quaternary level assessments were undertaken as a basis for mapping potential habitat.

Survey effort for the central greater glider included:

- Quaternary level vegetation assessments undertaken at 70 sites.
- Faecal pellet searches using the SAT survey method (Phillips and Callaghan 2011), with SAT searches at 37 locations across the Project area between 2018-2020.
- General habitat assessments undertaken at 92 sites within the Project area.
- General spotlighting by two observers on two nights. Nocturnal spotlighting transects within areas of mapped foraging habitat at the north of the Project area. Two ecologists walked a minimum of two, 1 km transects per night, searching for greater gliders with hand-held spotlights. Driving transects were also undertaken. Spotlighting transects are considered to be the most effective and efficient method for identifying the greater glider (Lindenmayer et al. 2001, Wintle et al. 2005).

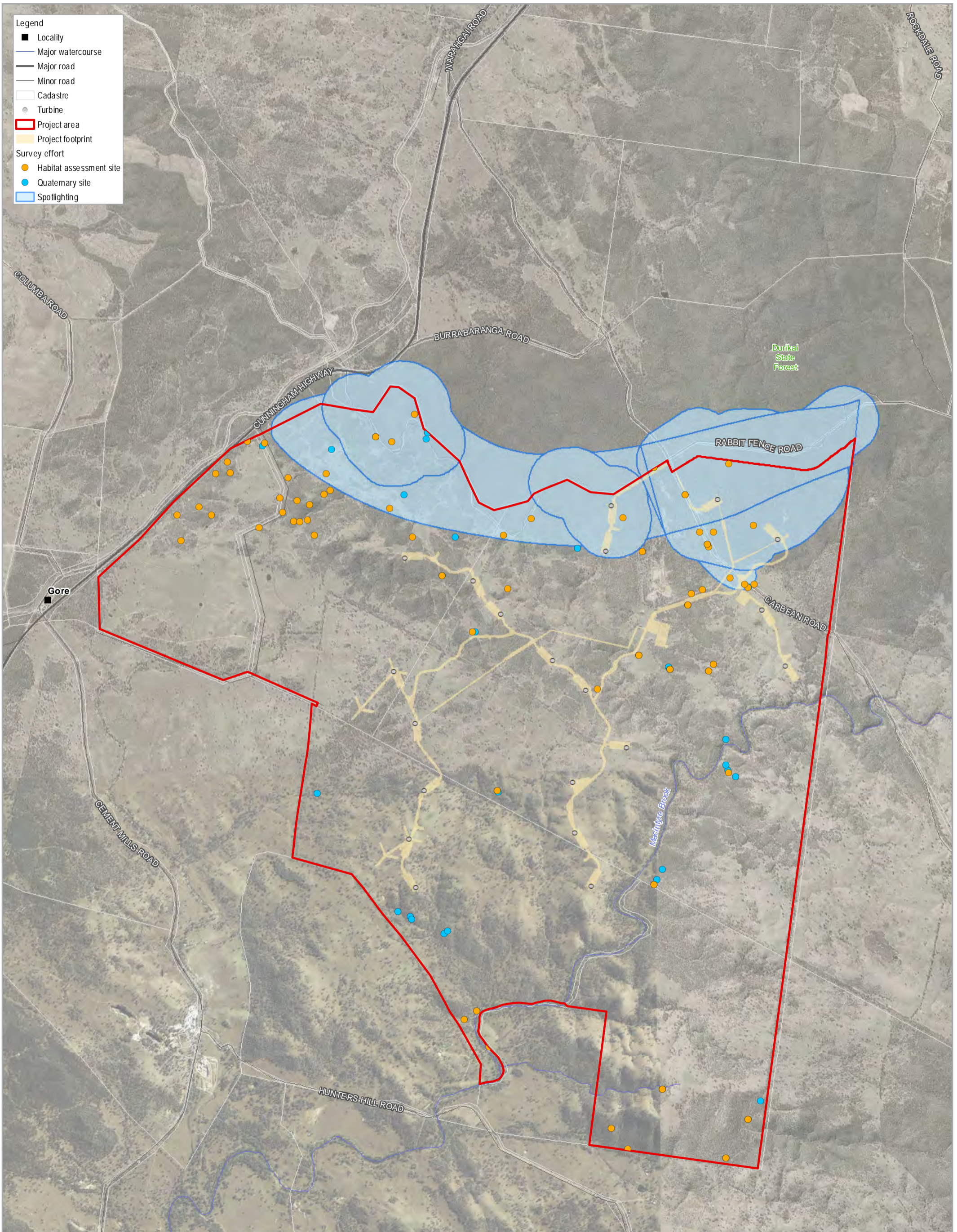
In addition to surveys undertaken between 2018 and 2020, additional targeted surveys for the central greater glider were undertaken in late December 2020 to provide further information on the species distribution and the value of habitats within the Project area (together with the proposed MacIntyre Wind Farm Project and OHTL Project areas). The December 2020 surveys were conducted over eight days from 13 to 21 December 2020. Field surveys were conducted by two suitably qualified ecologists with a total of 128 hours spent in the field undertaking:

- Nocturnal spotlighting transects within areas of mapped foraging habitat at the north of the Project area. Two ecologists walked a minimum of two, 1 km transects per night, searching for greater gliders with hand-held spotlights. Driving transects were also undertaken. Spotlighting transects are considered to be the most effective and efficient method for identifying the greater glider (Lindenmayer et al. 2001, Wintle et al. 2005).
- Diurnal surveys, searching for greater glider faecal pellets using a variation of the spot assessment technique (SAT) used to detect koalas (Phillips and Callaghan 2011). SAT searches were undertaken at 34 sites, with searches conducted around a central hollow-bearing tree. GHD has used this method to confirm the presence of the species in other projects.
- Targeted habitat assessments were undertaken at 10 sites to differentiate foraging and denning habitat based on the following criteria:
 - Soil type
 - Evidence of historical logging
 - Diameter at breast height (DBH) of feed trees
 - Hollow density (per hectare) counting all hollows > 10 cm diameter
 - Species richness of feed trees
 - Scat surveys to determine species presence

The additional surveys combined a revised desktop assessment and targeted field survey approach. In the absence of Commonwealth survey guidelines, survey methods were designed in accordance with the following guidelines and recommended survey approaches:

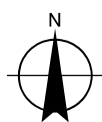
- The Action Plan for Australian Mammals 2012 (Woinarski et al., 2014)
- The Survey Guidelines for Australia's Threatened Mammals: Guidelines for detecting mammals listed under the EPBC Act (DSEWPaC, 2011)
- Survey Standards: Greater glider *Petauroides volans* (DSE, 2011)
- Terrestrial Vertebrate Survey Guidelines for Queensland (DSITIA, 2014).

The survey effort is considered appropriate and targeted survey effort for the central greater glider is mapped in Figure 5.4.



Based on or contains data provided by the State of Queensland 2021.
 In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

Paper Size ISO A3
 0 0.5 1
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



Acciona Energy Australia Global Pty Ltd
 MNES Assessment Report

Central greater glider
 survey effort

Project No. 12525037
 Revision No. 0
 Date 09/08/2021

FIGURE 5-4

5.2.3 Criteria used to map central greater glider habitat

The Commonwealth SPRAT profile identifies central greater glider habitat as Eucalypt forests and woodlands, occurring in highest abundance in taller, montane, moist Eucalypt forests with relatively old trees and abundant hollows (Andrews et al., 1994; Kavanagh 2000; Eyre 2004). In south Queensland, the species requires two to four live den trees for every 2 ha of suitable forest habitat (Eyre 2002).

Predicted habitat for the species based on woodland habitats that align with the Commonwealth's habitat definition are represented by the following REs where polygons with gaps less than 20 m have connectivity >160 km²:

- 11.3.2 *Eucalyptus populnea* woodland on alluvial plains
- 11.5.1 *Eucalyptus crebra* and/or *E. populnea*, *Callitris glaucophylla*, *Angophora leiocarpa*, *Allocasuarina luehmannii* woodland on Cainozoic sand plains and/or remnant surfaces
- 11.5.4 *Eucalyptus chloroclada*, *Callitris glaucophylla*, *C. endlicheri*, *Angophora leiocarpa* woodland on Cainozoic sand plains and/or remnant surfaces
- 11.7.7 *Eucalyptus fibrosa* subsp. *nubilis* +/- *Corymbia* spp. +/- *Eucalyptus* spp. woodland on Cainozoic lateritic duricrust
- 13.3.4 *Eucalyptus conica*, *E. microcarpa* or *E. moluccana*, *E. melliodora* grassy woodland. Occurs on Cainozoic alluvial plains
- 13.3.5 Fringing open forest of *Eucalyptus tereticornis*/*E. camaldulensis*, *Casuarina cunninghamiana*.
- 13.11.3 *Eucalyptus crebra*, *E. dealbata*, *E. albens* grassy woodland.
- 13.11.5 *Eucalyptus sideroxylon* +/- *E. fibrosa* subsp. *nubilis* shrubby open forest.
- 13.11.6 *Corymbia citriodora* subsp. *variegata*, *Eucalyptus crebra*, *E. dealbata* open forest.
- 13.11.8 *Eucalyptus melliodora* and/or *Eucalyptus microcarpa*/ *E. moluccana* woodland on metamorphics

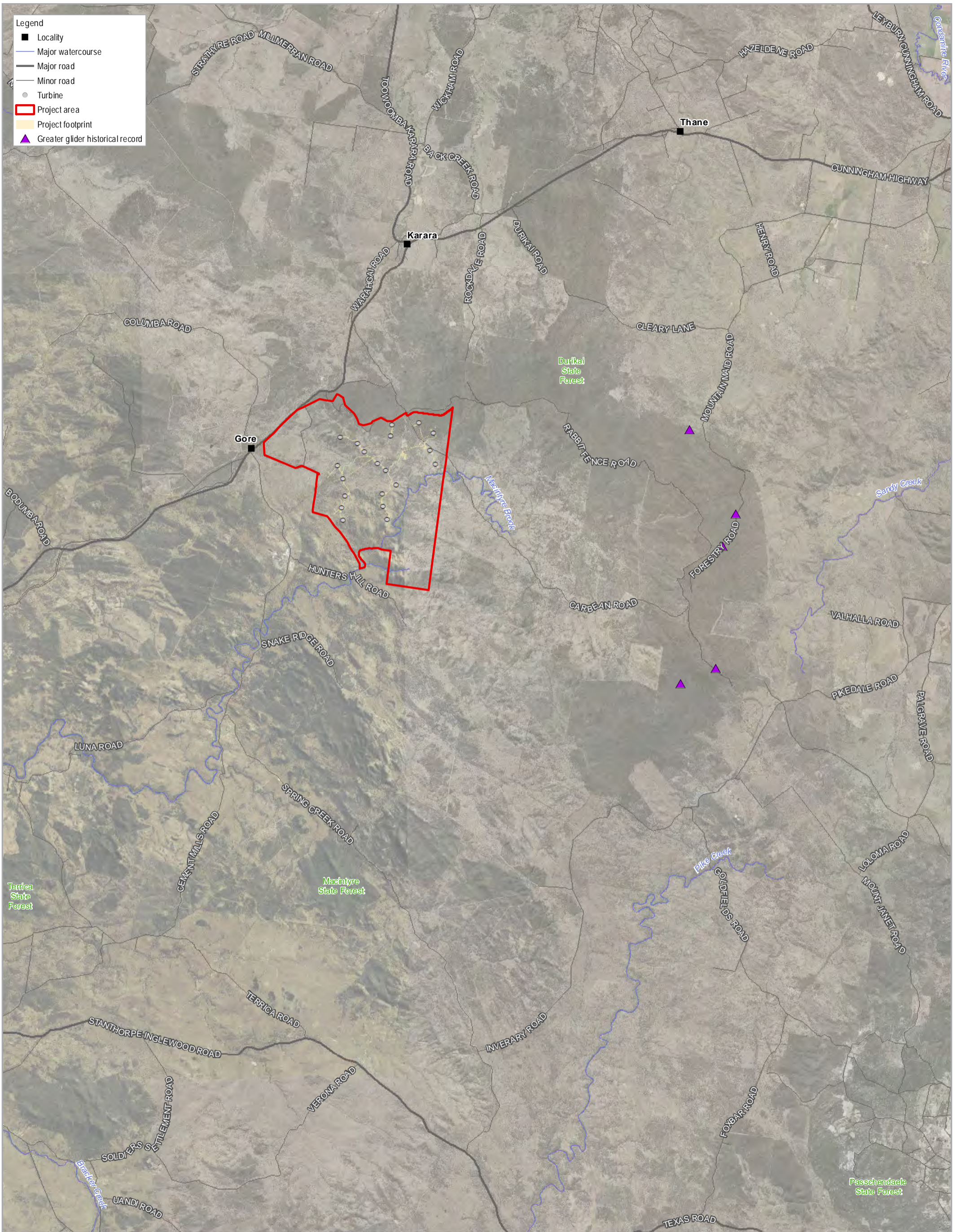
5.2.4 Desktop results

Four historical records of the greater glider are known from a 20 km radius of the Project area. All are located within Durikai State Forest, approximately 10 km north-east and east of the Project area. The distribution of central greater glider historical records is shown in Figure 5.5.

5.2.5 Survey results

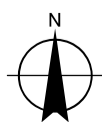
5.2.5.1 Central greater glider records

The central greater glider was confirmed present from scats collected in SAT searches at one location within the Project area. These were collected in targeted faecal pellet searches using an adapted version of the SAT search technique typically used to detect koalas. The record was recorded in an area of box-ironbark woodland at the north of the Project area as shown in Figure 5.5. Scats were independently verified as central greater glider scats by Georgeanna Story from ScatsAbout. No central greater gliders were observed during spotlighting for the Project.



Based on or contains data provided by the State of Queensland 2021.
 In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

Paper Size ISO A3
 0 1.5 3 4.5
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



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Distribution of historical records
 of the central greater glider

FIGURE 5-5

5.2.5.2 Central greater glider habitat

Predicted central greater glider habitat within the Project area was restricted to the following terrestrial habitat types:

- Mixed Eucalypt woodland/forest
- Ephemeral watercourses

Predicted foraging habitat is located within the northern extent of the Project area. This area supports insufficient densities of large hollow-bearing trees to represent denning habitat. Denning habitat was identified in areas within the adjacent Durikai State Forest. A conservative approach was applied to mapping of foraging habitat for the central greater glider. This included all areas of remnant box ironbark woodland that are connected to den sites. As the species has a small home range and does not move far from denning habitat, some areas potentially outside the home range of locally occurring central greater gliders are likely to have been mapped.

Mapping of greater glider habitat was based on criteria consistent with the definition of habitat provided within the Commonwealth SPRAT profile for the species (DAWE 2020) (Section 5.2.3) and habitat assessments undertaken by GHD over multiple surveys between 2018 and 2020 (Section 5.2.2). Habitat was identified as foraging and denning habitat based on the relative abundance of hollow-bearing trees. Large areas of remnant woodland showed evidence of historical logging and were considered unlikely to have sufficient hollow-bearing trees to provide suitable denning habitat.

Foraging and denning habitat had significant differences in their habitat characteristics. Tree diameter and hollow abundance were both significantly higher in denning habitat than in foraging habitat. Representative photos of suitable foraging habitat for the central greater glider are shown in Plate 5-8. Approximately 468.12 ha of suitable foraging habitat is mapped within the Project area, as presented in Figure 5.6.



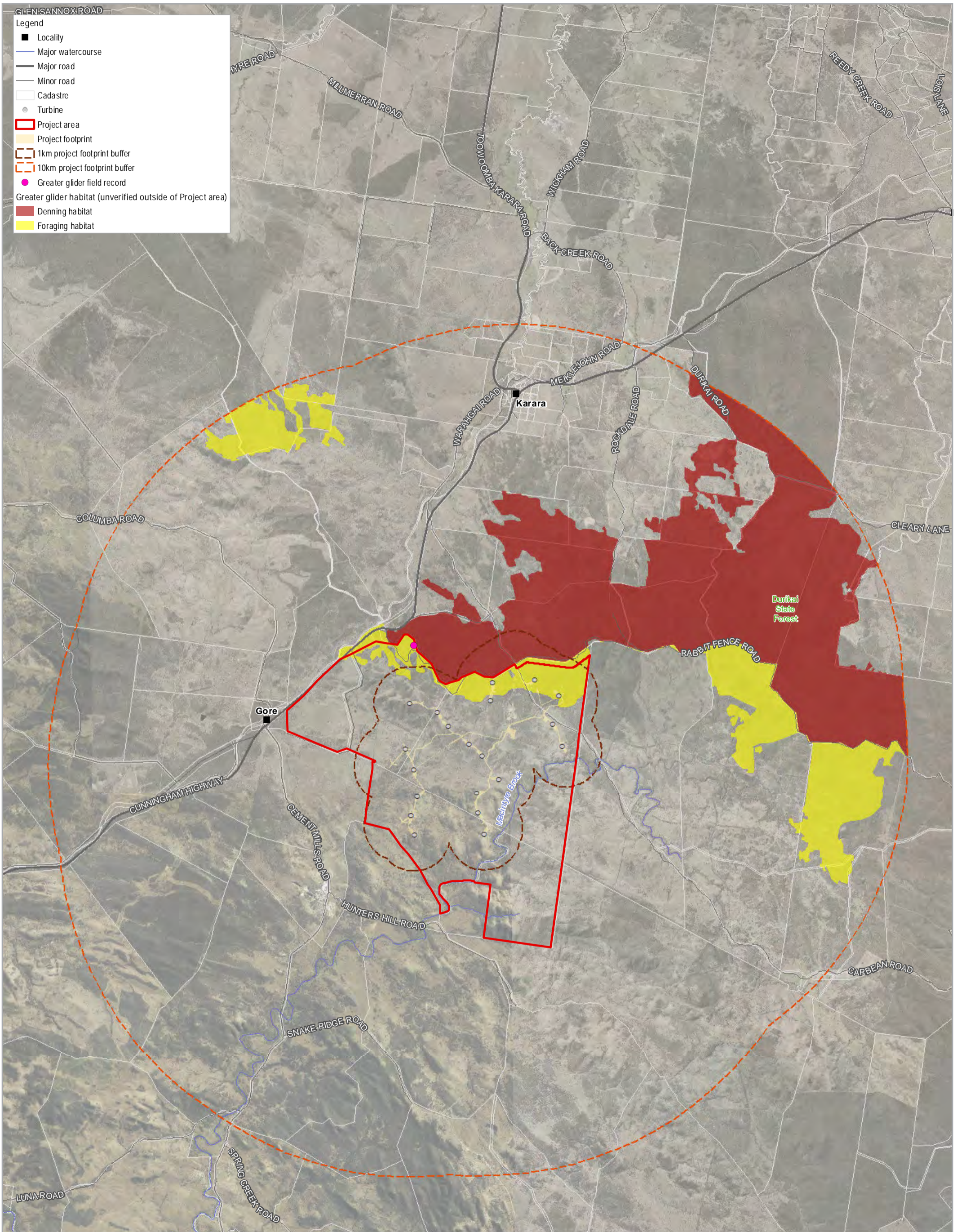
Plate 5-8 *Representative photos of foraging habitat within the Project area*

5.2.6 Significance of project footprint

This section assesses the significance of central greater glider habitats within the Project area, whether they constitute habitat critical to the survival of the species, their importance in the context of the local population and whether the local population is important at a national level.

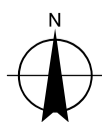
5.2.6.1 Status as an important population

Important populations have not been formally identified for the greater glider or central greater glider in the Commonwealth listing advice for the species. The local population is not near the limit of the species distribution and is therefore not likely to be an important population in the general definition outlined in the Significant impact guidelines 1.1 (DoE 2013).



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 In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

Paper Size ISO A3
 0 1 2 3
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



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 MNES Assessment Report
Distribution of central greater glider records and habitat within the project area

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FIGURE 5-6

5.2.6.2 Status as habitat critical to the survival of the species

Habitat critical to the survival of the species has not been specified in the Commonwealth listing advice for the central greater glider. However, using the general definition in the Significant impact guidelines 1.1 (DoE 2013), this is likely to include areas of denning habitat or areas of potential foraging habitat that are directly connected to those areas of denning habitat. While the habitats within the Project area do not support sufficient densities of hollow-bearing trees to represent denning habitat, they do provide foraging habitat and, based on their proximity and connectivity to denning habitat would be considered habitat critical to the survival of the species.

Predicted foraging habitat is located within larger patches of remnant woodland that occur along the northern side of the Project area. These areas have been selectively logged, and therefore have relatively low densities of mature hollow-bearing trees. As such, they are considered sub-optimal habitat and are predominantly likely to have value as foraging habitat. Areas of mature denning habitat are likely to occur within Durikai State Forest to the north of the Project area.

5.2.7 Threatening processes

Threatening processes for the central greater glider include:

- Habitat loss and fragmentation
- Intense or frequent fires
- Timber production
- Climate change
- Barbed wire fencing
- Hyper-predation by owls
- Competition from sulphur-crested cockatoos
- Phytophthora root fungus (TSSC 2016).

5.2.8 Potential impacts

Potential impacts on central greater glider populations and habitat within the Project area include:

- Loss of habitat
- Injury and mortality
- Disturbance to wildlife through increased light, noise and vibration
- Habitat degradation by increased dust run-off and sedimentation
- Introduction and spread of pest fauna species
- Fragmentation and barrier effects.

These are discussed below. Mitigation and management measures are described in Section 5.2.9.

5.2.8.1 Loss of habitat

The Project is anticipated to result in the loss of 13.13 ha of central greater glider foraging habitat, which represents 2.19 percent of habitat within a 1 km radius of the Project area and 0.16 percent of habitat within a 10 km radius of the Project area. As described in Section 1.1.2 significant efforts have been made to reduce the Project footprint noting a reduction in habitat impacts from the 43.81 ha presented in the EPBC 2020/8755.

The loss represents a localised impact on the southern fringe of an extensive area of greater glider habitat. This connects to a large, contiguous patch of suitable denning and foraging habitat that extends along the Rabbit Fence Road and both the eastern and western sides of Carbean Road, immediately south of Durikai State Forest.

No denning habitat will be cleared for the Project.

Reduction in habitat will increase the competition with other species for hollows. Hyper-predation by native owls is listed as a key threat to the greater glider (DAWE 2021). Predation can be exacerbated

by a loss of hollow-bearing trees which makes gliders more susceptible to owl predation (Lindenmayer et al., 2011; Lumsden et al., 2013). However, as no suitable denning habitat was identified within the Project area, the Project is unlikely to influence the availability of refuges from predatory owls.

5.2.8.2 Injury and mortality

Vegetation clearance during construction of the Project has the potential to cause injury and mortality to greater gliders that may be sheltering in hollow-bearing trees within the Project footprint. Given the low density at which hollows occur, it is considered unlikely that any central greater gliders will be denning within the Project footprint; however, routine clearing impact mitigation measures will be implemented through the clearing process to mitigate the risks through the use of targeted pre-clearance surveys and supervision of any clearance of denning trees by experienced fauna spotter-catchers.

5.2.8.3 Disturbance to wildlife through increased light, noise and vibration

Clearance of vegetation has the capacity to cause indirect degradation of adjacent habitats due to an increase in the exposure to light, noise and vibration. Consequentially, this has the potential to adversely impact native wildlife through the disruption of foraging, breeding and nesting behaviours (Longcore and Rich, 2004; Slabbekoorn et al. 2010; Popper and Hawkins, 2016). Construction will result in a substantial, localised increase in vehicle movements in the short-term. This will increase light, noise and vibration disturbance on local wildlife. Increased light, noise and vibration can alter individual species' behaviours, and disrupt the balance of inter-species interactions. Such disruptions typically favour feral predators and generalist species that owe their success to broad ecological tolerances and possess the ability to tolerate or actively exploit disturbed environments (Hero et al. 2004).

5.2.8.4 Habitat degradation by increased dust, run-off and sedimentation

Construction activities have the potential to generate localised dust, erosion, run-off and sedimentation through increased vehicle movements, clearance of vegetation and earthworks. This can reduce the abundance and diversity of adjacent terrestrial and aquatic habitats by physically smothering vegetation, changing nutrient levels, impeding the growth and germination of plant species, encouraging weed incursions and altering the movement and behaviour of fauna species.

Dust generated during construction has the potential to accumulate on vegetation, potentially rendering some food sources unpalatable, particularly for folivorous species like the central greater glider. Indirect impacts on habitat quality will vary in their spatial extent, with dust and sedimentation impacts caused by road activity generally limited to within 40 m of a road edge. Edge effects associated with runoff and sedimentation may extend further in circumstances where local topography increases the potential for run-off or where sediment has entered watercourses. The Project has the potential to generate an increase in dust within the Project area due to clearing activities, increased traffic and increased ground exposure. These impacts will be heightened during periods of low rainfall and high wind.

5.2.8.5 Introduction and spread of pest fauna species

While introduced predators such as foxes, cats and dogs have been known to predate on greater gliders (Maloney and Harris 2006) feral predation is not listed among the key threats to the species. The Project is unlikely to adversely impact on the greater glider through any change in feral predator densities.

5.2.8.6 Habitat fragmentation or barrier effects

The central greater glider is reluctant to cross large gaps between vegetation and is therefore susceptible to the adverse effects of habitat fragmentation (McCarthy and Lindenmayer 1999). Despite this, the dispersed and highly localised nature of the Project footprint and its location at the southern edge of a large, contiguous area of potential habitat is likely to reduce the severity of any fragmentation impacts that could result from the Project.

Within areas of foraging habitat, the extent of clearing required has been reduced by utilising previously established access tracks and open spaces to avoid contiguous remnant woodlands. The clearing footprint has been restricted to the smallest width needed (i.e. a maximum width of 30 m). Greater gliders are capable of gliding up to 100 m (Kerle 2001) and are therefore physically capable of overcoming that gap.

As the clearing is located on the southern fringe of a large area of denning habitat and is unlikely to pose a barrier to glider movement, the clearing is unlikely to result in any isolation or fragmentation of central greater glider habitat.

5.2.9 Measures to avoid, reduce or mitigate impacts

5.2.9.1 Loss of habitat

During the planning stage, a number of measures were employed to avoid and reduce the direct loss of habitat for the central greater glider. A preliminary ecological constraints assessment was undertaken to identify and avoid areas of high ecological value wherever possible. Key outcomes included:

- Avoiding large remnants of established woodland within Durikai State Forest
- Utilising existing tracks wherever practicable and locating proposed tracks within previously disturbed areas wherever practicable to avoid or minimise disturbance to vegetation and habitat.

The following measures will be implemented during construction of the Project to reduce the loss of vegetation and habitats:

- Land clearing will be restricted to the minimal amount necessary for the construction of the Project and will not extend outside of the Project footprint.
- Consistent with the Preliminary Fauna Management Plan, a Fauna Management Plan will be prepared and implemented to establish the environmental management framework for managing impacts on fauna and habitat.
- The extent of vegetation clearing (and no-go areas) will be clearly identified on construction plans and in the field using high visibility fencing or flagging in the vicinity of high conservation significant areas. Clearing extent will be communicated to construction supervisors. If fencing or flagging is in poor condition, it will be replaced as soon as practicable to reduce the potential of accidental clearing
- Where infrastructure must cross waterways, areas of existing disturbance (i.e. existing tracks) have been selected. Where this is not practicable, the Project footprint has been minimised and large habitat trees will be preferentially retained.
- Suitably qualified and experienced fauna spotter-catchers will be engaged to undertake pre-clearance surveys prior to clearing and to supervise the clearing process
- All clearing will be supervised by suitably qualified and experienced fauna spotter-catchers. This will involve searching and clearing hollow trees and logs prior to clearing and relocating resident fauna to the nearest suitable, safe habitat outside the clearing footprint.
- Undertake sequential clearing to allow fauna escape to areas outside the clearing footprint
- Remove any hollows that occur within the Project footprint that do not contain fauna at the early stages of clearing to avoid fauna relocating to other hollows in the clearing footprint
- Site offices, construction stockpiles and laydown/storage areas will be located within existing cleared or disturbed areas.
- Rehabilitation of temporary laydown areas, stockpiles, site offices and areas will be undertaken as soon as practicable after these facilities are no longer required.

- All construction personnel will attend environmental training as part of the site induction process prior to entering the work site. As part of this training, all personnel will be instructed on their obligations in regard to vegetation clearing protocols. Areas identified for vegetation clearance are to be clearly defined and detailed in site inductions.

5.2.9.2 Injury and mortality

The following measures will be implemented to minimise injury and mortality to the central greater glider during construction of the Project:

- Pre-clearance survey of mapped breeding habitat areas and will target specific areas of known and predicted habitat
- Marking the location of all impacted potential denning trees
- Inspect all potential den trees prior to clearing
- Encouraging gliders to leave hollows on their own accord, tapping trees and using spotlights
- Dismantling trees in sections if gliders are potentially present
- All clearing will be supervised by suitably qualified and experienced fauna spotter-catchers. This will involve searching trees prior to clearing and relocating any resident greater gliders to the nearest suitable, safe habitat outside the clearing footprint.
- Where wildlife need to be physically removed from hollows, dismantle the trees in sections under the direction of trained and experienced fauna spotter-catchers and experienced clearing crews. Trees will be felled immediately after removing wildlife to prevent animals from returning to hollows
- Sequential clearing of habitat will be undertaken to allow gliders to disperse into areas of adjacent habitat, encouraging gliders to leave hollows via indirect measures (i.e. using spotlights or tree-tapping to encourage individuals to leave of their own accord) and actively checking any remaining potential den sites prior to clearing. Sequential clearing will be undertaken towards areas of refugial habitat and maintaining trees to allow movement of gliders to refuge areas. Through this process, the risk to individuals and breeding places will be effectively mitigated. Adverse incident response procedures will be developed to detail actions to be taken in the event of wildlife injury or mortality during clearing.
- Clearing will be restricted to daylight hours to reduce impact to nocturnal species
- Habitat enhancement features (e.g. salvaged hollows) will be established outside the clearing area within suitable habitat
- Fencing of operational areas is limited (e.g. sub-stations). Where small, localised areas are fenced to avoid fauna entering and becoming entrapped, barbed wire fencing will not be used.
- A Traffic Management Plan, consistent with objectives and controls described in the transport and road network mitigation measures of the CMP, will be developed for the Project with designated access routes, speed limits and identified sensitive ecological areas
- A high risk SMP will be prepared and implemented in accordance with the requirements of Section 332 of the Nature Conservation (Wildlife Management) Regulation 2006.

5.2.9.3 Habitat degradation by dust, run-off and sedimentation

The following mitigation measures will be used to minimise the impacts of dust, run off and sedimentation during construction of the Project:

- Erosion and sediment controls have been developed as part of the CMP.
- A CMP has been prepared to inform actions with regard to managing weed hygiene, erosion, fuels and hazardous substances, fire, etc. and includes erosion and sediment control measures.
- Routine dust suppression and monitoring will be undertaken throughout construction and operation.
- Erosion and sediment control measures will be installed where in-stream disturbance must be undertaken during flow conditions.
- Areas subject to clearing will be stabilised as soon as practicable.

- All vehicle movement will be restricted to designated tracks located within the Project footprint.
- Weather conditions will be monitored during the construction stage and temporary controls will be established during extreme weather events.
- Construction activities during adverse weather conditions will be managed in accordance with the CMP
- Rehabilitation of temporary construction areas will be undertaken as soon as practicable after clearing once these facilities are no longer required (subject to agreement with the landowner).
- While commitment is made to rehabilitation in keeping with good practice and will be undertake, given the outcomes of rehabilitation cannot be confirmed or guaranteed at this time and are subject to detailed design and construction planning, conservatively, all central greater glider habitat within the Project footprint is for the purpose of the assessment taken to be a loss.

5.2.9.4 Disturbance to wildlife through increased light, noise and vibration

Routine mitigation measures will be undertaken to minimise the impact that noise, light, vibration and disturbance have on local central greater glider populations, particularly in the vicinity of known habitat. The following measures will be used to minimise the impacts of light, noise and vibration during construction:

- Artificial site lighting will be kept to the minimum (security) required for safety. Placement and orientation of lighting to be directed away from sensitive fauna habitat and construction machinery will be regularly serviced to reduce construction noise.
- Direction of lighting beam downwards or use of shields and baffles to limit light spill beyond site boundary.
- No operational lighting is proposed for areas of denning habitat and operational noise is expected to be negligible.
- Wherever practicable, construction activities will be limited to daylight hours to reduce the need for lighting and resultant light spill into adjacent habitat and to reduce noise and vibration impacts on the central greater glider.
- A Traffic Management Plan, consistent with objectives and controls described in the transport and road network mitigation measures of the CMP, will be developed and implemented for the Project to control vehicle movements and reduce unnecessary generation of vehicular noise.
- All construction vehicles will comply with maintenance schedules and operational restrictions designed to limit noise impacts during construction.

5.2.9.5 Introduction and spread of pest fauna species

The following mitigation measures will be used to minimise the introduction and spread of pest fauna species during construction for the Project:

- Responsible waste management practices (e.g. not leaving out food waste and not feeding wildlife) will be implemented and followed by all construction personnel. All waste will be stored in secure temporary holding containers and transported off site.
- Waste management actions are included in the CMP and include:
 - Requirements for details on the location and specifications for disposal and removal of waste from the construction site.
 - All putrescible waste to be stored in secure temporary holding containers and transported off site.
- Sightings or evidence of pest animals will be recorded during construction in a pest register. If increased densities of pest animals are observed, or new pest animals are identified, humane pest controls will be implemented to manage numbers.
- Construction staff will not bring domestic animals to the Project area.
- All construction personnel shall attend environmental training as part of site inductions. As part of this training, all personnel will be instructed on their responsibilities related to avoiding and minimising the introduction/attraction to the construction site of feral animals.

- Hygiene protocols restricting the movement of vegetation and soil between impacted areas and areas of significantly lower weed infestation.
- Restrict vehicle access to existing roads and tracks within the Project footprint.

5.2.10 Significance of impact assessment

An assessment of the significance of the Project’s impacts on the central greater glider was undertaken against the Significant Impact Guidelines 1.1 (DoE 2013), as outlined in Table 5-5.

Table 5-5 Significance of impact on the central greater glider

Impact criteria	Potential to occur
Lead to a long-term decrease in the size of an important population of a species.	<p>Unlikely</p> <p>Important populations have not been formally defined for the central greater glider. Although the species recent reclassification has meant its former distribution has been significantly reduced, the Project area is not at the edge of its known range and is unlikely to represent an important population on that basis. The local population is unlikely to represent an important population, as it is not at the limit of the species’ range, is unlikely to represent a key source population for breeding (due to the relative local absence of denning habitat) and is unlikely to be a population necessary for maintaining genetic diversity.</p> <p>The central greater glider is reliant on large, intact remnants of interconnected old-growth Eucalypt woodland with high densities of hollow-bearing trees. Habitats within the Project footprint were generally low value, having been subject to extensive habitat fragmentation and historical selective logging which has reduced the abundance of hollow-bearing trees. The Project is predicted to directly impact 13.13 ha of suitable foraging habitat for the species. In total, the loss of foraging habitat equates to 2.19 percent of habitat within a 1 km radius of the Project and 0.16 percent of habitat within a 10 km radius of the Project. Due to the high level of fragmentation and relative absence of hollows, this is considered to be low value foraging habitat with limited denning value. Most denning habitat is likely to be located within Durikai State Forest to the north-east of the Project area. The Project is therefore unlikely to impact on core breeding habitat for the species.</p> <p>As such the Project is unlikely to result in a long-term decline in the size of an important population.</p>
Reduce the area of occupancy of an important population.	<p>Unlikely</p> <p>The area of occupancy for the species has been estimated at 16,164 km² and the extent of occurrence at 1,586,879 km² (TSSC 2016). Geographic distribution was not one of the criterion met by the species when classified as Vulnerable under the EPBC Act (DoE 2018). Important populations have not been defined in the area. The Project will result in localised loss of predicted habitat. This is localised in nature and is unlikely to result in the disappearance of central greater gliders from an area sufficiently large to register a reduction in the area of occupancy (i.e. 2 km x 2 km). It is therefore considered unlikely that the Project will reduce the area of occupancy of an important population of the central greater glider.</p>
Fragment an existing important population into two or more populations.	<p>Unlikely</p> <p>The central greater glider is sensitive to habitat fragmentation due to poor dispersal ability and relatively small home ranges (Eyre 2006; McCarthy and Lindenmayer 1999; Lindenmayer et al. 2000). The species is known to have difficulty persisting in small forest fragments. Eyre (2002) has suggested that for populations to maintain viable, they would require native forest patches of at least 160 km². The Project area is already highly fragmented with cleared grazing land representing the majority of the land. The most suitable vegetation types for central greater glider occurred mostly in isolated or heavily grazed areas. The Project will remove approximately 13.13 ha of suitable foraging habitat for the species. In total, the loss of foraging habitat equates to 2.19 percent of habitat within a 1 km radius of the Project and 0.16 percent of habitat within a 10 km radius of the Project. This is generally located on the edges of existing habitat and will not fragment larger, more interconnected areas of habitat that occur within Durikai State Forest to the north-east.</p>

Impact criteria	Potential to occur
Adversely affect habitat critical to the survival of a species.	<p>Likely</p> <p>The Project will result in the direct loss of 13.13 ha of foraging habitat for the central greater glider, that would represent habitat critical to the survival of the species, due to its connectivity to potential denning habitat in Durikai State Forest. On this basis, the Project has the potential to adversely affect habitat critical to the survival of the species.</p>
Disrupt the breeding cycle of an important population.	<p>Unlikely</p> <p>The proposed Project footprint has generally avoided most local areas of breeding habitat for the central greater glider. Most locally important breeding habitat occurs in Durikai State Forest and Macintyre State Forest outside of the Project footprint. While small areas of breeding habitat will be impacted, these areas are relatively small in the local context and likely to have reduced value due to the history of selective logging, which has reduced the local abundance of large hollow-bearing trees that would represent potential den sites for the central greater glider. As detailed above, the local population is not considered an important population. As such, the Project is unlikely to disrupt the breeding cycle of an important population.</p>
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely</p> <p>In the order of 423.93 ha of foraging habitat is mapped for within the Project area. The Project is predicted to directly impact 13.13 ha of suitable foraging habitat for the species. The habitat to be impacted is not considered primary habitat, as it lacks an abundance of large hollows. Higher value habitat along riparian corridors within the Project area will be generally avoided. Large areas of older growth vegetation that represent more suitable habitat for this species will be retained within Durikai State Forest). In total, the loss of foraging habitat equates to 2.19 percent of habitat within a 1 km radius of the Project and 0.16 percent of habitat within a 10 km radius of the Project. The small, localised loss of predicted foraging habitat is not likely to impact the species' survival in the region. As such, it is unlikely the Project will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p>
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat	<p>Unlikely</p> <p>The Project is unlikely to result in the introduction or spread of invasive species beyond current levels. The implementation of a weed and pest management plan will further reduce potential impacts of invasive species. As such, the Project is unlikely to modify, destroy, remove or isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p>
Introduce disease that may cause the species to decline	<p>Unlikely</p> <p>Disease is not a known threat to the central greater glider. The Project is unlikely to introduce a disease that may cause the species to decline.</p>
Interfere substantially with the recovery of the species.	<p>Unlikely</p> <p>Although the Project will result in a significant impact due to adverse impacts on habitat critical to the survival of the species, the loss is unlikely to threaten the species' capacity to persist locally. Large areas of higher quality denning habitat will persist locally within the adjacent Durikai State Forest. The Project will not fragment the persisting habitat and will impose negligible impacts during the operation phase. Given the local population will persist, the Project is unlikely to substantially interfere with the recovery of the species.</p>

5.2.11 Conclusion

The Project is considered **likely** to have a significant impact on the central greater glider based on the loss of 13.13 ha of foraging habitat that would constitute habitat critical to the survival of the species.

Offsets are proposed and described in the Karara Wind Farm Project Environmental Offsets Strategy (Attexo 2021).

5.3 Grey-headed flying-fox

5.3.1 Conservation status and documentation

The grey-headed flying-fox is listed as Vulnerable under the EPBC Act.

The grey-headed flying-fox is Australia's only endemic flying-fox and only occurs on the east coast of Australia from Rockhampton in central Queensland south to Melbourne in Victoria (Tidemann 1998). The species selectively forages for food where it is readily available hence only utilises a small proportion of its range at any given time. Patterns of occurrence and relative abundance for the species fluctuate between seasons and years in line with food availability (Tidemann 1998).

The species maintains one intermixing population throughout Australia. The grey-headed flying-fox requires foraging habitat and roosting sites, with it being a canopy-feeding frugivore and nectarivore. The species roosts in camps typically associated with water sources, in vegetation communities including rainforest, Melaleuca, mangroves and riparian vegetation (Nelson 1965; Van der Ree et al. 2005). The species feeds in a variety of habitats ranging from rainforests, open forest, open and closed woodlands and vegetation dominated by Melaleuca and Banksia species (DAWE, 2021). The primary food source is Eucalyptus blossom and related genera (Eby 1998). The species' food sources are not continuously available throughout the year. As a result the species continually migrates throughout its range to access food resources that are patchily distributed and seasonally available (Nelson 1965; Spencer et al. 1991; Parry-Jones and Augee 1992; Eby 1996).

The grey-headed flying-fox experiences winter and spring bottlenecks in food resources within south-east Queensland and northern New South Wales (Parry-Jones and Augee 1991, Eby et al. 1999). Winter foraging habitat is particularly limiting in southern Queensland and northern New South Wales, as this typically occurs in coastal lowlands that are subject to high levels of land clearing for agriculture and urban development (Eby et al. 1999, Eby and Lunney 2002).

Important winter and spring foraging habitat includes woodlands with *Eucalyptus tereticornis*, *E. albens*, *E. crebra*, *E. fibrosa*, *E. melliodora*, *E. paniculata*, *E. pilularis*, *E. robusta*, *E. siderophloia*, *Banksia integrifolia*, *Castanospermum australe*, *Corymbia citriodora*, *C. eximia*, *C. maculata* (south from Nowra), *Grevillea robusta* and *Melaleuca quinquenervia* (DECCW 2009).

Grey-headed flying-foxes roost in groups of various sizes on exposed limbs of large trees, with a preference for roosting sites near water such as lakes, rivers or the coast (van der Ree et al. 2005). Roosting sites typically comprise of rainforest patches, Melaleuca stands, mangroves and riparian habitats (Nelson 1965a). The species typically utilise the same roosting site for long periods of time (Lunney & Moon 1997). The species commutes daily to foraging sites, which are usually within 15 km of the roosting site (Tidemann 1998), however can travel up to 50 km at night-time to different feeding areas as food resources change (Eby, 1991 in DAWE, 2021).

Mating of grey-headed flying-foxes occurs in early autumn followed by the larger roosting camps tending to disperse in pursuit of available food resources (Hall and Richards 2000). Males and females segregate in October, when females give birth. Females give birth to their young following six months of gestation (Hall and Richards 2000).

As most adult grey-headed flying-foxes conceive one young annually, there is a low maximum rate of population growth for their size (DAWE, 2021). Females have a high tendency for aborting or abandoning their young in response to environmental stress such as a lack of food or high temperatures (Dukelow et al. 1990, Tidemann, 1998, Hall et al. 1991 in DAWE, 2021).

5.3.2 Survey effort

Surveys for the grey-headed flying-fox utilised methods consistent with those recommended for the species in the Commonwealth Survey guidelines for Australia's threatened bats (DEWHA 2010a). This is not a mandatory guideline, but recommends a number of measures including:

- Desktop searches for information on known camps within the surrounding landscape
- Daytime searches for flying-fox camps
- Daytime surveys to identify vegetation communities that represent suitable foraging habitat
- Night-time spotlighting surveys for foraging flying-foxes.

Surveys for grey-headed flying-fox were undertaken for the Project between 2011 and 2020. Survey effort for the grey-headed flying-fox is summarised in Table 2-1 and surveys by GHD between 2018 and 2020 included:

- Rapid terrestrial fauna surveys undertaken at 92 sites within the Project area.
- Quaternary vegetation assessments at 70 sites
- Spotlighting 60 person hours over 10 nights.
- Dusk watches at one location involved a combination of vehicle based spotlighting and sunset stationary surveys at high points in the landscape. The watch involved two observers over two nights, watching a 360 degree field of view (i.e. 180 degrees each) for a one-hour period at and before dusk. All flying-foxes observed in flight were noted, recording the species, approximate height and direction of travel
- Searches for roost camps.

The distribution of survey effort for the grey-headed flying-fox is shown in Figure 5.7. Surveys were undertaken in conditions suitable for detecting the species and assessing the value and distribution of their habitat.

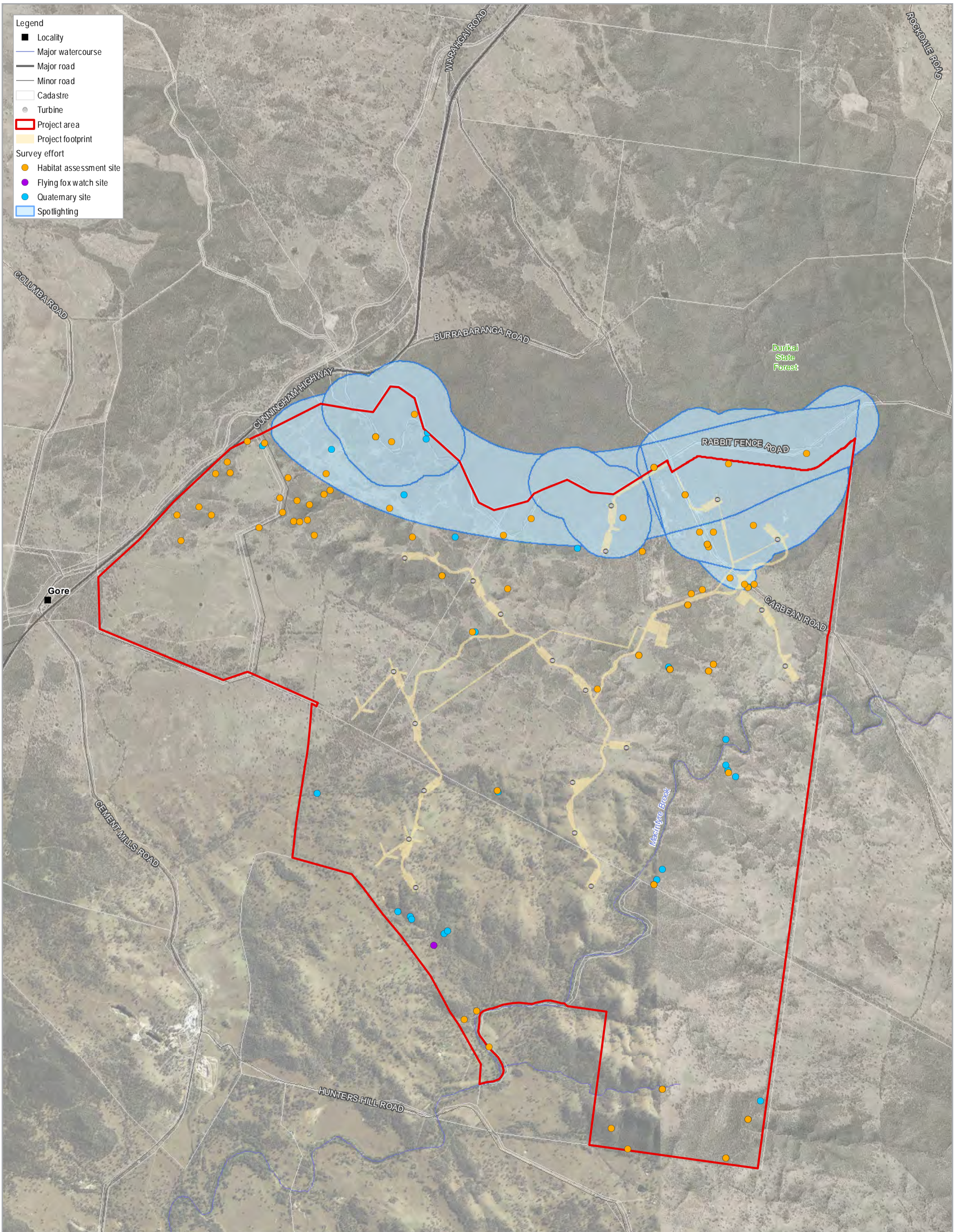
5.3.3 Criteria used to map grey-headed flying-fox habitat

The definition of habitat for grey-headed flying-fox is provided within the National Recovery Plan (DAWE 2021) for the species, being the habitat on which it relies as a continuous sequence of productive foraging habitats, the migration corridors or stopover habitats that link them, and suitable roosting habitat within nightly commuting distance of foraging areas (Fleming and Eby 2003).

Predicted habitat for the species within the Project area is based on woodland habitats represented by the following REs (Figure 3.1) in Queensland:

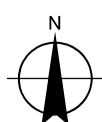
- 13.3.4 *Eucalyptus conica*, *E. microcarpa* or *E. moluccana*, *E. melliodora* grassy woodland. Occurs on Cainozoic alluvial plains
- 13.3.5 Fringing open forest of *Eucalyptus tereticornis*/*E. camaldulensis*, *Casuarina cunninghamiana*.
- 13.11.3 *Eucalyptus crebra*, *E. dealbata*, *E. albens* grassy woodland.
- 13.11.5 *Eucalyptus sideroxylon* +/- *E. fibrosa* subsp. *Nubilis* shrubby open forest.
- 13.11.8 *Eucalyptus melliodora* and/or *Eucalyptus microcarpa*/ *E. moluccana* woodland on metamorphics

It is considered that all foraging habitat has the potential to be productive during general food shortages and provides a critical resource (DAWE 2021). In the Project area this includes Eucalypt woodland that is productive in winter and spring, when foraging bottlenecks have been identified (Parry-Jones and Augee 1991, Eby et al 1999).



Based on or contains data provided by the State of Queensland 2021.
 In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

Paper Size ISO A3
 0 0.5 1
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



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Distribution of survey effort
 for the grey-headed flying-fox

FIGURE 5-7

The National Recovery Plan (DAWE 2021) defines nationally important roosting camps as:

- A camp used for more than one year in the last 10 years (beginning in 1995) by more than 10,000 individuals
- A camp that has been occupied permanently or seasonally by more than 2,500 individuals every year for the last 10 years (beginning in 1995), including reproductive females during the final stages of pregnancy, during lactation, or during the period of conception (i.e. September to May).

As all woodland areas within the Project area were dominated by winter and spring flowering food tree species, all areas of predicted habitat mapped in the Project area were considered to be habitat critical to the survival of the species.

5.3.4 Desktop results

The grey-headed flying-fox was identified within the PMST (Appendix B) as 'may occur' within a 20 km radius from a central point within the Project area. No historical records of the species have been recorded within 20 km of the centre of the Project area. The nearest historical records for the grey-headed flying-fox are located just outside the desktop search extent, in Durikai State Forest north of the Project area, as shown in Figure 5.8. The nearest roosting camps for the grey-headed flying-fox occur in Warwick, approximately 35 km north-east of the Project area and at Inglewood, approximately 45 km west of the Project area as shown in Figure 5.8.

Roosting camps are absent from within the Project area. Three mixed species flying-fox camps are known to occur within the region; two at Warwick, approximately 35 km to the northeast of the Project area and one at Inglewood, approximately 45 km to the west. While these camps are dominated by little red flying-fox (*Pteropus scapulatus*) and black flying-foxes (*Pteropus alecto*), grey-headed flying-foxes have been historically recorded there and are likely to utilise the camps periodically.

5.3.5 Survey results

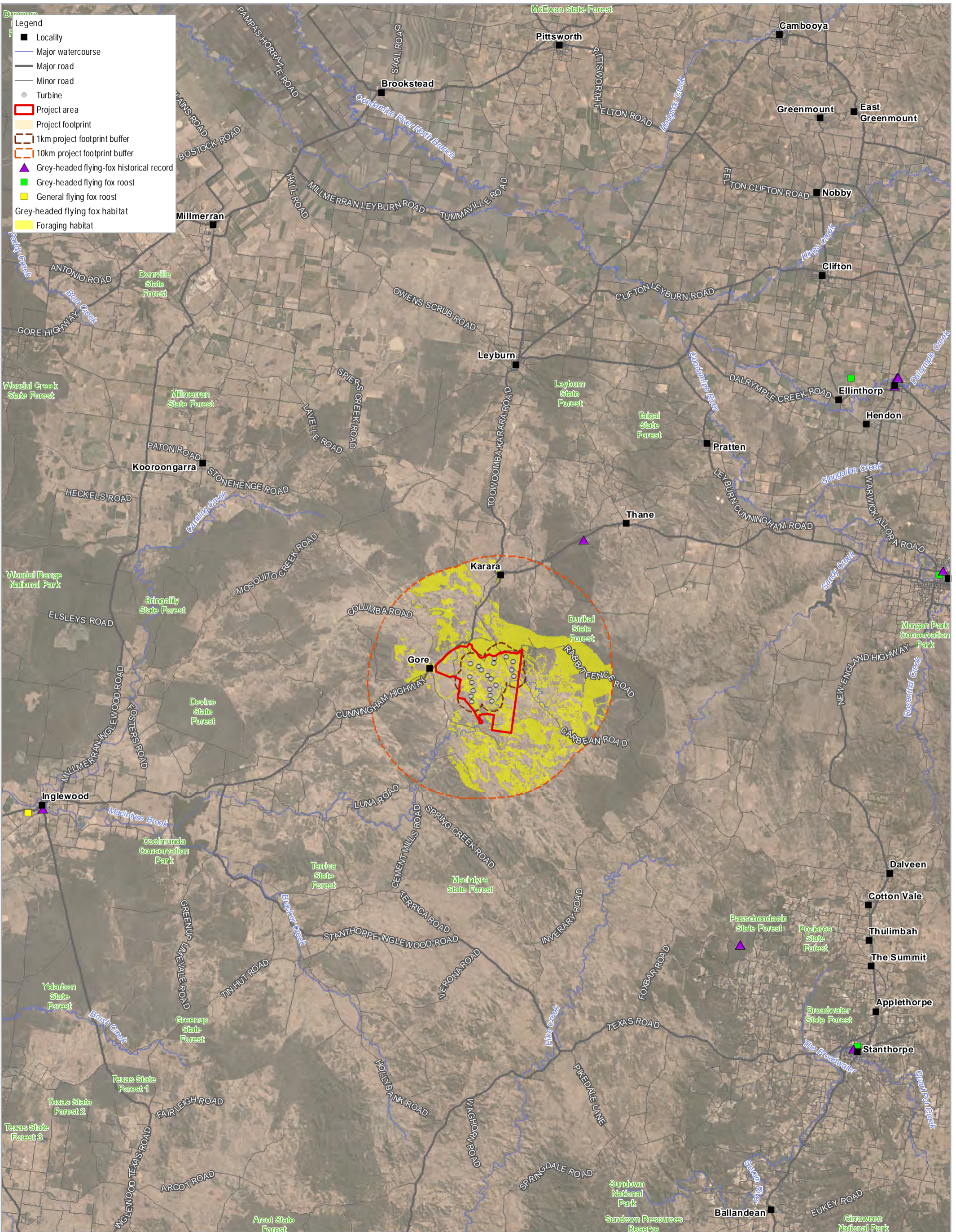
The species was not recorded within the Project area during any of the field surveys undertaken for the Project. However, the species has been historically recorded from Durikai State Forest immediately north of the Project area. No suitable roosting habitat is present within the Project area, with the nearest roosting camps being located at Warwick, approximately 35 km north-east of the Project area and at Inglewood, approximately 45 km to the west. While these camps are dominated by little red flying-foxes (*Pteropus scapulatus*) and black flying-foxes (*Pteropus alecto*), grey-headed flying-foxes have been historically recorded and are likely to utilise the camps periodically.

Within and around the Project area, grey-headed flying-fox habitat has been mapped using criteria consistent with the definition provided within the National Recovery Plan (DECCW 2009) for the species. Potential foraging habitat for grey-headed flying-fox has been mapped in areas of mixed Eucalypt woodland/forest containing *Eucalyptus tereticornis*, *E. albens*, *E. crebra*, *E. fibrosa* or *E. melliodora*.

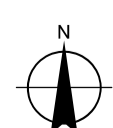
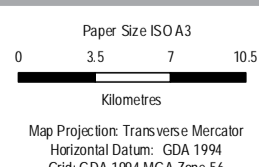
The Project area is bordered by large areas of intact, grey-headed flying-fox foraging habitat provided by Durikai State Forest to the north and east and MacIntyre State Forest to the south-west. Mixed Eucalypt woodland/forest provides foraging habitat for the grey-headed flying-fox at the northern and central extent of the Project area.

In the order of 2,769.41 ha of foraging habitat is mapped within the Project area. Suitable habitat is also mapped for areas in the surrounding vicinity, including throughout the Durikai State Forest.

The distribution of foraging habitat for grey-headed flying-fox is shown in Figure 5.9.



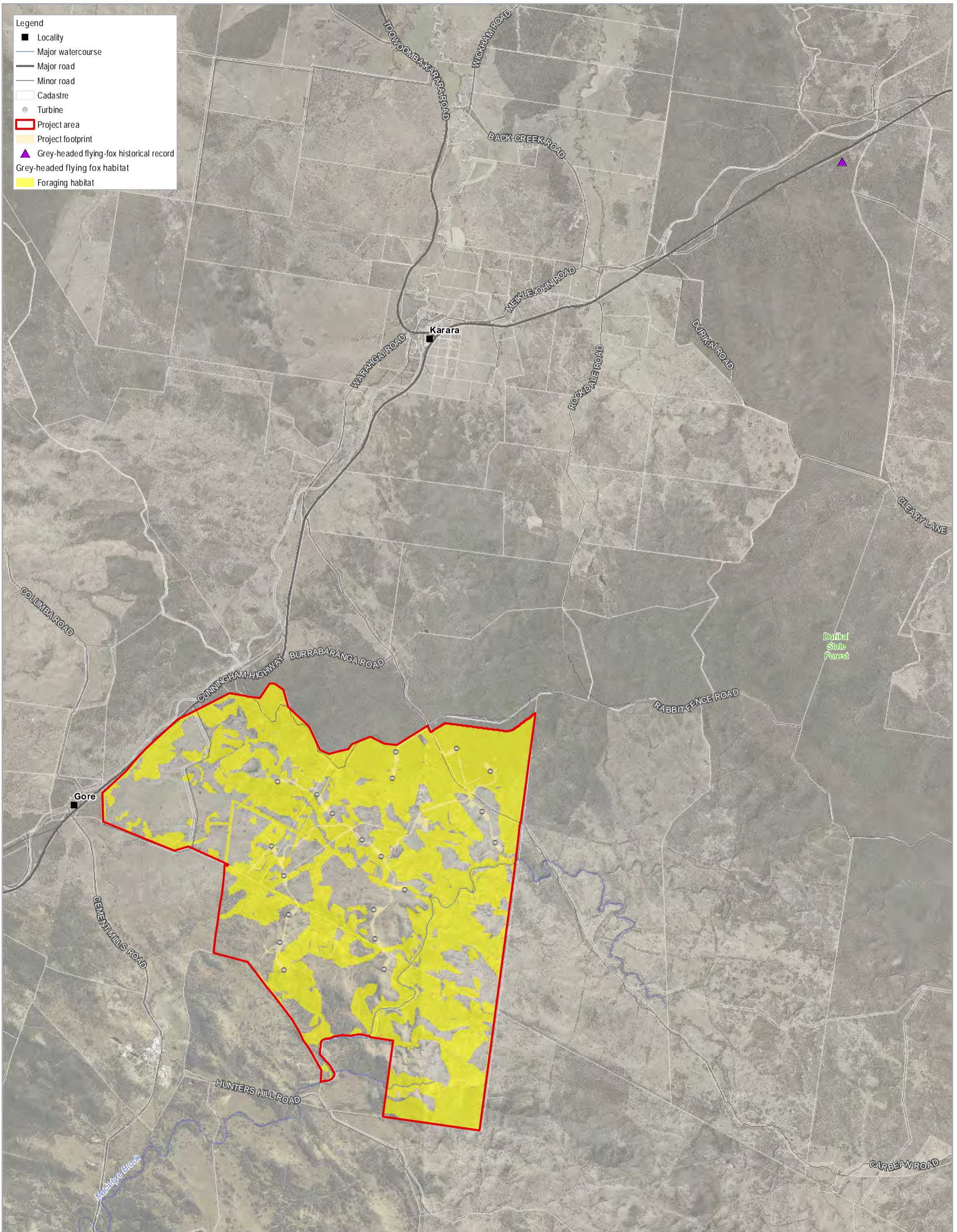
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**Distribution of historical records
 and roost camps of
 the grey-headed flying-fox**

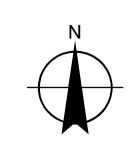
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FIGURE 5-8



Based on or contains data provided by the State of Queensland 2021.
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Paper Size ISO A3
 0 0.5 1 1.5
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



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Distribution of potential foraging habitat for the grey-headed flying-fox within the project area

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FIGURE 5-9

5.3.6 Significance of project footprint

This section assesses the significance of grey-headed flying-fox habitats within the Project area, whether they constitute habitat critical to the survival of the species, their importance in the context of the local population and whether the local population is important at a national level.

5.3.6.1 Status as an important population

The grey-headed flying-fox is considered to be one national intermixing population (DoE 2018). As such, the concept of 'important populations' does not apply.

5.3.6.2 Status as habitat critical to the survival of the species

Foraging habitat critical to the survival of the species includes Eucalypt woodland that is productive in winter and spring, when foraging bottlenecks have been identified (Parry-Jones and Augee 1991, Eby *et al.* 1999). Roosting habitat critical to the survival of the species includes known camps that have been used consistently, as defined in the National Recovery Plan for the species (DECCW 2009).

All woodland areas within the Project area were dominated by winter and spring flowering food tree species, key winter and spring bottleneck food species including *Eucalyptus tereticornis*, *E. albens*, *E. crebra*, *E. fibrosa* and *E. melliodora* were the dominant species in most woodland areas throughout the Project area. Accordingly, all predicted foraging habitat is considered habitat critical to the survival of the species. The Project area is bordered by more extensive areas of intact, grey-headed flying-fox foraging habitat within Durikai State Forest to the north. This would also provide a source of winter and spring foraging habitat

No suitable roosting habitat is present within the Project area, with the nearest roosting camps being located approximately 35 km north-east and approximately 45 km to the west of the Project area (Figure 5.8).

5.3.7 Threatening processes

Threatening processes for the grey-headed flying-fox include:

- Habitat loss and fragmentation
- Exploitation, particularly in commercial fruit growing areas
- Competition and hybridisation
- Pollutants, electrocution and pathogens (DoE, 2020).

5.3.8 Potential impacts

Potential impacts on grey-headed flying-fox populations and habitat within the Project include:

- Loss of habitat
- Injury and mortality
- Injury and mortality of wildlife by direct collision with turbines
- Injury and mortality resulting from barotrauma caused by wind farms
- Disturbance to wildlife through increased light, noise and vibration
- Habitat degradation by increased dust run-off and sedimentation.

These are discussed below.

5.3.8.1 Loss of habitat

The Project is anticipated to result in the loss of 52.40 ha of grey-headed flying-fox foraging habitat within the Project area, which represents 1.89 percent of habitat available with the Project area. Due to the presence of winter and spring flowering food tree species, habitat is considered habitat critical to the survival of the species. As described in Section 1.1.2 significant efforts have been made to reduce the Project footprint noting a reduction in habitat impacts from the 55.49 ha presented in the EPBC 2020/8755.

5.3.8.2 Injury and mortality

Vegetation clearance during construction of the Project area has the potential to cause injury and mortality to local fauna sheltering in trees. Increased traffic during the construction phase may also increase local incidence of fauna injury and mortality. These issues are unlikely to represent a substantial risk for the grey-headed flying-fox, given the species does not roost within the Project area and construction clearing of vegetation will be restricted to daylight hours. Injury and mortality risks to the species during construction are more likely to be due to the potential for entanglement in construction fencing, albeit fencing is localised to small areas and limited in extent.

The grey-headed flying-fox is known to fly at Rotor Swept Area (RSA) height and therefore has the potential for injury or mortality by direct collision with turbines, however, flying at RSA height does not necessarily mean species will experience collision impact. The risk of collision with wind turbines is influenced by a range of biotic factors including flying height, flight behaviour, abundance and flocking tendencies, the time and season of flight in relation to turbine operations, the animal's size and manoeuvrability and their capacity to perceive and actively avoid turbines (Marques et al 2014; Smales, 2015).

Collision risks can vary within species, as animals' age and display different seasonal behaviours (Marquez et al 2014; Smales 2015). Abiotic factors such as the number and layout of turbines, turbine size and colour, the use of lighting and the time, frequency and duration of operations have been found to influence collision risks among birds and bats (Marques et al 2014).

Given that no roosting sites occur on or adjacent to the Project area, the incidence of movement would be relatively low, limited to foraging activities of individual animals rather than the nightly dispersal of large numbers of flying-foxes that is typically seen in locations near roost sites.

5.3.8.3 Disturbance to wildlife through increased light, noise and vibration

Clearance of vegetation has the capacity to cause indirect disturbance to wildlife due to an increase in the exposure to light, noise and vibration. Consequentially, this has the potential to adversely impact native wildlife through the disruption of foraging, breeding and nesting behaviours (Longcore and Rich, 2004; Slabbekoorn et al. 2010; Popper and Hawkins, 2016). Construction will result in a substantial, localised increase in vehicle movements in the short-term. This will increase light, noise and vibration disturbance on local wildlife. Given no known grey-headed flying-fox camps are known to occur within or adjacent to the Project area, it is unlikely that there will be major impacts from daytime construction activities to the species.

5.3.8.4 Habitat degradation by increased dust, run-off and sedimentation

Construction activities have the potential to generate localised dust, erosion, run-off and sedimentation through increased vehicle movements, clearance of vegetation and earthworks. This can reduce the abundance and diversity of adjacent terrestrial and aquatic habitats by physically smothering vegetation, changing nutrient levels, impeding the growth and germination of plant species, encouraging weed incursions and altering the movement and behaviour of fauna species. Foraging habitats for the grey-headed flying-fox are considered habitat critical to the survival of the species. Localised degradation of that habitat would have the potential to reduce the quality and availability of local foraging habitats within the construction period.

5.3.9 Measures to avoid, reduce or mitigate impacts

5.3.9.1 Loss of habitat

During the planning stage, a number of measures were employed to avoid and reduce the direct loss of habitat for the grey-headed flying-fox. A preliminary ecological constraints assessment was undertaken to identify and avoid areas of high ecological value wherever possible. Key outcomes included:

- Avoiding large remnants of established woodland within Durikai State Forest
- Utilising existing tracks wherever possible and locating proposed tracks within previously disturbed areas wherever possible to avoid or minimise disturbance to vegetation and habitat.

The following measures will be implemented during construction of the Project to reduce the loss of vegetation and habitats:

- Land clearing will be restricted to the minimal amount necessary for the construction of the Project and will not extend outside of the Project footprint.
- Consistent with the Preliminary Fauna Management Plan a Fauna Management Plan will be prepared and implemented to establish the environmental management framework for managing impacts on fauna and habitat.
- The extent of vegetation clearing (and no-go areas) will be clearly identified on construction plans and in the field using high visibility fencing or flagging in the vicinity of high conservation significant areas. Clearing extent will be communicated to construction supervisors. If fencing or flagging is in poor condition, it will be replaced as soon as practicable to reduce the potential of accidental clearing
- Where infrastructure must cross waterways, areas of existing disturbance (i.e. existing tracks) have been selected. Where this is not practicable, the Project footprint will be minimised and large habitat trees will be preferentially retained. Clearing will not extend outside of the Project footprint.
- Site offices, construction stockpiles and laydown/storage areas will be located within existing predominantly cleared or disturbed areas.
- Rehabilitation of temporary laydown areas, stockpiles, site offices and areas will be undertaken as soon as practicable after these facilities are no longer required (subject to landholder agreement).
- All construction personnel will attend environmental training as part of the site induction process prior to entering the work site. As part of this training, all personnel will be instructed on their obligations in regard to vegetation clearing protocols. Areas identified for vegetation clearance are to be clearly defined and detailed in site inductions.

5.3.9.2 Injury and mortality

The following measures will be implemented to minimise injury and mortality to the grey-headed flying-fox during construction of Project:

- Pre-clearance surveys will be undertaken to mark the locations of potential grey-headed flying-fox habitat trees and will target specific areas of known and predicted habitat
- Clearing will be restricted to daylight hours to reduce impact on nocturnal species
- Adverse incident response procedures will be developed to detail actions to be taken in the event of wildlife injury or mortality during construction.
- A Traffic Management Plan, consistent with objectives and controls described in the transport and road network mitigation measures of the CMP, will be developed for the Project with designated access routes, speed limits and identified sensitive ecological areas
- The CMP will include protocols to limit injury and mortality to the grey-headed flying-fox, including management of risks associated with open excavations, trenching, waterbodies and responses and reporting for roadkill and adverse incident protocols.

Wind farm design and operation factors can influence collision risks among birds and bats (Marques et al 2014). The effectiveness of these factors varies regionally and depending on the species at risk. However, certain factors are universally considered to reduce the risks of collision among birds.

- Wind turbine spacing and orientation has been shown to influence collision risks with arrays that sit oblique to natural topography generally carrying elevated collision risks (Marques et al 2014).
- Lighting has also been shown to increase collision risks in some bird species, as this can disorient birds in flight (Smales 2015).

Measures to mitigate collision risk to bats are presented in the Bird and Bat Adaptive Management Plan (BBAMP) (Nature Advisory, 2021c) and include:

- Avoidance of turbine placement in high risk areas for bats (as per the adopted Project footprint)
- Design measures to reduce collision risk
 - Limiting lighting
 - Increasing turbine visibility
 - Limiting use of guy wires by adopting lattice-design or conventional turbine towers that limit the need for supporting guy wires
 - Where guy wires are required (limited to meteorological masts) high visibility devices (i.e. visibility balls) will be used to increase the daytime visibility of guy wires.
- Barotrauma risks have been reduced to some extent by locating the majority of turbines in open areas away from heavily vegetated forest areas likely to be important for bat foraging and roosting.
- Monitoring and adaptive management.

The BBAMP establishes monitoring and management procedures consistent with the methods outlined by the Australian Wind Energy Association (AusWEA 2005) and endorsed in the Clean Energy Council's Best Practice Guidelines (CEC 2018).

The BBAMP adopts an adaptive manage approach with specific objectives derived from recent conditions of approval for wind farm projects as follows:

- To implement a monitoring program to estimate the impact of the project on at-risk birds and/or bats that can reasonably be attributed to the operation of the Project
- To directly record impacts on birds and bats through a statistically-based program of carcass searches
- To document an agreed decision-making framework that identifies impact triggers requiring a management response
- To detail potential mitigation measures and related implementation strategies to reduce impacts on birds and bats
- To identify matters to be addressed in periodic reports on the outcomes of monitoring, the application of the decision-making framework, mitigation measures and their success.

5.3.9.3 Habitat degradation by dust, run-off and sedimentation

The following mitigation measures will be used to minimise the impacts of dust, run off and sedimentation during construction of the Project:

- Erosion and sediment controls have been developed as part of the CMP.
- Routine dust suppression and monitoring will be undertaken throughout construction and operation.
- Erosion and sediment control measures will be installed where in-stream disturbance must be undertaken during flow conditions.
- Areas subject to clearing will be stabilised as soon as practicable.
- All vehicle movement will be restricted to designated tracks located within the Project footprint.
- Weather conditions will be monitored during the construction stage and temporary controls will be established during extreme weather events.

- Construction activities during adverse weather conditions will be managed in accordance with the CMP
- Duration of in-stream works will be minimised wherever practicable to reduce the potential for sedimentation.
- Rehabilitation of temporary construction areas will be undertaken as soon as practicable after clearing once these facilities are no longer required (subject to agreement with the landowner).

5.3.9.4 Disturbance to wildlife through increased light, noise and vibration

Routine mitigation measures should be undertaken to minimise the impact that noise, light, vibration and disturbance have on local grey-headed flying-fox populations, particularly in the vicinity of known grey-headed flying-fox habitat. The following measures will be used to minimise the impacts of light, noise and vibration:

- Artificial site lighting will be kept to the minimum (security) required for safety. Placement and orientation of lighting to be directed away from sensitive fauna habitat and construction machinery will be regularly serviced to reduce construction noise.
- Direction of lighting beam downwards or use of shields and baffles to limit light spill beyond site boundary.
- Wherever practicable, construction activities will be limited to daylight hours to reduce the need for lighting and resultant light spill into adjacent habitat and to reduce noise and vibration impacts on the grey-headed flying-fox.
- A Traffic Management Plan, consistent with objectives and controls described in the transport and road network mitigation measures of the CMP, will be developed and implemented for the Project to control vehicle movements and reduce unnecessary generation of vehicular noise.
- All construction vehicles will comply with maintenance schedules and operational restrictions designed to limit noise impacts during construction.

Lighting is not required on the turbines for the site and is not proposed.

5.3.10 Significance of impact assessment

The significance of the Project's impacts on the grey-headed flying-fox were assessed against the Significant Impact Guidelines 1.1 (DoE 2013) outcomes provided in Table 5-6.

Table 5-6 Significance of impact on the grey-headed flying-fox

Impact criteria	Potential to occur
Lead to a long-term decrease in the size of an important population of a species.	Unlikely For the purposes of assessment under the EPBC Act, the grey-headed flying-fox is considered to be one national intermixing population (DoE 2018). As such, the concept of 'important populations' does not apply. The Project area provides suitable foraging habitat for the grey-headed flying-fox but does not support a resident breeding colony. Three flying-fox camps are known to occur within the region to the west and the northeast of the Project area. Flying-foxes from these camps are likely to periodically move through and forage within the Project area. Flying-foxes are known to fly at considerable height when dispersing out each night, however it is possible that flying-foxes will occasionally move through the Project area at RSA height. Operation of the wind farm may result in ongoing mortality to grey-headed flying-fox individuals, throughout the operation phase. However, the magnitude and frequency of collision mortality is unlikely to result in a long-term decrease in the size of the local grey-headed flying-fox population.
Reduce the area of occupancy of an important population.	Unlikely The Project will result in the loss of 52.40 ha of foraging habitat for the grey-headed flying-fox. This represents 1.89 percent of habitat available with the Project area. Localised habitat losses are at a localised scale that would not cause the species to disappear from an area of sufficient size to reduce the area of occupancy of the species (i.e. from a 2 km x 2 km area).

Impact criteria	Potential to occur
Fragment an existing important population into two or more populations.	<p>Unlikely</p> <p>The grey-headed flying-fox is considered to be one, national intermixing population, with the capacity to overfly open areas of cleared land when migrating or foraging locally. As a result, any localised clearing within the Project area would have no capacity to restrict movement at a scale that could fragment the population into two or more populations.</p>
Adversely affect habitat critical to the survival of a species.	<p>Likely</p> <p>Winter and spring flowering species are noted as critical habitat to the survival of the species. As detailed in Section 5.3.6, all habitat mapped within the Project area is considered to represent habitat critical to the survival of the species as it is dominated by winter and spring flowering species such as <i>Eucalyptus tereticornis</i>, <i>E. albens</i>, <i>E. crebra</i>, <i>E. fibrosa</i> and <i>E. melliodora</i> that represent a critical temporal bottleneck in food availability, according to the DAWE listing advice. The Project will clear up to of 52.40 ha of foraging habitat that represents habitat critical to the survival of the species.</p> <p>The magnitude of loss of foraging habitat represents 1.89 percent of habitat available with the Project area.</p>
Disrupt the breeding cycle of an important population.	<p>Unlikely</p> <p>The Project is not expected to disrupt the breeding cycle of the local population. No breeding colonies occur within the Project area. The nearest breeding camps occur at Warwick, to the north of the Project area. Mating commences in early autumn, with young produced in October. Although construction will likely be timed for this period to avoid other environmental impacts (including fauna breeding cycles), no breeding habitat has been recorded within the Project area.</p>
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely</p> <p>The Project will result in the loss of 52.40 ha of suitable foraging habitat for the grey-headed flying-fox. Installation of the turbines may deter flying-fox from utilising the site during operation. However due to the low current utilisation of the site by the species and the lack of suitable breeding habitat within the Project area, the Project is unlikely to significantly impact grey-headed flying-fox habitat to the extent the species is likely to decline.</p>
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat	<p>Unlikely</p> <p>No invasive species are known or considered likely to present a threat to the ecology of the grey-headed flying-fox. No feral predators are known to adversely impact the species. The Project is therefore not expected to result in establishment of invasive species that have the potential to harm the grey-headed flying-fox.</p>
Introduce disease that may cause the species to decline	<p>Unlikely</p> <p>Disease is not a listed threat for this species. The Project is not expected to introduce any diseases that may cause the species to decline.</p>
Interfere substantially with the recovery of the species.	<p>Unlikely</p> <p>Given that the species is highly mobile and moves with the availability of resources, and the loss of predicted foraging habitat represents such a small percentage of regional available habitat, the Project is not expected to interfere with the recovery of the species.</p>

5.3.11 Conclusion

The Project is considered **likely** to have a significant impact on the grey-headed flying-fox due to the loss of habitat critical to the survival of the species as a result of clearing. Offsets are proposed and described in the Karara Wind Farm Project Environmental Offsets Strategy (Attexo 2021).

5.4 Squatter pigeon (southern)

5.4.1 Conservation status and documentation

The squatter pigeon (southern) is listed as Vulnerable under the EPBC Act. Its current distribution extends from central Queensland, west to Longreach and Charleville, and south to New South Wales (TSSC, 2015a).

The species occurs in remnant and regrowth open forest and woodland dominated by *Eucalyptus*, *Corymbia*, *Acacia* and *Callitris* species with tussock grassy understorey within 3 km of water sources (TSSC, 2015a). Soils are generally a good predictor of their foraging and breeding habitat, which is generally restricted to well-draining, gravelly, sandy or loamy soils. These typically have a patchy ground layer composed of native perennial tussock grasses or a mix of native perennial tussock grasses and low shrubs or forbs (Squatter Pigeon Workshop 2011). Breeding habitats are typically on stony rises within 1 km of permanent water (Squatter Pigeon Workshop 2011). The subspecies is unlikely to move far from woodland trees which provide protection from predatory birds (Squatter Pigeon Workshop 2011). Where scattered trees still occur, and the distance of cleared land between remnant trees or patches of habitat does not exceed 100 m, individuals may be found foraging in, or moving across modified or degraded environments (Squatter Pigeon Workshop 2011).

Populations known to occur in the Warwick-Inglewood-Texas region (including the local population) are considered to be important populations for the species under the EPBC Act, given they occur near the southern extent of the species range in an area within which the species has experienced substantial declines (Squatter Pigeon Workshop 2011).

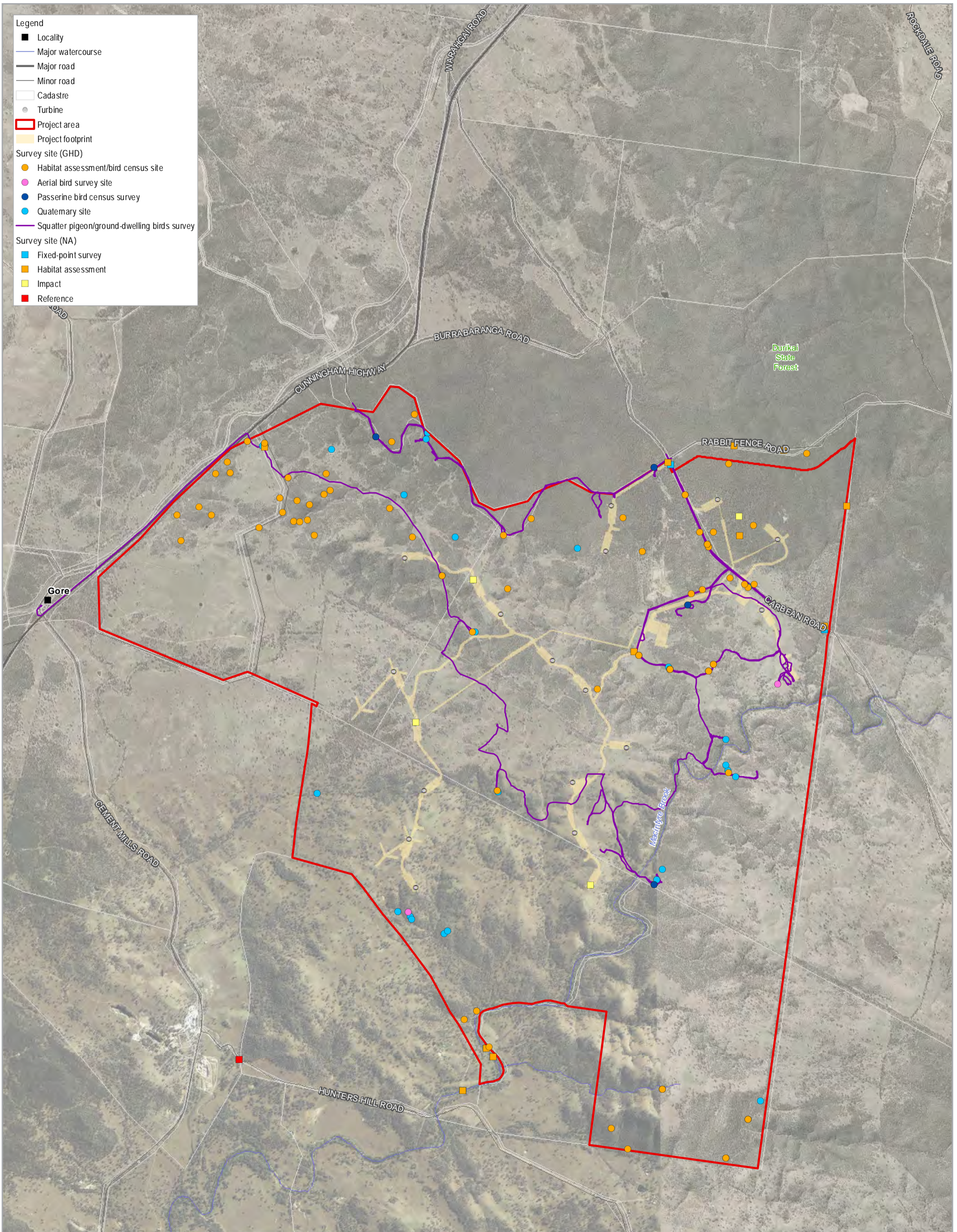
5.4.2 Survey effort

Surveys for the squatter pigeon (southern) utilised methods consistent with those recommended for the species in the Commonwealth Survey guidelines for Australia's threatened birds (DEWHA 2010b).

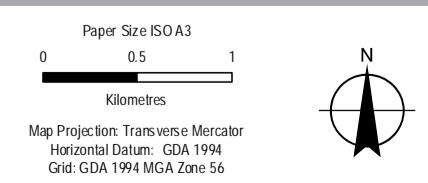
Survey effort for the squatter pigeon (southern) included:

- Area searches/diurnal bird surveys (12 hrs over 5 days)
- Targeted habitat assessments at 9 sites
- Rapid habitat assessments at 92 sites
- Targeted bird census surveys at 2 sites
- Flushing surveys driving a minimum of 542 km
- Area searches for nests (12 hrs)
- RE field verification/habitat confirmation at 70 sites.

Surveys were undertaken in conditions suitable for detecting the species and assessing the value and distribution of their habitat. Survey duration exceeded the number of days and hours. The distribution of survey effort for the squatter pigeon (southern) is mapped in Figure 5.10.



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Distribution of survey effort
 for the squatter pigeon (southern)

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FIGURE 5-10

5.4.3 Criteria used to map squatter pigeon (southern) habitat

5.4.3.1 Commonwealth description of squatter pigeon (southern) habitat

Breeding habitat occurs on stony rises occurring on sandy or gravelly soils, within 1 km of a suitable, permanent waterbody (Squatter Pigeon Workshop 2011). In Queensland, the Commonwealth listing advice specifically nominates RE Land Zone 5 (well-draining, sandy or loamy soils on low, gently sloping, flat to undulating plains and foothills) and RE Land Zone 7 (lateritic (duplex) soils on low 'jump-ups' and escarpments) as suitable foraging and breeding habitat for the species. Ground-level vegetation is typically patchy with vegetation cover rarely exceeding 33 percent (Squatter Pigeon Workshop 2011).

Waterbodies that are suitable for the squatter pigeon (southern) occur on RE land zones 10, 3 and 4 (DAWE 2021). Hence, where natural foraging or breeding habitat occurs (i.e. on RE Land Zones 5 and 7), the squatter pigeon (southern) may be found in vegetation types growing on the above soil types (DAWE 2021).

5.4.3.2 Criteria used to map squatter pigeon (southern) habitat

Mapping of squatter pigeon breeding and foraging habitat was based on the habitat description outlined in the Commonwealth listing advice (DAWE 2021) and utilised the following locally occurring RE communities (Figure 3.1) that are identified by the Queensland Government essential habitat mapping framework as essential habitat factors for the squatter pigeon (southern) as a basis for mapping:

- 11.3.2 *Eucalyptus populnea* woodland on alluvial plains
- 11.3.4 *Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains
- 13.3.4 *Eucalyptus conica*, *E. microcarpa* or *E. moluccana*, *E. melliodora* grassy woodland. Occurs on Cainozoic alluvial plains
- 13.3.5 *Eucalyptus camaldulensis* fringing forest
- 13.11.3 *Eucalyptus crebra*, *E. dealbata*, *E. albens* grassy woodland.
- 13.11.8 *Eucalyptus melliodora* and/or *Eucalyptus microcarpa*/ *E. moluccana* woodland on metamorphics.

Areas of breeding and foraging habitat were differentiated by RE land zone, the condition of habitats as influenced by existing sheep grazing pressures and the density of ground-level vegetation.

As stated in the Commonwealth listing advice, breeding habitat occurs on stony rises within 1 km of permanent water (DAWE 2021). This is specific, nominating RE Land Zone 5 and 7 as breeding habitat. Given no RE land zones 5 or 7 occur within or near the Project area, other suitable RE communities were also considered potential breeding habitat. Land zone 11 REs are located on metamorphosed undulating areas and lower slopes with shallow, gravelly soils (Wilson and Taylor 2012), and are therefore consistent with the Commonwealth definition of breeding habitat.

Land zone 3 REs are restricted to lower alluvial areas along rivers and creek flats and all three local land zone 3 REs (11.3.2, 11.3.4 and 13.3.4) have clay soils. The Commonwealth listing advice states that clay soils usually support denser vegetation types which the squatter pigeon is unlikely to use as foraging or breeding habitat (DAWE 2021). Clay soils that typically occur in lower-lying alluvial areas are however considered important for local movement of squatter pigeons (DAWE 2021).

Mapping of breeding habitat also considered the extent to which ground-level habitats have been degraded by sheep grazing, as observed during field surveys undertaken across the Project area. Extensive parts of the Project area, including some areas that would otherwise represent suitable breeding habitat were highly degraded by sheep grazing and unlikely to hold any breeding value for the squatter pigeon given the absence of tussocky grasses. Examples of suitable and unsuitable potential breeding habitat are shown in Plate 5-9 and Plate 5-10, respectively.



Plate 5-9 *Potentially suitable squatter pigeon habitat*



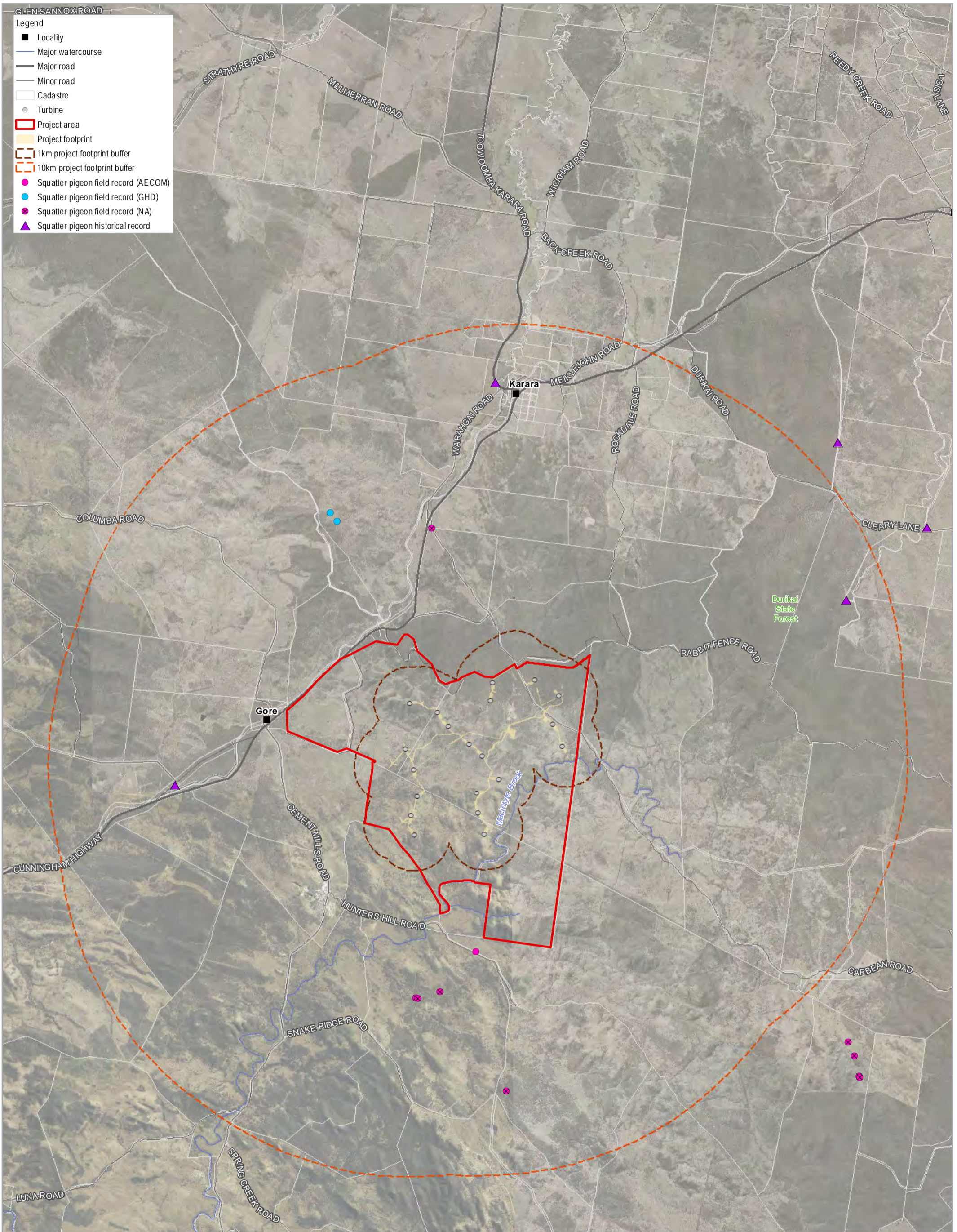
Plate 5-10 *Areas with no habitat value for the squatter pigeon due to degradation of the ground level microhabitats by sheep grazing*

In summary, the following criteria were used to map squatter pigeon (southern) habitat:

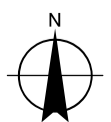
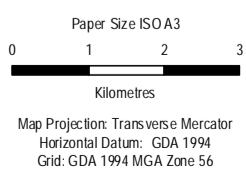
- Breeding habitat included any field verified patch of land zone 11 RE (13.11.3 or 13.11.8) (within the Project area) that occurred within 1 km of permanent water that retained suitable ground-level habitat complexity and vegetation densities (i.e. ground cover of < 33 percent).
- Foraging habitat included any field verified patch of land zone 3 RE (11.3.2, 11.3.4, 13.3.4 or 13.3.5) or any heavily sheep-grazed patch of land zone 11 RE (13.11.3 or 13.11.8) that occurred within 3 km of permanent water.

5.4.4 Desktop results

The squatter pigeon (southern) was identified within the PMST (Appendix A) as known to occur within a 20 km radius from a central point within the Project area. Nearby historical records have been reported 3 km south-west of the Project area, 9 km north of the Project area and two records approximately 10 km north-east of the Project area in Durikai State Forest. The distribution of historical records of the squatter pigeon (southern) is shown in Figure 5.11.



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Distribution of historical records of squatter pigeon (southern)

FIGURE 5-11

5.4.5 Survey results

5.4.5.1 Squatter pigeon (southern) records

The squatter pigeon was not recorded during field surveys within the Project area. The species has been recorded outside of the Project area in surveys undertaken between 2018 and 2021 for the adjacent proposed MacIntyre Wind Farm Project and OHTL Project by AECOM and Nature Advisory.

5.4.5.2 Squatter pigeon (southern) habitat

Potential breeding habitat for the squatter pigeon (southern) occurs towards the south and at the east of the Project area on low stony rises adjacent to Macintyre Brook and around permanent dams near that location. Macintyre Brook is a deeply incised watercourse lined on both sides by low rocky rises with stony or gravelly soils and a patchy ground cover of native tussock grasses. Other patches of RE 13.11.3 and RE 13.11.8 within 1 km of permanent water had been substantially degraded by sheep grazing.

Foraging habitat has been identified and mapped in accordance with criteria defined on the basis of the habitat description outlined in the Commonwealth listing advice (DAWE 2021c) and locally occurring RE communities that are identified by the Queensland Government essential habitat mapping framework as essential habitat factors for the squatter pigeon (southern) (Section 5.4.3.2).

In the order of 254.87 ha of breeding habitat and 560.26 ha of foraging habitat for the squatter pigeon (southern) is present within the Project area.

The distribution of breeding and foraging habitat is mapped in Figure 5.12.

5.4.6 Significance of project footprint

This section assesses the significance of squatter pigeon (southern) habitats within the Project area, whether they constitute habitat critical to the survival of the species, their importance in the context of the local population and whether the local population is important at a national level.

5.4.6.1 Status as an important population

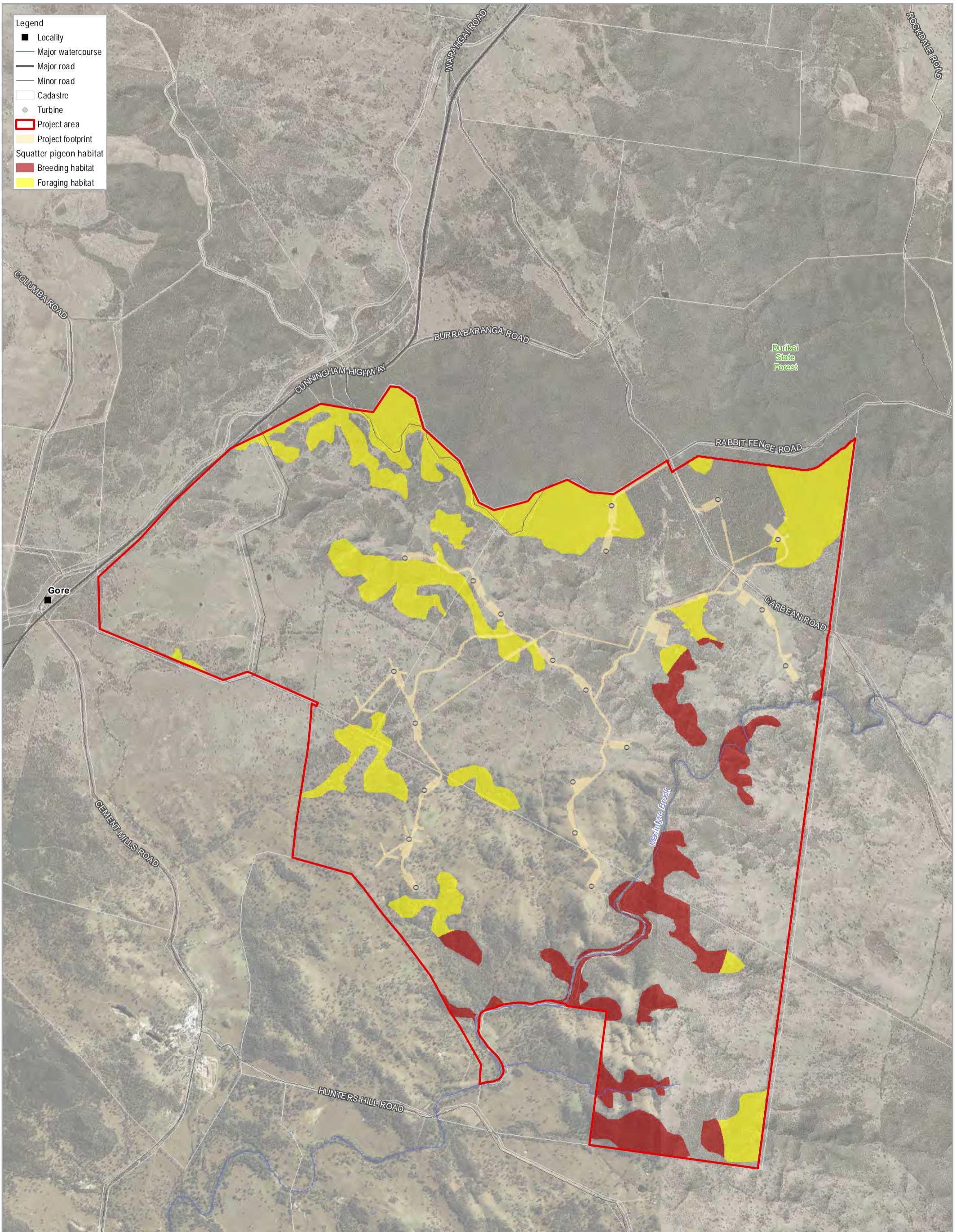
The local squatter pigeon (southern) population is recognised in the Commonwealth listing advice as part of an important population centred on the Warwick-Inglewood-Texas region (Squatter Pigeon Workshop 2011).

5.4.6.2 Status as habitat critical to the survival of the species

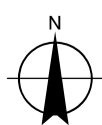
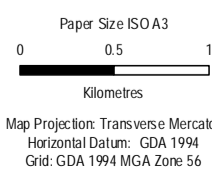
Habitat critical to the survival of the species is not formally defined in the Commonwealth listing advice but is likely to include areas of breeding habitat on the basis of the definitions for MNES in general in the Significant Impact Guidelines 1.1. Within important populations, all breeding, foraging and drinking sites are likely to represent habitat critical to the survival of the species as they are critical to maintaining the local population. All mapped areas of foraging and breeding habitat within the Project area are considered habitat critical to the survival of the species.

The importance of these areas of habitat is exacerbated by the extent and intensity of sheep grazing in the local landscape. Many parts of the Project area and surrounding landscape has been subject to generations of sheep grazing, which have contributed to substantial loss and fragmentation of natural habitat for the squatter pigeon (southern). The understorey and natural substrates have been extensively degraded by grazing and trampling by stock. While the squatter pigeon is known to tolerate localised grazing, the impacts of sheep grazing are considered more damaging and represent one of the principle causes of the species' decline from southern parts of its range (Squatter Pigeon Workshop 2011). The intensity of grazing in many parts of the Project area is likely to be too great to support habitat for this species. Despite this, localised areas of higher value habitat were observed in the Project area as mapped in Figure 5.12.

These occur within 1 km of permanent water sources (i.e. artificial dams).



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Distribution of potential habitat for squatter pigeon (southern) within the project area

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FIGURE 5-12

5.4.7 Threatening processes

Squatter pigeon populations have declined rapidly during the late 19th and early 20th centuries in southern Queensland, as much of its original habitat has been replaced with improved pastures for cattle grazing (Cooper et al., 2014; Higgins & Davies, 1996; Garnett & Crowley, 2000 cited in TSSC, 2015a). The Threatened Species Scientific Committee (TSSC) (2015a) lists a range of threats including ongoing vegetation clearance and fragmentation, loss of habitat through overgrazing by livestock and feral herbivores, such as rabbits, introduction of weeds, inappropriate fire regimes, thickening of understorey vegetation, predation by feral cats and foxes, trampling of nests by domestic stock and illegal shooting.

5.4.8 Potential impacts

The Project will not result in any direct impact on habitat for the squatter pigeon (southern). The Project footprint has been sighted to avoid areas of habitat,

The Project is unlikely to have any substantial impact in terms of operational impacts to the squatter pigeon, with negligible noise, vibration, land disturbance and vehicular movements occurring. Operation of the turbines is not expected to have an impact on the squatter pigeon as the species is generally restricted to ground level and is unlikely to occur at RSA height. Vehicle movements during operations are expected to be in the order of one to two light utility vehicles daily traversing designated access tracks and impacts will be negligible.

Potential impacts to the squatter pigeon that are likely to be experienced during the construction phase of the Project may include the following:

- Loss of habitat
- Injury and mortality
- Disturbance from increased light, noise and vibration
- Habitat degradation through increased dust, run-off and sedimentation
- Introduction and spread of invasive fauna species
- Introduction and spread of weed species
- Disturbance of surface waterways and waterbodies.

These impacts are described further in the following sections.

5.4.8.1 Loss of habitat

The Project is not expected to result in any loss of breeding habitat or artificial dams that represent drinking sites for the species. The Project is anticipated to result in the loss of 12.10 ha of foraging habitat, which represents a loss of 1.65 percent of habitat within a 1 km radius of the Project area.

5.4.8.2 Injury and mortality

Vegetation clearance during construction of the Project will potentially cause injury and/or mortality to squatter pigeons sheltering within ground-level microhabitats. Increased vehicular movements during the construction phase will also increase the risk of injury and mortality, due to the squatter pigeon's sedentary nature and habit of foraging on access tracks.

5.4.8.3 Disturbance from increased light, noise and vibration

Construction will result in a substantial, localised increase in vehicle movements in the short-term, which will increase light, noise and vibration disturbance to local wildlife. Increased light, noise and vibration can alter individual species' behaviours, and disrupt the balance of inter-species interactions. Such disruptions typically favour feral predators and generalist species that owe their success to broad ecological tolerances and possess the ability to tolerate or actively exploit disturbed environments (Hero et al. 2004).

5.4.8.4 Habitat degradation by increased dust, run-off and sedimentation

Construction activities have the potential to generate localised dust, erosion, run-off and sedimentation through increased vehicle movements, clearance of vegetation and earthworks. This can reduce the abundance and diversity of adjacent terrestrial and aquatic habitats by physically smothering vegetation, changing nutrient levels, impeding the growth and germination of plant species, encouraging weed incursions and altering the movement and behaviour of fauna species.

The receiving environment has already been subject to high levels of erosion and sedimentation as a result of existing land-clearing and grazing activities. Nevertheless, sensitive ecological receptors (e.g. larger woodland remnants and aquatic habitats) are particularly susceptible to adverse impacts associated with dust, run-off, erosion and sedimentation. These areas require protection through the implementation of sediment and erosion control measures during construction.

Adverse weather conditions during construction can exacerbate the potential impact of erosion and sedimentation. High rainfall has the potential to remove exposed topsoil, destabilise creek beds and distribute sediment through creek line. Strong winds have the potential to spread exposed topsoil, decreasing the likelihood of recolonisation by vegetation and potentially distributing dust into nearby sensitive environments.

5.4.8.5 Introduction and spread of pest fauna species

Pest fauna species recorded within the Project area included feral pigs (*Sus scrofa*), dog (*Canis lupus*), cat (*Felis catus*) and fox (*Vulpes vulpes*). The Commonwealth listing advice identifies predation by cats and foxes and to a lesser extent, dingos as key threats to the species (DAWE, 2021). The Project is already subject to high levels of disturbance and cats and foxes are likely to be ubiquitous in the landscape. While construction of new tracks can facilitate the movement of feral predators, the network of existing farm tracks is such that the Project is unlikely to exacerbate movement of feral animals across the Project area. Management measures will be incorporated to reduce the abundance of distribution of introduced pests throughout the Project area. Wild dogs are known to attack sheep on grazing properties within the Project area and are likely to feed opportunistically on squatter pigeons. Land holders currently undertake ad hoc wild dog management to protect sheep stock, but this is not monitored or managed in any way and has the potential to inadvertently increase cat and fox predation pressures on squatter pigeons by removing dogs from the area. Monitoring and periodic control of dogs, cats and foxes will be undertaken as part of the Project's operational management measures, providing a level of ecological management to feral predator control that is currently lacking. The Project therefore has the potential to reduce predation pressures on the local squatter pigeon population.

5.4.8.6 Introduction and spread of weed species

The Project has the potential to adversely impact habitat for the squatter pigeon (southern) by introducing or spreading exotic weed species. The squatter pigeon is reliant on foraging habitat within native tussocky grasses. As such, the introduction and spread of weeds, particularly exotic pasture grasses can substantially reduce the availability and quality of foraging habitat. Foraging habitat within the Project area is already highly degraded by exotic pasture grasses. The Project has the potential to exacerbate the loss through introduction and spread of weeds. Clearing native vegetation creates areas of disturbance that are naturally susceptible to colonisation by invasive weed species. These can form a local source of future weed infestations within the surrounding landscape.

5.4.8.7 Disturbance of surface waterways and waterbodies

Construction activities within and/or in the vicinity of watercourses have the potential to cause degradation of riparian habitats through:

- Removal of riparian vegetation
- Run-off, sedimentation and erosion
- Point-source pollution (chemical and fuel spills)
- Disturbance associated with noise, vibration and/or artificial lighting.

Turbines have primarily been sited high on slopes away from watercourses and drainage lines. Access tracks have been sited to minimise the number of water crossings; however, there are a number of intersections of mapped watercourses and ephemeral creek lines. These areas are ecologically important for movement of wildlife, as habitat and drinking sites and are potentially susceptible to construction-related disturbance.

5.4.9 Measures to avoid, reduce or mitigate impacts

5.4.9.1 Loss of habitat

Planning phase measures that have been employed to avoid and reduce the direct loss of habitat include:

- Locating the Project footprint, where practicable, in open areas that have been subject to historical land clearing and sheep grazing
- Minimising impacts to watercourses wherever practicable
- Utilising existing tracks where practicable and locating proposed tracks within previously disturbed areas where practicable.

During the construction phase of the Project, the following mitigation measures will be employed:

- Land clearing will be restricted to the minimal amount necessary for the construction of the Project and will not extend outside of the Project footprint.
- The extent of vegetation clearing (and no-go areas) will be clearly identified on construction plans and in the field using high visibility fencing or flagging in the vicinity of high conservation significant areas. Clearing extent will be communicated to construction supervisors.
- Where infrastructure must cross waterways, areas of existing disturbance (i.e. existing tracks) have been selected. Where this is not practicable, the Project footprint has been minimised.
- Site offices, construction stockpiles and laydown/storage areas will be located within existing cleared or disturbed areas.
- Rehabilitation of temporary laydown areas, stockpiles, site offices and areas will be undertaken as soon as practicable after these facilities are no longer required.
- A CMP has been prepared to inform actions with regard to managing weed hygiene, erosion, fuels and hazardous substances, fire, etc. and includes erosion and sediment control measures.
- All construction personnel will attend environmental training as part of the site induction process prior to entering the work site. As part of this training, all personnel will be instructed on their obligations in regard to vegetation clearing protocols. Areas identified for vegetation clearance are to be clearly defined and detailed in site inductions.
- A portion of the pad adjacent to turbines will be revegetated with locally occurring grasses and will therefore retain habitat values for the squatter pigeon. While commitment is made to rehabilitation in keeping with good practice and will be undertaken, given the outcomes of rehabilitation cannot be confirmed or guaranteed at this time and are subject to detailed design and construction planning, conservatively, all habitat within the Project footprint is for the purpose of the assessment taken to be a loss.

5.4.9.2 Injury and mortality

While the squatter pigeon (southern) is susceptible to injury and mortality during construction projects, the risks can be effectively managed using routine management measures targeted at the species. The following measures will be implemented to avoid/minimise injury and/or mortality to squatter pigeons during construction of the Project:

- Pre-clearance surveys will specifically target areas of habitat identified within the clearing footprint. Pre-clearance surveys will be undertaken to mark the locations of potential breeding places.
- Vehicles to be restricted to 40 km/hr along access tracks

- Areas of habitat for the squatter pigeon will be flushed immediately prior to clearing (i.e. spotter-catcher to walk in front of clearing machinery).
- All clearing will be supervised by suitably qualified and experienced fauna spotter-catchers. This will involve relocating any resident fauna to the nearest suitable, safe habitat outside the clearing footprint.
- Temporary exclusion fencing will be established around cleared areas in locations of high ecological sensitivity to prevent wildlife from returning to works areas where deemed appropriate.
- Adverse incident response procedures will be developed to detail actions to be taken in the event of wildlife injury or mortality during clearing.
- A Traffic Management Plan, consistent with objectives and controls described in the transport and road network mitigation measures of the CMP, will be developed for the Project with designated access routes, speed limits and identified sensitive ecological areas (particularly areas where squatter pigeons have the potential to occur on access roads).
- Given the specific susceptibility of the squatter pigeon to vehicle collision - warning signs will be erected on all tracks that intersect locations in which the squatter pigeon has been confirmed present
- Squatter pigeon awareness will be included in all worker inductions and in the Traffic Management Plan.
- A register of squatter pigeon sightings will be maintained to identify areas that have a high risk of collision.
- The CMP will comprise protocols to limit injury and mortality to fauna including management of risks associated with open excavations, trenching, waterbodies and responses and reporting for roadkill and adverse incident protocols.
- A high risk SMP will be prepared in accordance with the requirements of Section 332 of the Nature Conservation (Wildlife Management) Regulation 2006.

5.4.9.3 Disturbance from increased light, noise and vibration

Routine mitigation measures will be undertaken to minimise the impact that noise, light, vibration and disturbance have on local wildlife populations. This is particularly important within the vicinity of habitat for conservation significant fauna species, including the squatter pigeon. The following measures will be used to minimise the impacts of light, noise and vibration during construction:

- Site lighting will be kept to the minimum (security) required for safety. Placement and orientation of lighting to be directed away from sensitive fauna habitat. Direction of lighting beam downwards or use of shields and baffles to limit light spill beyond site boundary.
- Wherever practicable, construction activities will be limited to daylight hours to reduce the need for lighting and resultant light spill into adjacent habitat.
- A Traffic Management Plan will be developed for the construction site to control vehicle movements and reduce the unnecessary generation of vehicular noise.
- All construction vehicles will comply with maintenance schedules and operational restrictions designed to limit noise impacts during construction.

5.4.9.4 Habitat degradation by increased dust, run-off and sedimentation

The following mitigation measures will be used to minimise the impacts of dust, run off and sedimentation during construction of the Project:

- Erosion and sediment controls have been developed as part of the CMP.
- Routine dust suppression and monitoring will be undertaken throughout construction and operation.
- Duration of in-stream works will be minimised wherever practicable to reduce the potential for sedimentation.
- Erosion and sediment control measures will be installed where in-stream disturbance must be undertaken during flow conditions.

- Areas subject to clearing will be stabilised as soon as practicable.
- All vehicle movement will be restricted to designated tracks located within the Project footprint.
- Weather conditions will be monitored during the construction stage and temporary controls will be established during extreme weather events.
- Construction activities during adverse weather conditions will be managed in accordance with the CMP
- Rehabilitation of temporary construction areas will be undertaken as soon as practicable after clearing (subject to landowner agreement). While commitment is made to rehabilitation in keeping with good practice and will be undertaken, given the outcomes of rehabilitation cannot be confirmed or guaranteed at this time and are subject to detailed design and construction planning, conservatively, all habitat within the Project footprint is for the purpose of the assessment taken to be a loss.

5.4.9.5 Introduction and spread of pest fauna species

Although the Project area is already exposed to relatively high levels of pest infestation, mitigation measures will be required to limit any spread of pest fauna that could result from construction activities. The following mitigation measures will be used to minimise the introduction and spread of pest fauna and weed species during construction for the Project:

- Responsible waste management practices (e.g. not leaving out food waste and not feeding wildlife) will be implemented and followed by all construction personnel. All waste will be stored in secure temporary holding containers and transported off site.
- Waste management actions are included in the CMP and include:
 - Requirements for details on the location and specifications for disposal and removal of waste from the construction site.
 - All putrescible waste to be stored in secure temporary holding containers and transported off site.
- Sightings or evidence of pest fauna will be recorded in a pest register. If increased densities of pest fauna are observed, or new pest animals are identified, humane pest controls will be implemented to manage numbers.
- Implement a pest (feral animal) management plan, in consultation with landholders. This will represent a comprehensive management of feral predators including cats and foxes which are recognised as key threats to the squatter pigeon (southern).
- Construction staff will not bring domestic animals to the Project area.
- All construction personnel shall attend environmental training as part of site inductions. As part of this training, all personnel will be instructed on their responsibilities related to avoiding and minimising the introduction/attraction to the construction site of pest animals.

5.4.9.6 Introduction and spread of weed species

The following measures will be implemented to minimise the introduction and spread of weeds:

- Weed management actions are included in the CMP and include:
 - Hygiene protocols restricting the movement of vegetation and soil between impacted areas and areas of significantly lower weed infestation.
 - Protocols for monitoring and management of weeds to identify and appropriately respond to significant changes in weed distribution and density
- Vehicles / equipment travelling from a declared restricted place or quarantine area will be required to wash down and possess a current weed hygiene inspection certificate before moving to a weed free area.
- All machinery and equipment will undertake washdown prior to accessing site and possess a current weed hygiene inspection certificate from an inspector who is deemed competent and is certified in line with DAF requirements.
- Vehicle access will be restricted to within the Project footprint and existing roads and tracks
- Preliminary weed mapping will be undertaken. This will provide a baseline of existing weed infestation across the Project area to inform weed management.

5.4.9.7 Disturbance of surface waterways and waterbodies

The following mitigation measures will be used to minimise the disturbance of waterways and waterbodies during construction of the Project:

- The potential for direct impact on waterways has been largely avoided by locating the Project footprint away from existing waterways during the preliminary design phase. Impact to waterways is limited to waterway crossings along access tracks and underground cabling located within the Project footprint.
- Wherever practicable, watercourse crossings have been located at established crossing points on existing access tracks. Where this is not practicable, the disturbance area is restricted to within the Project footprint.
- Erosion and sediment controls have been developed as part of the CMP.
- Dust suppression activities will be undertaken where appropriate. Stabilisation of disturbed areas will be undertaken as soon as practicable after disturbance.
- Rehabilitation of cleared areas adjacent to waterways will be undertaken as soon as practicable after clearing. While commitment is made to rehabilitation in keeping with good practice and will be undertaken, given the outcomes of rehabilitation cannot be confirmed or guaranteed at this time and are subject to detailed design and construction planning, conservatively, all habitat within the Project footprint is for the purpose of the assessment taken to be a loss.
- Refuelling will be undertaken away from waterways.
- Storage of fuels, chemicals, wastes and other potentially environmentally hazardous substances will be banded or otherwise contained areas away from waterways.
- Emergency response protocols and procedures have been developed as part of the CMP for implementation in the event of a contaminant spill or leak and provision of spill response equipment.

5.4.9.8 Summary of residual impacts on squatter pigeon (southern)

A summary of the Project's potential impacts on the squatter pigeon (southern) and mitigation measures is presented in Table 5-7. The risk ratings are presented in Appendix E.

Table 5-7 Residual impact assessment for the squatter pigeon (southern)

Impact	Initial impact rating	Mitigation measures	Residual impact
Injury or mortality due to vegetation clearing	High	Employ a fauna spotter catcher during clearing. Reduce speed limits within areas of potential habitat Allow a fauna spotter catcher to walk through clearing footprints prior to clearing. Identify areas of potential habitat with signage and flagging tape.	Low
Habitat fragmentation and reduced connectivity	Moderate	Project to remain unfenced to allow dispersal throughout the Project area. Revegetate temporarily cleared areas (e.g. laydown areas) with native grasses.	Low
Disturbance from increased light, noise and vibration	Moderate	Restricted sources of artificial lighting. Direct lighting away from sensitive areas for the species	Low
Habitat degradation through increased dust, run-off and sedimentation.	Low	Restrict works within watercourse to minor excavations only (e.g. bed level crossings). Monitor weather events when working within watercourses. Reduce speed limits during dry conditions or employ and water truck to reduce dust rates.	Negligible
Introduction and spread of invasive fauna and weed species	Moderate	Implement measures for introduced flora and fauna contained within the CMP. Require construction vehicles to hold valid weed free declarations. Educate staff on the impacts of weeds and their general environmental obligation. Identify areas of dense outcrops of introduced flora to eliminate construction vehicles from entering the area. Implement trapping and baiting programs should introduced pests be identified.	Low
Disturbance of surface waterways and waterbodies.	Moderate	Restrict works within watercourse to minor excavations only (e.g. bed level crossings). Monitor weather events when working within watercourses. Reduce speed limits during dry conditions to reduce dust generation and potential sedimentation.	Low

5.4.10 Significance of impact assessment

An assessment of the significance of the Project's impacts on the squatter pigeon (southern) was undertaken against the Significant Impact Guidelines 1.1 (DoE 2013) and presented in Table 5-8.

Table 5-8 Significance of impact on squatter pigeon

Impact criteria	Potential to occur
Lead to a long-term decrease in the size of an important population of a species.	<p>Unlikely</p> <p>The local squatter pigeon population is at the southern extent of the species' known range and is therefore recognised as an important population under the EPBC Act (Squatter Pigeon Workshop 2011). Existing habitats within the Project area have been extensively degraded by drought and intensive grazing and while the species is known to tolerate localised grazing, the intensity of grazing is likely to be too great in most parts of the Project area to support habitat for this species. The Project will result in a direct loss of 12.10 ha of foraging habitat for the squatter pigeon (southern), representing only 1.65 percent of the habitat available within a 1 km radius of the Project area. No suitable breeding habitat or drinking sites will be directly impacted. The Project is unlikely to have any substantial impact on the species in the operation phase. Increased vehicular movements during construction has the potential to increase the risk of mortality and injury of squatter pigeons, however this will be managed through implementing speed limits and signage in areas that may support the species. The Project is unlikely to have any substantial operational impacts on this species, with negligible noise, vibration, land disturbance and vehicular movements. The squatter pigeon is generally restricted to ground level and is unlikely to ever occur at RSA height. Permanent speed limits and signage on internal roads and education of staff during inductions will minimise the risk of direct mortality by operational vehicles. As such, the Project is therefore unlikely to lead to a long-term decrease in the size of an important population of a species.</p>
Reduce the area of occupancy of an important population.	<p>Unlikely</p> <p>As detailed above the local squatter pigeon population is currently among the listed important populations of the species. The project will result in the direct loss of 12.10 ha of foraging habitat for the squatter pigeon, representing only 1.65 percent of the habitat available within a 1 km radius. The project is unlikely to have any substantial impact on the species in the operation phase. The species is therefore likely to persist within the local 2 km x 2 km area that is used to measure changes in local area of occupancy. Given the Project is unlikely to have any substantial impact on the species in the operational phase, and the continued presence of suitable habitat within the local area, the Project is unlikely to reduce the area of occupancy of the local squatter pigeon population.</p>
Fragment an existing important population into two or more populations.	<p>Unlikely</p> <p>Within the Project area, the squatter pigeon already utilises habitats that have been subject to a high level of fragmentation, occurring in sparse, modified grassland and open woodland habitats, where connectivity is loosely maintained to larger woodland remnants and water sources. The Project will have minimal direct impact on habitat for the squatter pigeon, resulting in a loss of 12.10 ha from a relatively dispersed area. Habitat connectivity will be maintained among areas of habitat both within the Project area and adjacent to it by maintaining ground-level substrates and vegetation and by retaining existing unsealed tracks that provide pathways for local squatter pigeon movement. Accordingly, the Project is unlikely to fragment the important population into two or more populations.</p>
Adversely affect habitat critical to the survival of a species.	<p>Likely</p> <p>The Project will result in the direct loss of 12.10 ha of foraging habitat for the squatter pigeon. While the loss of habitat represents only 1.65 percent of that available within a 1 km radius of the Project area and there will be no impact on breeding habitat or drinking sites, given the local population is considered important at a national level, all habitat would represent habitat critical to the survival of the species. The loss of foraging habitat therefore represents and adverse impact on habitat critical to the survival of the species.</p>

Impact criteria	Potential to occur
Disrupt the breeding cycle of an important population.	<p>Unlikely</p> <p>The local population is among those populations that are currently listed as 'important'. No predicted breeding habitat will be cleared for the Project. Connectivity will be maintained with adjacent drinking sources. Critical drinking sources such as dams and water troughs will be maintained where practicable to support the viability of local breeding habitats. Construction activities have the potential to cause short-term disruption to breeding activities immediately adjacent to construction areas. The impact will be temporary and is unlikely to result in a loss of an entire annual cohort as the species is expected to continue to breed in some areas that are located further from construction areas and the species is known to breed all year round (Squatter Pigeon Workshop 2011). The Project is therefore not expected to disrupt the breeding cycle of the population.</p>
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely</p> <p>The Project will impose no direct or indirect impact on breeding habitat or drinking sites for the squatter pigeon. As the Project will not impose any barriers to squatter pigeon movement it will not restrict ongoing access to resources during the operation phase. Habitat impacts will be limited to a loss of 12.10 ha of sub-optimal foraging habitat. The impact is dispersed over a large area and affects areas of foraging habitat that are already substantially degraded by sheep and goat grazing. The proportional loss of resources is relatively minor, representing only 1.65 percent of the foraging habitat in a 1 km radius of the Project area. On this basis, the loss is considered unlikely to cause the species to decline. Furthermore, the 12.10 ha includes areas such as tracks, underground electrical reticulation and temporary works areas that will be reinstated and utilised by the species for foraging and/or dispersal during the operation phase. Weed and feral pest management measures will be implemented over the lifetime of the Project. As there is currently no strategic weed or pest management in the area, these management measures are likely to increase the quality of foraging habitats by reducing competition with weeds and limiting predation by foxes and cats.</p>
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat	<p>Unlikely</p> <p>Known feral predators of the squatter pigeon (i.e. cats and foxes) are considered to be ubiquitous in the Project area region. The Project will not introduce any external food sources that could increase the local densities of these feral predators. The Project area is currently subject to low levels of weed infestation. Unmitigated, the Project has the potential to increase local weed densities and thereby threaten the potential for squatter pigeons to move through the landscape. Implementation of standard weed management protocols during construction and operation is expected to mitigate this risk to low levels. The Project is unlikely to result in invasive species that are harmful to the squatter pigeon becoming established in the species habitat.</p>
Introduce disease that may cause the species to decline, or	<p>Unlikely</p> <p>No diseases or pathogens are identified among current known threats to the squatter pigeon. The weed-wash down and hygiene protocols that will be implemented through construction to manage the on-site spread or export of weeds will also act to reduce the potential for transmission of disease. This risks to squatter pigeons associated with disease transmission are therefore considered negligible.</p>
Interfere substantially with the recovery of the species.	<p>Unlikely</p> <p>Despite the impacts on foraging habitat, the project is unlikely to have any substantial impact in terms of its impact during the operational phase.</p> <p>Operation of the project is unlikely to have any impact on the behaviour or use of habitats among the local squatter pigeon population. Implementation of a Weed Management Plan for the project has the potential to increase the value of local habitats. Local noise disturbance and mortality threats associated with the project are also expected to be low.</p>

5.4.11 Conclusion

The Project is considered **likely** to have a significant impact on the squatter pigeon (southern).

5.5 White-throated needletail

Investigations and assessment of white-throated needletail has been informed by GHD surveys undertaken between 2018 and 2020 and additional targeted assessment undertaken by Nature Advisory in 2020 and reported in EPBC Act threatened birds – habitat and regional assessment and targeted surveys (Report No. 20033 (14.3) (Nature Advisory, 2021a) with summaries provided in sections below.

5.5.1 Conservation status and documentation

This species is widespread in eastern and south-eastern Australia and is recorded in all coastal regions of Queensland and New South Wales extending inland to the western slopes of the Great Dividing Range and occasionally onto the adjacent inland plains. The species is also widespread in Victoria and Tasmania and occurs in south-eastern South Australia (Threatened Species Scientific Committee 2019).

The white-throated needletail subspecies that occurs in Australia is *Hirundapus caudacutus*. This subspecies is a trans-equatorial migrant that breeds in the Northern Hemisphere summer and migrates south for the Southern Hemisphere summer. The white-throated needletail is mostly aerial in Australia, flying at heights of less than 1 m up to more than 1,000 m above the ground. It has been recorded eating a wide variety of insects, including beetles, cicadas, flying ants, bees, wasps, flies, termites, moths, locusts and grasshoppers (Threatened Species Scientific Committee 2019).

The species occurs over most habitat types and is recorded most often above wooded areas, including open forest and rainforest, and may also fly below the canopy between trees or in clearings. When flying above farmland, it is more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks (Threatened Species Scientific Committee 2019).

In Australia, confirmed and high confidence records of white-throated needletail roosting indicate the species roosts in dense foliage of canopy trees in large tracts of treed remnant vegetation along or contiguous with mountain ranges as detailed in the records below:

- Very dense foliage in the crown of a eucalypt (16 m tall) on a spur at Mt Coot-tha, Brisbane Queensland (D'Aguilar Range) (Corben et al. 1982).
- Fairly thick foliage in the crown of two acacias (14 m tall) and one banksia at Little Waterloo Bay, Wilsons Promontory, Victoria (mainland southern extremity of Great Dividing Range) (Day 1993).
- Eucalypt on a spur at Nearum, Queensland (Gongiberoo Range) (Tarburton 1993).
- Outer branch of a large Narrow-leaved Ironbark (*Eucalyptus crebra*) and near the top of mid-sized White Cypress Pine (*Callitris glaucophylla*) in West Pilliga, New South Wales (remnant vegetation contiguous with Warrumbungle Mountain Range and mountain range within Pilliga Nature Reserve) (Stanton 2011).
- It is also noted the species has been recorded landing in the crown of a Rough-barked Apple at Munghorn Gap New South Wales (Great Dividing Range) where the individual remained for four minutes (Quested 1982) although this is not considered a confirmed or high confidence record of the species roosting as the individual was only observed in the tree for a short period of time.

The species is also reported to roost in tree hollows (Threatened Species Scientific Committee 2019), bark on trees or rock faces and is likely to have traditional roost sites (DoE 2015c). It has been noted that the number of references to White-throated Needletail roosting in trees possibly over-emphasizes such occurrences. During extreme conditions including bushfires and cold, hot or inclement weather, the species is also known to take refuge in tree hollows, trees and stunted scrub (Department of Agriculture, Water and the Environment 2021).

5.5.2 Survey effort

There are no Commonwealth survey guidelines for the white-throated needletail.

Bird surveys in general were designed to meet the assessment requirements of the Queensland State Code 23 for Wind Farm Development (DILGP, 2017), the National Wind Farm Development Guidelines Draft (EPHC, 2010) and survey guidelines for conservation significant species with

potential to occur, as detailed in the Queensland Terrestrial Vertebrate Fauna Survey Guidelines (Eyre et al., 2018) and Commonwealth Survey guidelines for Australia's threatened birds (DEWHA, 2010b) and included:

- Habitat assessments / rapid survey – (including bird census) at 103 sites
- Aerial bird surveys at two sites
- Fixed point bird census at four locations
- Bird utilisation surveys of airspace at five sites

Aerial surveys were undertaken to identify the presence of white-throated needletails within the Project area. Habitat assessments were undertaken to assess the value of habitat for the species. Surveys were undertaken in conditions suitable for detecting the species and assessing the value and distribution of their habitat

A summary of ecological survey effort is provided in Table 2-1 and shown in Figure 2.2. Surveys were undertaken in conditions suitable for detecting the species and assessing the value and distribution of their habitat.

Pre-construction bird utilisation surveys undertaken by Nature Advisory (2021b) to inform the BBAMP (Section 2.3.5) were based on the standards for assessing risks to birds from wind farms in Australia as outlined in the 'Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia' (Clean Energy Council 2018). The survey provided for the following information:

- Bird species (diversity) utilising the study area
- The relative frequency of activity and density of birds on site
- Flight patterns and heights in relation to wind turbine heights
- The broad distribution of bird species across the wind farm site.

5.5.3 Criteria used to map white-throated needletail habitat

The Commonwealth conservation advice lists white-throated needletail habitat as (TSSC 2019):

- **General habitat:** In Australia, the white-throated needletail is mostly aerial, from heights of less than 1 m up to more than 1000 m above the ground. Although they occur over most types of habitat, they are recorded most often above wooded areas, including open forest and rainforest, and may also fly below the canopy between trees or in clearings (TSSC 2019)
- **Roosting habitat:** The species roosts in trees amongst dense foliage in the canopy or in hollows (TSSC 2019).

In Australia, confirmed and high confidence records of white-throated needletail roosting indicate the species roosts in dense foliage of canopy trees in large tracts of treed remnant vegetation along or contiguous with mountain ranges (Nature Advisory, 2021a)). Given the absence of suitable roosting habitat, no habitat for the white-throated needletail has been mapped for the Project area.

5.5.4 Desktop results

The white-throated needletail was identified within the PMST (Appendix A) as known to occur within a 20 km radius from a central point within the Project area. The distribution of historical records of the white-throated needletail is mapped in Figure 5.13.

5.5.5 Survey results

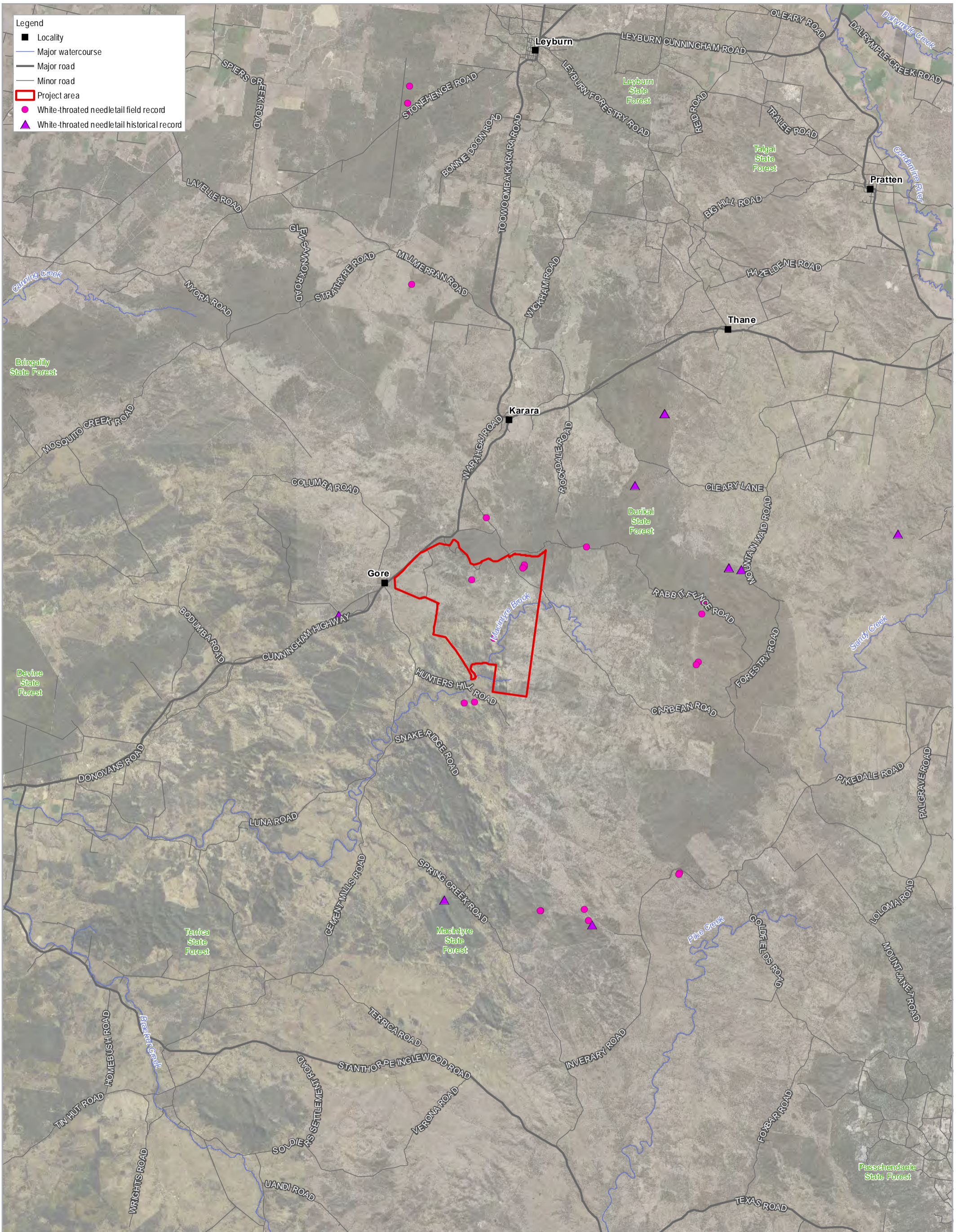
No white-throated needletail habitat was recorded within the Project area; however, the species has been observed in airspace above the Project area from eight records during Nature Advisory early wet (3-8 December 2020) and late wet season (1-6 February 2021) field surveys. Three observations were made, consisting of a total of 20 counts. The species was observed in counts of two, four and 14. The species was observed at heights between 10 m and 200 m. In addition there are 17 records of the species within the proposed MacIntyre Wind Farm Project area (Nature Advisory 2020b, Nature Advisory unpublished data, GHD 2020b).

Survey records are shown in Figure 5.13.

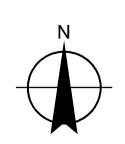
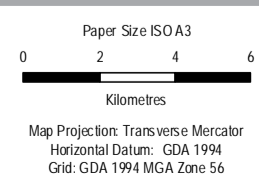
All individuals were observed foraging at height as. No individuals were observed in the tree canopy, searching for or landing at a roosting location.

In locations elsewhere in Australia where roosting locations have been confirmed or there is high confidence of the species roosting at a location, the species has been observed exhibiting roost searching behaviour close to dusk which includes flying through the tree canopy and landing and leaving a location a number of times before settling to roost (Corben et al. 1982; Day 1993; Tarburton 1993; Stanton 2011).

As stated in the Commonwealth listing advice, the white-throated needletail is almost exclusively aerial, and does not have typical associations with habitat (TSSC, 2019). While the species does utilise roosting habitat on rare occasions, this is typically associated with densely vegetated woodland in mountainous terrain.



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Acciona Energy Australia Global Pty Ltd
 MNES Assessment Report

Distribution of records for white-throated needletail within the project area

Project No. 12525037
 Revision No. 0
 Date 09/08/2021

FIGURE 5-13

5.5.6 Significance of project footprint

This section assesses the significance of white-throated needletail habitats within the Project area, whether they constitute habitat critical to the survival of the species, their importance in the context of the local population and whether the local population is important at a national level.

5.5.6.1 Status as an important population

Important populations have not been formally identified for the white-throated needletail in the Commonwealth listing advice for the species. The species does not breed in Australia and the local population is not near the limit of the species distribution and is therefore not likely to be an important population in the general definition outlined the Significant impact guidelines 1.1 (DoE 2013).

5.5.6.2 Status as habitat critical to the survival of the species

Habitat critical to the survival of the species has not been specified in the Commonwealth conservation advice for the white-throated needletail. However, using the general definition in the Significant impact guidelines 1.1 (DoE 2013), this is likely to include areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal
- For the long-term maintenance of the species (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
- For the reintroduction of populations or recovery of the species.

Utilisation of the airspace above the Project area was consistent with general foraging that would be undertaken over a broad area in the surrounding landscape. The species does not breed in Australia, so is not reliant on any breeding resources locally. While roosting habitat is likely to represent habitat critical to the survival of the species, this is typically associated with heavily vegetated woodland on mountainous terrain. No suitable roosting habitat occurs within the Project area. On that basis, the Project area would not provide habitat critical to the survival of the white-throated needletail.

5.5.7 Threatening processes

There is evidence of white-throated needletails colliding with wind turbines, overhead wires, windows and lighthouses in Australia; however, the scale of impact at the population level requires further investigation (TSSC 2019). Other threatening processes identified as possible causes of decline of the white-throated needletail in Australia include the use of insecticides and the loss of roosting sites (Tarbuton 2014, cited in TSSC 2019). Loss of forest and woodland habitats may have also resulted in reduction in invertebrate prey (TSSC 2019).

The greatest risk posed to the white-throated needletail occurs in the northern hemisphere where logging of forests has occurred in breeding grounds and where the species was formerly hunted in its breeding grounds (TSSC 2019).

5.5.8 Potential impacts

5.5.8.1 Injury and mortality

Collision mortality of white-throated needletails has been occasionally reported from Australian wind farms where the species occurs, although this is a low severity threat and affects a small number of birds (Hull et al 2013, Nature Advisory, unpublished data).

Adjacent to the Project area, the species has been recorded flying at RSA height at times. A threshold of mortality of ten individuals annually can be considered a significant impact to the species (Department of Environment 2015). Records of white-throated needletail within the Project area despite survey over years and at across appropriate seasons, are not extensive. Together with wind turbine strikes affecting only small number of individuals across wind farms in Australia, it is not expected that the mortality threshold would be exceeded. Ongoing bird utilisation surveys will inform the Before-After-Control-Impact (BACI) assessments for the Project.

5.5.8.2 Loss of habitat

Consistent with habitat definitions provided in Section 5.5.3, white-throated needletail roosting habitat was considered to be absent from the Project area (Nature Advisory 2021). It is considered that the Sundown National Park located 28 km to the south of the Project area may provide potential roosting habitat as it contains large tracts of treed remnant vegetation along a mountain range (Nature Advisory, 2021a) in keeping with habitat definitions.

As reported by Nature Advisory (2021a) the airspace above the Project area is not of particular significance to the species. There is generally an even distribution of records of the species over the Project area and within 50 km of the Project area.

The loss of forest and woodland habitats may contribute to the decline in the species as a result of impacts to and loss of habitat for invertebrate prey for white-throated needletail (TSSC 2019). In the order of 18.68 ha of treed remnant vegetation may be removed for the proposed Project area, approximately 7,927.14 ha of treed remnant vegetation occurs within 10 km of the Project area. Given the long-ranging daily movements and flight height range of the white-throated needletail, this is not considered a significant reduction in treed remnant vegetation that would reduce invertebrate prey to an extent that would impact the capacity for the airspace over the Project area to provide foraging habitat for the species.

5.5.9 Measures to avoid, reduce or mitigate impacts

The following factors of wind farm design and operation are universally considered to reduce the risk of collision among birds:

- Wind turbine spacing and orientations have shown to influence collision risks with arrays that sit oblique to natural topography generally carrying elevated collision risks (Marques et al 2014)
- Lighting has been shown to increase collision risks in some bird species, as this can disorient birds in flight (Smales 2015).

During the planning stage, a number of measures were employed to avoid and reduce the direct loss of habitat for the white-throated needletail. A preliminary ecological constraints assessment was undertaken to identify and avoid areas of high ecological value wherever possible. Key outcomes included:

- Avoiding large remnants of established woodland within Durikai State Forest
- Utilising existing tracks wherever possible and locating proposed tracks within previously disturbed areas wherever possible to avoid or minimise disturbance to vegetation and habitat.

Lighting is not required on the turbines for the site and is not proposed.

A BBAMP has been prepared for the Project and includes monitoring and adaptive management measures to assess and mitigate collision impacts on the white-throated needletail.

The BBAMP establishes monitoring and management procedures consistent with the methods outlined by the Australian Wind Energy Association (AusWEA 2005) and endorsed in the Clean Energy Council's Best Practice Guidelines (CEC 2018).

The BBAMP adopts an adaptive manage approach with specific objectives derived from recent conditions of approval for wind farm projects as follows:

- To implement a monitoring program to estimate the impact of the project on at-risk birds and/or bats that can reasonably be attributed to the operation of the Project

- To directly record impacts on birds and bats through a statistically-based program of carcass searches
- To document an agreed decision-making framework that identifies impact triggers requiring a management response
- To detail potential mitigation measures and related implementation strategies to reduce impacts on birds and bats
- To identify matters to be addressed in periodic reports on the outcomes of monitoring, the application of the decision-making framework, mitigation measures and their success.

5.5.10 Significance of impact assessment

An assessment against the Significant Impact Guidelines 1.1 (DoE 2013) with regards to the white-throated needletail was undertaken and the outcomes provided in Table 5-9.

Table 5-9 Significance of impact on the white-throated needletail

Impact criteria	Potential to occur
<p>Lead to a long-term decrease in the size of an important population of a species.</p>	<p>Unlikely</p> <p>White-throated needletail important populations have not been identified in the species' conservation advice (TSSC 2019). Though the 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 2021). As a result, the white-throated needletail subspecies that occurs in Australia is considered a single population.</p> <p>The action is unlikely to lead to a long-term decrease in the size of the population as:</p> <ul style="list-style-type: none"> – No roosting habitat for white-throated needletail is present within the Project area and no white-throated needletail habitat is proposed to be removed – The airspace over the Project area is not of particular significance to the species as there is generally an even distribution of records of the species over the Project area as there is within 50 km of the Project area – There is a very small possibility of injury or mortality of the species during clearing within the Project footprint, although due to the absence of white-throated needletail roosting habitat within the Project area, this possibility is considered remote. Any residual risk of impacts can be removed with the implementation of the CMP, based on the Preliminary Vegetation Management Plan and Preliminary Fauna Management Plan, that ensures that the species is not present before vegetation is removed or modified – White-throated needletail mortality from collision with overhead wires within Australia is known to occur, although is a low severity threat and affects a small number of birds (Hull et al. 2013). A threshold of mortality of 10 individuals annually can be considered a significant impact on the species (DoE 2015c). Given there are not extensive records of the species within the Project area and that overhead wires affect a small number of individuals, this threshold is not expected to be exceeded with the construction of above ground power lines for the action – White-throated needletail mortality from collision with wind turbines within Australia is known to occur, although is a low severity threat and affects a small number of birds (Hull et al. 2013, Nature Advisory). It is noted the species has been recorded flying at RSA within and adjacent to the Project area at times. A threshold of mortality of ten individuals annually (i.e. 0.1% or more of the flyway population) can be considered a significant impact to the species (DoE 2015c). Given there are not extensive records of the species within the Project area and that wind turbine strike affects a small number of individuals, this threshold is not expected to be exceeded with the construction and operation of the proposed Karara Wind Farm. Ongoing Bird Utilisation Surveys will inform a Before-After-Control-Impact (BACI) bird assessment for the Project to confirm this. – The loss of forest and woodland habitats may have resulted in the decline of invertebrate prey for white-throated needletail, which may be contributing to the decline of the species (TSSC 2019). While 18 ha of treed remnant vegetation may be removed for the action, approximately 8,500 ha of treed remnant vegetation occurs within 5 km of the Project area. This is not

Impact criteria	Potential to occur
	<p>considered a significant reduction in treed remnant vegetation that would reduce invertebrate prey to an extent that would impact the capacity for the airspace over the Project area to provide foraging habitat for the species.</p> <ul style="list-style-type: none"> - The use of insecticides, particularly organochlorines, has been identified as a possible cause of decline of white-throated needletails, either through a decrease in the abundance of invertebrates from wide use of insecticides or from secondary poisoning by insecticides accumulated as sublethal doses in prey (TSSC 2019). The action will not lead to an increase in the use of these chemicals within the Project area so impacts on insect abundance are not anticipated.
Reduce the area of occupancy of an important population.	<p>Unlikely</p> <p>The action is unlikely to reduce the area of occupancy of the white-throated needletail population as:</p> <ul style="list-style-type: none"> - The action is not considered to create a barrier for the species to access the airspace over or adjacent to the Project area given the long-ranging daily movements and flight height range of white-throated needletail - No roosting habitat for white-throated needletail is present within the Project area and no white-throated needletail habitat is proposed to be removed.
Fragment an existing important population into two or more populations.	<p>Unlikely</p> <p>The action is unlikely fragment the white-throated needletail population into two or more populations as:</p> <ul style="list-style-type: none"> - The action is not considered to create a barrier for the species to access the airspace over or adjacent to the Project area given the long-ranging daily movements and flight height range of white-throated needletail - No roosting habitat for white-throated needletail is present within the Project area and no white-throated needletail habitat is proposed to be removed.
Adversely affect habitat critical to the survival of a species.	<p>Unlikely</p> <p>Habitat critical to the survival of the species is not considered to be present within or above the Project area, as such the action is unlikely to adversely affect habitat critical to the survival of the species.</p> <p>Habitat critical to the survival of white-throated needletail refers to areas that are necessary (DoE 2013):</p> <ul style="list-style-type: none"> - For activities such as foraging, breeding, roosting, or dispersal - For the long-term maintenance of the species (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 - For the reintroduction of populations or recovery of the species. <p>While the airspace above the Project area provides an area for white-throated needletail to forage and disperse; will assist with the long-term maintenance of the species; will help to maintain genetic diversity and long-term evolutionary development; and provides habitat for the recovery of the species; the airspace above the Project area is not considered necessary for these processes to occur. The species also breeds in the Northern Hemisphere and roosting habitat is not considered to be present within the Project area. As a result, habitat critical to the survival of the species is not considered to be present within or above the Project area.</p>
Disrupt the breeding cycle of an important population.	<p>Unlikely</p> <p>The white-throated needletail subspecies that occurs in Australia is <i>Hirundapus caudacutus</i>. This subspecies is a trans-equatorial migrant that breeds in the Northern Hemisphere summer and migrates south for the Southern Hemisphere summer (TSSC 2019). As the species does not breed in Australia, the action will not disrupt the breeding cycle of the species' population.</p>
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely</p> <p>The action is unlikely to lead to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline as:</p> <ul style="list-style-type: none"> - No roosting habitat for white-throated needletail is present within the Project area and no white-throated needletail habitat is proposed to be removed

Impact criteria	Potential to occur
	<ul style="list-style-type: none"> – The airspace over the Project area is not of particular significance to the species as there is generally an even distribution of records of the species over the Project area as there is within 50 km of the Project area – The loss of forest and woodland habitats may have resulted in the decline of invertebrate prey for white-throated needletail, which may be contributing to the decline of the species (TSSC 2019). While 18 ha of treed remnant vegetation may be removed for the action, approximately 8,500 ha of treed remnant vegetation occurs within 5 km of the Project area. This is not considered a significant reduction in treed remnant vegetation that would reduce invertebrate prey to an extent that would impact the capacity for the airspace over the Project area to provide foraging habitat for the species. – The use of insecticides, particularly organochlorines, has been identified as a possible cause of decline of white-throated needletails, either through a decrease in the abundance of invertebrates from wide use of insecticides or from secondary poisoning by insecticides accumulated as sublethal doses in prey (TSSC 2019). The project will not lead to an increase in the use of these chemicals on the project site so impacts on insect abundance are not anticipated.
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat	<p>Unlikely</p> <p>Invasive species have not been identified as a threat to white-throated needletail (TSSC 2019). The action is unlikely to result in invasive species that are harmful to the species becoming established in the species' habitat. It is noted that a project-specific Preliminary Vegetation Management Plan and Preliminary Fauna Management Plan have been prepared to reduce the impact of invasive species on habitats in the project site.</p>
Introduce disease that may cause the species to decline	<p>Unlikely</p> <p>Disease is not identified as a threat to white-throated needletail. The action is not considered likely to introduce disease during construction and operation that may cause white-throated needletail to decline, particularly given the species is mostly aerial in Australia (TSSC 2019). The execution of the project combined with the way the species uses the landscape will not create opportunities for disease to spread.</p>
Interfere substantially with the recovery of the species.	<p>Unlikely</p> <p>The action is unlikely to interfere substantially with the recovery of the species as:</p> <ul style="list-style-type: none"> – No roosting habitat for white-throated needletail is present within the Project area and no white-throated needletail habitat is proposed to be removed – The airspace over the Project area is not of particular significance to the species as there is generally an even distribution of records of the species over the Project area as there is within 50 km of the Project area. – There is a very small possibility of injury or mortality of the species during clearing within the Project footprint, although due to the absence of white-throated needletail roosting habitat within the Project area, this possibility is considered remote. Any residual risk of impacts can be removed with the implementation of the CMP, based on Preliminary Vegetation Management Plan and Preliminary Fauna Management Plan, that ensures that the species is not present before vegetation is removed or modified. – White-throated needletail mortality from collision with overhead wires within Australia is known to occur, although is a low severity threat and affects a small number of birds (Hull et al. 2013). A threshold of mortality of 10 individuals annually can be considered a significant impact on the species (DoE 2015c). Given there are not extensive records of the species within the Project area and that overhead wires affect a small number of individuals, this threshold is not expected to be exceeded with the construction of aboveground power lines for the action. – White-throated needletail mortality from collision with wind turbines within Australia is known to occur, although is a low severity threat and affects a small number of birds (Hull et al. 2013, Nature Advisory, unpublished data). It is noted the species has been recorded flying at RSA within and adjacent to the Project area at times. A threshold of mortality of ten individuals annually (0.1% of the flyway population) can be considered a significant impact to the species (DoE 2015c). Given there are not extensive records of the species within the Project area and that wind turbine strike affects a small number of individuals, this threshold is not expected to be exceeded with the construction

Impact criteria	Potential to occur
	<p>and operation of the proposed Karara Wind Farm. Ongoing Bird Utilisation Surveys will inform a BACI bird assessment for the proposed Project to confirm this.</p> <ul style="list-style-type: none"> - The loss of forest and woodland habitats may have resulted in the decline of invertebrate prey for white-throated needletail, which may be contributing to the decline of the species (TSSC 2019). While 18 ha of treed remnant vegetation may be removed for the action, approximately 8,500 ha of treed remnant vegetation occurs within 5 km of the Project area. This is not considered a significant reduction in treed remnant vegetation that would reduce invertebrate prey to an extent that would impact the capacity for the airspace over the Project area to provide foraging habitat for the species. - The use of insecticides, particularly organochlorines, has been identified as a possible cause of decline of white-throated needletails, either through a decrease in the abundance of invertebrates from wide use of insecticides or from secondary poisoning by insecticides accumulated as sublethal doses in prey (TSSC 2019). The project will not lead to any change in the use of these chemicals on the project site so impacts on the insect food supply of this species are not anticipated.

5.5.11 Conclusion

The Project is **unlikely** to have a significant impact on the white-throated needletail.

5.6 Regent honeyeater

Investigations and assessment of regent honeyeater has been informed by GHD surveys undertaken between 2018 and 2020 and additional targeted assessment undertaken by Nature Advisory in 2020 and reported in EPBC Act threatened birds – habitat and regional assessment and targeted surveys (Nature Advisory, 2021c) with summaries provided in sections below.

5.6.1 Conservation status and documentation

The regent honeyeater is listed as Critically Endangered under the EPBC Act.

The species is highly nomadic and mobile, with a patchy distribution that extends from south-east Queensland to central Victoria. The species was formerly distributed throughout temperate woodland forests of south-eastern Australia, extending from Rockhampton in Queensland to Wilmington in South Australia (TSSC, 2015b). Its range has contracted significantly in recent decades. Records are widely distributed across the species' range, but it is only found regularly at a few localities in New South Wales and Victoria where most of the sightings have been recorded (DoE 2015a).

The regent honeyeater is most commonly associated with box-ironbark eucalypt woodlands, spotted gum-ironbark woodlands and dry sclerophyll forest and seems to prefer more fertile sites with higher soil water content, including creek flats, broad river valleys and lower slopes. Mature, large individual trees tend to be more important as they produce more nectar more reliably. The species also uses road-side remnant vegetation, remnant patches in farmland and urban areas, and travelling stock routes. Nests are typically in the canopy of mature, rough-barked trees such as ironbarks, sheoaks and rough-barked apple (*Angophora floribunda*) (DoE 2015a, 2016; Geering and French, 1998; Oliver et al. 1998).

Key tree and mistletoe species for the regent honeyeater are listed below (DoE 2015a).

- Mugga ironbark (*Eucalyptus sideroxylon*)
- Yellow box (*E. melliodora*)
- White box (*E. albens*)
- Yellow gum (*E. leucoxylon*)
- Spotted gum (*Corymbia maculata*)
- Swamp mahogany (*E. robusta*)
- Needle-leaf mistletoe (*Amyema cambagei*) on river sheoak (*Casuarina cunninghamiana*)

- Box mistletoe (*A. miquelii*)
- Long-flower mistletoe (*Dendrophthoe vitellina*).

Other tree species are considered regionally important for the species include broad-leaved ironbark (*E. fibrosa*) and thin-leaved stringybark (*E. eugenioides*) (DoE 2015a).

5.6.2 Survey effort

A summary of ecological survey effort associated with baseline fauna surveys is provided in Table 2-1 and shown in Figure 2.2, including for regent honeyeater in accordance with the survey guidelines for Australia's threatened birds (DEWHA 2010). For the period 2018 to 2020 survey effort included:

- Area searches/diurnal bird surveys (12 hrs over 5 days)
- Targeted habitat assessments at 9 sites
- Area searches for nests (12 hrs)
- Rapid habitat assessments at 92 sites
- Targeted bird census surveys at 2 sites

Additional targeted surveys for woodland birds, including regent honeyeater, were undertaken as reported in EPBC Act threatened birds – habitat and regional assessment and targeted surveys (Nature Advisory, 2021c). A total of 11 habitat assessments and four fixed point surveys were completed. In accordance with the survey guidelines for Australia's threatened birds (DEWHA 2010) targeted surveys adopted two methods, namely targeted point counts (fixed-point surveys) and area searches. Twenty-eight fixed point surveys were completed within and surrounding the Project area as shown on Figure 2.2.

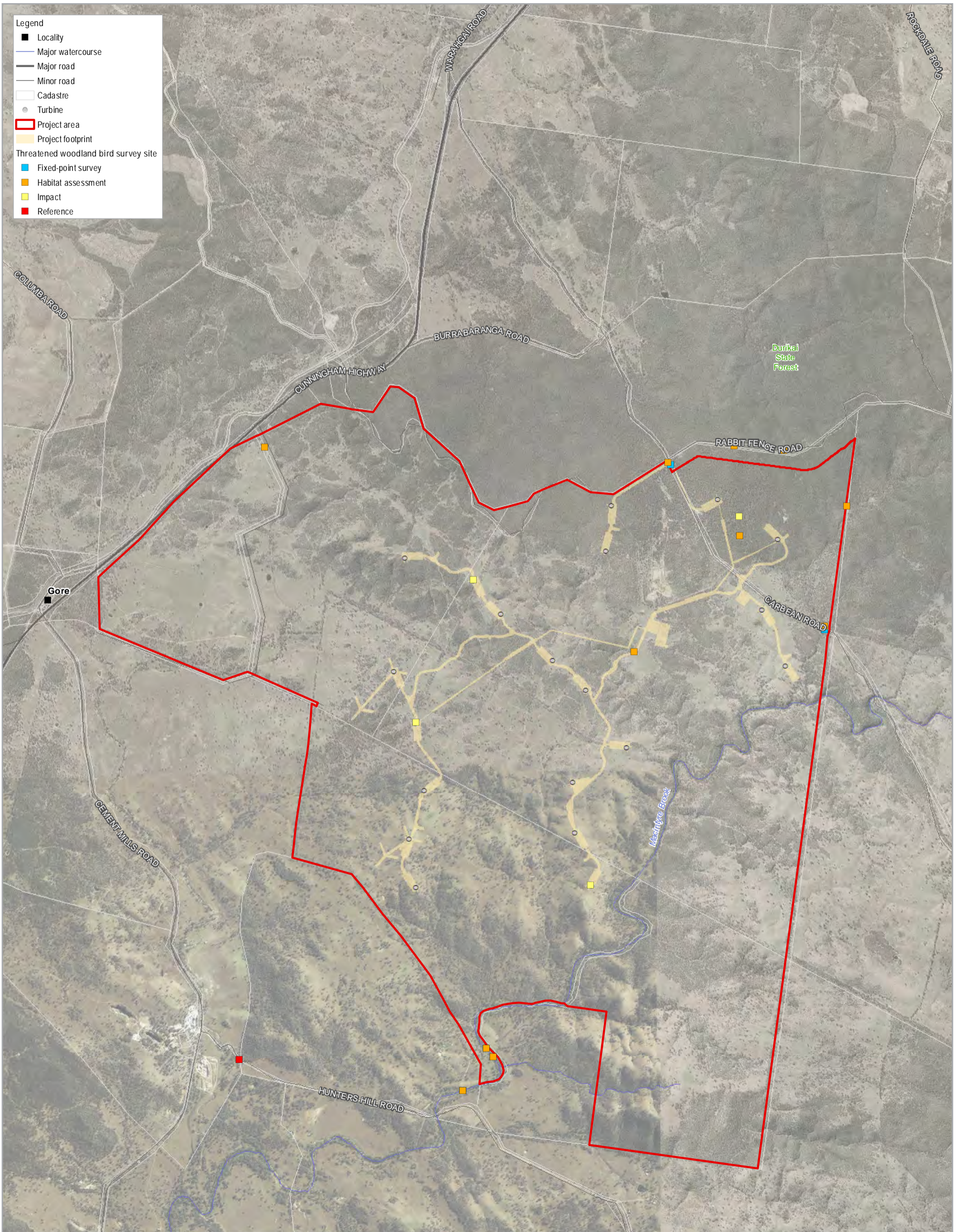
Fixed-point searches were chosen as several studies suggest that point counts may be more efficient at detecting more vocally active birds than transects or searches (Arnold 1984, Cunningham et al. 1999), and targeted surveys predefined by habitat preferences increase the probability of detecting rare and cryptic species. As the regent honeyeater is highly vocal and territorial in the months leading up to breeding, the species is conspicuous and can be successfully detected using the fixed-point survey technique.

The fixed-point bird surveys were undertaken during May, June and July 2020 consistent with the survey guidelines for Australia's threatened birds (DEWHA 2010) guideline that regent honeyeater surveys on the mainland be conducted between March and July.

Fixed point bird surveys involved an observer stationed at a fixed-point for 10 minutes in high quality or potential habitat for the species, recording all bird species and numbers of individual birds heard or observed within 100 metres of the fixed-point. Fixed-point bird survey points were completed in each patch of habitat for the targeted species except for the most southern patch of regent honeyeater high quality habitat along the southern boundary of the Project area, where species was recorded in 1995. The majority of fixed-point bird surveys were completed along creek lines as recommended for regent honeyeater (DEWHA 2010).

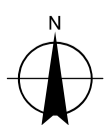
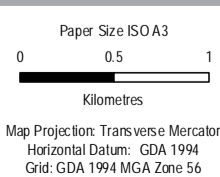
A total of four fixed-point survey locations were selected within and adjacent to the Project area (Figure 5.14). Each fixed-point was surveyed twice during the survey period except for one site that was surveyed once as it was added later in the survey period. Targeted surveys were undertaken in areas of suitable habitat, including remnants consisting of mature growth box-ironbark or lemon-scented gum-ironbark, as well as riparian zones dominated by river she-oak and rough-barked apple, particularly in areas located nearer to historic sightings.

Fixed-point bird surveys were completed across different times throughout the day including during the morning, middle of the day and afternoon. This aligns with the recommendation for surveys to be completed preferably in the morning (but other times may also be appropriate) for regent honeyeater and included a total of 12 hours across a total of 12 days.



- Legend**
- Locality
 - Major watercourse
 - Major road
 - Minor road
 - ▭ Cadastre
 - Turbine
 - ▭ Project area
 - ▭ Project footprint
- Threatened woodland bird survey site**
- Fixed-point survey
 - Habitat assessment
 - Impact
 - Reference

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 MNES Assessment Report

**Threatened woodland
 bird survey effort**

Project No. 12525037
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FIGURE 5-14

Area searches were undertaken in regent honey eater high quality and potential habitat (Section 5.6.3) for an average of eight hours per day by two observers over eight days (128 person-hours).

In addition, isolated flowering eucalypts were monitored opportunistically to confirm the presence or absence of the species during flowering events on the basis that the presence of regent honeyeater is best predicted by high nectar abundance (Crates et al. 2017, DEWHA 2010). It is noteworthy however that the incidence of flowering eucalypts during the surveys was low, possibly in response to recent dry climatic conditions.

Observers also documented the presence and abundance of nectar feeding species, as competition for resources with more aggressive honeyeaters, particularly the noisy miner (*Manorina melanocephala*) and noisy friarbird (*Philemon corniculatus*), may be a factor in regent honeyeater decline (Department of the Environment 2016, Menkhorst et al. 1999). A high abundance of nectar feeding species may limit the value and suitability of some habitat, particularly if the habitat is highly fragmented.

Surveys were undertaken in conditions suitable for detecting the species and assessing the value and distribution of their habitat. Survey duration exceeded the number of days and hours required for smaller areas of habitat in the survey guidelines for Australia's threatened birds (DEWHA 2010). Dr Stephen Debus (Adjunct Lecturer at University of New England) from the BirdLife Australia Regent Honeyeater Recovery Team was also consulted and provided a review of the approach and findings reported by Nature Advisory in EPBC Act threatened birds – habitat and regional assessment and targeted surveys (Nature Advisory, 2021c).

5.6.3 Criteria used to map regent honeyeater habitat

Habitat assessment locations were selected after a detailed review of the potential habitat mapping (based on field-verified RE mapping) presented in the Ecological Assessment Report of the Karara Wind Farm (GHD 2020a) and based on a review of aerial and satellite imagery to identify sections of the Project area where larger trees were present.

Habitat was characterised based on eucalypt community species composition, mistletoe community species composition, maximum canopy height, canopy crown cover, ground cover, percentage of old growth trees and proximity to riparian zones and potential disturbances. Whether eucalypts or mistletoes were in flower, was also documented and the flowering event scored. Eucalypt and mistletoe dieback was also noted.

The Project area's habitat connectivity (i.e. degree of isolation/fragmentation), including linkages to other habitat in the region, was determined using field observations, recent aerial photography and previous sightings of the threatened species.

Areas with all characteristics consistent with the habitat requirements for regent honeyeater were identified as high quality habitat while those that had some characteristics were classed as potential habitat.

The habitat assessment criteria as presented below were derived from the Conservation Advice for regent honeyeater and the National Recovery Plan for regent honeyeater as applied to the particular vegetation and habitat on the site:

- High quality habitat:
 - Areas with old growth >50-70 percent
 - Abundant mugga ironbark (*Eucalyptus sideroxylon*) or white box (*E. albens*) or mixed mugga ironbark–white box patches, yellow box (*E. melliodora*) woodland areas, river she-oak (*C. cunninghamiana*) riparian zones with Angophora/box and Blakely’s Red Gum (*E. blakelyi*) and river red gum (*E. camaldulensis*); OR
 - Narrow-leaved ironbark – box woodlands, abundance of box with drooping needle-leaf mistletoe (*Amyema cambagei*) available and were close to open patches as preferred by target species.
- Potential habitat:
 - Old growth <50 percent
 - Areas that have limited presence of mugga ironbark or white box, areas with narrow-leaved ironbark or broad-leaved ironbark (*E. fibrosa*) or lemon-scented gum woodlands with scattered box eucalypts or riparian zones with river she-oak and some Angophora.
 - At all sites mistletoe is infrequent or dying. Immature eucalypt woodland patches occur.

5.6.4 Desktop results

The regent honeyeater was identified within the PMST (Appendix A) as known to occur within a 20 km radius from a central point within the Project area.

The species has been historically recorded (15 records) within the vicinity of the Project area as shown on Figure 5.15. The historic records include 14 Birddata records and one record from Dr Stephen Debus, recorded within larger tracts of regent honeyeater habitat within Durikai State Forest and along MacIntyre Brook, a patch of habitat on Coopers along Branch Creek (tributary of MacIntyre Brook), and one record within a larger tract of regent honeyeater habitat at Connolly Dam, 41 km to the east of the Project area.

The Durikai State Forest that runs along the northern boundary of the Project area and MacIntyre State Forest to the south-west are within the Traprock Important Bird Area (Section 5.6.6) and contain significant tracts of selectively logged (in places) eucalypt forest and woodlands comprised mainly of lemon-scented gum associations and box-ironbark associations (BirdLife International 2020). The Durikai State Forest totals 12,357 hectares and MacIntyre State Forest totals 1,002 hectares. Thirteen of the 14 records of regent honeyeater within the Traprock Important Bird Area are within larger tracts of regent honeyeater habitat within Durikai State Forest and along MacIntyre Brook. The regent honeyeater records outside the Traprock Important Bird Area are within large tracts of habitat within Wondul Range National Park and Connolly Dam, and immediately adjacent to Sundown National Park which are between 36 kilometres and 46 kilometres from the Project area.

Southwest of the Project area at Macintyre Brook, local ornithologist Lorraine Welsh has recorded the species from numerous locations. Small numbers of birds have been recorded over multiple years between 1995 and 2008. The abundance of local historical records of this species was the impetus for designation of the Traprock IBA by BirdLife International.

5.6.5 Survey results

While the species has not been recorded in any of the surveys undertaken for the Project, the abundance of local recent records suggest the regent honeyeater is likely to occur.

As reported by Nature Advisory (2021a), the Project area consists of diverse types of habitat from cleared, treeless areas to dense, mixed eucalypt-pine forests. Most habitat assessment sites were dominated by cypress and black pine with spotted gum, white box, narrow-leaved ironbark and grey box scattered throughout.

The distribution of high quality and potential habitat for the regent honeyeater is mapped in Figure 5.16 based on the outcomes of targeted surveys and habitat criteria as defined in Section 5.6.3 and is consistent with contemporary DAWE expectations for the species.

In the order of 58.64 ha of habitat (21.15 ha high quality habitat and 37.49 ha of potential habitat) is mapped within the Project area.

High quality habitat for regent honeyeater occurs in the riparian zone along MacIntyre Brook in the southern portion of the Project area. The patch along MacIntyre Brook consists of mature river she-oak and Blakeley's red gum, with scattered Angophora, yellow box and white Box. These riparian zones have connection with the location of known breeding records and sightings directly adjacent to the Project area, on the neighbouring property, Glenelg.

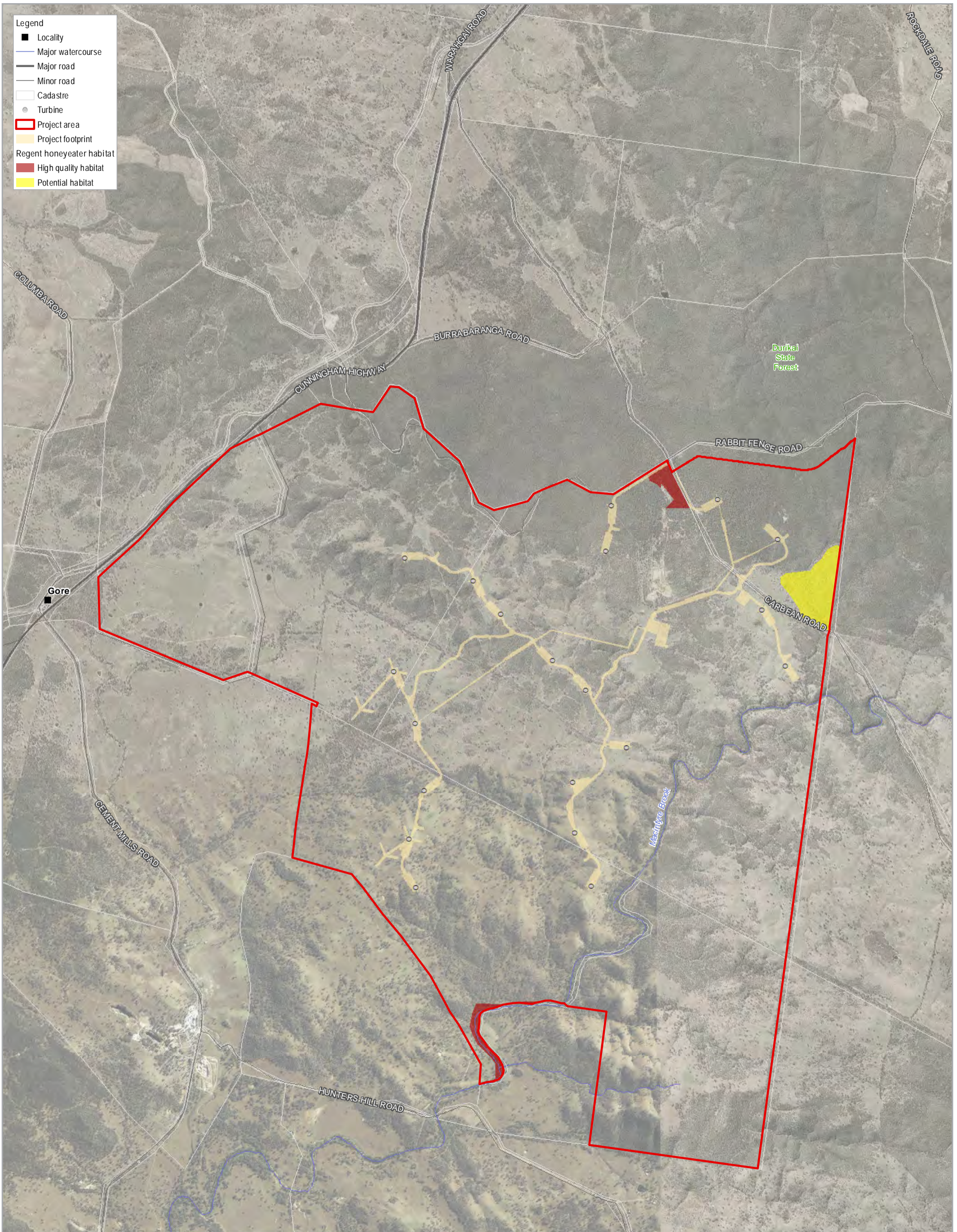
At times when key tree and mistletoe species are flowering within the regent honeyeater habitat in the Project area, the species may forage in these patches. It is noted that there have been no records of the species within these smaller patches (including after targeted surveys for the species within the Project area) indicating that these patches may not provide sufficient quantities of reliable nectar for the species. There is also no evidence that the regent honeyeater utilises these patches for roosting or breeding. These smaller and fragmented patches provide areas which may be utilised by the species, although the majority of regent honeyeater activity within the region is within larger tracts of regent honeyeater habitat within Protected Areas and along waterways. It is also noted that the species is most often recorded in a few localities in New South Wales and Victoria. While breeding events have been recorded in the Cement Mills-Durikai area, which has significance as the only remaining outpost of regent honeyeater breeding in Queensland (S Debus 2021, pers. comm. 15 January), there are no key breeding areas or other breeding areas for the species mapped within Queensland (Department of the Environment 2016).

5.6.6 Significance of project footprint

The Gore-Karara area is named as an important local hotspot for the regent honeyeater in the Recovery Plan for the species, with regular breeding activity recorded in the Cement Mills-Durikai area (DoE 2016). Important local habitat occurs in Durikai State Forest and within the upper catchment of Macintyre Brook (including Oaky Creek and Spring Creek) to a point about 3.5 km downstream of the confluence of Macintyre Brook and Spring Creek (Birdlife International 2020).

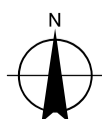
Local ornithologist Lorraine Welsh has recorded the species from numerous locations along Macintyre Brook, southwest of the Project area (AECOM 2013). Small numbers of birds have been recorded over multiple years between 1995 and 2008.

The abundance of local historical records of this species was the impetus for designation of the Traprock Important Bird Area by BirdLife International. This covers almost the entire Project area (Figure 5.15).



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Paper Size ISO A3
 0 0.5 1
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



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 MNES Assessment Report
**Distribution of habitat
 for regent honeyeater
 within the project area**

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FIGURE 5-16

Habitat critical to the survival of the regent honeyeater includes the following (Department of the Environment 2016):

- Any breeding or foraging habitat in areas where the species is likely to occur (as defined by the distribution map provided in the National Recovery Plan for the Regent Honeyeater)
- Any newly discovered breeding or foraging locations.

As the high quality and potential regent honeyeater habitat within the Project area is within the 'likely to occur' portion of the distribution map in the National Recovery Plan for the regent honeyeater, the high quality and potential habitat within the Project area is considered habitat critical to the survival of the species.

5.6.7 Threatening processes

The decline of the regent honeyeater is thought to be mainly due to clearing, fragmentation and degradation of its habitat, as the species relies on a range of different food resources and is particularly vulnerable to removal of large mature trees that provide important feeding and breeding habitat (TSSC 2015b).

5.6.8 Potential impacts

Potential impacts to the regent honeyeater are likely to be experienced during the construction phase of the Project and may include the following:

- Loss of habitat
- Injury and mortality
- Habitat fragmentation and reduced connectivity
- Disturbance from increased light, noise and vibration
- Habitat degradation through increased dust, run-off and sedimentation
- Introduction and spread of invasive fauna species
- Introduction and spread of weed species.

These impacts are described further in the following sections.

5.6.8.1 Loss of habitat

Clearing is anticipated to result in the loss of 0.62 ha of high quality regent honeyeater habitat. This habitat loss represents 1.06 percent of the total 58.64 ha of regent honeyeater habitat within the Project area. Loss of habitat in parts of these patches is considered acceptable for the reasons summarised below:

- Larger tracts of regent honeyeater habitat that are also considered habitat critical to the survival of the species are located within Protected Areas and along waterways within close proximity to the study area, including in Durikai State Forest and along MacIntyre Brook
- Habitat for the species within the Project footprint is restricted to one smaller patch
- The species is only found regularly at a few localities in New South Wales and Victoria where most of the sightings have been recorded (Department of the Environment 2015a; Department of the Environment 2016)
- The species has not been recorded within the Project area, although when key tree species are flowering in the identified patches within the Project area, the species may forage there
- There is no evidence that regent honeyeater utilise the patches of habitat within the Project area for roosting or breeding.

Regent honeyeater preferentially utilises the larger tracts of habitat critical to the survival of the species surrounding the Project area rather than smaller and more fragmented patches of habitat, such as those within the Project area.

5.6.8.2 Injury and mortality

Vegetation clearance during construction of the Project has the potential to cause injury and/or mortality to regent honeyeaters sheltering or foraging in the canopy in hollows and nests.

There is no evidence that roosting or nesting occurs within the habitat areas within the Project area.

Regent honeyeater is principally a tree canopy species (Department of the Environment 2016). The tree canopy within the Project area is between approximately 20 m and 25 m in height with the wind turbine RSA height between 40 m and 285 m above ground level. Regent honeyeater has not been recorded during extensive carcass searches at operational wind farm sites throughout the species' distribution in southern, eastern and south-eastern Australia (Nature Advisory, unpublished data). It is noted that the species occurs more often in New South Wales and Victoria than Queensland. As such and in combination with the absence of regent honeyeater records within the Project area, mortality of this species from wind turbine strike within the study area is unlikely to occur.

5.6.8.3 Habitat fragmentation and reduced connectivity

The Project will be constructed within a landscape that has already experienced extensive fragmentation from development for agriculture. As much of the Project footprint has been located within areas already subject to clearing, the impacts of habitat fragmentation are expected to be relatively minor and localised. The extent of clearing is within the context of the existing landscape and is unlikely to restrict fauna movement; however, fragmentation of habitat is expected to have localised impacts of the composition of forest bird assemblages by reducing the area of available habitat.

5.6.8.4 Disturbance from increased light, noise and vibration

Construction will result in a substantial, localised increase in vehicle movements in the short-term, which will increase light, noise and vibration disturbance to local wildlife. Increased light, noise and vibration can alter individual species' behaviours, and disrupt the balance of inter-species interactions. Such disruptions typically favour feral predators and generalist species that owe their success to broad ecological tolerances and possess the ability to tolerate or actively exploit disturbed environments (Hero et al. 2004).

5.6.8.5 Habitat degradation by increased dust, run-off and sedimentation

Construction activities have the potential to generate localised dust, erosion, run-off and sedimentation through increased vehicle movements, clearance of vegetation and earthworks. This can reduce the abundance and diversity of adjacent terrestrial and aquatic habitats by physically smothering vegetation, changing nutrient levels, impeding the growth and germination of plant species, encouraging weed incursions and altering the movement and behaviour of fauna species.

The receiving environment has already been subject to high levels of erosion and sedimentation as a result of existing land-clearing and grazing activities. Nevertheless, sensitive ecological receptors (e.g. larger woodland remnants and aquatic habitats) are particularly susceptible to adverse impacts associated with dust, run-off, erosion and sedimentation. These areas require protection through the implementation of sediment and erosion control measures during construction.

Adverse weather conditions during construction can exacerbate the potential impact of erosion and sedimentation. High rainfall has the potential to remove exposed topsoil, destabilise creek beds and distribute sediment through creek line. Strong winds have the potential to spread exposed topsoil, decreasing the likelihood of recolonization by vegetation and potentially distributing dust into nearby sensitive environments.

5.6.8.6 Introduction and spread of pest fauna species

The introduction and/or spread of pest fauna species can result in substantial disruptions to natural ecosystem functioning by altering the balance of inter-species competition and predation. Inappropriate waste disposal and provision of water has the capacity to attract higher local concentrations of feral predators, increasing the predation pressures on local wildlife. Pest fauna species recorded within the Project area included feral pigs (*Sus scrofa*), dog (*Canis lupus*), cat (*Felis*

catus) and fox (*Vulpes vulpes*). Access tracks created for the Project have the potential to facilitate movement of feral predators such as dogs and foxes, thereby increasing predation pressures on local wildlife. Although the Project area is already exposed to relatively high levels of pest fauna infestation, mitigation measures will be required to limit any spread of pest animals that could result from construction activities.

5.6.8.7 Introduction and spread of weed species

Construction activities have the potential to introduce and spread weeds through the movement of contaminated vehicles, fill and vegetative material. This can undermine the ecological integrity of bushland remnants by competitively excluding native plant species that provide food, shelter and nesting resources for native wildlife. Clearance of native vegetation creates areas of disturbance that are naturally susceptible to colonisation by invasive weed species. These can form a local source of future weed infestations within the surrounding landscape.

5.6.9 Measures to avoid, reduce or mitigate impacts

5.6.9.1 Loss of habitat

Planning phase measures that have been employed to avoid and reduce the direct loss of habitat include:

- Locating the Project footprint in open areas that have been subject to historical land clearing and sheep grazing as far as possible
- Minimising impacts to watercourses wherever practicable
- Utilising existing tracks where possible and locating proposed tracks within previously disturbed areas where possible.

During the construction phase of the Project, the following mitigation measures will be employed to reduce the loss of habitat:

- Land clearing will be restricted to the minimal amount necessary for the construction of the Project and will not extend outside of the Project footprint.
- Land clearing will be undertaken outside the peak breeding season of the regent honeyeater (i.e. September to January). While clearing of these areas will be supervised by experienced spotter-catchers and subject to pre-clearance surveys
- The extent of vegetation clearing (and no-go areas) will be clearly identified on construction plans and in the field using high visibility fencing or flagging in the vicinity of high conservation significant areas. Clearing extent will be communicated to construction supervisors. If fencing or flagging is in poor condition, it will be replaced as soon as practicable to reduce the potential of accidental clearing
- Consistent with the Preliminary Fauna Management Plan prepare and implement a Fauna Management Plan to establish the environmental management framework for managing impacts on fauna and habitat.
- Where infrastructure must cross waterways, areas of existing disturbance (i.e. existing tracks) have been selected. Where this is not practicable, the Project footprint has been minimised.
- Site offices, construction stockpiles and laydown/storage areas will be located within existing cleared or disturbed areas.
- Rehabilitation of temporary laydown areas, stockpiles, site offices and areas will be undertaken as soon as practicable after these facilities are no longer required.
- A CMP has been prepared to inform actions with regard to managing weed hygiene, erosion, fuels and hazardous substances, fire, etc. and includes erosion and sediment control measures.
- All construction personnel shall attend environmental training as part of the site induction process prior to entering the work site. As part of this training, all personnel will be instructed on their obligations in regard to vegetation clearing protocols. Areas identified for vegetation clearance are to be clearly defined and detailed in site inductions.

5.6.9.2 Injury and mortality

The following measures will be implemented to avoid/minimise injury and/or mortality to the regent honeyeater during construction of the Project:

- Pre-clearance surveys within the Project footprint will be undertaken to mark the locations of breeding places and potential regent honeyeater foraging trees a
- Pre-clearance surveys of mapped habitat within the Project footprint to locate nests
- Spotter-catcher to check all suitable trees prior to clearing
- All clearing will be supervised by suitably qualified and experienced fauna spotter-catchers. This will involve relocating any resident fauna to the nearest suitable, safe habitat outside the clearing footprint.
- Clearance of within regent honeyeater habitat areas will be undertaken outside the peak breeding season of the species (i.e. September to January). While clearing of these areas will be supervised by experienced spotter-catchers and subject to pre-clearance surveys, the temporal avoidance will provide an extra level of certainty to manage potential direct and indirect impact to breeding places during clearing.
- Adverse incident response procedures will be developed to detail actions to be taken in the event of wildlife injury or mortality during clearing.
- The CMP includes protocols to limit injury and mortality to fauna including management of risks associated with open excavations, trenching, waterbodies and responses and reporting for roadkill and adverse incident protocols.

5.6.9.3 Habitat fragmentation and reduced connectivity

The sensitivity of habitats and wildlife populations to fragmentation has been considered during the planning and design stage of the Project. A route-selection process was undertaken to limit and where possible, avoid intersecting areas important for maintaining habitat connectivity. Despite this, some localised habitat fragmentation will occur. The following mitigation measures will be implemented during construction to limit fragmentation and reduced connectivity:

- Access tracks will be restricted to areas that are already disturbed and will not extend outside of the Project footprint.
- Construction laydown areas and stockpiles will be limited to areas that have already been cleared to minimise unnecessary clearing and not extend outside the Project footprint.
- The footprint needed for ancillary activities and hardstand areas has been minimised without compromising the safety and integrity of structures.
- Temporary construction areas will be rehabilitated as soon as practicable after the completion of construction works to reconnect fragmented habitats.

5.6.9.4 Disturbance from increased light, noise and vibration

Routine mitigation measures should be undertaken to minimise the impact that noise, light, vibration and disturbance have on local wildlife populations. This is particularly important within the vicinity of habitat for conservation significant fauna species. The following measures will be used to minimise the impacts of light, noise and vibration during construction:

- Site lighting is to be kept to the minimum (security) required for safety. Placement and orientation of lighting to be directed away from sensitive fauna habitat
- Direction of lighting beam downwards or use of shields and baffles to limit light spill beyond site boundary.
- Wherever practicable, construction activities will be limited to daylight hours to reduce the need for lighting and resultant light spill into adjacent habitat.
- A Traffic Management Plan will be developed for the construction site to control vehicle movements and reduce the unnecessary generation of vehicular noise.
- All construction vehicles will comply with maintenance schedules and operational restrictions designed to limit noise impacts during construction.

- While commitment is made to rehabilitation in keeping with good practice and will be undertaken, given the outcomes of rehabilitation cannot be confirmed or guaranteed at this time and are subject to detailed design and construction planning, conservatively, all habitat within the Project footprint is for the purpose of the assessment taken to be a loss.

5.6.9.5 Habitat degradation by increased dust, run-off and sedimentation

The following mitigation measures will be used to minimise the impacts of dust, run off and sedimentation during construction of the Project:

- Erosion and sediment controls have been developed as part of the CMP.
- Routine dust suppression and monitoring will be undertaken throughout construction and operation.
- Erosion and sediment control measures will be installed where in-stream disturbance must be undertaken during flow conditions.
- Areas subject to clearing will be stabilised as soon as practicable.
- All vehicle movement will be restricted to designated tracks located within the Project footprint.
- Weather conditions will be monitored during the construction stage and temporary controls will be established during extreme weather events.
- Construction activities during adverse weather conditions will be managed in accordance with the CMP
- Rehabilitation of temporary construction areas will be undertaken as soon as practicable after clearing.

5.6.9.6 Introduction and spread of pest fauna species

Although the Project area is already exposed to relatively high levels of pest infestation, mitigation measures will be required to limit any spread of pest fauna that could result from construction activities. The following mitigation measures will be used to minimise the introduction and spread of pest fauna during construction for the Project:

- Responsible waste management practices (e.g. not leaving out food waste and not feeding wildlife) will be implemented and followed by all construction personnel. All waste will be stored in secure temporary holding containers and transported off site.
- Waste management actions are included in the CMP and include:
 - Requirements for details on the location and specifications for disposal and removal of waste from the construction site.
 - All putrescible waste to be stored in secure temporary holding containers and transported off site.
- Sightings or evidence of pest fauna will be recorded during construction in a pest register. If increased densities of pest fauna are observed, or new pest animals are identified, humane pest controls will be implemented to manage numbers.
- Implement a pest (feral animal) management plan, in consultation with landholders. This will represent a comprehensive management of feral predators including cats and foxes which are recognised as key threats to the squatter pigeon (southern).
- Construction staff will not bring domestic animals to the Project area.
- All construction personnel shall attend environmental training as part of site inductions. As part of this training, all personnel will be instructed on their responsibilities related to avoiding and minimising the introduction/attraction to the construction site of pest animals.

5.6.9.7 Introduction and spread of weed species

The following measures will be implemented to minimise the introduction and spread of weeds:

- Weed management actions are included in the CMP and include:
 - Hygiene protocols restricting the movement of vegetation and soil between impacted areas and areas of significantly lower weed infestation.
 - Protocols for monitoring and management of weeds to identify and appropriately respond to significant changes in weed distribution and density
- Vehicles / equipment travelling from a declared restricted place or quarantine area will be required to wash down and possess a current weed hygiene inspection certificate before moving to a weed free area.
- All machinery and equipment will undertake washdown prior to accessing site and possess a current weed hygiene inspection certificate from an inspector who is deemed competent and is certified in line with DAF requirements.
- Vehicle access will be restricted to within the Project footprint and existing roads and tracks where practicable.
- Preliminary weed mapping will be undertaken. This will provide a baseline of existing weed infestation across the Project area to inform weed management.

5.6.10 Significance of impact assessment

An assessment against the Significant Impact Guidelines 1.1 (DoE 2013) with regards to the regent honeyeater was undertaken and the outcomes provided in Table 5-10.

5.6.11 Conclusion

The project is **likely** to have a significant impact on the regent honeyeater as a result of the removal of 0.62 ha of habitat critical to the survival of the species. This impact will further be exacerbated at a broader scale by the removal of habitat critical to the survival of the species associated with the proposed MacIntyre Wind Farm Project and the OHTL Project. "

Offsets are proposed and described in the Karara Wind Farm Project Environmental Offsets Strategy (Attexo 2021).

Table 5-10 Significance of impact on regent honeyeater

Impact criteria	Potential to occur
<p>Lead to a long-term decrease in the size of a population.</p>	<p>Unlikely</p> <p>The removal of 0.62 ha of regent honeyeater habitat that is also considered habitat critical to the survival of the species is unlikely to lead to a long-term decrease in the size of the population as:</p> <ul style="list-style-type: none"> - Only 1.06 percent of regent honeyeater habitat within the Project area is proposed to be removed - Larger tracts of regent honeyeater habitat that are also considered habitat critical to the survival of the species (and is habitat where the species has been recorded) are located within Protected Areas and along waterways within close proximity to the Project area, including in Durikai State Forest and along MacIntyre Brook - Habitat for the species within the Project footprint is restricted to the edge of one smaller patch - The species is only found regularly at a few localities in NSW and Victoria where most of the sightings have been recorded (DoE 2015a; Department of the Environment 2016) - The species has not been recorded within the Project area, although when key tree species are flowering in the identified patches within the Project area, the species may forage here - There is no evidence that regent honeyeater utilise the patches of habitat within the Project area for roosting or breeding - The species preferentially utilises the larger tracts of habitat critical to the survival of the species surrounding the Project area rather than smaller and more fragmented patches of habitat, such as those within the Project area - There is only a very small possibility of injury or mortality of the species during clearing within this patch of habitat, and due to the limited regent honeyeater activity within the area and the smaller size of this patch, this possibility can be removed with the implementation of a CMP, based on the Preliminary Vegetation Management Plan and Preliminary Fauna Management Plan, that ensures that the species is not present before vegetation is removed or modified. <p>Regent honeyeater mortality from wind turbine strike within the Project area is unlikely to occur as the species is principally found within the tree canopy (DoE 2016). The tree canopy within the Project area is between approximately 20 and 25 m in height with the wind turbine RSA height between 40 m and 285 m above ground level.</p>
<p>Reduce the area of occupancy of a species.</p>	<p>Unlikely</p> <p>The removal of 0.62 ha of regent honeyeater habitat along the edge of one patch will not completely remove this patch of habitat. Fragmentation of this patch will occur with a clearing of approximately 20 m wide along the edge of this patch. This very minor level of habitat fragmentation is considered to have minimal impact on regent honeyeater, given the availability of larger tracts of habitat adjacent to the Project area and elsewhere in the region. The removal of the habitat within the Project footprint will also result in an inconsequential reduction in habitat connectivity, particularly considering the species is highly mobile. As the removal of habitat will not completely remove the patch of habitat, will result in only very minor levels of habitat fragmentation and an inconsequential reduction in habitat connectivity, the area of occupancy of the species is unlikely to be reduced.</p>

Impact criteria	Potential to occur
Fragment an existing population into two or more populations.	<p>Unlikely</p> <p>The regent honeyeater comprises a single population (Garnett et al. 2011) and is not severely fragmented (DoE 2015a). The removal of only 0.62 ha of regent honeyeater habitat will not fragment the existing population into two or more populations. The species is highly mobile and only 1.06 percent of regent honeyeater habitat within the Project area is proposed to be removed.</p>
Adversely affect habitat critical to the survival of a species.	<p>Likely</p> <p>A total of 0.62 ha of regent honeyeater habitat is proposed to be removed from one, 10.63 ha patch of habitat. It is noted this habitat is considered to be habitat critical to the survival of the species.</p> <p>However, taken together with loss of habitat associated with proposed related projects, being MacIntyre Wind Farm (8.06 ha) and OHTL (4.66 ha), inclusion of the loss of 0.62 ha into a total loss of habitat within the project areas of 13.34 ha is likely to be an adverse impact on habitat critical to the survival of the species.</p>
Disrupt the breeding cycle of a population.	<p>Unlikely</p> <p>Regent honeyeater breeding events have been recorded in the Cement Mills-Durikai region (DoE 2016) including adjacent to the Project area. The species has not been recorded breeding within the Project area. It is also noted there are no key breeding areas or other breeding areas for the species mapped within Queensland (DoE 2016). As a result, the action is unlikely to disrupt the breeding cycle of the regent honeyeater population.</p>
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely</p> <p>The removal of only 0.62 ha of regent honeyeater habitat that is also considered habitat critical to the survival of the species is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline as:</p> <ul style="list-style-type: none"> – Only 1.06 percent of regent honeyeater habitat within the Project area is proposed to be removed – Larger tracts of regent honeyeater habitat that are also considered habitat critical to the survival of the species (and is habitat where the species has been recorded) are located within Protected Areas and along waterways within close proximity to the Project area, including in Durikai State Forest and along MacIntyre Brook – Habitat for the species within the Project footprint is restricted to one smaller patch – The species is only found regularly at a few localities in NSW and Victoria where most of the sightings have been recorded (DoE 2015a; Department of the Environment 2016) – The species has not been recorded within the Project area, although when key tree species are flowering in the identified patches within the Project area, the species may forage here – There is no evidence that regent honeyeater utilise the patches of habitat within the Project area for roosting or breeding – The species preferentially utilises the larger tracts of habitat critical to the survival of the species surrounding the Project area rather than smaller and more fragmented patches of habitat, such as those within the Project area.

Impact criteria	Potential to occur
Result in invasive species that are harmful to a Critically Endangered species becoming established in the Critically Endangered species' habitat	<p>Unlikely</p> <p>Invasive weeds and rabbits cause degradation of regent honeyeater habitat and have been identified as a threat to the species (DoE 2015a). Invasive weeds and rabbits have been recorded throughout the Project area and the removal of 0.62 ha of regent honeyeater habitat (0.62 ha of high quality habitat and 0 ha of potential habitat) is not considered to increase the likelihood of invasive species that are harmful to the species becoming established in the species habitat throughout the Project area. It is noted that a project-specific Preliminary Vegetation Management Plan and Preliminary Fauna Management Plan includes measures to reduce the impact of invasive species on all biota, including on the regent honeyeater.</p>
Introduce disease that may cause the species to decline	<p>Unlikely</p> <p>Due to the small size of the population, the species is at greater risk from the potential impact of stochastic events including disease (DoE 2016). The action is not considered likely to introduce disease during construction and operation that may cause regent honeyeater to decline.</p>
Interfere substantially with the recovery of the species.	<p>Unlikely</p> <p>It is noted that Strategy 1 of the National Recovery Plan of the Regent Honeyeater is to improve the extent and quality of regent honeyeater habitat (DoE 2016) and that the regent honeyeater habitat within the Project footprint is considered habitat critical to the survival of the species.</p> <p>The removal of only 0.62 ha of regent honeyeater habitat from one habitat patch of 10.63 ha will not interfere with the recovery of the species as the proposed habitat removal will result in only the minor modification of one patch with the removal of approximately 20 m along the edge of the patch (and represents the removal of only 5.83 percent of the patch).</p>

5.7 Painted honeyeater

Investigations and assessment of painted honeyeater has been informed by GHD surveys undertaken between 2018 and 2020 and additional targeted assessment undertaken by Nature Advisory in 2020 and reported in EPBC Act threatened birds – habitat and regional assessment and targeted surveys (Nature Advisory, 2021c) with summaries provided in sections below.

5.7.1 Conservation status and documentation

The painted honeyeater is listed as Vulnerable under the EPBC Act.

The species is sparsely distributed from south-eastern Australia to north-western Queensland and eastern Northern Territory and exhibits seasonal north-south movements governed principally by the fruiting of mistletoe (Department of the Environment 2015b).

The species inhabits mistletoes within Eucalypt forests/woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, Acacia-dominated woodlands, paperbarks, casuarinas, callitris, and trees on farmland or gardens (TSSC, 2015c).

The highly specialised diet of painted honeyeater consists mainly of mistletoe fruit, although when there is a shortage of this food item, nectar and arthropods will also be consumed (Garnett et al. 2011, Higgins et al. 2001, Oliver et al. 2003). The species is strongly associated with the presence of mistletoe, particularly during the breeding season. The species prefers woodlands that contain a higher number of mature trees that host more mistletoe (Department of the Environment 2015b).

5.7.2 Survey effort

A summary of ecological survey effort associated with baseline fauna surveys is provided in Table 2-1 and shown in Figure 2.2, including for painted honeyeater in accordance with the survey guidelines for Australia's threatened birds (DEWHA 2010). For the period 2018 to 2020 survey effort included:

- Area searches/diurnal bird surveys (12 hrs over 5 days)
- Targeted habitat assessments at 9 sites
- Area searches for nests (12 hrs)
- Rapid habitat assessments at 92 sites
- Targeted bird census surveys at 2 sites

Additional surveys for woodland birds, including painted honeyeater, were undertaken as reported in EPBC Act threatened birds – habitat and regional assessment and targeted surveys (Nature Advisory, 2021c). A total of 11 habitat assessments were completed together with four fixed-point surveys. In accordance with the survey guidelines for Australia's threatened birds (DEWHA 2010) targeted surveys adopted two methods, namely targeted point counts (fixed-point surveys) and area searches. 28 fixed point surveys were completed within and surrounding the Project area as shown on Figure 2.2.

The survey guidelines for Australia's threatened birds (DEWHA 2010) does not specify survey recommendations for painted honeyeater. Due to the diet of painted honeyeater consisting of mistletoe, and the timing of their breeding coinciding with periods of mistletoe fruit and flower abundance, surveys should be conducted in early spring to late summer (Oliver et al. 2003). In addition, this is the period when birds are more likely to gather in aggregations, engage in displays, and become highly vocal and thus, more detectable (Watson 2012). The fixed-point bird surveys were undertaken during May, June and July 2020. Bird utilisation surveys reported in Bird Utilisation Survey Baseline Report (Nature Advisory, 2021b) to inform the BBAMP, while not targeted at woodland birds did include survey within potential habitat areas for painted honeyeater included surveys in May 2020, September/October 2020, December 2020 and February 2021 so aligned with spring and summer periods.

Fixed point bird surveys involved an observer stationed at a fixed-point for 10 minutes in high quality or potential habitat for the species, recording all bird species and numbers of individual birds heard or observed within 100 metres of the fixed-point. Fixed-point bird survey points were completed in each patch of habitat for the targeted species. The majority of fixed-point bird surveys were completed along creek lines as recommended for regent honeyeater (DEWHA 2010).

A total of four fixed-point survey locations were selected within and adjacent to the Project area (Figure 5.14). Each fixed-point was surveyed twice during the survey period except for one site that was surveyed once as it was added later in the survey period. Targeted surveys were undertaken in areas of suitable habitat, including remnants consisting of mature growth box-ironbark or lemon-scented gum-ironbark, as well as riparian zones dominated by river she-oak and rough-barked apple, particularly in areas located nearer to historic sightings.

Fixed-point bird surveys were completed across different times throughout the day including during the morning, middle of the day and afternoon. This aligns with the recommendation for surveys to be completed diurnally for species such as honeyeaters and included a total of 12 hours across a total of 12 days.

Area searches were undertaken in high quality and potential habitat (Section 5.7.3) for an average of eight hours per day by two observers over eight days (128 person-hours).

As for regent honeyeater, isolated flowering eucalypts were monitored opportunistically to confirm the presence or absence of the species during flowering events. It is noteworthy however that the incidence of flowering eucalypts during the surveys was low, possibly in response to recent dry climatic conditions.

Observers also documented the presence and abundance of nectar feeding species, as competition for resources with more aggressive honeyeaters. A high abundance of nectar feeding species may limit the value and suitability of some habitat, particularly if the habitat is highly fragmented.

Surveys were undertaken in conditions suitable for detecting the species and assessing the value and distribution of their habitat. Survey duration exceeded the number of days and hours required for smaller areas of habitat in the survey guidelines for Australia's threatened birds (DEWHA 2010). Dr Stephen Debus (Adjunct Lecturer at University of New England) from the BirdLife Australia Regent Honeyeater Recovery Team was also consulted and provided a review of the approach and findings reported by Nature Advisory in EPBC Act threatened birds – habitat and regional assessment and targeted surveys (Nature Advisory, 2021c).

5.7.3 Criteria used to define painted honeyeater habitat

Habitat assessment locations were selected after a detailed review of the potential habitat mapping (based on field-verified RE mapping) presented in the Ecological Assessment Report of the MacIntyre Wind Farm (GHD 2020a) and based on a review of aerial and satellite imagery to identify sections of the Project area where larger trees were present.

Habitat was characterised based on eucalypt community species composition, mistletoe community species composition, maximum canopy height, canopy crown cover, ground cover, percentage of old growth trees and proximity to riparian zones and potential disturbances. Whether eucalypts or mistletoes were in flower, was also documented and the flowering event scored. Eucalypt and mistletoe dieback was also noted.

The Project area's habitat connectivity (i.e. degree of isolation/fragmentation), including linkages to other habitat in the region, was determined using field observations, recent aerial photography and previous sightings of the threatened species.

Areas with all characteristics consistent with the habitat requirements for regent honeyeater were identified as high quality habitat while those that had some characteristics were classed as potential habitat.

The habitat assessment criteria as presented below were derived from the Conservation Advice for painted honeyeater as applied to the particular vegetation and habitat on the site:

- High quality habitat:
 - Areas with old growth >50-70 percent
 - Abundant mugga ironbark or white box or mixed mugga ironbark–white box patches, riparian woodland zones with river red gum (*E. camaldulensis*); AND/OR
 - Casuarina species and abundance of mistletoe species. White cypress pine woodlands with abundance of needle-leaved mistletoe.
- Potential habitat:
 - Old growth <50 percent
 - Areas that have limited presence of mugga ironbark or white box. Riparian woodland areas with casuarina species; AND/OR
 - River red gum and some mistletoe.
 - In these zones, mistletoe totally absent or present but in low abundance or dying condition thus considered to be of lower quality.

5.7.4 Desktop results

The painted honeyeater was identified within the PMST (Appendix A) as 'likely to occur' within a 20 km radius from a central point within the Project area.

There are nine records for the painted honeyeater within the vicinity of the Project area as shown in Figure 5.17. Two records of the species are located within the Traprock Important Bird Area (BirdLife International 2020) in Durikai State Forest and an additional two records of the species from the town of Karara, to the north of the Project area.

Painted honeyeater is more common in more extensive blocks of remnant woodland than in narrower strips, although it breeds in quite narrow roadside strips if ample mistletoe fruit is available (Department of the Environment 2015b). The distribution of records of the species (Figure 5.17) demonstrates this with more records in Protected Areas (particularly noting Durikai State Forest which is the closest Protected Area to the Project area and covers an area of 12,357 hectares) and larger tracts of remnant vegetation compared with one record within remnant vegetation in the Millmerran Road corridor.

5.7.5 Survey results

The painted honeyeater was not recorded within the Project area during any of the field surveys undertaken for the Project, including the bird utilisation surveys undertaken in spring and summer through 2020 and 2021. The species has been recorded within Durikai State Forest, 12 km northeast of the Project area (Figure 5.17).

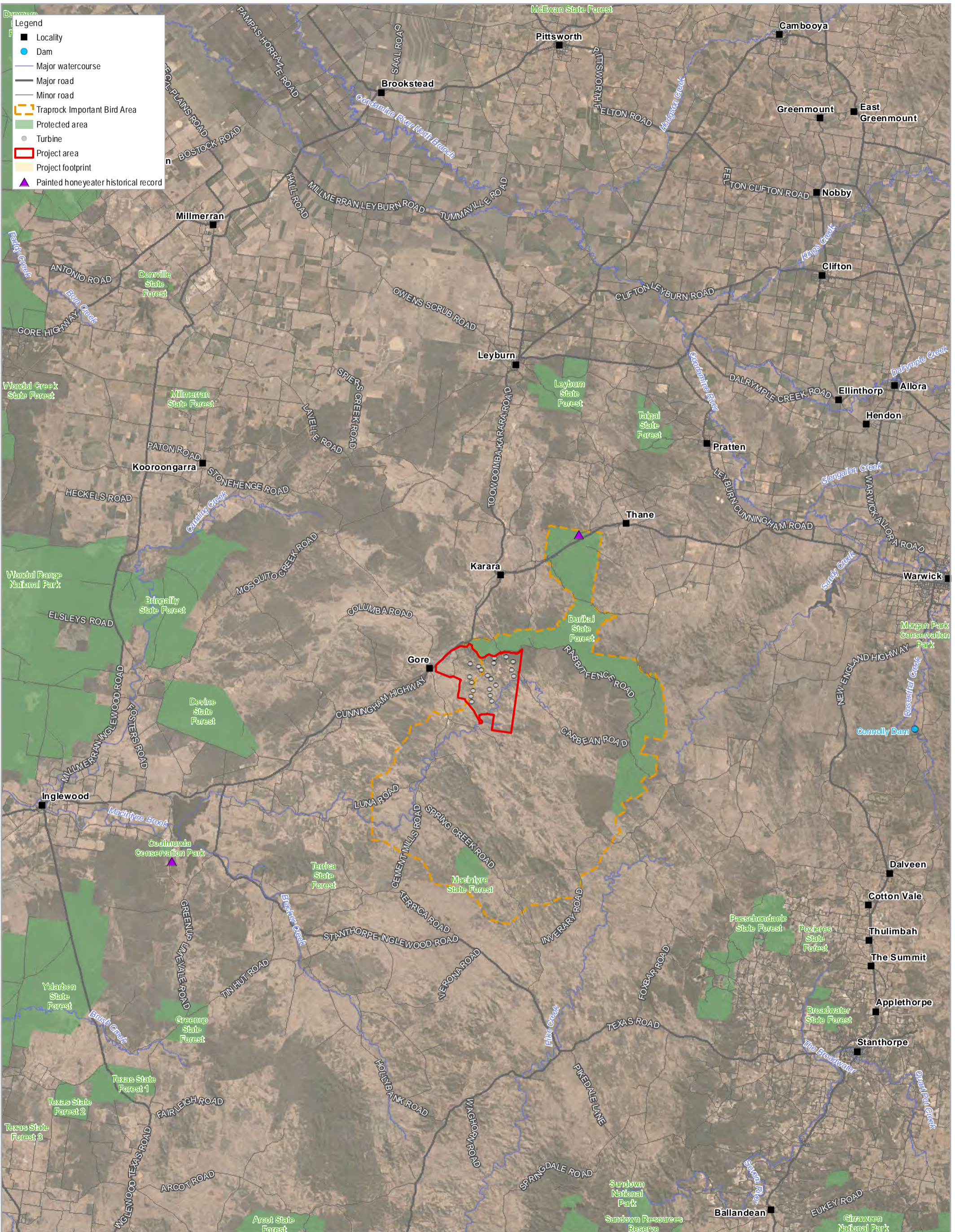
One patch of high quality habitat for painted honeyeater was identified and mapped based on the methodology described in Section 5.7.3. This patch of high quality habitat was mapped on the basis that it would provide good habitat during the summer months, corresponding with mistletoe flowering and fruiting. The distribution of habitat for painted honeyeater is shown in Figure 5.18.

The patch of high quality habitat occurs in a riparian zone along MacIntyre Brook (Figure 3). This patch consists of mature River She-oak and Blakely's Red Gum with scattered Rough-barked Apple, Yellow Box and White Box and with a higher density of Box Mistletoe. It is noted that Weeping Myall (*Acacia pendula*) with Grey Mistletoe (*Amyema quandang*) was not observed within the study area

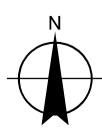
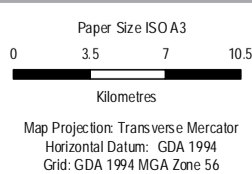
In the order of 10.60 ha of high quality habitat is mapped within the Project area. The reduced area of habitat mapped within the Project area is a result of the additional targeted surveys (Section 5.7.2) being undertaken to refine the habitat values across the Project area in accordance with definitions consistent with DAWE guidelines as described in Section 5.7.3.

The patch of high quality habitat occurs in a riparian zone along MacIntyre Brook, consisting of mature river she-oak and Blakely's red gum with scattered rough-barked apple, yellow box and white box and with a higher density of box mistletoe. It is noted that weeping myall (*Acacia pendula*) with grey mistletoe (*Amyema quandang*) was not observed within the Project area.

At times when mistletoe is fruiting and flowering within this smaller and more fragmented patch of painted honeyeater high quality habitat within the Project area, the species may occasionally forage in this patch. When mistletoe is fruiting and flowering in the larger tracts of remnant vegetation in the surrounding area (such as Durikai State Forest), regional records indicates that it is more likely that the species would prefer these areas than the smaller and more fragmented patch of habitat within the Project area. Painted honeyeater would also preferentially breed in these areas, as well as narrow roadside remnants if ample mistletoe fruit is available (Department of the Environment 2015b).



Based on or contains data provided by the State of Queensland 2021.
 In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

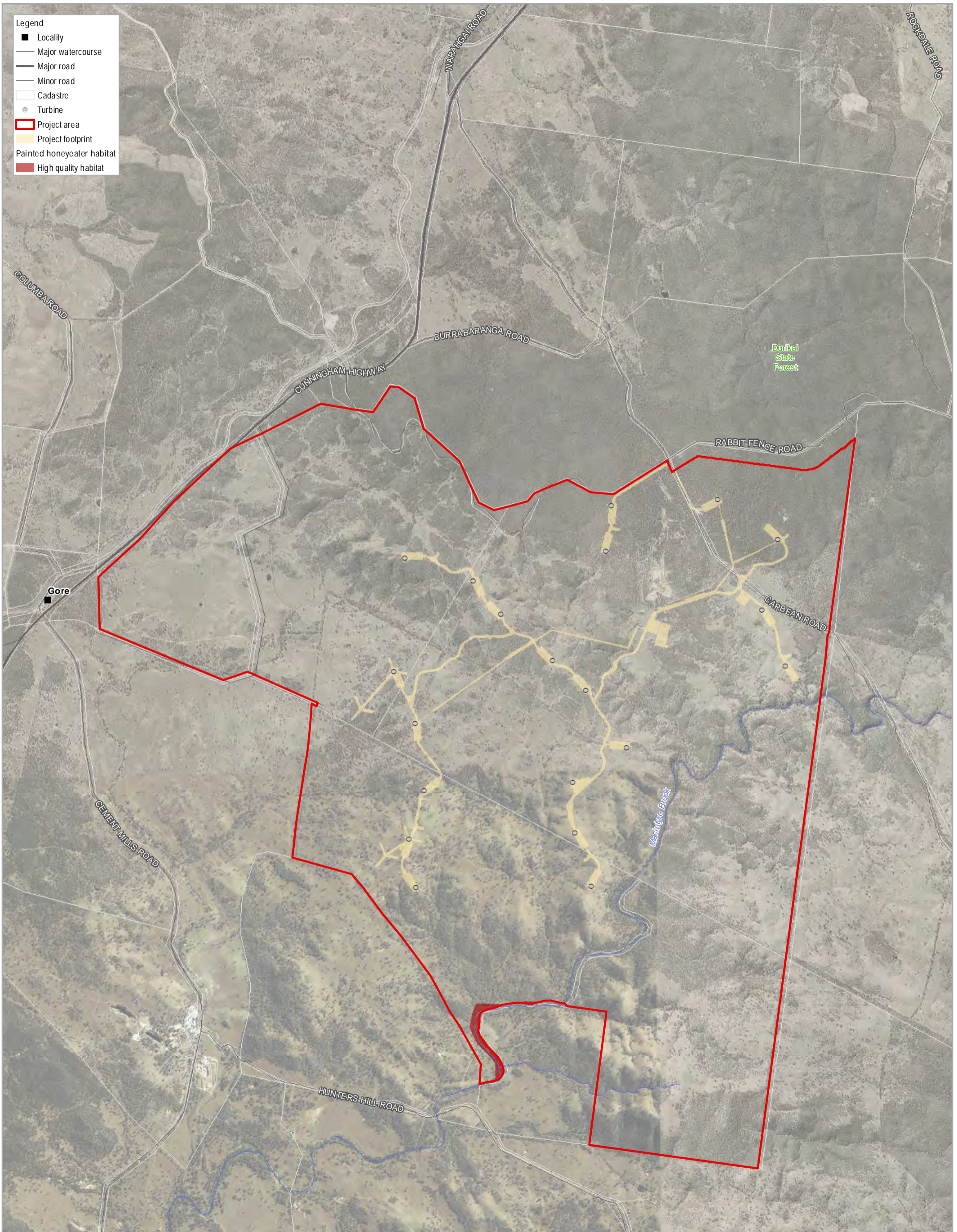


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 MNES Assessment Report

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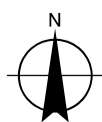
Painted honeyeater
 historical records

FIGURE 5-17



Based on or contains data provided by the State of Queensland 2021.
 In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

Paper Size ISO A3
 0 0.5 1
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



Acciona Energy Australia Global Pty Ltd
 MNES Assessment Report
**Distribution of habitat
 for painted honeyeater
 within the project area**

Project No. 12525037
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FIGURE 5-18

5.7.6 Significance of project footprint

Painted honeyeater important populations have not been identified in the species' conservation advice (DoE 2015b). Considering its dispersive habits, the species is considered to have a single population (Garnett et al. 2011).

Areas of high quality for painted honeyeater were identified within the Project area (Figure 5.18).

Habitat critical to the survival of the species has not been specified in the Commonwealth conservation advice for the painted honeyeater. However, using the general definition in the Significant impact guidelines 1.1 (DoE 2013), this is likely to include areas that are necessary:

- For activities such as foraging, breeding, roosting or dispersal
- For the long-term maintenance of the species (including the maintenance of species essential to the survival of the species, such as pollinators)
- To maintain genetic diversity and long term evolutionary development
- For the reintroduction of populations or recovery of the species.

Areas that are necessary for the processes outlined above to function in a region contain the following characteristics:

- Large, continuous blocks of remnant woodland (Department of the Environment 2015b)
- Significant abundance of mistletoe for painted honeyeater
- Records of the species within or adjacent to the habitat.

Examples of areas that meet these are the larger tracts of remnant vegetation in the region (such as Durikai State Forest where the species has been recorded) with fruiting and flowering mistletoe. Painted honeyeater preferentially forage and breed in these areas where and when ample mistletoe fruit and flower are available (Department of the Environment 2015b).

The painted honeyeater habitat mapped within the Project area is not considered necessary for the processes outlined above to function in the region as:

- The patches of painted honeyeater habitat that occur are small and fragmented rather than large, continuous blocks of remnant woodland
- The habitat does not contain a significant quantity of mistletoe.

Consequently, painted honeyeater habitat within the Project area is not considered habitat critical to the survival of the species.

5.7.7 Threatening processes

Habitat loss is a key threat to the painted honeyeater which has had much of its breeding habitat cleared or reduced to ageing, widely-spaced trees. Its non-breeding habitat is still being cleared for agriculture (Barea, 2008a cited in DoE 2015). Most of the painted honeyeater's remaining habitat is on private land that continues to be degraded by grazing by livestock, native macropods and rabbits, as grazing inhibits recruitment through consumption of seedlings.

Other threats to the painted honeyeater include competition with the aggressive noisy miner, predation by invasive species, particularly black rats, pasture improvement activities, collision with road vehicles and nest predation (DoE 2015).

5.7.8 Potential impacts

The Project will not result in any direct impact on habitat for the painted honeyeater. The Project footprint has been sighted to avoid areas of habitat.

The Project is unlikely to have any substantial impact in terms of operational impacts to the painted honeyeater, with negligible noise, vibration, land disturbance and vehicular movements occurring. Operation of the turbines is not expected to have an impact on the squatter pigeon as the species is generally restricted to ground level and is unlikely to occur at RSA height. Vehicle movements during operations are expected to be in the order of one to two light utility vehicles daily traversing designated access tracks and impacts will be negligible.

Painted honeyeater is a woodland bird species and is largely found in trees. The tree canopy within the Project area is between approximately 20 m and 25 m in height and the wind turbine RSA height between 40 m and 285 m above ground level. Painted honeyeater has not been recorded during extensive carcass searches at operational wind farm sites throughout the species' distribution in southern, eastern and south-eastern Australia (Nature Advisory, unpublished data). As such and in combination with the absence of painted honeyeater records within the Project area, mortality of this species from wind turbine strike within the Project area is unlikely to occur.

Potential impacts to the painted honeyeater are likely to be experienced as result of the Project may include the following:

- Injury and mortality
- Disturbance from increased light, noise and vibration
- Habitat degradation through increased dust, run-off and sedimentation
- Introduction and spread of invasive fauna species
- Introduction and spread of weed species.

These impacts are described further in the following sections.

5.7.8.1 Disturbance from increased light, noise and vibration

Construction will result in a substantial, localised increase in vehicle movements in the short-term, which will increase light, noise and vibration disturbance to local wildlife. Increased light, noise and vibration can alter individual species' behaviours, and disrupt the balance of inter-species interactions. Such disruptions typically favour feral predators and generalist species that owe their success to broad ecological tolerances and possess the ability to tolerate or actively exploit disturbed environments (Hero et al. 2004).

5.7.8.2 Habitat degradation by increased dust, run-off and sedimentation

Construction activities have the potential to generate localised dust, erosion, run-off and sedimentation through increased vehicle movements, clearance of vegetation and earthworks. This can reduce the abundance and diversity of adjacent terrestrial and aquatic habitats by physically smothering vegetation, changing nutrient levels, impeding the growth and germination of plant species, encouraging weed incursions and altering the movement and behaviour of fauna species.

The receiving environment has already been subject to high levels of erosion and sedimentation as a result of existing land-clearing and grazing activities. Nevertheless, sensitive ecological receptors (e.g. larger woodland remnants and aquatic habitats) are particularly susceptible to adverse impacts associated with dust, run-off, erosion and sedimentation. These areas require protection through the implementation of sediment and erosion control measures during construction.

Adverse weather conditions during construction can exacerbate the potential impact of erosion and sedimentation. High rainfall has the potential to remove exposed top soil, destabilise creek beds and distribute sediment through creek line. Strong winds have the potential to spread exposed top soil, decreasing the likelihood of recolonization by vegetation and potentially distributing dust into nearby sensitive environments.

5.7.8.3 Introduction and spread of pest fauna species

The introduction and/or spread of pest fauna species can result in substantial disruptions to natural ecosystem functioning by altering the balance of inter-species competition and predation. Inappropriate waste disposal and provision of water has the capacity to attract higher local concentrations of feral predators, increasing the predation pressures on local wildlife. Pest fauna species recorded within the Project area included feral pigs, dog, cat and fox. Access tracks created for the Project have the potential to facilitate movement of feral predators such as dogs and foxes, thereby increasing predation pressures on local wildlife. Although the Project area is already exposed to relatively high levels of pest fauna infestation, mitigation measures will be required to limit any spread of pest animals that could result from construction activities.

5.7.8.4 Introduction and spread of weed species

Construction activities have the potential to introduce and spread weeds through the movement of contaminated vehicles, fill and vegetative material. This can undermine the ecological integrity of bushland remnants by competitively excluding native plant species that provide food, shelter and nesting resources for native wildlife. Clearance of native vegetation creates areas of disturbance that are naturally susceptible to colonisation by invasive weed species. These can form a local source of future weed infestations within the surrounding landscape.

5.7.9 Measures to avoid, reduce or mitigate impacts

5.7.9.1 Disturbance from increased light, noise and vibration

Routine mitigation measures should be undertaken to minimise the impact that noise, light, vibration and disturbance have on local wildlife populations. This is particularly important within the vicinity of habitat for conservation significant fauna species. The following measures will be used to minimise the impacts of light, noise and vibration during construction of the Project:

- Site lighting is to be kept to the minimum (security) required for safety. Placement and orientation of lighting to be directed away from sensitive fauna habitat
- Direction of lighting beam downwards or use of shields and baffles to limit light spill beyond site boundary.
- Wherever practicable, construction activities will be limited to daylight hours to reduce the need for lighting and resultant light spill into adjacent habitat.
- A Traffic Management Plan will be developed for the construction site to control vehicle movements and reduce the unnecessary generation of vehicular noise.
- All construction vehicles will comply with maintenance schedules and operational restrictions designed to limit noise impacts during construction.

5.7.9.2 Habitat degradation by increased dust, run-off and sedimentation

The following mitigation measures will be used to minimise the impacts of dust, run off and sedimentation during construction of the Project:

- Erosion and sediment controls have been developed as part of the CMP.
- Routine dust suppression and monitoring will be undertaken throughout construction and operation.
- Erosion and sediment control measures will be installed where in-stream disturbance must be undertaken during flow conditions.
- Areas subject to clearing will be stabilised as soon as practicable.
- All vehicle movement will be restricted to designated tracks located within the Project footprint.
- Weather conditions will be monitored during the construction stage and temporary controls will be established during extreme weather events.
- Construction activities during adverse weather conditions will be managed in accordance with the CMP

- Rehabilitation of temporary construction areas will be undertaken as soon as practicable after clearing.

5.7.9.3 Introduction and spread of pest fauna species

Although the Project area is already exposed to relatively high levels of pest infestation, mitigation measures will be required to limit any spread of pest fauna that could result from construction activities. The following mitigation measures will be used to minimise the introduction and spread of pest fauna during construction for the Project

- Responsible waste management practices (e.g. not leaving out food waste and not feeding wildlife) will be implemented and followed by all construction personnel. All waste will be stored in secure temporary holding containers and transported off site.
- Waste management actions are included in the CMP and include:
 - Requirements for details on the location and specifications for disposal and removal of waste from the construction site.
 - All putrescible waste to be stored in secure temporary holding containers and transported off site.
- Sightings or evidence of pest fauna will be recorded during construction in a pest register. If increased densities of pest fauna are observed, or new pest animals are identified, humane pest controls will be implemented to manage numbers.
- Implement a pest (feral animal) management plan, in consultation with landholders. This will represent a comprehensive management of feral predators including cats and foxes which are recognised as key threats to the squatter pigeon (southern).
- Construction staff will not bring domestic animals to the Project area.
- All construction personnel shall attend environmental training as part of site inductions. As part of this training, all personnel will be instructed on their responsibilities related to avoiding and minimising the introduction/attraction to the construction site of pest animals.

5.7.9.4 Introduction and spread of weed species

The following measures will be implemented to minimise the introduction and spread of weeds:

- Weed management actions are included in the CMP and include:
 - Hygiene protocols restricting the movement of vegetation and soil between impacted areas and areas of significantly lower weed infestation.
 - Protocols for monitoring and management of weeds to identify and appropriately respond to significant changes in weed distribution and density
- Vehicles / equipment travelling from a declared restricted place or quarantine area will be required to wash down and possess a current weed hygiene inspection certificate before moving to a weed free area.
- All machinery and equipment will undertake washdown prior to accessing site and possess a current weed hygiene inspection certificate from an inspector who is deemed competent and is certified in line with DAF requirements.
- Vehicle access will be restricted to within the Project footprint and existing roads and tracks where practicable.
- Preliminary weed mapping will be undertaken. This will provide a baseline of existing weed infestation across the Project area to inform weed management.

5.7.10 Significance of impact assessment

An assessment against the Significant Impact Guidelines 1.1 (DoE 2013) with regards to the painted honeyeater was undertaken and the outcomes provided in Table 5-11.

Table 5-11 Significance of impact on painted honeyeater

Impact criteria	Potential to occur
Lead to a long-term decrease in the size of an important population of a species.	<p>Unlikely</p> <p>Painted honeyeater important populations have not been identified in the species' conservation advice (DoE 2015b). Considering its dispersive habits, the species is considered to have a single population (Garnett et al. 2011).</p> <p>No painted honeyeater habitat is proposed to be removed and there is only a very small possibility of injury or mortality of the species during clearing within the Project footprint, this possibility can be removed with the implementation of a CMP, based on the Preliminary Vegetation Management Plan and Preliminary Fauna Management Plan.</p> <p>Painted honeyeater is a woodland bird species and is largely found in trees. The tree canopy within the Project area is between approximately 20 and 25 m in height and the wind turbine RSA height between 40 m and 285 m above ground level. Given this, mortality of this species from wind turbine strike within the Project area is unlikely to occur. As painted honeyeater mortality from wind turbine strike is unlikely to occur and no painted honeyeater is proposed to be removed habitat, the action is considered unlikely to lead to a long-term decrease in the size of the population of the species.</p>
Reduce the area of occupancy of an important population.	<p>Unlikely</p> <p>As no painted honeyeater habitat is proposed to be removed, the action is unlikely to reduce the area of occupancy of the species' population.</p>
Fragment an existing important population into two or more populations.	<p>Unlikely</p> <p>The painted honeyeater is considered to have a single population (Garnett et al. 2011) and is not severely fragmented (DoE 2015a). As no painted honeyeater habitat is proposed to be removed, the action will not fragment the existing population into two or more populations.</p>
Adversely affect habitat critical to the survival of a species.	<p>Unlikely</p> <p>As no painted honeyeater habitat is proposed to be removed, the action is unlikely to adversely affect habitat critical to the survival of the species.</p>
Disrupt the breeding cycle of an important population.	<p>Unlikely</p> <p>The species exhibits seasonal north-south movements governed principally by the fruiting of mistletoe, with which its breeding season is closely matched (DoE 2015b). It is likely that numbers of painted honeyeaters breeding in southern and central Queensland are extremely low (DoE 2015b).</p> <p>Painted honeyeater would preferentially breed in in the larger tracts of remnant vegetation in the surrounding area (such as Durikai State Forest) when mistletoe is fruiting and flowering in these areas (DoE 2015b) rather than within the smaller and more fragmented patch of painted honeyeater habitat within the Project area.</p> <p>As no painted honeyeater habitat is proposed to be removed, the action is unlikely to disrupt the breeding cycle of the species' population.</p>
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely</p> <p>As no painted honeyeater habitat is proposed to be modified or removed, the action is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</p>
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat	<p>Unlikely</p> <p>Painted honeyeater predation by invasive species (e.g. black rat <i>Rattus rattus</i>) has been identified as a threat to the species. Grazing from rabbits results in an uneven age structure of mistletoe host trees and promotion of future collapse of mistletoe resources and has also been identified as a threat to the species (DoE 2015b). As no painted honeyeater habitat is proposed to be removed and rabbits have been recorded throughout the Project area, the action is not considered to increase the likelihood of invasive species that are harmful to the species becoming established or further established in the species habitat. It is noted that a project-specific Preliminary Vegetation Management Plan and Preliminary Fauna Management Plan includes measures to reduce the impact of invasive species on all biota, including on the painted honeyeater.</p>

Impact criteria	Potential to occur
Introduce disease that may cause the species to decline, or	Unlikely Disease is not identified as a threat to painted honeyeater (DoE 2015b). The action is not considered likely to introduce disease during construction and operation that may cause painted honeyeater to decline, particularly given the species has not been recorded within the Project area and is preferentially foraging in habitat within Durikai State Forest. It is noted that a project-specific Preliminary Vegetation Management Plan and Preliminary Fauna Management Plan include measures that will reduce the likelihood of disease introduction.
Interfere substantially with the recovery of the species.	Unlikely No painted honeyeater habitat is proposed to be removed and there is only a very small possibility of injury or mortality of the species during clearing within the Project footprint, this possibility can be removed with the implementation of a CMP, based on the Preliminary Vegetation Management Plan and Preliminary Fauna Management Plan. Painted honeyeater is a woodland bird species and is largely found in trees. The tree canopy within the Project area is between approximately 20 and 25 m in height and the wind turbine RSA height between 40 m and 285 m above ground level. Given this, mortality of this species from wind turbine strike within the Project area is unlikely to occur. As painted honeyeater mortality from wind turbine strike is unlikely to occur and no painted honeyeater habitat is proposed to be removed, the action is considered unlikely to interfere substantially with the recovery of the species.

5.7.11 Conclusion

The Project is considered **unlikely** to have a significant impact on the painted honeyeater.

5.8 Swift parrot

5.8.1 Conservation status and documentation

The swift parrot is listed as Critically Endangered under the EPBC Act.

The species breeds and nests in Tasmania over summer and migrates each winter to the Australian mainland (Saunders and Tzaros 2011). During winter, it forages predominantly in parts of Victoria and New South Wales. Smaller numbers regularly forage in the Australian Capital Territory and in south-east Queensland and less commonly in the south-east of South Australia (Saunders and Tzaros 2011).

In south-east Queensland, records indicate that swift parrot typically feed on lerp and nectar from yellow box, grey box (*Eucalyptus microcarpa*), forest red gum (*E. tereticornis*) and swamp mahogany. There is a strong association between swift parrot and mugga ironbark, white box and spotted gum elsewhere in their mainland distribution (Saunders & Tzaros 2011).

5.8.2 Survey effort

A summary of ecological survey effort associated with baseline fauna surveys is provided in Table 2-1 and shown in Figure 2.2, including for swift parrot in accordance with the survey guidelines for Australia's threatened birds (DEWHA 2010). For the period 2018 to 2020 survey effort included:

- Area searches/diurnal bird surveys (12 hrs over 5 days)
- Targeted habitat assessments at 9 sites
- Rapid habitat assessments at 92 sites
- Targeted bird census surveys at 2 sites

Additional surveys for woodland birds, including swift parrot, were undertaken as reported in EPBC Act threatened birds – habitat and regional assessment and targeted surveys (Nature Advisory, 2021c). A total of 11 habitat assessments were completed together with four fixed-point surveys. In accordance with the survey guidelines for Australia's threatened birds (DEWHA 2010) targeted surveys adopted

two methods, namely targeted point counts (fixed-point surveys) and area searches. Twenty-eight fixed point surveys were completed within and surrounding the Project area as shown on Figure 2.2.

Fixed-point searches were chosen as several studies suggest that point counts may be more efficient at detecting more vocally active birds than transects or searches (Arnold 1984, Cunningham et al. 1999), and targeted surveys predefined by habitat preferences increase the probability of detecting rare and cryptic species.

The survey guidelines for Australia's threatened birds (DEWHA 2010) does not specify survey periods for swift parrot. The fixed-point bird surveys were undertaken during May, June and July 2020 that coincide with periods for which the species has been recorded in the adjacent Durikai State Forest, being between July 2017 to September 2017 and from May 2018 to September 2018.

Fixed point bird surveys involved an observer stationed at a fixed-point for 10 minutes in high quality or potential habitat for the species, recording all bird species and numbers of individual birds heard or observed within 100 metres of the fixed-point. Fixed-point bird survey points were completed in each patch of habitat for the targeted species.

A total of four fixed-point survey locations were selected within and adjacent to the Project area (Figure 5.14). Each fixed-point was surveyed twice during the survey period except for one site that was surveyed once as it was added later in the survey period. Targeted surveys were undertaken in areas of suitable habitat, including remnants consisting of mature growth box-ironbark or lemon-scented gum-ironbark, as well as riparian zones dominated by river she-oak and rough-barked apple, particularly in areas located nearer to historic sightings.

Fixed-point bird surveys were completed across different times throughout the day including during the morning, middle of the day and afternoon. This aligns with the recommendation for surveys to be completed diurnally for species such as honeyeaters and included a total of 12 hours across a total of 12 days.

Area searches were undertaken in high quality and potential habitat (Section 5.8.3) for an average of eight hours per day by two observers over eight days (128 person-hours).

As for regent honeyeater, isolated flowering eucalypts were monitored opportunistically to confirm the presence or absence of the species during flowering events. It is noteworthy however that the incidence of flowering eucalypts during the surveys was low, possibly in response to recent dry climatic conditions.

Observers also documented the presence and abundance of nectar feeding species, as competition for resources with more aggressive honeyeaters. A high abundance of nectar feeding species may limit the value and suitability of some habitat, particularly if the habitat is highly fragmented.

Surveys were undertaken in conditions suitable for detecting the species and assessing the value and distribution of their habitat. Survey duration exceeded the number of days and hours required for smaller areas of habitat in the survey guidelines for Australia's threatened birds (DEWHA 2010). Dr Stephen Debus (Adjunct Lecturer at University of New England) from the BirdLife Australia Regent Honeyeater Recovery Team was also consulted and provided a review of the approach and findings reported by Nature Advisory in EPBC Act threatened birds – habitat and regional assessment and targeted surveys (Nature Advisory, 2021c).

5.8.3 Criteria used to map swift parrot habitat

Habitat assessment locations were selected after a detailed review of the potential habitat mapping (based on field-verified RE mapping) presented in the Ecological Assessment Report of the MacIntyre Wind Farm (GHD 2020a) and based on a review of aerial and satellite imagery to identify sections of the Project area where larger trees were present.

Habitat was characterised based on eucalypt community species composition, mistletoe community species composition, maximum canopy height, canopy crown cover, ground cover, percentage of old growth trees and proximity to riparian zones and potential disturbances. Whether eucalypts or mistletoes were in flower, was also documented and the flowering event scored. Eucalypt and mistletoe dieback was also noted.

The Project area's habitat connectivity (i.e. degree of isolation/fragmentation), including linkages to other habitat in the region, was determined using field observations, recent aerial photography and previous sightings of the threatened species.

Areas with all characteristics consistent with the habitat requirements for regent honeyeater were identified as high quality habitat while those that had some characteristics were classed as potential habitat.

The habitat assessment criteria as presented below were derived from the Conservation Advice and the National Recovery Plan for swift parrot as applied to the particular vegetation and habitat on the site:

- High quality habitat:
 - Areas with old growth >50-70 percent
 - Abundant mugga ironbark or white box or both species, areas of lemon-scented gum (*Corymbia citriodora*) woodlands when in flower. Areas of abundant grey box (*E. moluccana*) and/or yellow box or river red gum. Areas of abundant white box – blackbutt with lerp infestations, narrow-leaved ironbark (*E. crebra*) woodlands with several mature high nectar-producing trees.
- Potential habitat:
 - Old growth <50 percent
 - Areas of low density mugga or white box. Areas of box woodlands lacking mature flowering trees, with scattered ironbark species. Immature eucalypt woodland patches.

5.8.4 Desktop results

The swift parrot was identified within the PMST (Appendix A) as 'likely to occur' within a 20 km radius from a central point within the Project area.

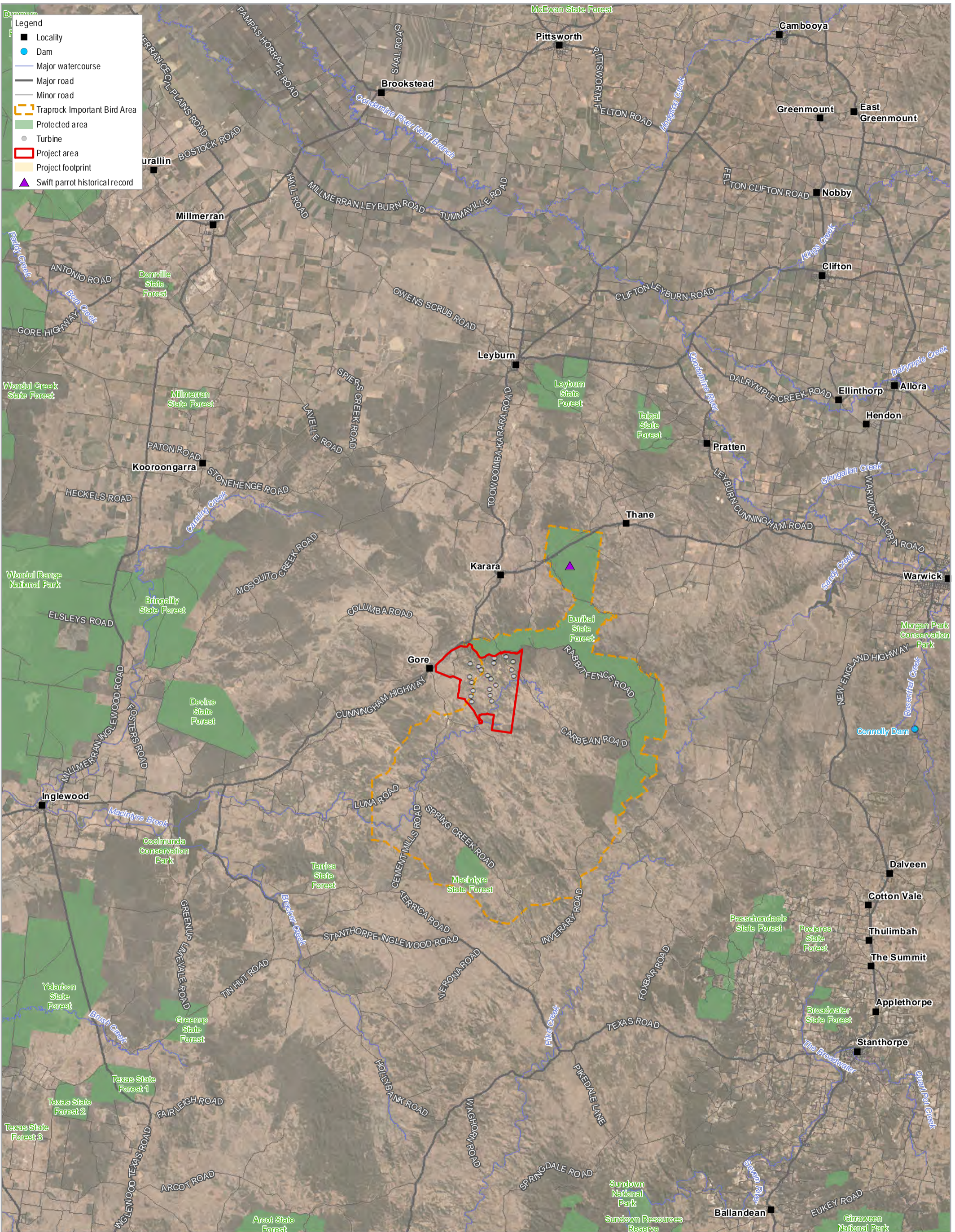
Twenty-six records of swift parrot are located within 50 kilometres of the Project area as shown on Figure 5.19. The species is reported occasionally within the Traprock Important Bird Area (BirdLife International 2020) with 23 of the records for swift parrot located within the Traprock Important Bird Area, all of which are within Durikai State Forest.

5.8.5 Survey results

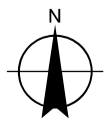
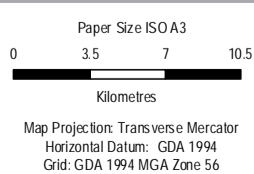
The swift parrot has not been recorded within the Project area during any of the field surveys undertaken for the Project. The species was recorded from Durikai State Forest, approximately 8 km north of the project area in 2017 (Figure 5.19). The species preferentially forages in large, mature trees in eucalypt forests and woodlands, particularly box-ironbark forest and woodlands, as well as grassy woodlands (Saunders & Tzaros 2011).

Within the Project area 18.05 ha of high quality swift parrot habitat has been mapped as shown in Figure 5.20. The patch of high quality habitat was observed in the north-eastern portion of the Project area and is dominated by mugga ironbark with broad-leaved ironbark and white box also present. Some flowering white box was observed.

The species exhibits high site fidelity and the production of lerp and nectar food resources are considered the main limiting factors to the species (Saunders & Tzaros 2011). At times, when sufficient levels of lerp and nectar are available, the species may occasionally forage within the smaller and more fragmented patches in the Project area. It is noted though that the lack of records within these patches indicates that these patches may not produce sufficient levels of lerp and/or nectar to allow the species to forage. Based on the distribution of records, the species is preferentially foraging in habitat within the Durikai State Forest which covers an area of 12,357 ha compared to the 18.05 ha of swift parrot habitat within the Project area. Habitat characteristics of roosting sites for swift parrot are relatively unknown. Based on the lack of records within the Project area, the swift parrot habitat is not considered roosting habitat. The species is likely roosting in areas such as Durikai State Forest where it has been recorded, as proximity to foraging habitat is likely to be important in roost site selection (Saunders & Tzaros 2011).



Based on or contains data provided by the State of Queensland 2021.
 In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

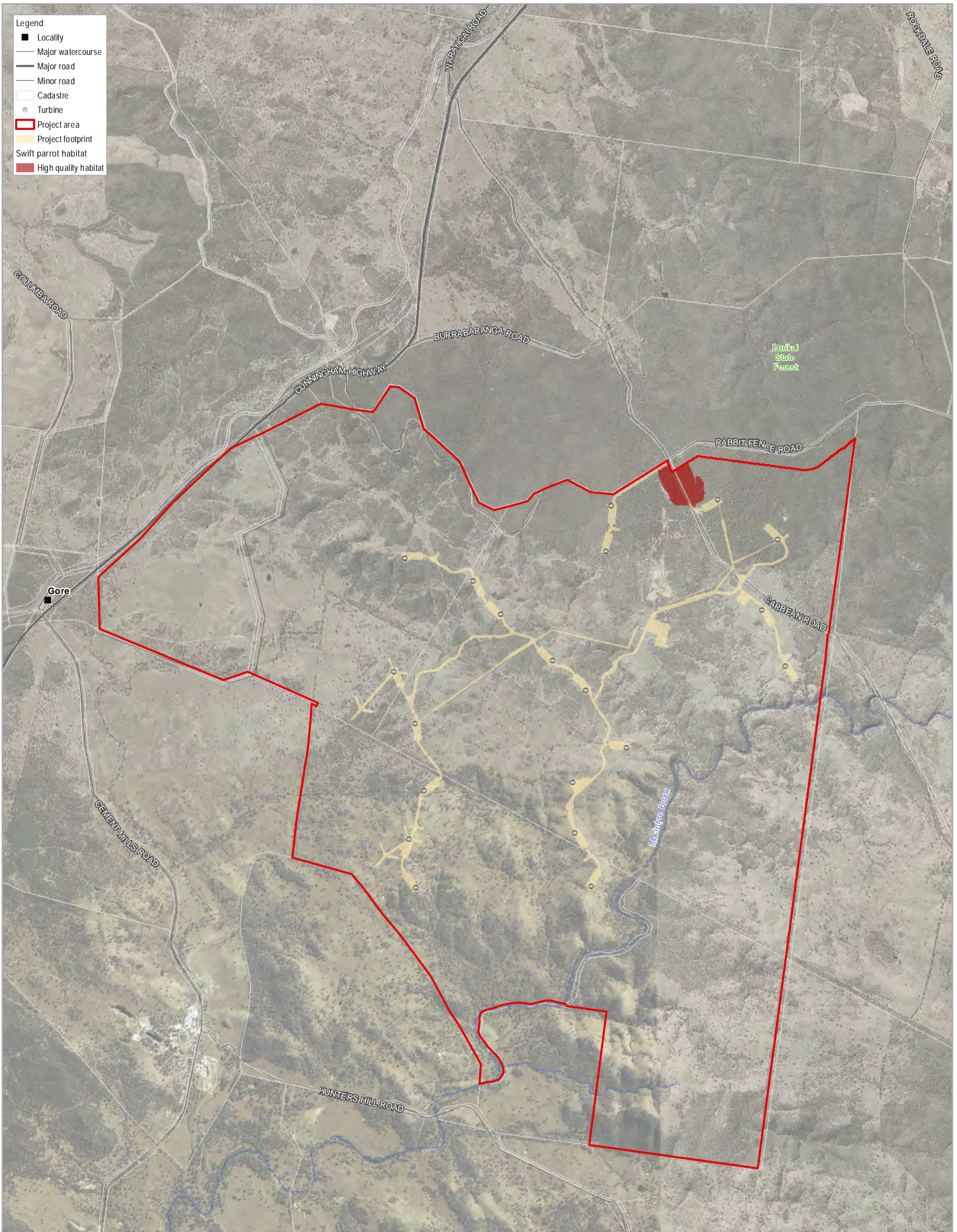


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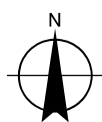
Historical records of the swift parrot

FIGURE 5-19



Based on or contains data provided by the State of Queensland 2021.
 In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

Paper Size ISO A3
 0 0.5 1
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



Acciona Energy Australia Global Pty Ltd
 MNES Assessment Report

Distribution of habitat
 for the swift parrot

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FIGURE 5-20

5.8.6 Significance of project footprint

Areas of high-quality habitat for the species were identified and mapped for the Project area (Figure 5.20), with high quality habitat observed in single patch dominated by mugga ironbark with broad-leaved ironbark and white box also present.

Habitat critical to the survival of the swift parrot includes those areas of priority habitat for which the swift parrot has a level of site fidelity or possesses phenological characteristics likely to be of importance to the swift parrot, or otherwise identified by the recovery team (Saunders & Tzaros 2011).

The absence of swift parrot records within the Project area from WildNet, Birddata and Atlas of Living Australia databases and following targeted surveys for the species as well as following Bird Utilisation Surveys (Nature Advisory, 2021b) and fauna surveys throughout the Project area (GHD 2020b) indicates an absence of a level of swift parrot site fidelity for the patches of high quality and potential habitat within the Project area. It is noted that the WildNet, Birddata and Atlas of Living Australia records for the species in the adjacent Durikai State Forest indicate a level of swift parrot site fidelity with the species being present in two consecutive years with records from July 2017 to September 2017 and from May 2018 to September 2018.

The high quality habitat within the Project area may possess phenological characteristics that can support swift parrot foraging at times when sufficient levels of lerp and nectar are available, although the absence of any records within these patches indicates that these patches are less likely to produce sufficient levels of lerp and/or nectar to allow the species to forage. Due to the lack of any records, and swift parrot site fidelity in the region being represented by the presence of the species in the adjacent Durikai State Forest only in two consecutive years (2017 and 2018), the phenological characteristics of this patch is not considered to be of importance for swift parrot.

The habitat within the Project area is also not identified by the recovery team as priority habitat for the species (Saunders & Tzaros 2011).

Consequently, swift parrot habitat mapped within the Project area is not considered habitat critical to the survival of the species.

5.8.7 Threatening processes

In Queensland, land clearing has dramatically reduced the foraging habitat of the swift parrot. Wildfire also impacts swift parrot habitat by altering tree flowering phenology and tree cavity availability (Inions et al., 1989; Gibbons et al., 2000 in TSSC 2016).

Other threats to the swift parrot include:

- Collision mortality with wire netting, mesh fences, windows and cars in urban areas
- Competition for resources from other bird species and bees
- Psittacine beak and feather disease, a lethal parrot disease which has been recorded in swift parrot nestlings in wild populations
- Illegal wildlife capture and trading.

5.8.8 Potential impacts

Potential impacts on swift parrot populations and habitat within the Project area include:

- Loss of habitat
- Injury and mortality.

These are further discussed below.

5.8.8.1 Loss of habitat

A total of 0.65 ha of high quality habitat is located within the Project footprint. Loss of high quality habitat is in the order of 3.60 percent of habitat available within the Project area.

As described in Section 5.8.6, habitat is not considered habitat critical to the survival of the species and the loss of habitat is considered acceptable based on:

- The species typically disperses through Victoria and New South Wales; however, smaller numbers are observed in south-east Queensland on a regular basis (Saunders & Tzaros 2011)
- Twenty-three of the 26 records of swift parrot within 50 kilometres of the Project area are within the Traprock Important Bird Area, all of which are within the Durikai State Forest where the species is foraging and likely roosting
- There are no records of the species within the patch of swift parrot habitat mapped in the Project area. The species exhibits high site fidelity, returning to locations on an irregular cyclic basis (Threatened Species Scientific Committee 2016). The lack of records indicates that these patches may not produce sufficient levels of lerp and/or nectar to allow the species to forage regularly.

5.8.8.2 Injury and mortality

Vegetation clearance during construction of the Project has a very small possibility of causing injury and/or mortality to swift parrots in sheltering and foraging in the canopy.

It has been reported that the construction of wind energy turbines in south-eastern Australia may have implications for the conservation of the swift parrot where they are poorly sited (Saunders & Tzaros 2011). While there is limited information on the flight heights of swift parrot, flight height data for a variety of parrot species of south-eastern Australia indicates that parrot species fly within RSA at times, although most flight heights are recorded below RSA. While foraging, swift parrots generally fly within the tree canopy (the tree canopy within the Project area is between approximately 20 m and 25 m in height), although while flying between feeding and roosting locations and on migration, the species may fly higher (Smales 2005). Given the species is expected to fly more often below RSA, mortality of the species from wind turbine strike within the Project area is considered unlikely to occur.

5.8.9 Measures to avoid, reduce or mitigate impacts

5.8.9.1 Loss of habitat

Planning phase measures that have been employed to avoid and reduce the direct loss of habitat include:

- Locating the Project footprint in open areas that have been subject to historical land clearing and sheep grazing as far as possible
- Minimising impacts to watercourses wherever practicable
- Utilising existing tracks where possible and locating proposed tracks within previously disturbed areas where possible.

During the construction phase of the Project, the following mitigation measures will be employed to reduce the loss of habitat:

- Land clearing will be restricted to the minimal amount necessary for the construction of the Project and will not extend outside of the Project footprint.
- The extent of vegetation clearing (and no-go areas) will be clearly identified on construction plans and in the field using high visibility fencing or flagging in the vicinity of high conservation significant areas. Clearing extent will be communicated to construction supervisors. If fencing or flagging is in poor condition, it will be replaced as soon as practicable to reduce the potential of accidental clearing
- Consistent with the Preliminary Fauna Management Plan prepare and implement a Fauna Management Plan to establish the environmental management framework for managing impacts on fauna and habitat.
- Where infrastructure must cross waterways, areas of existing disturbance (i.e. existing tracks) have been selected. Where this is not practicable, the Project footprint has been minimised.

- Engage suitably qualified and experienced fauna spotter-catchers to undertake pre-clearance surveys prior to clearing and to supervise the clearing process
- Site offices, construction stockpiles and laydown/storage areas will be located within existing cleared or disturbed areas.
- Rehabilitation of temporary laydown areas, stockpiles, site offices and areas will be undertaken as soon as practicable after these facilities are no longer required.
- A CMP has been prepared to inform actions with regard to managing weed hygiene, erosion, fuels and hazardous substances, fire, etc. and includes erosion and sediment control measures.
- All construction personnel shall attend environmental training as part of the site induction process prior to entering the work site. As part of this training, all personnel will be instructed on their obligations in regard to vegetation clearing protocols. Areas identified for vegetation clearance are to be clearly defined and detailed in site inductions.

5.8.9.2 Injury and mortality

The following measures will be implemented to avoid/minimise injury and/or mortality to the swift parrot during construction of the Project:

- Pre-clearance surveys will be undertaken within the Project footprint to mark the locations of potential swift parrot habitat trees.
- Spotter-catcher to check all suitable trees prior to clearing
- All clearing will be supervised by suitably qualified and experienced fauna spotter-catchers. This will involve relocating any resident fauna to the nearest suitable, safe habitat outside the clearing footprint.
- Adverse incident response procedures will be developed to detail actions to be taken in the event of wildlife injury or mortality during clearing.
- The CMP includes protocols to limit injury and mortality to fauna including management of risks associated with open excavations, trenching, waterbodies and responses and reporting for roadkill and adverse incident protocols.

During the planning stage, a number of measures were employed to avoid and reduce the direct loss of habitat for the swift parrot. A preliminary ecological constraints assessment was undertaken to identify and avoid areas of high ecological value wherever possible. Key outcomes included:

- Avoiding large remnants of established woodland within Durikai State Forest
- Utilising existing tracks wherever possible and locating proposed tracks within previously disturbed areas wherever possible to avoid or minimise disturbance to vegetation and habitat.

Lighting is not required on the turbines for the site and is not proposed.

A BBAMP has been prepared for the Project and includes monitoring and adaptive management measures to assess and mitigate collision impacts on the birds.

The BBAMP establishes monitoring and management procedures consistent with the methods outlined by the Australian Wind Energy Association (AusWEA 2005) and endorsed in the Clean Energy Council's Best Practice Guidelines (CEC 2018).

The BBAMP adopts an adaptive manage approach with specific objectives derived from recent conditions of approval for wind farm projects as follows:

- To implement a monitoring program to estimate the impact of the project on at-risk birds and/or bats that can reasonably be attributed to the operation of the Project
- To directly record impacts on birds and bats through a statistically-based program of carcass searches
- To document an agreed decision-making framework that identifies impact triggers requiring a management response
- To detail potential mitigation measures and related implementation strategies to reduce impacts on birds and bats

- To identify matters to be addressed in periodic reports on the outcomes of monitoring, the application of the decision-making framework, mitigation measures and their success.

5.8.10 Significance of impact assessment

An assessment against the Significant Impact Guidelines 1.1 (DoE, 2013) with regards to the swift parrot was undertaken and the outcomes provided in Table 5-12.

Table 5-12 Significance of impact on the swift parrot

Impact criteria	Potential to occur
Lead to a long-term decrease in the size of a population.	<p>Unlikely</p> <p>The removal of only 0.65 ha of swift parrot habitat is unlikely to lead to a long-term decrease in the size of the population as:</p> <ul style="list-style-type: none"> – Only 3.60 percent of swift parrot habitat within the Project area is proposed to be removed – The species typically disperses through Victoria and New South Wales, with smaller numbers observed in south-east Queensland on a regular basis (Saunders & Tzaros 2011) – 23 of the 26 records of swift parrot within 50 km of the Project area are within the Traprock Important Bird Area, all of which are within the Durikai State Forest where the species is preferentially foraging and likely roosting in important habitat for the species – There are no records of the species within the patch of swift parrot habitat mapped in the Project area. The species exhibits high site fidelity, returning to locations on an irregular cyclic basis (TSSC 2016). The lack of records indicates that the patch of habitat within the Project area may not produce sufficient levels of lerp and/or nectar to allow the species to forage regularly – The patch of swift parrot habitat within the Project area is not considered important habitat for the species as the patch may not produce sufficient levels of lerp and/or nectar to allow the species to forage regularly, is smaller and more fragmented and does not contain records of the species – The species does not breed on mainland Australia (Saunders & Tzaros 2011) – There is only a very small possibility of injury or mortality of the species during clearing of this patch of habitat, and due to the limited swift parrot activity within the area and the smaller size of this patch, this possibility can be removed with the implementation of a CMP, based on the Preliminary Vegetation Management Plan and Preliminary Fauna Management Plan, that ensures that the species is not present before vegetation is removed or modified. <p>It has been reported that the construction of wind energy turbines in south-eastern Australia may have implications for the conservation of the swift parrot where they are poorly sited (Saunders & Tzaros 2011). While foraging, swift parrots generally fly within the tree canopy, although while flying between feeding and roosting locations and on migration, the species may fly higher (Smales 2005). Given the species is expected to fly more often below RSA (i.e. longer-distance movements are less frequent than routine foraging flights within the tree canopy), mortality of the species from wind turbine strike within the Project area is considered unlikely to occur.</p>
Reduce the area of occupancy of the species.	<p>Unlikely</p> <p>The removal of only 0.65 ha of swift parrot habitat along the edge of one patch will not completely remove this patch of habitat. Fragmentation of this patch will occur with a clearing of approximately 20 m wide along the edge of this patch. This very minor level of habitat fragmentation is considered to have minimal impact on swift parrot, given the availability of larger</p>

Impact criteria	Potential to occur
	<p>tracts of habitat adjacent to the Project area and elsewhere in the region. The removal of the habitat within the development footprint will also result in an inconsequential reduction in habitat connectivity, particularly considering the species is highly mobile. As the removal of habitat will not completely remove the patch of habitat, will result in only very minor levels of habitat fragmentation and an inconsequential reduction in habitat connectivity, the area of occupancy of the species is unlikely to be reduced.</p>
<p>Fragment an existing population into two or more populations.</p>	<p>Unlikely</p> <p>The swift parrot comprises a single population (Garnett et al. 2011). The removal of only 0.65 ha of swift parrot habitat will not fragment the existing population into two or more populations. The species is highly mobile and only 3.60 percent of swift parrot habitat within the Project area is proposed to be removed.</p>
<p>Adversely affect habitat critical to the survival of a species.</p>	<p>Unlikely</p> <p>A total of 0.65 ha of Swift Parrot habitat is proposed to be removed. This habitat is not considered to be habitat critical to the survival of the species.</p> <p>Habitat critical to the survival of the Swift Parrot includes (Saunders & Tzaros 2011):</p> <ul style="list-style-type: none"> – Those areas of priority habitat for which the Swift Parrot has a level of site fidelity or possess phenological characteristics likely to be of importance to the Swift Parrot: or – Are otherwise identified by the recovery team. <p>Priority habitat for Swift Parrot are areas of particular importance for conservation management which are used (Saunders & Tzaros 2011):</p> <ul style="list-style-type: none"> – For nesting – By large proportions of the Swift Parrot population repeatedly between seasons (site fidelity) – For prolonged periods of time (site persistence). <p>The patch of Swift Parrot habitat within the Project area is not considered priority habitat for the species as this patch is:</p> <ul style="list-style-type: none"> – Not used for nesting with nesting occurring in Tasmania (Saunders & Tzaros 2011) – Not used by large proportions of the Swift Parrot population with no records of the species within the Project area from WildNet, Birdata and Atlas of Living Australia databases and following targeted surveys for the species as well as following Bird Utilisation Surveys and fauna surveys throughout the Project area. It is noted there are some Swift Parrot records within the adjacent Durikai State Forest – Not repeatedly used between seasons (lack of site fidelity) with no records of the species within the Project area. It is noted there are some Swift Parrot records within the adjacent Durikai State Forest with records from July 2017 to September 2017, from May 2018 to September 2018 and in June 2021 – Not used for prolonged periods of time (lack of site persistence) with no records of the species within the Project area. <p>The patch of Swift Parrot habitat within the Project area is also not identified by the recovery team as priority habitat for the species (Saunders & Tzaros 2011). It is noted that the WildNet, Birdata and Atlas of Living Australia records for the species in the adjacent Durikai State Forest indicate a level of Swift Parrot site fidelity with records from July 2017 to September 2017, from May 2018 to September 2018 and in June 2021, and as a result these areas within Durikai State Forest are considered priority habitat and habitat critical to the survival of the species.</p>

Impact criteria	Potential to occur
	<p>It is noted that the patch of Swift Parrot habitat within the Project area may possess phenological characteristics that may support Swift Parrot foraging if sufficient levels of lerp and nectar are available in winter flowering eucalypt species, however, there are no Swift Parrot records within this patch and high quantities of lerp or heavy flowering in winter flowering eucalypt species was not observed in this patch. This indicates that this patch may not produce sufficient levels of lerp and/or nectar to allow the species to forage and is therefore not considered likely to be of importance to the Swift Parrot. If one or more of the patches of Swift Parrot habitat within the Project area or within the adjacent proposed MacIntyre Wind Farm or proposed MacIntyre Wind Farm transmission line corridor contained one or more records of Swift Parrot and/or high quantities of lerp or very heavy flowering in winter flowering eucalypt species had been observed in these patches, the Swift Parrot habitat within the Project area would be considered to possess phenological characteristics likely to be of importance to the Swift Parrot and therefore habitat critical to the survival of the species.</p> <p>As a result of the above, Swift Parrot habitat mapped within the Project area is not considered habitat critical to the survival of the species</p>
Disrupt the breeding cycle of a population.	<p>Unlikely</p> <p>The swift parrot breeds in Tasmania in summer and the entire population migrates north and leaves the island for the winter. While on mainland Australia, the swift parrot typically disperses through Victoria and New South Wales, however, smaller numbers are observed in south-east Queensland on a regular basis (Saunders & Tzaros 2011). As the species does not breed on mainland Australia, the action will not disrupt the breeding cycle of the swift parrot population.</p>
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>Unlikely</p> <p>The removal of only 0.65 ha of swift parrot habitat is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline as:</p> <ul style="list-style-type: none"> – Only 3.60 percent of swift parrot habitat within the Project area is proposed to be removed – The species typically disperses through Victoria and New South Wales, with smaller numbers observed in south-east Queensland on a regular basis (Saunders & Tzaros 2011) – 23 of the 26 records of swift parrot within 50 km of the Project area are within the Traprock Important Bird Area, all of which are within the Durikai State Forest where the species is preferentially foraging and likely roosting in important habitat for the species – There are no records of the species within the patch of swift parrot habitat mapped in the Project area. The species exhibits high site fidelity, returning to locations on an irregular cyclic basis (TSSC 2016). The lack of records indicates that the patch of habitat within the Project area may not produce sufficient levels of lerp and/or nectar to allow the species to forage regularly – The patch of swift parrot habitat within the Project area is not considered important habitat for the species as the patch may not produce sufficient levels of lerp and/or nectar to allow the species to forage regularly, is smaller and more fragmented and does not contain records of the species; and – The species does not breed on mainland Australia (Saunders & Tzaros 2011).

Impact criteria	Potential to occur
<p>Result in invasive species that are harmful to a Critically Endangered species becoming established in the Critically Endangered species' habitat</p>	<p>Unlikely</p> <p>Resource competition with the introduced European Honeybee (<i>Apis mellifera</i>) is likely to pose a threat to the swift parrot and the potential introduction of the invasive Large Earth Bumblebee (<i>Bombus terrestris</i>) to mainland Australia also poses a threat to over-wintering foraging habitat for swift parrot (Saunders & Tzaros 2011). The action is not considered to increase the likelihood of European Honeybee and Large Earth Bumblebee becoming established in the swift parrot habitat within the Project area. It is noted that the project-specific Preliminary Vegetation Management Plan and Preliminary Fauna Management Plan includes measures to reduce the impact of invasive species on all biota, including on the swift parrot.</p>
<p>Introduce disease that may cause the species to decline, or</p>	<p>Unlikely</p> <p>Psittacine Beak and Feather Disease (Pbfd) is a common and potentially deadly disease of parrots (Saunders & Tzaros 2011) and is known to occur in swift parrots (Sarker et al. 2013). This disease could potentially have serious implications for the swift parrot population should the general health of these birds be reduced from stress associated with competition for food resources (Saunders & Tzaros 2011). The proposed removal of only 0.65 ha of swift parrot habitat (0.65 ha of high quality habitat and 0 ha of potential habitat) within the Project area is not considered to increase the stress associated with the competition for food resources, particularly given the species has not been recorded within the Project area and is preferentially foraging in habitat within Durikai State Forest. Considering the way in which the project will be implemented, it is unlikely that this disease will be introduced or spread by the project.</p>
<p>Interfere substantially with the recovery of the species.</p>	<p>Unlikely</p> <p>The removal of only 0.65 ha of swift parrot habitat that is not considered habitat critical to the survival of the species will not interfere with the recovery of the species as:</p> <ul style="list-style-type: none"> – Only 3.60 percent of swift parrot habitat within the Project area is proposed to be removed – The species typically disperses through Victoria and New South Wales, with smaller numbers observed in south-east Queensland on a regular basis (Saunders & Tzaros 2011); – 23 of the 26 records of swift parrot within 50 km of the Project area are within the Traprock Important Bird Area, all of which are within the Durikai State Forest where the species is preferentially foraging and likely roosting in important habitat for the species – There are no records of the species within the patch of swift parrot habitat mapped in the Project area. The species exhibits high site fidelity, returning to locations on an irregular cyclic basis (TSSC 2016). The lack of records indicates that the patch of habitat within the Project area may not produce sufficient levels of lerp and/or nectar to allow the species to forage regularly – The patch of swift parrot habitat within the Project area is not considered important habitat for the species as the patch may not produce sufficient levels of lerp and/or nectar to allow the species to forage regularly, is smaller and more fragmented and does not contain records of the species – The species does not breed on mainland Australia (Saunders & Tzaros 2011) – There is only a very small possibility of injury or mortality of the species during clearing of this patch of habitat, and due to the limited swift parrot activity within the area and the smaller size of this patch, this possibility can be removed

Impact criteria	Potential to occur
	<p>with the implementation of a CMP, based on the Preliminary Vegetation Management Plan and Preliminary Fauna Management Plan, that ensures that the species is not present before vegetation is removed or modified.</p> <p>It has been reported that the construction of wind energy turbines in south-eastern Australia may have implications for the conservation of the swift parrot where they are poorly sited (Saunders & Tzaros 2011). While foraging, swift parrots generally fly within the tree canopy, although while flying between feeding and roosting locations and on migration, the species may fly higher (Smales 2005). Given the species is expected to fly more often below RSA (i.e. longer-distance movements are less frequent than routine foraging flights within the tree canopy), mortality of the species from wind turbine strike within the Project area is considered unlikely to occur.</p>

5.8.11 Conclusions

The Project is considered **unlikely** to have a significant impact on the swift parrot.

5.9 Fork-tailed swift

5.9.1 Conservation status and documentation

The fork-tailed swift is listed as a Migratory species under the EPBC Act. The species is a non-breeding visitor to all states and territories in Australia between October and April. There are widespread but scattered records of the fork-tailed swift in coastal areas from 20°S, south to Brisbane and in much of the south south-eastern region (Higgins 1999, cited in DAWE, 2020a).

The fork-tailed swift is an aerial eater, flying anywhere in a range from 1 m to 300 m above the ground to forage on insects. It occurs over a wide range of dry and open habitats including riparian woodland, salt marshes, grasslands, sand plains and farmland (DAWE, 2020a).

5.9.2 Survey effort

There are no Commonwealth survey guidelines for the fork-tailed swift. The survey effort is considered appropriate for this species and in general were designed to meet the assessment requirements of the Queensland State Code 23 for Wind Farm Development (DILGP 2017), the National Wind Farm Development Guidelines Draft (EPHC 2010) and as detailed in the Survey guidelines for Australia's threatened birds (DEWHA 2010b).

Pre-construction surveys in relation to threatened birds were based on the standards for assessing the risks to birds from wind farms in Australia, outlined in the 'Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia' (Clean Energy Council 2018).

A summary of ecological survey effort was provided in Table 2-1 and shown in Figure 2.2.

Aerial surveys were undertaken to identify the presence of fork-tailed swifts within the Project area. Habitat assessments were undertaken to assess the value of habitat for the species.

Survey effort for the fork-tailed swift included:

- Area searches/diurnal bird surveys (12 hrs over 5 days)
- Targeted habitat assessments at 9 sites
- Rapid habitat assessments at 92 sites
- Targeted bird census surveys at 2 sites
- Six aerial bird surveys (i.e. 2 x 3 aerial surveys)
- Bird utilisation of airspace surveys at 22 sites.

Bird utilisation surveys were undertaken (Section 2.3.5) for the periods:

- Early dry season (23 – 30 May 2020)
- Late dry season (22 September to 2 October 2020)
- Early wet season (3 – 8 December 2020)
- Late wet season (1 – 6 February 2021).

Surveys were undertaken in conditions and over periods suitable for detecting the species and assessing the value and distribution of their habitat.

5.9.3 Criteria used to define fork-tailed swift habitat

The fork-tailed swift is almost exclusively aerial in nature. The species typically roosts aerially. Accordingly, the Project area does not provide habitat for this species and no habitat has been mapped.

5.9.4 Desktop results

The fork-tailed swift was identified within the PMST (Appendix A) as 'likely to occur' within a 20 km radius from a central point within the Project area. The species has only been historically recorded twice since 1980 within a 20 km radius of the Project area.

5.9.5 Survey results

The fork-tailed swift has not been recorded in any of the field surveys or bird utilisation surveys undertaken for the Project.

5.9.6 Significance of project footprint

There is no formal Commonwealth listing advice for the fork-tailed swift. However, the Commonwealth SPRAT profile, suggests the fork-tailed swift is mostly found above dry and open habitats including riparian woodland, salt marshes, grasslands, sand plains and farmland (DAWE 2020a). They are sometimes recorded above wetter habitats including rainforest, wet sclerophyll and pine plantations (Higgins 1999). The species typically forages aerially, using low pressure systems to assist their movement. Birds are sometimes observed at canopy level within open forests (Higgins 1999). As the species is exclusively aerial, it is not dependent on terrestrial habitats. As such, no suitable habitat has been identified or mapped within the Project area. The species is a seasonal migrant to the region, breeding in the northern hemisphere and only visiting the region during non-breeding periods between October and April. It has the potential to occur at foraging heights across the Project area. Important habitats for this species are likely to include areas utilised for breeding and nesting purposes. No breeding or nesting habitat occurs in Australia (DAWE 2020a).

5.9.7 Threatening processes

Potential threats to the fork-tailed swift include habitat destruction and predation by feral animals however due to the wide range of the species, the potential impacts are thought to be negligible (BirdLife International 2009b, cited in DAWE 2020).

5.9.8 Potential impacts

As the fork-tailed swift is exclusively aerial, it does not have typical associations with habitat. Clearing for the Project is unlikely to have a significant impact on the species' local abundance. The species occurs in Australia during the non-breeding season and as such the Project has no capacity to impact on more sensitive breeding habitat. Potential impacts on fork-tailed swift populations include injury and mortality, notwithstanding that the species is not known from or recorded within the Project area.

5.9.8.1 Injury and mortality

The fork-tailed swift flies at RSA height, which presents a risk of collision injury or mortality with moving rotors during the operational phase of the Project. Low levels of collision mortality have been reported for this species at wind farms in Tasmania, New South Wales and Victoria.

The collision risk assessment undertaken for the Project, as reported in the Bird and Bat Utilisation Report prepared as part of the EPBC Referral application, determined that under normal conditions, the Project is expected to have a low likelihood of collision, affecting a small number of individuals.

5.9.9 Measures to avoid, reduce or mitigate impacts

5.9.9.1 Injury and mortality

The following factors of wind farm design and operation are universally considered to reduce the risk of collision among birds:

- Wind turbine spacing and orientations has shown to influence collision risks with arrays that sit oblique to natural topography generally carrying elevated collision risks (Marques et al 2014)
- Lighting has been shown to increase collision risks in some bird species, as this can disorient birds in flight (Smales 2014)

The BBAMP which includes monitoring and adaptive management measures to assess and mitigate collision impacts on the fork-tailed swift.

5.9.10 Significance of impact assessment

An assessment against the Significant Impact Guidelines 1.1 (DoE 2013) with regards to the fork-tailed swift was undertaken and the outcomes provided in Table 5-13.

Table 5-13 Significance of impact on the fork-tailed swift

Impact criteria	Potential to occur
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	Unlikely The fork-tailed swift is exclusively aerial and does not have typical associations with habitat. As such, clearing for the Project is unlikely to have a significant impact on the species' local abundance. The species occurs in Australia during the non-breeding season. As such, the Project has no capacity to impact on more sensitive breeding habitat.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	Unlikely No invasive species are identified as threats to the fork-tailed swift. The Project is unlikely to cause any increase in invasive species that could threaten local abundance of the species.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	Unlikely The fork-tailed swift does not breed in Australia, spending its breeding season in Asia, from central and south-eastern Siberia and Mongolia, east to the Maritime Territories of Russia, Sakhalin and the Kuril Islands and south to northern Japan and north-eastern China (DoE 2020b). As such, the Project will not disrupt the breeding cycle of an important population of this species.

5.9.11 Conclusion

The Project is considered **unlikely** to have a significant impact on the fork-tailed swift.

5.10 Rufous fantail

5.10.1 Conservation status and documentation

The rufous fantail is listed as a Migratory species under the EPBC Act. It is known to have two subspecies in Australia, the *R. r. rufifrons* and *R. r. intermedia*.

The species occurs in coastal and near coastal districts of northern and eastern Australia, with breeding populations of both subspecies occurring east of the Great Dividing Range near the New South Wales-Queensland border (Higgins, et al. 2006, cited in DAWE, 2020b).

The rufous fantail mainly inhabits wet gullies in rainforest and sclerophyll forests but may also inhabit dry woodland habitat during migrations (Higgins, et al. 2006, cited in DAWE, 2020b). The species forages at shrub and understorey levels and rarely flies above canopy height. In south-east Queensland, breeding habitat is restricted to wet gullies east of the Great Dividing Range (Higgins et al 2006). Evidence from bird banding studies indicates individuals are likely to return to and move through the same locations each season (Higgins et al 2006).

5.10.2 Survey effort

There are no Commonwealth survey guidelines for the rufous fantail. The survey effort is considered appropriate for this species and in general were designed to meet the assessment requirements of the Queensland State Code 23 for Wind Farm Development (DILGP 2017), the National Wind Farm Development Guidelines Draft (EPHC 2010) and as detailed in the Survey guidelines for Australia's threatened birds (DEWHA 2010b).

A summary of ecological survey effort was provided in Table 2-1 and shown in Figure 2.2.

Survey effort for the rufous fantail included:

- Area searches/diurnal bird surveys (12 hrs over 5 days)
- Targeted habitat assessments at 9 sites
- Rapid habitat assessments at 92 sites
- Targeted bird census surveys at 2 sites.

Surveys were undertaken in conditions suitable for detecting the species and assessing the value and distribution of their habitat. Surveys were undertaken in summer, suitable for detecting the species before their winter migration further north.

5.10.3 Criteria used to map rufous fantail habitat

5.10.3.1 Commonwealth habitat definition

There is no formal Commonwealth listing advice or recovery plan for the rufous fantail. However, the Commonwealth SPRAT profile identifies rufous fantail habitat as dense gullies in wet sclerophyll forests but indicates the species can utilise drier open woodland on passage (DAWE 2020). These migratory habitats include drier sclerophyll forests and woodlands, including Spotted Gum (*Eucalyptus maculata*), Yellow Box (*E. melliodora*), ironbarks or stringybarks, often with a shrubby or heath understorey (DAWE 2020).

5.10.3.2 Criteria used to map rufous fantail habitat within the Project area

Predicted rufous fantail habitat has been mapped using criteria consistent with the definition of habitat provided within the Commonwealth SPRAT profile for the species (DAWE 2020). Predicted habitat for the species has been based on the presence of remnant riparian woodland along watercourses throughout the Project area, based on all remnant woodland within 200 m of watercourses of stream order 2 or higher.

Mapping of rufous fantail habitat was based on habitat assessments undertaken by GHD over multiple surveys between 2018 and 2020 including habitat assessments at 92 sites.

5.10.4 Desktop results

The rufous fantail was identified within the PMST (Appendix A) as 'known to occur' within a 20 km radius from a central point within the Project area. The species has been recorded once approximately 15 km south of the Project area as shown in Figure 5.21.

5.10.5 Survey results

The rufous fantail has not been recorded in any of the field surveys undertaken for the Project. Predicted habitat suitable to the rufous fantail has been mapped in patches across the Project area consistent with criteria outlined in Section 5.10.3. Habitat is associated with MacIntyre Brook in the eastern portion of the Project area, and within dense gullies in the western and northern portions of the Project area as shown in Figure 5.22.

Habitats within the Project area are consistent with those drier habitats potentially utilised during migration.

5.10.6 Significance of Project footprint

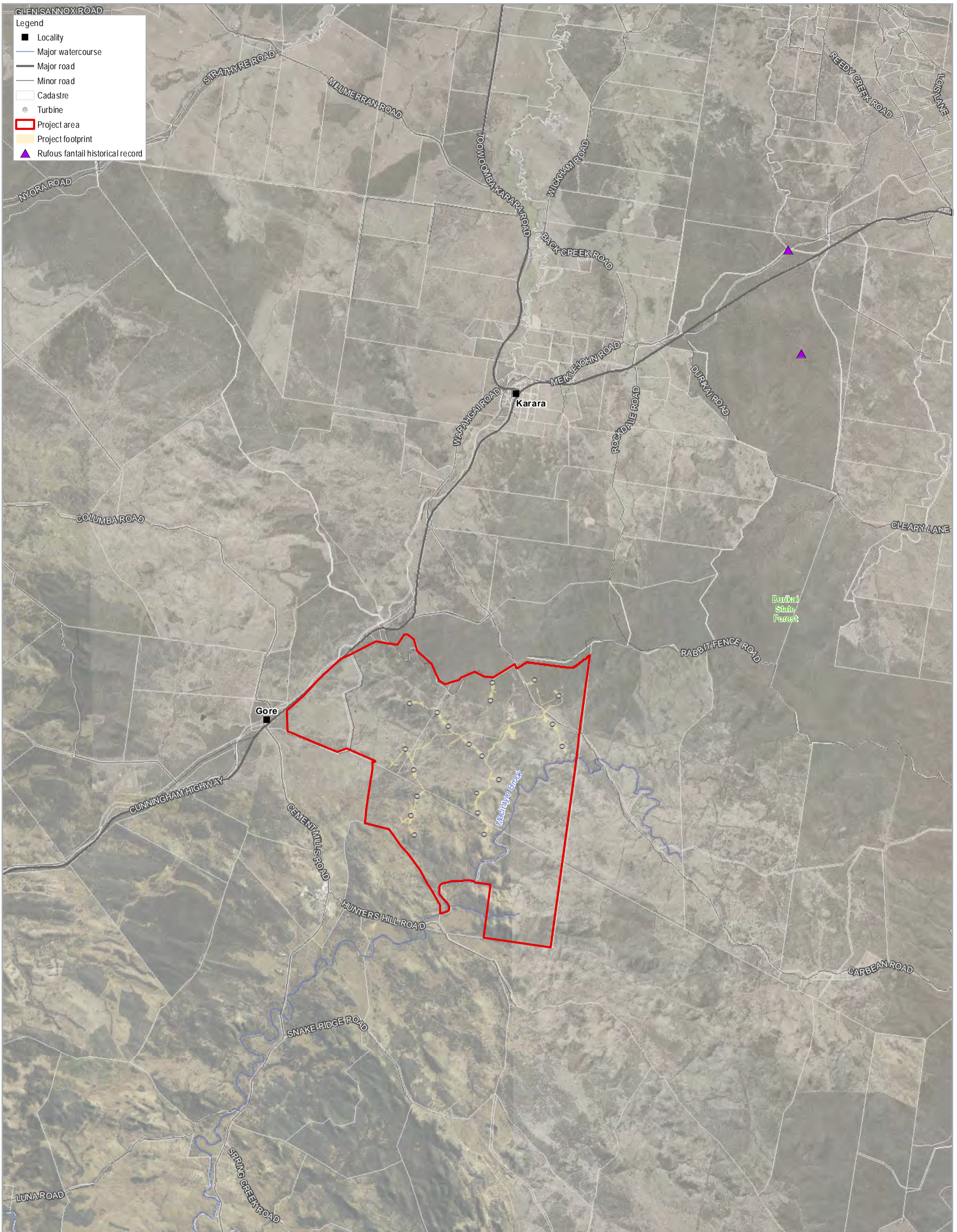
This section assesses the significance of rufous fantail habitats within the Project area and whether they constitute important habitat at a national level.

5.10.6.1 Status as important habitat

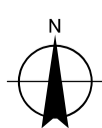
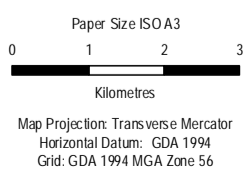
Important habitat for the rufous fantail is broadly defined in the Referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE 2015). This typically includes 'moist, dense habitats, including mangroves, rainforest, riparian forests and thickets, and wet eucalypt forests with a dense understorey, however, when on passage a wider range of habitats are used including dry eucalypt forests and woodlands and Brigalow shrublands' (DoE 2015). While dry sclerophyll woodland habitats can provide important habitat for the rufous fantail during seasonal migrations, the lack of historical records for a species that is known to move along the same movement pathways each season in an area that has been subject to intensive historical survey effort (due to its occurrence within the Traprock Important Bird Area), would suggest habitats within the Project area are unlikely to be important.

5.10.7 Threatening processes

The main threat to the rufous fantail is fragmentation and loss of moist breeding habitat through clearing and urbanisation. This is particularly prevalent through forest remnants and corridors along the species' migration routes (Huggett 2000, cited in DAWE 2020).



Based on or contains data provided by the State of Queensland 2021.
 In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

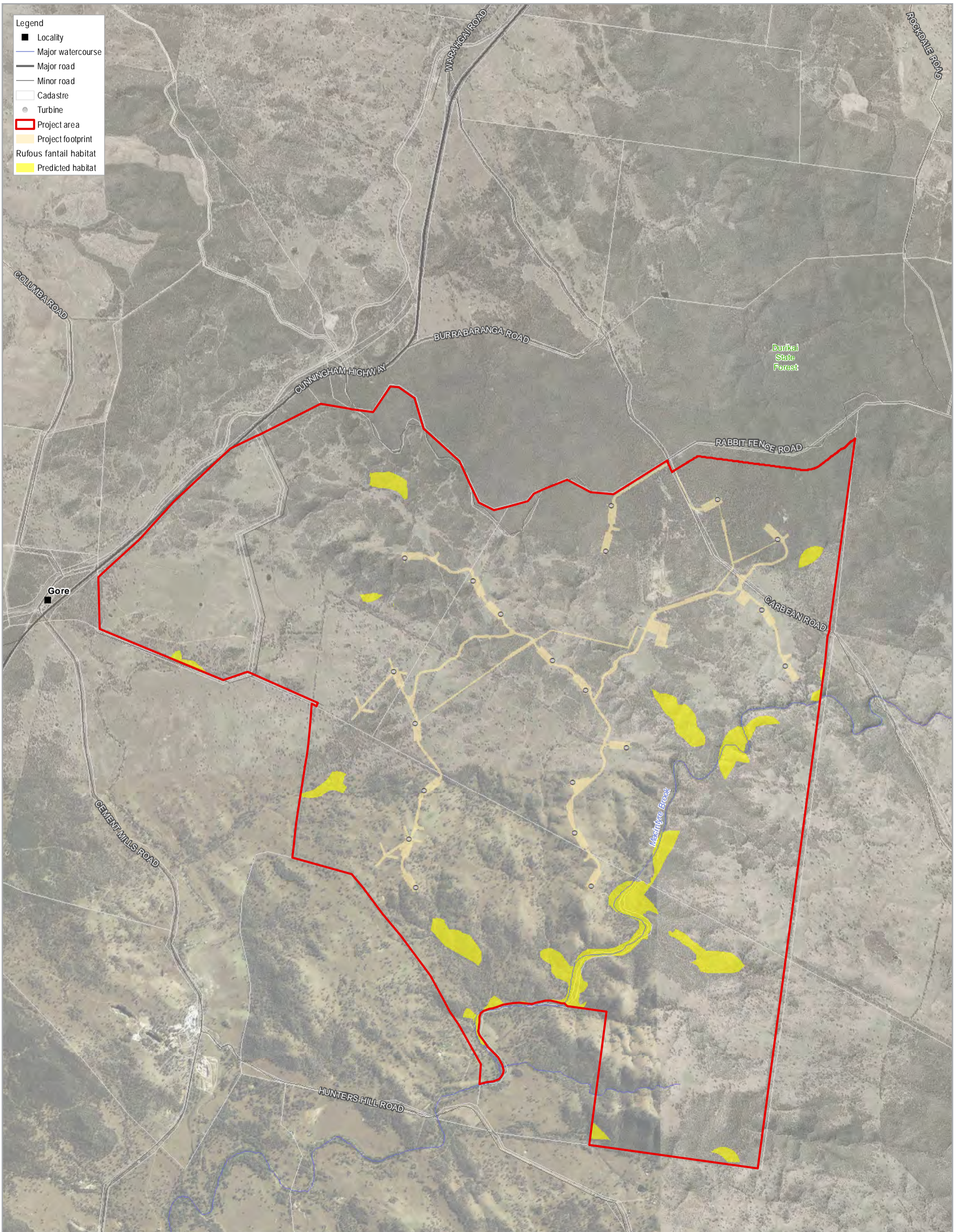


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 MNES Assessment Report

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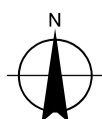
Distribution of rufous fantail historical records

FIGURE 5-21



Based on or contains data provided by the State of Queensland 2021.
 In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

Paper Size ISO A3
 0 0.5 1
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



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Distribution of predicted habitat for the rufous fantail within the project area

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FIGURE 5-22

5.10.8 Potential impacts

The rufous fantail occurs in dry sclerophyll habitats during migration. The Project will not impact any potential habitat utilised by the species. Direct impacts on habitat areas have been avoided through Project design. Given that habitat will not be directly impacted, the Project will not cause any indirect impact due to isolation or fragmentation of habitat. Collision risks are also considered negligible for the rufous fantail. The rufous fantail typically flies at or below canopy height and will therefore not fly at RSA height. Potential indirect impacts on the species associated with increased light, noise and degradation of adjacent habitat are appropriately managed as described below.

As these areas are typically used briefly and hold limited ecological value for the species, habitats within the Project area are not considered important habitat. The Project is unlikely to impact any important habitat for this species however other potential impacts may include the following:

- Disturbance from increased light, noise and vibration
- Habitat degradation through increased dust, run-off and sedimentation
- Introduction and spread of invasive fauna species
- Introduction and spread of weed species.

These impacts are described further in the following sections.

5.10.8.1 Disturbance from increased light, noise and vibration

Construction will result in a substantial, localised increase in vehicle movements in the short-term, which will increase light, noise and vibration disturbance to local wildlife. Increased light, noise and vibration can alter individual species' behaviours, and disrupt the balance of inter-species interactions. Such disruptions typically favour feral predators and generalist species that owe their success to broad ecological tolerances and possess the ability to tolerate or actively exploit disturbed environments (Hero et al. 2004).

5.10.8.2 Habitat degradation by increased dust, run-off and sedimentation

Construction activities have the potential to generate localised dust, erosion, run-off and sedimentation through increased vehicle movements, clearance of vegetation and earthworks. This can reduce the abundance and diversity of adjacent terrestrial and aquatic habitats by physically smothering vegetation, changing nutrient levels, impeding the growth and germination of plant species, encouraging weed incursions and altering the movement and behaviour of fauna species.

The receiving environment has already been subject to high levels of erosion and sedimentation as a result of existing land-clearing and grazing activities. Nevertheless, sensitive ecological receptors (e.g. larger woodland remnants and aquatic habitats) are particularly susceptible to adverse impacts associated with dust, run-off, erosion and sedimentation. These areas require protection through the implementation of sediment and erosion control measures during construction.

Adverse weather conditions during construction can exacerbate the potential impact of erosion and sedimentation. High rainfall has the potential to remove exposed topsoil, destabilise creek beds and distribute sediment through creek line. Strong winds have the potential to spread exposed topsoil, decreasing the likelihood of recolonization by vegetation and potentially distributing dust into nearby sensitive environments.

5.10.8.3 Introduction and spread of pest fauna species

The introduction and/or spread of pest fauna species can result in substantial disruptions to natural ecosystem functioning by altering the balance of inter-species competition and predation. Inappropriate waste disposal and provision of water has the capacity to attract higher local concentrations of feral predators, increasing the predation pressures on local wildlife. Pest fauna species recorded within the Project area included feral pigs (*Sus scrofa*), dog (*Canis lupus*), cat (*Felis catus*) and fox (*Vulpes vulpes*). Access tracks created for the Project have the potential to facilitate movement of feral predators such as dogs and foxes, thereby increasing predation pressures on local wildlife. The black rat (*Rattus rattus*) represents a particular threat to the rufous fantail (DoE 2015).

Inappropriate waste disposal during construction could conceivably increase local black rat numbers in areas already subject to disturbance. Although the Project area is already exposed to relatively high levels of pest fauna infestation, mitigation measures will be required to limit any spread of pest animals that could result from construction activities.

5.10.8.4 Introduction and spread of weed species

Rubber vine (*Cryptostegia grandiflora*) is a recognised threat to the rufous fantail (DoE 2015), choking areas of potential habitat and limiting nesting and foraging opportunities. Rubber vine was not recorded during surveys for the Project and is generally considered a low threat in the region. Despite this, construction activities have the potential to introduce and spread weeds through the movement of contaminated vehicles, fill and vegetative material. This can undermine the ecological integrity of bushland remnants by competitively excluding native plant species that provide food, shelter and nesting resources for native wildlife. Clearance of native vegetation creates areas of disturbance that are naturally susceptible to colonisation by invasive weed species. These can form a local source of future weed infestations within the surrounding landscape.

5.10.9 Measures to avoid, reduce or mitigate impacts

5.10.9.1 Disturbance from increased light, noise and vibration

Routine mitigation measures should be undertaken to minimise the impact that noise, light, vibration and disturbance have on local wildlife populations. This is particularly important within the vicinity of habitat for conservation significant fauna species. The following measures will be used to minimise the impacts of light, noise and vibration during construction:

- Site lighting is to be kept to the minimum (security) required for safety. Placement and orientation of lighting to be directed away from sensitive fauna habitat. Direction of lighting beam downwards or use of shields and baffles to limit light spill beyond site boundary.
- Wherever practicable, construction activities will be limited to daylight hours to reduce the need for lighting and resultant light spill into adjacent habitat.
- A Traffic Management Plan will be developed for the construction site to control vehicle movements and reduce the unnecessary generation of vehicular noise.
- All construction vehicles will comply with maintenance schedules and operational restrictions designed to limit noise impacts during construction.

5.10.9.2 Habitat degradation by increased dust, run-off and sedimentation

The following mitigation measures will be used to minimise the impacts of dust, run off and sedimentation during construction of the Project:

- A preliminary CMP, including a preliminary erosion and sediment control plan, has been prepared and will inform the preparation of the Project's CMP to be implemented for standards such as weed hygiene, erosion, fuels and hazardous substances, fire, etc. and will include erosion and sediment control measures
- Routine dust suppression and monitoring will be undertaken throughout construction and operation.
- Erosion and sediment control measures will be installed where in-stream disturbance must be undertaken during flow conditions.
- Areas subject to clearing will be stabilised as soon as practicable.
- All vehicle movement should stay on the designated tracks and not deviate from them unless necessary.
- Weather conditions will be monitored during the construction stage and temporary controls will be established during extreme weather events.
- Construction activities during adverse weather conditions will be managed in accordance with the CMP

- Rehabilitation of temporary construction areas will be undertaken as soon as practicable after clearing once these facilities are no longer required (subject to agreement with the landowner).

5.10.9.3 Introduction and spread of pest fauna species

Although the Project area is already exposed to relatively high levels of pest infestation, mitigation measures will be required to limit any spread of pest fauna that could result from construction activities, particularly species that present risks to the rufous fantail such as the black rat. The following mitigation measures will be used to minimise the introduction and spread of pest fauna during construction for the Project:

- A Waste Management Plan will be prepared as part of the CMP. This will detail the location and specifications for disposal and removal of waste from the construction site.
- Responsible waste management practices (e.g. not leaving out food waste and not feeding wildlife) will be implemented and followed by all construction personnel. All waste will be stored in secure temporary holding containers and transported off site.
- Sightings or evidence of pest fauna will be recorded during construction in a pest register. If increased densities of pest fauna are observed, or new pest animals are identified, humane pest controls will be implemented to manage numbers.
- Construction staff will not bring domestic animals to the Project area.
- All construction personnel shall attend environmental training as part of site inductions. As part of this training, all personnel will be instructed on their responsibilities related to avoiding and minimising the introduction/attraction to the construction site of pest animals.

5.10.9.4 Introduction and spread of weed species

The following measures will be implemented to minimise the introduction and spread of weeds:

- A Weed Management Plan will be prepared for the Project and included within the CMP.
- The Weed Management Plan will include hygiene protocols restricting the movement of vegetation and soil between impacted areas and areas of significantly lower weed infestation.
- Vehicles / equipment travelling from a declared restricted place or quarantine area will be required to wash down and possess a current weed hygiene inspection certificate before moving to a weed free area.
- All machinery and equipment will undertake washdown prior to accessing site and possess a current weed hygiene inspection certificate from an inspector who is deemed competent and is certified in line with DAF requirements.
- Vehicle access will be restricted to within the Project footprint and existing roads and tracks where practicable.
- The Weed Management Plan will include protocols for monitoring and management of weeds to identify and appropriately respond to significant changes in weed distribution and density. Preliminary weed mapping will be undertaken. This will provide a baseline of existing weed infestation across the Project area to inform the Weed Management Plan.

5.10.10 Significance of impact assessment

An assessment against the Significant Impact Guidelines 1.1 (DoE 2013) with regards to the rufous fantail was undertaken and the outcomes provided in Table 5-14.

Table 5-14 Significance of impact on rufous fantail

Impact criteria	Potential to occur
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	<p>Unlikely</p> <p>The Project will result in no direct loss or fragmentation of habitat for the rufous fantail. Indirect impacts on habitat are considered negligible and will be mitigated through routine mitigation measures. The habitats within the Project area are unlikely to be considered important habitat. While important habitats for the rufous fantail are typically associated with wet sclerophyll and rainforest, dry sclerophyll habitats can be used during migration. Despite this, given the species is known to follow the same movement pathways each season and the Project area and surrounds have been subject to high levels of historical survey effort due to their occurrence within the Traprock Important Bird Area, the low number of historical records would suggest habitat within the Project area is not important for migrating individuals. As such, the Project is unlikely to impact any important habitat for this species.</p>
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	<p>Unlikely</p> <p>The black rat (<i>Rattus rattus</i>) and rubber vine (<i>Cryptostegia grandiflora</i>) are considered threats to the rufous fantail. Rubber vine typically occurs further north and was not identified on the Project area. While the black rat could occur, its local abundance is unlikely to be impacted by the Project. Waste hygiene protocols will be implemented to during construction to prevent any increase in invasive pest fauna species. The Project is unlikely to cause any increase in invasive species that could threaten local abundance of the species.</p>
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	<p>Unlikely</p> <p>The rufous fantail has only been recorded once within the desktop search extent. As individuals are known to utilise and follow the same movement pathways each season, the relatively low number of historical records in an area that has been intensively surveyed suggests the area does not represent important habitat for breeding, foraging or resting during migration. While the species has been recorded historically, the low number of records suggests the local habitats are not likely to be used by an ecologically significant proportion of the population. Given the habitats will not be directly or indirectly impacted, and are not considered important habitat, the Project is unlikely to disrupt the lifecycle of an ecologically significant proportion of the population of the species.</p>

5.10.11 Conclusion

The Project is considered **unlikely** to have a significant impact on the rufous fantail.

6. Summary of impacts on MNES

6.1 Project impacts

Table 6-1 presents a summary of the Project's anticipated impact on MNES communities and species.

Table 6-1 Summary of impacts on MNES

Matter	Impact	Significance of impact
TEC		
White box-yellow box-Blakely's red gum grassy woodland and derived native grassland	No impact - clearing avoided through Project design	Not significant
Flora species		
<i>Macrozamia conferta</i>	No impact – clearing avoided through Project design	Not significant
<i>Tylophora linearis</i>	No impact – clearing avoided through Project design	Not significant
<i>Eucalyptus infera</i>	No impact – clearing avoided through project design	Not significant
Fauna species		
Koala	Loss of habitat (52.40 ha) of habitat critical to the survival of the species	Significant Adverse impacts on habitat critical to the survival of the species
Central greater glider	Loss of habitat (13.13 ha of foraging habitat)	Significant Adverse impacts on habitat critical to the survival of the species
Grey-headed flying-fox	Loss of habitat (52.40 ha of foraging habitat)	Significant Adverse impacts on habitat critical to the survival of the species
Squatter pigeon (southern)	Loss of habitat (12.10 ha of foraging habitat)	Significant
White-throated needletail	No impact - collision risk is low as the species typically occurs in small numbers and flies substantially higher than the RSA height.	Not significant
Regent honeyeater	Loss of habitat (0.62 ha)	Significant Adverse impacts (cumulative) on habitat critical to the survival of the species
Painted honeyeater	No impact – clearing avoided through Project design	Not significant
Swift parrot	Loss of habitat (0.65 ha)	Not significant No adverse impact on habitat critical to the survival of the species

Matter	Impact	Significance of impact
Migratory species		
Fork-tailed swift	No impact The fork-tailed swift is exclusively aerial and does not have typical associations with habitat. Collision risk is expected to be low.	Not significant
Rufous fantail	No impact - clearing has been avoided through Project design	Not significant

6.2 Cumulative impacts

6.2.1 Overview

Projects with spatial and/or temporal overlap can result in cumulative impacts, which can occur at a local, regional or national scale. For the purpose of this assessment, cumulative impacts are analysed on a local and regional scale in the context of development patterns in the locality and region.

A project's cumulative impacts are likely to occur at the construction and operation phases, with impacts temporal or spatial in nature.

Project impacts will largely be realised through the construction phase of the Project where direct and/or indirect impacts on MNES within the Project area that may occur are as follows:

- Loss of vegetation and habitat including habitat for conservation significant species and vegetation communities
- Direct mortality and injury of wildlife
- Habitat fragmentation and reduced connectivity
- Wildlife disturbance through light, noise and vibration
- Habitat degradation through dust, erosion, run-off and sedimentation
- Introduction and spread of invasive flora and fauna species
- Disturbance of surface waterways and waterbodies or groundwater systems.

While the operational phase of a wind farm typically has the potential to cause mortality or injury through direct or indirect impacts from collision with turbines or barotrauma, the proposed Project operational impacts are minor and risk to aerial species (white-throated needletail and fork-tail swift) is limited through the implementation of the BBAMP.

These direct and indirect impacts are assessed in relation to the current surrounding land use and likely major impacts for related and additional projects in the region.

6.2.2 Related projects in the region

The Project is related to the MacIntyre Wind Energy Precinct, which includes ACCIONA's proposed MacIntyre Wind Farm Project (EPBC 2020/8756) and a proposed OHTL Project (EPBC 2020/8759) shown on Figure 6.1. The MacIntyre Wind Farm Project proposes the development of up to 169 wind turbines which are anticipated to generate approximately 969 MW of renewable energy to contribute to the national grid. Both the Project and the MacIntyre Wind farm Project tie into the OHTL Project for connection to the national grid.

The MacIntyre Wind Farm will include:

- Wind turbine foundations and hardstand areas
- Main site access from Carbean Road
- Access tracks
- Overhead 33 kV electrical reticulation
- Underground 33 kV electrical reticulation
- Up to two substations
- A potential battery energy storage facility
- Up to six permanent meteorological masts
- Up to two construction compounds
- Up to three laydown areas
- A workers' accommodation facility
- Up to two operations and maintenance facilities.

The proposed OHTL Project proposes the development of 64 km of 330 kV OHTL that traverses both the proposed MacIntyre Wind Farm and proposed Karara Wind Farm in the south within a 60 m wide easement. The MacIntyre switching station is co-located within the proposed Karara Wind Farm Project area. The Tummaville switching station is located at the northern end of the OHTL alignment. The OHTL proposes to connect the proposed MacIntyre and Karara Wind Farms to the existing Powerlink Millmerran – Middle Ridge 330 kV OHTL, located 22 km east of Millmerran.

Each action has been referred, namely:

- MacIntyre Wind Farm (EPBC 2020/8756)
- OHTL Project (EPBC 2020/8759).

The individual loss of habitat for each of the related projects is shown in Table 6-2 along with the cumulative impacts for all projects combined for each MNES impacted by the Project.

Table 6-2 Cumulative impacts of related projects

MNES	Karara Wind Farm Project impacts	MacIntyre Wind Farm Project impacts	OHTL Project impacts	Cumulative impact for related actions
Threatened ecological communities				
White box-yellow box-Blakely's red gum grassy woodland and derived native grassland	No impact. Project designs have avoided clearing. Appropriate mitigations in place to manage indirect impacts.			
Flora species				
<i>Macrozamia conferta</i>	No impact. Species absent from within the Project footprint.	2,578 individuals within the Project footprint. Significant impact likely. Offsets proposed.	160 individuals within the Project footprint. Significant impact likely. Offsets proposed.	2,738 individuals within combined project footprints
<i>Eucalyptus infera</i>	No impact. Species absent from within all project footprints.			
<i>Tylophora linearis</i>	No impact. Species absent from within all project footprints.			
Fauna species				
Koala	Loss of habitat (52.40 ha) Significant impact likely. Offsets proposed.	Loss of habitat (498.10 ha) Significant impact likely. Offsets proposed.	Loss of habitat (236.51 ha) Significant impact likely. Offsets proposed.	Loss of habitat (787.01 ha)
Central greater glider	Loss of habitat (13.13 ha) Significant impact likely. Offsets proposed.	Loss of habitat (156.65 ha) Significant impact likely. Offsets proposed.	Loss of habitat (88.91 ha) Significant impact likely. Offsets proposed.	Loss of habitat (258.69 ha)
Grey-headed flying-fox	Loss of habitat (52.40 ha) Significant impact likely. Offsets proposed.	Loss of habitat (498.10 ha) Significant impact likely. Offsets proposed.	Loss of habitat (236.51 ha) Significant impact likely. Offsets proposed.	Loss of habitat (787.01 ha)
Squatter pigeon (southern)	Loss of habitat (12.10 ha) Significant impact likely. Offsets proposed.	Loss of habitat (136.69 ha) Significant impact likely. Offsets proposed.	Loss of habitat (126.65 ha) Significant impact likely. Offsets proposed.	Loss of habitat (275.44 ha)

MNES	Karara Wind Farm Project impacts	MacIntyre Wind Farm Project impacts	OHTL Project impacts	Cumulative impact for related actions
White-throated needletail	<p>No loss of habitat as the species is almost exclusively aerial.</p> <p>White-throated needletail mortality from collision with wind turbines within Australia is known to occur, although is a low severity threat and affects a small number of birds (Hull et al. 2013, Nature Advisory). It is noted the species has been recorded flying at RSA within and adjacent to the project areas at times. A threshold of mortality of ten individuals annually (i.e. 0.1% or more of the flyway population) can be considered a significant impact to the species (DoE 2015c). Given there are not extensive records of the species within the project areas and that wind turbine strike affects a small number of individuals, this threshold is not expected to be exceeded with the construction and operation of the proposed MacIntyre Wind Farm and/or Karara Wind Farm.</p> <p>Ongoing Bird Utilisation Surveys will inform Before-After-Control-Impact (BACI) bird assessments for the projects to confirm this.</p>			
Regent honeyeater	Loss of habitat (0.62 ha) Significant impact likely as part of cumulative loss Offsets proposed.	Loss of habitat (8.06 ha) Significant impact likely. Offsets proposed.	Loss of habitat (4.67 ha) Significant impact likely. Offsets proposed.	Loss of habitat (13.35 ha)
Painted honeyeater	No impact . Clearing avoided through project design and appropriate mitigations in place to manage indirect impacts.	Loss of habitat (19.67 ha) Significant impact unlikely. Single population, not habitat critical to the survival, dispersal maintained.	Loss of habitat (2.99 ha) Significant impact unlikely. Single population, not habitat critical to the survival, dispersal maintained.	Loss of habitat (22.66 ha)
Swift parrot	No impact . Clearing avoided through project design and appropriate mitigations in place to manage indirect impacts.	Loss of habitat (12.42 ha) Significant impact unlikely. Single population, not habitat critical to the survival, no species recorded, dispersal maintained.	Loss of habitat (4.47 ha) Significant impact unlikely. Single population, not habitat critical to the survival, no species recorded, dispersal maintained	Loss of habitat (16.89 ha)
Migratory species				
Fork-tailed swift	The fork-tailed swift is exclusively aerial and does not have typical associations with habitat. Collision risk is expected to be low.			
Rufous fantail	No impact . Clearing avoided through project design and appropriate mitigations in place to manage indirect impacts.	Loss of habitat (10.44 ha). Significant impact unlikely. No impact on important habitat.	Loss of habitat (10.47). Significant impact unlikely. No impact on important habitat.	Loss of habitat (21.18 ha)

6.2.3 Development patterns in the locality and region

The Project area is within the Southern Downs Regional Council and Goondiwindi Regional Council local government areas (LGAs). Each LGA has a planning scheme outlining the strategic framework and planning provisions to ensure appropriate development and land use occurs within their respective LGAs.

The Southern Downs Regional Council LGA comprises a mosaic of communities within extensive areas of land used for rural purposes. The key regional centres supporting the region are Warwick and Stanthorpe. The Southern Downs Regional Plan recognises the following as part of its strategic intent:

- While the agricultural and grazing values of this land are recognised as a significant economic resource and employment generator for the region, the land is also an important social and environmental resource. Development is managed to minimise impacts on existing and future farming and agricultural operations.
- Detrimental past settlement patterns have resulted in a fragmented rural landscape in parts of the Southern Downs. Land use for rural production will be protected from further fragmentation and from urban and rural residential encroachment so that rural industries can contribute to the economy, character and identity, and food security of the Southern Downs.
- As well as supporting rural production, the non-urban areas support environmental, recreational, cultural and scenic functions and will be protected from urban and rural residential development. Landscapes that have aesthetic and amenity values are conserved and protected from development that diminishes their values.
- Incompatible land uses are separated to maintain the well-being and health of residents and support the ongoing activity of uses that are important to the Southern Downs's economy and the enjoyment of residents and visitors.
- Future population growth is directed towards the regional centres and towns rather than dispersed population growth throughout the rural and non-urban area.
- Appropriate infrastructure is required to support future development. Infrastructure required for new development areas will be, in most cases, the responsibility of the developer.
- Transport corridors and facilities provide for the safe and efficient movement of people and goods throughout the Southern Downs.
- The generation of renewable energy and use of low emission technologies is supported subject to consideration of the amenity including the scenic amenity of adjoining areas.

The Goondiwindi Region contains a rich and varied cultural landscape, with an economic context and settlement pattern established from pastoralism, agriculture and transportation. The region's economic and social wellbeing is linked to rural land uses including agriculture, and wool and beef cattle production. The towns of Goondiwindi, Inglewood and Texas are the major settlements in the region, with several smaller townships throughout.

The Goondiwindi Regional Plan recognises the following as part of its strategic intent:

- A compact settlement pattern is achieved that limits urban development to within identified areas of the towns of Goondiwindi, Inglewood and Texas.
- Land use conflict is minimised through the appropriate separation of incompatible activities, including industrial and rural activities from sensitive land uses.
- Development is located in areas that avoids significant adverse impacts on MSES or MNES.
- Broad corridors of interconnected habitat provide connectivity between pockets of semi-isolated areas of biodiversity values.
- The development and use of rural land is limited to productive rural activities that provide significant economic benefits to the regional economy.
- Major infrastructure corridors and sites are co-located where possible to reduce land use conflict and environmental impacts.

Other existing or proposed major projects in the region that have the potential to impact on MNES as a result of construction (clearing and disturbance) or operation are included in Table 6-3.

The Project area is within existing rural land uses that are not intended to support future urban or industrial development patterns. The historic broadscale clearly associated with a largely agricultural landscape does not provide for connected areas of remnant vegetation or provide significant environmental value outside of protected areas. Development in general within the broader region would impact common elements of landscape ecological processes largely as a result of impacts to habitat through clearing.

The Project is compatible with the strategic intent of the Southern Downs Regional Plan and the Goondiwindi Regional Plan as it can be developed without impacting the agricultural, grazing, natural landscape and amenity values of the land. The Project will not contribute to further fragmentation of rural areas, nor will it impact transport corridors. The Project supports the generation of renewable energy, which benefits local communities and will be a key driver in the decarbonisation of the broader economy.

Table 6-3 Regional projects

Existing and proposed projects	Activity	Location	Major impacts	Timing and status
Maydan Feedlot	8,000 head capacity feedlot for beef cattle	Approximately 23 km north-west of Warwick	Land use impacts related to potential air quality and soil impacts Potential impacts to watercourses from nutrient-laden runoff	Operational
John Dee Cold Storage Facility	40% increase of meat processing capacity at an existing abattoir	Warwick	Air quality – noise, odour Potential pollution of water and land from effluent and solid wastes	Operational
Warwick Solar Farm	64MWac renewable energy facility (solar)	5 km north-east of Warwick	Clearing of vegetation, loss of habitat, habitat fragmentation, fauna injury.	Operational
Coopers Gap Wind Farm	453 MW wind farm (up to 123 turbines)	65 km north of Dalby	Clearing of vegetation, loss of habitat, habitat fragmentation, fauna injury.	Operational
Yarranlea Solar Farm	100 MW solar farm	50 km west of Toowoomba	Land use impacts – conversion of 300 ha of cropping land Air quality – dust impacts Potential run-off impacts to Condamine River Clearing of vegetation, loss of habitat, habitat fragmentation, fauna injury	Operational
Bulli Creek Solar Farm	1,200 MW solar farm	140 km south-west of Toowoomba	Air quality – dust impacts Clearing of vegetation, loss of habitat, habitat fragmentation, fauna injury	Currently in approvals stage

Existing and proposed projects	Activity	Location	Major impacts	Timing and status
Inland Rail – Border to Gowrie section	145 km of new dual gauge track and upgrading 71 km of existing track	From NSW/QLD border, near Yelarbon, to Gowrie Junction, northwest of Toowoomba	<p>Land use impacts related to potential air quality, noise and visual impacts, loss of rural agricultural land, loss of access.</p> <p>Release of contaminants from construction plant, equipment and vehicles into adjacent waters.</p> <p>Impacts to groundwater elevations from earthworks and bridge piling.</p> <p>Clearing of vegetation, loss of habitat, habitat fragmentation, fauna injury.</p> <p>Construction plant and equipment may potentially impact the local ambient noise environment.</p>	Currently in reference design stage

7. Conclusion

The construction and operation of the Project will result in the removal of vegetation, and disturbance of existing ground conditions on either a temporary or permanent basis. The assessment of impacts to MNES determined that the following impacting processes are those most likely to result in a significant impact to a MNES:

- Loss of habitat
- Injury or mortality
- Fragmentation of habitat and loss of connectivity
- Disturbance to habitat from noise, light, and vibration
- Habitat degradation and increased erosion
- Spread of invasive species.

To manage the impacts to MNES a number of management and mitigation measures are proposed as summarised in Table 7-1.

Table 7-1 Mitigation measures summary

Impacting process	Mitigation and management measures
Loss of habitat	Clearing restricted to minimum area required for Project footprint Clearing areas to be clearly identified during construction Existing disturbed areas to be utilised where practicable Rehabilitation of temporary disturbance areas Implementation of a CMP, Flora Management Plan and Fauna Management Plan Environmental awareness training for construction personnel
Injury or mortality	Preclearance surveys Clearing supervised by qualified fauna spotter catchers Adverse incident response procedures implemented CMP to include protocols on fauna injury and mortality Implement the Bird and Bat Adaptive Management Plan
Fragmentation of habitat and loss of connectivity	Activities undertaken in existing disturbed areas where practicable Rehabilitation of temporarily disturbed areas as soon as practicable
Disturbance to habitat from noise, light, and vibration	Lighting kept to minimum required for safety Construction activities to occur in daylight hours where practicable Traffic Management Plan as part of CMP Maintenance schedule for construction vehicles
Habitat degradation and increased erosion	CMP to include erosion and sediment controls Vehicle movements to remain on dedicated tracks where practicable
Spread of invasive species	Waste management plan included in CMP Weed management plan to include weed hygiene protocols Vehicle movements to remain on dedicated tracks where practicable

Wherever practicable, the Project footprint has been sited within areas of relatively low local ecological value. The Project footprint intersects a landscape that has been subject to extensive historical land clearing and decades of intensive sheep grazing. Despite this, the Project footprint retains areas of remnant vegetation with high ecological values for native flora and fauna.

Pre-clearance surveys will be undertaken to provide small-scale information on key sensitive ecological receptors. These will allow opportunities for avoidance of breeding places and other key habitat values through localised re-alignments during construction and adaptive management during the operation phase.

The significant impact assessments determined that the Project is likely to result in significant impacts on the following MNES:

- Koala – due to the impact on habitat critical to the survival of the species and the potential for injury and mortality during construction
- Central greater glider - due to the impact on habitat critical to the survival of the species
- Grey-headed flying fox – due to the of impact on winter foraging habitat
- Squatter pigeon (southern) – due to impact on habitat critical to the survival of the species
- Regent honeyeater – due to the loss of habitat critical to the survival of the species.

The proponent will seek to establish a direct, land-based offset to address any significant residual impacts associated with the Project. A preliminary assessment of environmental offsets opportunities within and surrounding the Project area suggests that significant potential exists to provide tangible local benefits to the impacted MNES. Initial conversations have been had with a number of landowners in the area, with many of them expressing an interest in utilising suitable locations within their properties as offset sites. Initial targets for offsetting impacts on the koala, grey-headed flying-fox and regent honeyeater will focus on the currently highly-fragmented environments in the east of the Project area connective with Macintyre Brook.

The aim will be to re-establish pre-clear REs in these areas in a manner that strengthens the corridor function of Macintyre Brook. On a regional scale, this will also deliver benefits for landscape function and species mobility by improving connectivity with Macintyre State Forest in the south and Durikai State Forest in the north. It is expected that there is significant potential for an environmental offsets package to not only address the significant residual impact on the koala, but to also deliver considerable benefits to the species in the immediate area of the Project in a manner that meets the principles of the EPBC Act Environmental Offsets Policy. General landowner sentiment throughout the area provides confidence that commercial arrangements for such offsets will be possible. The finer detail of these opportunities will be established as the Project progresses through assessment processes under the EPBC Act. Considering the above, it is posited that the Project reflects the principles of ecologically sustainable development as described within Section 3A of the EPBC Act.

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Appendices

Appendix A

Conservation significant species subject to DAWE's request for additional information

1. Overview

This section presents a more detailed justification of the likelihood of occurrence assessment for conservation significant species that were identified as may occur or unlikely to occur within the Project area but subject to a request for information from DAWE. More information is provided on the following species:

- Austral cornflower (*Rhaponticum australe*)
- Austral toadflax (*Thesium australe*)
- Bluegrass (*Dichanthium setosum*)
- *Callistemon pungens*
- *Macrozamia machinii*
- *Macrozamia pauli-guilielmi*
- Border thick-tailed gecko

1.1 *Rhaponticum australe*

Rhaponticum australe is listed as Vulnerable under the EPBC Act.

Rhaponticum australe is an erect perennial herbaceous plant with a current known distribution that extends from Allora (north of Warwick) to Callide (north-west of Biloela) in Queensland (DAWE, 2020). *Rhaponticum australe* flowers between spring and late summer to autumn, and the dead flowering stems can remain on the plant for several months after the seeds have dispersed (DAWE, 2020).

A WildNet search undertaken in December 2020 did not identify records for this species within the Project area. The Queensland government's Species Profile Search (DES, 2021) which is sourced from the WildNet database identified that the Project area is more than 40 km away from the known distribution of *R. australe*. Specifically, the closest *R. australe* record to the Project area is located approximately 44 km to the north and was collected in 2002. The Project area is outside the species' modelled distribution based on DAWE (2020).

No individuals have been recorded within the Project area, with the closest historical record located approximately 44 km to the north. The Project area is outside the species' modelled distribution based on DAWE (2020). Intensive search effort was undertaken at times optimal for detection of this species, with searches for threatened flora species undertaken as part of assessment.

All field surveys within the Project area were undertaken at a time optimal for detection of this species, with a total of 54 survey days (based on combined individual effort per person) during the following times:

- October/November 2018
- December 2018
- January 2019
- March/April 2020.

Intensive search effort was afforded to detection of threatened flora species, with searches for threatened flora species undertaken as part of assessment at 70 quaternary sites and 20 TEC verification sites during appropriate seasonality for this species. These sites were distributed across the diversity of habitat types represented within the Project area.

Rhaponticum australe is often found in woodland and grassland and in association with *Eucalyptus crebra*, *E. orgadophila*, *E. populnea*, *E. tereticornis*, *E. melanophloia*, *Angophora subvelutina* and *A. floribunda* (DAWE, 2020). While *E. crebra* woodlands were recorded within the Project area, it is relevant to note that *R. australe* usually grows on heavy black or red-brown clay, or clay loams derived from basalt (DAWE, 2020). In this regard, surface geology of the *E. crebra* communities and across much of the Project area was metamorphosed sediments, with alluvial soils also present. Accordingly, the surface geology within the Project area is not ideal for inhabitation by *R. australe*.

The Commonwealth Conservation Advice for this species notes that the distribution of *R. australe* overlaps with the distribution of the white box-yellow box-Blakely's red gum grassy woodland and derived natural grassland

TEC. Although this TEC was confirmed present within the Project area, areas of this TEC within the Project area occurred on metamorphosed sediments and therefore surface geology was not appropriate for inhabitation by *R. australe*.

Despite extensive survey effort being undertaken at the appropriate time, this species was not recorded within the Project area. Based on habitats within the Project area being sub-optimal for this species due to the incorrect surface geology, together with the absence of historic records within more than 40 km surrounding the Project area, *R. australe* is considered unlikely to occur.

1.2 *Thesium australe*

Thesium australe is listed as Vulnerable under the EPBC Act.

Thesium australe (Austral toadflax) is a hairless, yellowish-green perennial herb with slender, wiry stems that occurs in New South Wales, the Australian Capital Territory, Queensland and Victoria. Its current distribution is sporadic but widespread. The species was considered extinct in Queensland prior to the mid-1980s, with collections since the 1990s from Kumbia, Glen Rock Regional Park, Carnarvon National Park, Crows Nest, Clifton, Warwick, Greenmount, Cambooya, Dalby, the Bunya Mountains, Blackbutt and Imbil (DAWE, 2020).

A WildNet search undertaken in December 2020 did not identify records for this species within the Project area. The Species Profile Search (DES, 2021) identified that the Project area is more than 30 km away from the known distribution of *T. australe*. Specifically, the closest *T. australe* record to the Project area is located approximately 39 km to the north-east and was collected in 1999, with a more recent record from 2016 located approximately 49 km to the north-east.

Semi-parasitic on roots of a range of grass species, notably *Themeda triandra*. It occurs in subtropical, temperate and subalpine climates over a wide range of altitudes. It occurs on soils derived from sedimentary, igneous and metamorphic geology on a range of soils including black clay loams to yellow podzolics and peaty loams (DEE 2018).

No individuals were recorded within the Project area despite extensive survey effort undertaken at the appropriate time. All field surveys within the Project area were undertaken at a time optimal for detection of this species, with a total of 54 survey days (based on combined individual effort per person) during the following times:

- October/November 2018
- December 2018
- January 2019
- March/April 2020.

Intensive search effort was afforded to detection of threatened flora species, with searches for threatened flora species undertaken as part of assessment at 70 quaternary sites and 20 TEC verification sites during appropriate seasonality for this species. These sites were distributed across the diversity of habitat types represented within the Project area.

Thesium australe inhabits shrubland, grassland or woodland, often on damp sites and is found on soils derived from sedimentary, igneous and metamorphic geology on a range of soils including black clay loams to yellow podzolics and peaty loams (DAWE, 2020). In this regard, woodlands on metamorphosed sediments were recorded within the Project area and may be suitable for inhabitation by *T. australe*.

The Commonwealth Conservation Advice for this species notes that the distribution of *T. australe* overlaps with the distribution of the white box-yellow box-Blakely's red gum grassy woodland and derived natural grassland TEC. Both *T. australe* and the TEC have relatively widespread distributions within which they occur at relatively few locations, such that the presence of the TEC does not necessarily indicate the presence of *T. australe*. Although this TEC was confirmed present within the Project area, extensive search effort within the TEC during appropriate seasonality did not detect this species.

Despite extensive survey effort being undertaken at the appropriate time, this species was not recorded within the Project area. Based on the absence of historic records within more than 30 km surrounding the Project area, *T. australe* is considered unlikely to occur within the Project area and therefore no potential impact or significance of impact assessments were undertaken for this species.

1.3 *Dichanthium setosum*

Dichanthium setosum is listed as Vulnerable under the EPBC Act.

Dichanthium setosum (bluegrass) is an erect perennial grass that is known from the Leichhardt, Morton, North Kennedy and Port Curtis botanical districts (DAWE, 2020). The Project area is located within the Darling Downs botanical district. *Dichanthium setosum* commences growing in spring and flowers from November to June (Simon and Alfonso, 2011).

A WildNet search undertaken in December 2020 did not identify records for this species within the Project area. Specifically, the Species Profile Search (DES, 2021) identified that the Project area is more than 80 km away from the known distribution of *D. setosum*. The closest *D. setosum* record to the Project area is located approximately 86 km to the north-north-east and was collected in 2009.

No individuals were recorded within the Project area. All field surveys within the Project area were undertaken at a time optimal for detection of this species, with a total of 54 survey days (based on combined individual effort per person) during the following times:

- October/November 2018
- December 2018
- January 2019
- March/April 2020.

Intensive search effort was afforded to detection of threatened flora species, with searches for threatened flora species undertaken as part of assessment at 70 quaternary sites and 20 TEC verification sites during appropriate seasonality for this specie. These sites were distributed across the diversity of habitat types represented within the Project area.

Dichanthium setosum is found in moderately disturbed areas such as cleared woodland, grassy roadside remnants, grazed land and highly disturbed pasture, and is associated with heavy basaltic black soils and red-brown loams with clay subsoil (DAWE, 2020). In this regard, surface geology across much of the Project area was metamorphosed sediments, with light clay soils on alluvial plains also recorded during field surveys. Accordingly, the surface geology within the Project area is not ideal for inhabitation by *D. setosum*.

The Commonwealth Conservation Advice for this species notes that the distribution of *D. setosum* overlaps with the distribution of the white box-yellow box-Blakely's red gum grassy woodland and derived natural grassland TEC. Although this TEC was confirmed present within the Project area, areas of this TEC within the Project area occurred on metamorphosed sediments and therefore surface geology was not appropriate for inhabitation by *D. setosum*.

Despite extensive survey effort being undertaken at the appropriate time, this species was not recorded within the Project area. Based on habitats within the Project area being inappropriate for this species due to the incorrect surface geology, together with the absence of historic records within more than 80 km surrounding the Project area, *D. setosum* is considered unlikely to occur within the Project area.

1.4 *Callistemon pungens*

Callistemon pungens is listed as Vulnerable under the EPBC Act.

Callistemon pungens is a shrub or small tree occurs in the Stanthorpe region of south-east Queensland and the northern tablelands of northeast New South Wales (DEWHA, 2006). Occurs along rocky watercourses usually with sandy granite (or occasionally basalt) creek beds, and generally among naturalised species (TSSC, 2008).

Callistemon pungens flowers in spring and summer (DEWHA, 2006), but is a highly distinctive species that can be identified year-round based on vegetative features.

The WildNet search and Species Profile Search (DES, 2021) undertaken in January 2021 did not identify records for this species, and the AVH (2020) identified that the Project area is more than 20 km away from the known distribution of *C. pungens*. Specifically, the closest *C. pungens* record to the Project area is located approximately 44 km to the southeast and was collected in 1983. The only other Queensland record more recent than this is from 1993 and is approximately 64 km to the south-east.

No individuals were recorded within the Project area, with the closest known distribution of *C. pungens* identified more than 20 km away from the Project area. All field surveys within the Project area were undertaken at a time optimal for detection of this species, with a total of 54 survey days (based on combined individual effort per person) during the following times:

- October/November 2018
- December 2018
- January 2019
- March/April 2020.

Intensive search effort was afforded to detection of threatened flora species, with searches for threatened flora species undertaken as part of assessment at 70 quaternary sites and 20 TEC verification sites during appropriate seasonality for this species. These sites were distributed across the diversity of habitat types represented within the Project area.

Callistemon pungens is found along rocky watercourses usually with sandy granite (or occasionally basalt) creek beds (DEWHA, 2006). In this regard, watercourses within the Project area were typically not rocky, but were instead characterised by alluvial sands and gravels. Accordingly, the surface geology within the Project area is not ideal for inhabitation by *C. pungens*.

The Commonwealth Conservation Advice for this species (DEWHA, 2006) notes that the distribution of *C. pungens* overlaps with the distribution of the white box-yellow box-Blakely's red gum grassy woodland and derived natural grassland TEC. Although this TEC was confirmed present within the Project area, *C. pungens* has specific habitat requirements that do not equate to those that are provided by this TEC, given that *C. pungens* occurs along rocky watercourses and the areas of the white box-yellow box-Blakely's red gum grassy woodland and derived natural grassland TEC within the Project area are characterised by hills and lowlands on metamorphosed sediments and light clay soils on alluvial plains.

Despite extensive survey effort being undertaken, this species was not recorded within the Project area. Based on habitats within the Project area being inappropriate for this species, together with the absence of historic records within more than 40 km surrounding the Project area, *C. pungens* is considered unlikely to occur within the Project area.

1.5 *Macrozamia machinii*

Macrozamia machinii is listed as Vulnerable under the EPBC Act.

Macrozamia machinii is a cycad with a subterranean trunk. It occurs on the Darling Downs in Queensland between Texas and Wondul Range National Park (DAWE, 2006).

Macrozamia machinii cones mature in September to December and seeds ripen February to April (DAWE, 2020), such that the majority of field surveys for the Project were undertaken at a time suitable for detecting this species in a reproductive state. Regardless, this is a highly distinctive species that can be identified year-round based on vegetative features.

This species was not identified by the updated PMST search undertaken in December 2020. A WildNet search undertaken in December 2020 did not identify records for this species within the Project area, and the Project area is outside the species' distribution as modelled by DAWE (2020). The Species Profile Search (DES, 2021) did not identify records for *M. machinii*, and AVH (2020) identified that the closest record for *M. machinii* is located approximately 40 km to the west of the Project area and is from 1992, noting however that the data was generalised to 0.1 degrees due to the sensitivity of the species such that there may be a margin of error up to 11 km.

No individuals were recorded within the Project area. Habitats and the altitude within the Project area are considered inappropriate for this species, together with the absence of historic records within approximately 30 km to 40 km surrounding the Project area, the presence of this species is considered unlikely.

All field surveys within the Project area were undertaken at a time optimal for detection of this species, equivalent to a total of 54 survey days (based on combined individual effort per person) during the following times:

- October/November 2018

- December 2018
- January 2019
- March/April 2020.

Intensive search effort was afforded to detection of threatened flora species, with searches for threatened flora species undertaken as part of assessment at 70 quaternary sites and 20 TEC verification sites during appropriate seasonality for this. These sites were distributed across the diversity of habitat types represented within the Project area.

Most *M. machinii* populations occur in deep sandy soils in flat areas of open forest dominated by *Angophora leiocarpa*, *Allocasuarina inophloa*, *Callitris glaucophylla*, *Lysicarpus angustifolius* and *Acacia conferta*; and one population occurs on a red lateritic ridge with *Callitris endlicheri*, *Eucalyptus panda* and *E. apothalassica* (DAWE, 2020). Vegetation communities similar to these descriptions were not recorded within the Project area.

Furthermore, the species is found at altitude between 320 m and 460 m above sea level (DAWE, 2020), noting that the lowest point within the Project area is 453 m above sea level such that the majority of the Project area occurs at an altitude above which the species is known to occur.

Despite extensive survey effort being undertaken, this species was not recorded within the Project area. Based on habitats and the altitude within the Project area being inappropriate for this species, together with the absence of historic records within approximately 30 km to 40 km surrounding the Project area, *M. machinii* is considered unlikely to occur.

1.6 *Macrozamia pauli-guilielmi*

Macrozamia pauli-guilielmi is listed as Endangered under the EPBC Act.

Macrozamia pauli-guilielmi (pineapple zamia) is a small cycad with an underground ovoid trunk and spiral leaves. It is endemic to south-east Queensland where it is found in the Wide Bay district, from near the Isis River in the north, to near Wolvi in the south (DAWE, 2020).

Macrozamia pauli-guilielmi seeds ripen in March to April (DAWE, 2020); however, this is a highly distinctive species that can be identified year-round based on vegetative features.

Macrozamia pauli-guilielmi was not identified by the updated PMST search undertaken in December 2020. A WildNet search undertaken in December 2020 did not identify records for this species within the Project area, and the Project area is outside the species' distribution as modelled by DAWE (2020). The Species Profile Search (DES, 2021) did not identify records for *M. pauli-guilielmi*, and AVH (2020) identified that the closest record for *M. pauli-guilielmi* is located approximately 212 km to the north-east of the Project area and is from 1964, noting however that the data was generalised to 0.1 degrees due to the sensitivity of the species such that there may be a margin of error up to 11 km.

No individuals were recorded within the Project area, and the Project area is outside the species' distribution as modelled by DAWE (2020). All field surveys within the Project area were undertaken at a time optimal for detection of this species, with a total of 54 survey days (based on combined individual effort per person) during the following times:

- October/November 2018
- December 2018
- January 2019
- March/April 2020.

Intensive search effort was afforded to detection of threatened flora species, with searches for threatened flora species undertaken as part of assessment at 70 quaternary sites and 20 TEC verification sites during appropriate seasonality for this species. These sites were distributed across the diversity of habitat types represented within the Project area.

Macrozamia pauli-guilielmi occurs in lowland (5 m – 230 m altitude) open forest or woodland (wallum) dominated by banksias or eucalypts, or in shrub land or heath land, generally on stabilised sand dunes (DAWE, 2020). Vegetation communities similar to these descriptions were not recorded within the Project area. Furthermore, the

lowest point within the Project area is 453 m above sea level such that this is well above the altitudinal range within which the species is known to occur.

Despite extensive survey effort being undertaken, this species was not recorded within the Project area. Based on habitats within the Project area being inappropriate for this species, together with the incorrect altitude and the absence of historic records within approximately 200 km surrounding the Project area, *M. pauli-guilielmi* is considered unlikely to occur.

1.7 Border thick-tailed gecko

1.7.1 Species ecology

The border thick-tailed gecko is listed as Vulnerable under the EPBC Act.

Border thick-tailed gecko's preferred habitat consists of undisturbed woodland remnants occurring on rocky outcrops and stony hills within Eucalypt and cypress-pine (*Callitris*) open forest or woodland (NSW SC 2010). An association with steep rocky or scree slope has also been reported (NSW OEH 2013) and occupied sites often have a dense tree canopy that creates sparse shrub cover and abundant leaf litter (NSW SC 2010). While the species was previously thought to be restricted to granitic areas, the species has occasionally been found to occur in more fertile lower slopes and flats (DAWE 2021).

GHD ecologists are familiar with the microhabitat requirements of the border thick-tailed gecko having found populations of the species and mapped the local distribution of their habitat for projects in the New England Tablelands (confidential). In this region, the species is often associated with well-shaded, rocky woodland areas at the base of scree slopes where sheeting and slabbing rock and woody debris sit directly on rocky substrate.

1.7.2 Historical records

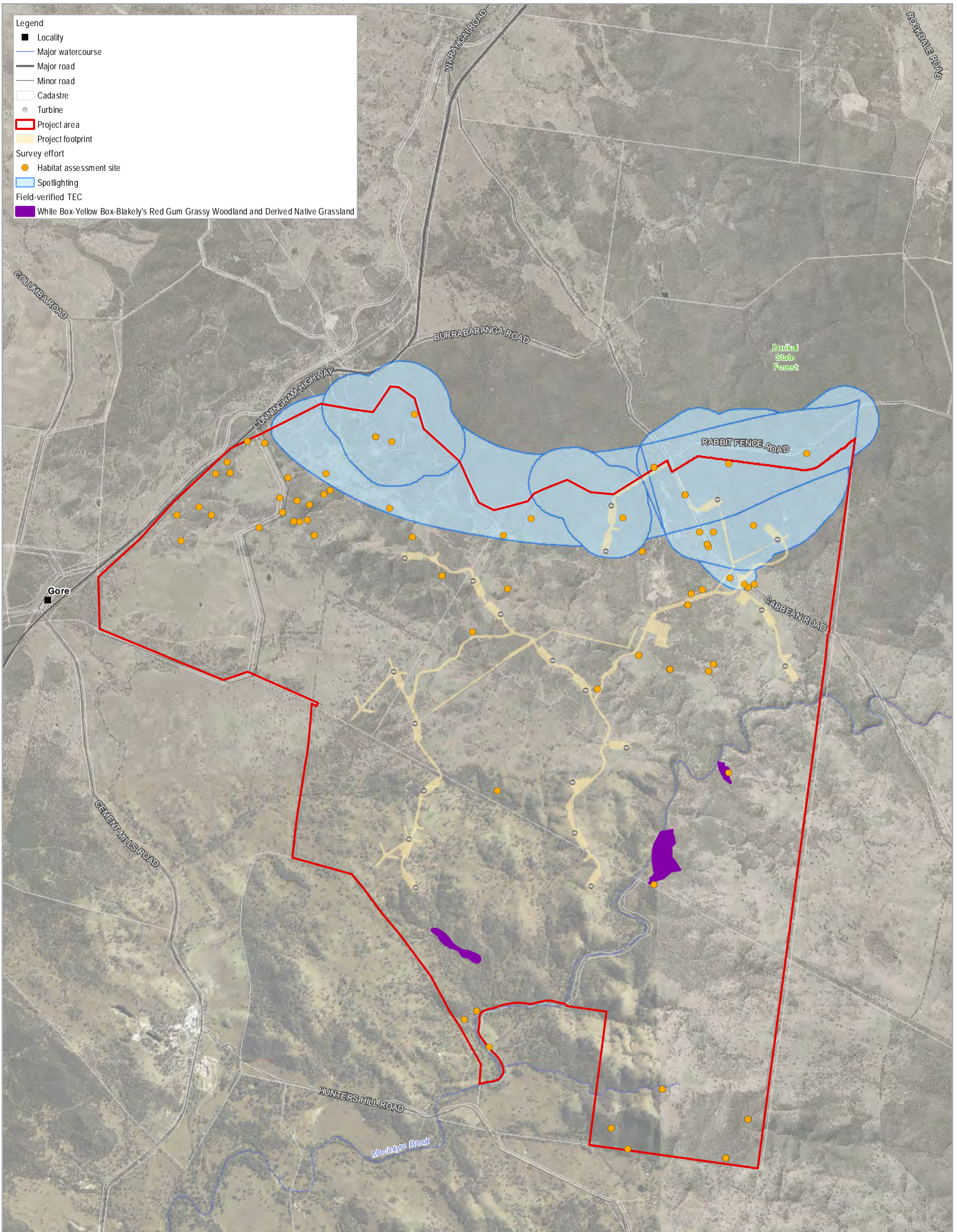
Historical records of the border thick-tailed gecko were not previously available in Wildlife Online searches. The border thick-tailed gecko is among a list of confidential species whose locations are protected from public knowledge to prevent illegal collection. Recent changes to the Biomaps conservation significant species layer have included confidential species, whilst not providing information on their precise geographic location. The border thick-tailed gecko now appears on Wildlife Online searches using Biomaps. A recent search of the Biomaps 'conservation significant species' layer reported no historical records of the species within the Project area. However, nine records are known from within a 20 km radius of the Project. The nearest records are from locations within Durikai State Forest. As the species is currently listed as a confidential species within Queensland, the historical records are not georeferenced and therefore the locations could not be determined. Durikai State Forest is considered the northern extent of the species' known distribution (DAWE, 2021).

1.7.3 Survey effort

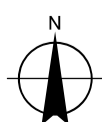
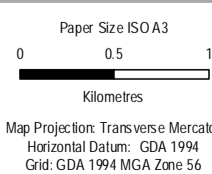
During surveys it was determined that the quality of habitat was low and no individuals were detected in nocturnal spotlighting or daytime active searches.

The species was targeted in baseline ecological surveys undertaken by GHD in 2018 and 2019. Based on the low quality of habitats observed, and the absence of records at that time, the species was considered to have a likelihood of occurrence of 'may occur'. Additional targeted surveys were undertaken for the border thick-tailed gecko in December 2020. Surveys were conducted over two days in December 2020 by two suitably qualified ecologists. The timing of the surveys was coordinated to align with the optimal detection period for the species (November – February). Surveys were undertaken at 13 sites and included both daylight and nocturnal active searches of sheltering sites within rocky areas, aligning with the survey guidelines for the species (DSEWPaC 2011). The survey targeted three areas of white box yellow box-Blakely's red gum grassy woodland and derived native grassland TEC, as this has been recognised in the listing advice as potential habitat for the species. Areas of box ironbark woodland with *Callitris* that occur at the northern extent of the Project area were also surveyed.

Survey effort for the border thick-tailed gecko is shown in Figure 1-1.



Based on or contains data provided by the State of Queensland 2021.
 In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.



Acciona Energy Australia Global Pty Ltd
 MNES Assessment Report

Project No. 12525037
 Revision No. 0
 Date 09/08/2021

Border thick-tailed gecko survey effort

FIGURE 1-1

1.7.4 Habitat quality within the Project area

The Conservation Advice for border thick-tailed gecko (DEWHA 208) states that the distribution of the white box-yellow box-Blakely's red gum grassy woodland and derived native grassland TEC is known to overlap with the distribution of the border thick-tailed gecko (DEWHA, 2008). The National Recovery Plan for the white box-yellow box-Blakely's red gum grassy woodland and derived natural grassland (DECCW 2010) indicates the border thick-tailed gecko 'may occur' within the TEC (DECCW, 2010). Targeted surveys undertaken during baseline assessments for the Project identified and mapped the distribution of white box-yellow box-Blakely's red gum grassy woodland and derived natural grassland TEC within the Project area. Areas identified as habitat are shown in Figure 1-1.

In Queensland, the ecological community is a component of a number of REs listed under the *Vegetation Management Act 1999* (VM Act), namely RE 13.3.1, RE 13.3.4, RE 13.12.8, RE 13.12.9, RE 13.11.8 and RE 12.8.1. The TEC was identified within the Project area, primarily associated with mixed polygons of Res 13.11.3/13.11.8 and 13.3.4/13.3.5. These locations are presented in Figure 1-1. Approximately 18.75 ha of this community occurs within the Project area, all of which has been avoided through the Project design.

The ecological quality of habitats for the border thick-tailed gecko within the Project area were assessed in baseline surveys undertaken between 2018 and 2020. Surveys in December 2020 specifically targeted potential habitat in areas of white box-yellow box-Blakely's red gum grassy woodland and derived natural grassland TEC and areas of Eucalypt woodland with *Callitris* at the north of the Project area.

The quality of habitats observed within the Project area was generally low. Whilst Eucalypt and *Callitris* woodland habitats were widely distributed throughout the Project area, most areas did not contain suitable rocky outcrops, granite sheeting or refuge sites for the species. While the species has occasionally been found to occur in more fertile lower slopes and flats (DAWE 2021), within the Project area most lower slopes within the white box-yellow box-Blakely's red gum grassy woodland and derived natural grassland TEC have been heavily degraded by sheep-grazing. This has substantially reduced the value of microhabitats for the border thick-tailed gecko. Higher value habitats for the border thick-tailed gecko were observed within Durikai State Forest adjacent to the Project area. Low value habitat is shown in Plate 1.1.



Plate 1.1 *Callitris* dominated Eucalypt woodland lacking sufficient rocky substrate

Based on the low quality of habitat observed in the field survey, the species likelihood of occurrence remains as 'may occur'. While the Project area contains 18.75 ha of white box-yellow box-Blakely's red gum grassy woodland and derived natural grassland TEC, none occurs within the Project footprint. The Project will have no direct impact on habitat for the border thick-tailed gecko.

Appendix B

Desktop search results



EPBC Act Protected Matters Report

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

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

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

Report created: 29/06/21 21:33:26

[Summary](#)

[Details](#)

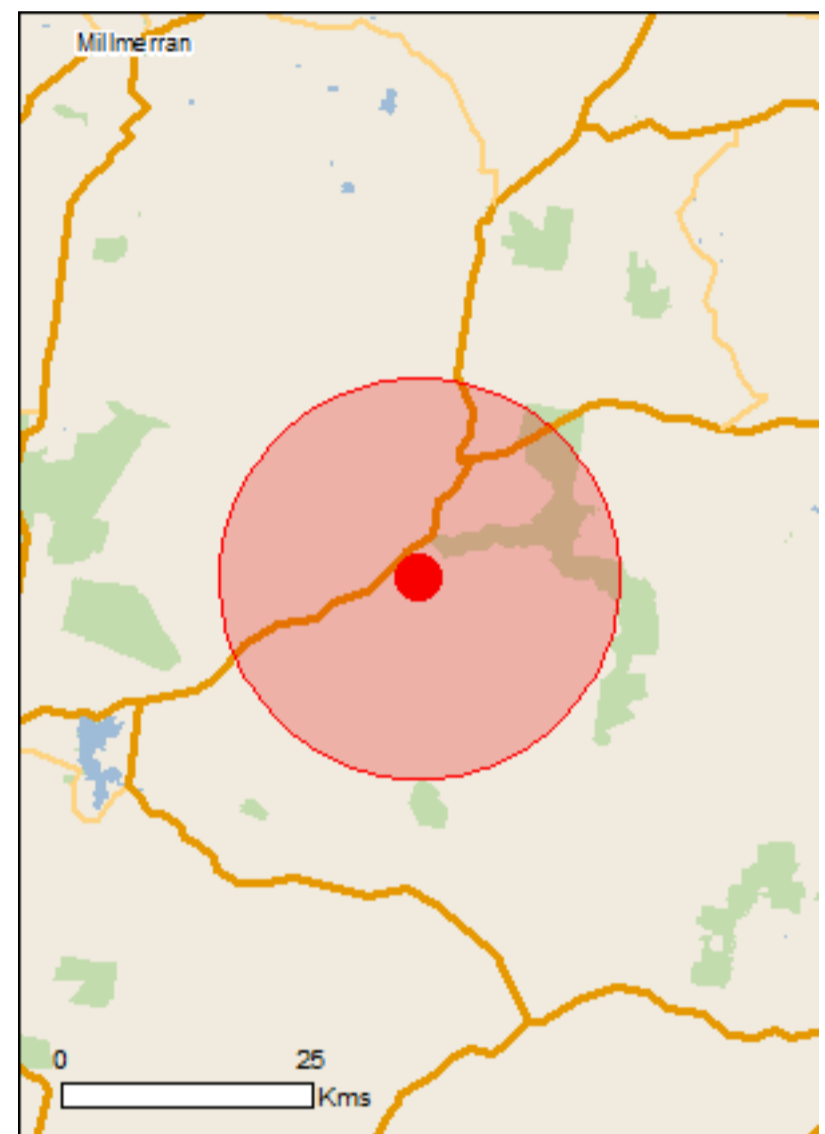
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

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Buffer: 20.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	36
Listed Migratory Species:	13

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	18
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	28
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Banrock station wetland complex	1200 - 1300km
Narran lake nature reserve	400 - 500km upstream
Riverland	1100 - 1200km
The coorong, and lakes alexandrina and albert wetland	1300 - 1400km

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community may occur within area
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	Critically Endangered	Community may occur within area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community may occur within area
Weeping Myall Woodlands	Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Breeding known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat likely to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Plants		
Acacia lauta Tara Wattle [4165]	Vulnerable	Species or species habitat may occur within area
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area
Cadellia pentastylis Ooline [9828]	Vulnerable	Species or species habitat likely to occur within area
Callistemon pungens [55581]	Vulnerable	Species or species habitat may occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus infera Durikai Mallee [55145]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus mckieana McKie's Stringybark [20199]	Vulnerable	Species or species habitat may occur within area
Homopholis belsonii Belson's Panic [2406]	Vulnerable	Species or species

Name	Status	Type of Presence
Lepidium monoplocoides Winged Pepper-cress [9190]	Endangered	habitat may occur within area Species or species habitat may occur within area
Lepidium peregrinum Wandering Pepper-cress [14035]	Endangered	Species or species habitat may occur within area
Macrozamia conferta [64582]	Vulnerable	Species or species habitat likely to occur within area
Macrozamia cranei [64681]	Endangered	Species or species habitat may occur within area
Rhaponticum australe Austral Cornflower, Native Thistle [22647]	Vulnerable	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Tylophora linearis [55231]	Endangered	Species or species habitat may occur within area
Reptiles		
Delma torquata Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
Furina dunmalli Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area
Uvidicolus sphyrurus Border Thick-tailed Gecko, Granite Belt Thick-tailed Gecko [84578]	Vulnerable	Species or species habitat known to occur within area
Listed Migratory Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species	[Resource Information]	
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

Invasive Species

[[Resource Information](#)]

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat may occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Plants		
<p><i>Dolichandra unguis-cati</i> Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]</p>		Species or species habitat likely to occur within area
<p><i>Lantana camara</i> Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]</p>		Species or species habitat likely to occur within area
<p><i>Lycium ferocissimum</i> African Boxthorn, Boxthorn [19235]</p>		Species or species habitat likely to occur within area
<p><i>Nassella neesiana</i> Chilean Needle grass [67699]</p>		Species or species habitat likely to occur within area
<p><i>Opuntia</i> spp. Prickly Pears [82753]</p>		Species or species habitat likely to occur within area
<p><i>Parthenium hysterophorus</i> Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]</p>		Species or species habitat likely to occur within area
<p><i>Pinus radiata</i> Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]</p>		Species or species habitat may occur within area
<p><i>Salix</i> spp. except <i>S.babylonica</i>, <i>S.x calodendron</i> & <i>S.x reichardtii</i> Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]</p>		Species or species habitat likely to occur within area
<p><i>Senecio madagascariensis</i> Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]</p>		Species or species habitat likely to occur within area

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-28.3006 151.5222

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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Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point

Species: All

Type: All

Status: All

Records: All

Date: All

Latitude: -28.3006

Longitude: 151.5606

Distance: 20

Email: Simon.Hodgkison@ghd.com

Date submitted: Tuesday 29 Jun 2021 21:35:31

Date extracted: Tuesday 29 Jun 2021 21:40:02

The number of records retrieved = 836

Disclaimer

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

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

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

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Hylidae	<i>Cyclorana novaehollandiae</i>	eastern snapping frog		C		1
animals	amphibians	Hylidae	<i>Litoria fallax</i>	eastern sedgefrog		C		25/3
animals	amphibians	Hylidae	<i>Litoria dentata</i>	bleating treefrog		C		2/1
animals	amphibians	Hylidae	<i>Litoria peronii</i>	emerald spotted treefrog		C		43/2
animals	amphibians	Hylidae	<i>Litoria latopalmata</i>	broad palmed rocketfrog		C		58
animals	amphibians	Hylidae	<i>Litoria caerulea</i>	common green treefrog		C		7
animals	amphibians	Hylidae	<i>Litoria wilcoxii</i>	eastern stony creek frog		C		9/1
animals	amphibians	Hylidae	<i>Litoria verreauxii</i>	whistling treefrog		C		1
animals	amphibians	Hylidae	<i>Litoria rubella</i>	ruddy treefrog		C		29/2
animals	amphibians	Limnodynastidae	<i>Limnodynastes tasmaniensis</i>	spotted grassfrog		C		60/3
animals	amphibians	Limnodynastidae	<i>Limnodynastes terraereginae</i>	scarlet sided pobblebonk		C		15/1
animals	amphibians	Limnodynastidae	<i>Limnodynastes fletcheri</i>	barking frog		C		6/1
animals	amphibians	Limnodynastidae	<i>Limnodynastes dumerilii</i>	grey bellied pobblebonk		C		2
animals	amphibians	Limnodynastidae	<i>Platyplectrum ornatum</i>	ornate burrowing frog		C		14
animals	amphibians	Limnodynastidae	<i>Neobatrachus sudellae</i>	meeowing frog		C		1
animals	amphibians	Limnodynastidae	<i>Limnodynastes sp.</i>			C		5
animals	amphibians	Limnodynastidae	<i>Limnodynastes peronii</i>	striped marshfrog		C		1
animals	amphibians	Myobatrachidae	<i>Crinia parinsignifera</i>	beeping froglet		C		90/4
animals	amphibians	Myobatrachidae	<i>Uperoleia laevigata</i>	eastern gungan		C		17/5
animals	amphibians	Myobatrachidae	<i>Pseudophryne major</i>	great brown broodfrog		C		16/2
animals	amphibians	Myobatrachidae	<i>Uperoleia rugosa</i>	chubby gungan		C		5
animals	amphibians	Myobatrachidae	<i>Crinia signifera</i>	clicking froglet		C		2
animals	arachnids	Urodacidae	<i>Urodacus manicatus</i>	black rock scorpion		C		1
animals	birds	Acanthizidae	<i>Acanthiza nana</i>	yellow thornbill		C		74
animals	birds	Acanthizidae	<i>Smicrornis brevirostris</i>	weebill		C		299
animals	birds	Acanthizidae	<i>Pyrrholaemus sagittatus</i>	speckled warbler		C		194
animals	birds	Acanthizidae	<i>Aphelocephala leucopsis</i>	southern whiteface		C		10
animals	birds	Acanthizidae	<i>Acanthiza uropygialis</i>	chestnut-rumped thornbill		C		2
animals	birds	Acanthizidae	<i>Acanthiza chrysorrhoa</i>	yellow-rumped thornbill		C		51
animals	birds	Acanthizidae	<i>Sericornis frontalis</i>	white-browed scrubwren		C		41
animals	birds	Acanthizidae	<i>Acanthiza reguloides</i>	buff-rumped thornbill		C		109
animals	birds	Acanthizidae	<i>Acanthiza apicalis</i>	inland thornbill		C		33
animals	birds	Acanthizidae	<i>Gerygone olivacea</i>	white-throated gerygone		C		130
animals	birds	Acanthizidae	<i>Acanthiza pusilla</i>	brown thornbill		C		3
animals	birds	Acanthizidae	<i>Gerygone fusca</i>	western gerygone		C		6
animals	birds	Acanthizidae	<i>Acanthiza lineata</i>	striated thornbill		C		13
animals	birds	Accipitridae	<i>Accipiter fasciatus</i>	brown goshawk		C		12
animals	birds	Accipitridae	<i>Lophoictinia isura</i>	square-tailed kite		C		4
animals	birds	Accipitridae	<i>Elanus axillaris</i>	black-shouldered kite		C		4
animals	birds	Accipitridae	<i>Circus assimilis</i>	spotted harrier		C		2
animals	birds	Accipitridae	<i>Aquila audax</i>	wedge-tailed eagle		C		79
animals	birds	Accipitridae	<i>Haliaeetus leucogaster</i>	white-bellied sea-eagle		C		4
animals	birds	Accipitridae	<i>Haliastur sphenurus</i>	whistling kite		C		3
animals	birds	Accipitridae	<i>Accipiter cirrocephalus</i>	collared sparrowhawk		C		13
animals	birds	Accipitridae	<i>Aviceda subcristata</i>	Pacific baza		C		8
animals	birds	Accipitridae	<i>Hieraaetus morphnoides</i>	little eagle		C		28

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Acrocephalidae	<i>Acrocephalus australis</i>	Australian reed-warbler		C		3
animals	birds	Aegothelidae	<i>Aegotheles cristatus</i>	Australian owl-nightjar		C		29
animals	birds	Alaudidae	<i>Mirafra javanica</i>	Horsfield's bushlark		C		2
animals	birds	Alcedinidae	<i>Ceyx azureus</i>	azure kingfisher		C		12
animals	birds	Anatidae	<i>Aythya australis</i>	hardhead		C		3
animals	birds	Anatidae	<i>Anas superciliosa</i>	Pacific black duck		C		35
animals	birds	Anatidae	<i>Anas gracilis</i>	grey teal		C		12
animals	birds	Anatidae	<i>Spatula rhynchotis</i>	Australasian shoveler		C		2
animals	birds	Anatidae	<i>Malacorhynchus membranaceus</i>	pink-eared duck		C		1
animals	birds	Anatidae	<i>Cygnus atratus</i>	black swan		C		4
animals	birds	Anatidae	<i>Biziura lobata</i>	musk duck		C		1
animals	birds	Anatidae	<i>Chenonetta jubata</i>	Australian wood duck		C		37
animals	birds	Anhingidae	<i>Anhinga novaehollandiae</i>	Australasian darter		C		5
animals	birds	Apodidae	<i>Hirundapus caudacutus</i>	white-throated needletail		V	V	17
animals	birds	Apodidae	<i>Apus pacificus</i>	fork-tailed swift		SL		2
animals	birds	Ardeidae	<i>Egretta novaehollandiae</i>	white-faced heron		C		30
animals	birds	Ardeidae	<i>Ardea alba modesta</i>	eastern great egret		C		5
animals	birds	Ardeidae	<i>Ardea pacifica</i>	white-necked heron		C		20
animals	birds	Ardeidae	<i>Nycticorax caledonicus</i>	nankeen night-heron		C		10
animals	birds	Artamidae	<i>Artamus cinereus</i>	black-faced woodswallow		C		2
animals	birds	Artamidae	<i>Artamus personatus</i>	masked woodswallow		C		19
animals	birds	Artamidae	<i>Gymnorhina tibicen</i>	Australian magpie		C		194
animals	birds	Artamidae	<i>Strepera graculina</i>	pieb currawong		C		214
animals	birds	Artamidae	<i>Artamus minor</i>	little woodswallow		C		2
animals	birds	Artamidae	<i>Cracticus torquatus</i>	grey butcherbird		C		150
animals	birds	Artamidae	<i>Artamus leucorhynchus</i>	white-breasted woodswallow		C		3
animals	birds	Artamidae	<i>Artamus superciliosus</i>	white-browed woodswallow		C		43
animals	birds	Artamidae	<i>Cracticus nigrogularis</i>	pieb butcherbird		C		93
animals	birds	Artamidae	<i>Artamus cyanopterus</i>	dusky woodswallow		C		133
animals	birds	Burhinidae	<i>Burhinus grallarius</i>	bush stone-curlew		C		3
animals	birds	Cacatuidae	<i>Cacatua galerita</i>	sulphur-crested cockatoo		C		106/2
animals	birds	Cacatuidae	<i>Cacatua sanguinea</i>	little corella		C		27
animals	birds	Cacatuidae	<i>Eolophus roseicapilla</i>	galah		C		112
animals	birds	Cacatuidae	<i>Nymphicus hollandicus</i>	cockatiel		C		12
animals	birds	Cacatuidae	<i>Calyptorhynchus lathamii</i>	glossy black-cockatoo		V		5
animals	birds	Cacatuidae	<i>Calyptorhynchus lathamii</i>	glossy black-cockatoo (eastern)		V		9
animals	birds	Cacatuidae	<i>Calyptorhynchus funereus</i>	yellow-tailed black-cockatoo		C		13
animals	birds	Campephagidae	<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike		C		103
animals	birds	Campephagidae	<i>Coracina tenuirostris</i>	cicadabird		C		41
animals	birds	Campephagidae	<i>Coracina papuensis</i>	white-bellied cuckoo-shrike		C		110
animals	birds	Campephagidae	<i>Lalage leucomela</i>	varied triller		C		2
animals	birds	Campephagidae	<i>Coracina maxima</i>	ground cuckoo-shrike		C		6
animals	birds	Campephagidae	<i>Lalage tricolor</i>	white-winged triller		C		24
animals	birds	Casuariidae	<i>Dromaius novaehollandiae</i>	emu		C		7
animals	birds	Charadriidae	<i>Euseyonis melanops</i>	black-fronted dotterel		C		14
animals	birds	Charadriidae	<i>Vanellus tricolor</i>	banded lapwing		C		2

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animals	birds	Charadriidae	<i>Vanellus miles</i>	masked lapwing		C		14
animals	birds	Charadriidae	<i>Vanellus miles novaehollandiae</i>	masked lapwing (southern subspecies)		C		14
animals	birds	Charadriidae	<i>Erythronyctes alpinus</i>	red-kneed dotterel		C		2
animals	birds	Climacteridae	<i>Cormobates leucophaea</i>	white-throated treecreeper		C		177
animals	birds	Climacteridae	<i>Climacteris picumnus victoriae</i>	brown treecreeper (south-eastern)		C		1
animals	birds	Climacteridae	<i>Cormobates leucophaea metastasis</i>	white-throated treecreeper (southern)		C		104
animals	birds	Climacteridae	<i>Climacteris picumnus</i>	brown treecreeper		C		204
animals	birds	Columbidae	<i>Geophaps scripta scripta</i>	squatter pigeon (southern subspecies)	V		V	18
animals	birds	Columbidae	<i>Leucosarcia melanoleuca</i>	wonga pigeon		C		2
animals	birds	Columbidae	<i>Ocyphaps lophotes</i>	crested pigeon		C		54
animals	birds	Columbidae	<i>Phaps chalcoptera</i>	common bronzewing		C		120
animals	birds	Columbidae	<i>Geopelia humeralis</i>	bar-shouldered dove		C		7
animals	birds	Columbidae	<i>Geopelia cuneata</i>	diamond dove		C		5
animals	birds	Columbidae	<i>Geopelia striata</i>	peaceful dove		C		129
animals	birds	Columbidae	<i>Geophaps scripta</i>	squatter pigeon		C		2
animals	birds	Coraciidae	<i>Eurystomus orientalis</i>	dollarbird		C		25
animals	birds	Corcoracidae	<i>Struthidea cinerea</i>	apostlebird		C		44
animals	birds	Corcoracidae	<i>Corcorax melanorhamphos</i>	white-winged chough		C		89
animals	birds	Corvidae	<i>Corvus coronoides</i>	Australian raven		C		182
animals	birds	Corvidae	<i>Corvus orru</i>	Torresian crow		C		155
animals	birds	Corvidae	<i>Corvus sp.</i>			C		1
animals	birds	Cuculidae	<i>Scythrops novaehollandiae</i>	channel-billed cuckoo		C		14
animals	birds	Cuculidae	<i>Chalcites minutillus barnardi</i>	Eastern little bronze-cuckoo		C		1
animals	birds	Cuculidae	<i>Chalcites lucidus</i>	shining bronze-cuckoo		C		11
animals	birds	Cuculidae	<i>Chalcites basalis</i>	Horsfield's bronze-cuckoo		C		9
animals	birds	Cuculidae	<i>Cacomantis flabelliformis</i>	fan-tailed cuckoo		C		25
animals	birds	Cuculidae	<i>Centropus phasianinus</i>	pheasant coucal		C		6
animals	birds	Cuculidae	<i>Cacomantis variolosus</i>	brush cuckoo		C		9
animals	birds	Cuculidae	<i>Eudynamis orientalis</i>	eastern koel		C		6
animals	birds	Cuculidae	<i>Chalcites minutillus</i>	little bronze-cuckoo		C		3
animals	birds	Cuculidae	<i>Chalcites osculans</i>	black-eared cuckoo		C		2
animals	birds	Cuculidae	<i>Cacomantis pallidus</i>	pallid cuckoo		C		22
animals	birds	Dicruridae	<i>Dicrurus bracteatus</i>	spangled drongo		C		5
animals	birds	Estrildidae	<i>Neochmia temporalis</i>	red-browed finch		C		114
animals	birds	Estrildidae	<i>Neochmia modesta</i>	plum-headed finch		C		35
animals	birds	Estrildidae	<i>Taeniopygia bichenovii</i>	double-barred finch		C		124
animals	birds	Estrildidae	<i>Taeniopygia guttata</i>	zebra finch		C		5
animals	birds	Estrildidae	<i>Stagonopleura guttata</i>	diamond firetail		C		89
animals	birds	Eurostopodidae	<i>Eurostopodus mystacalis</i>	white-throated nightjar		C		5
animals	birds	Falconidae	<i>Falco berigora</i>	brown falcon		C		16
animals	birds	Falconidae	<i>Falco subniger</i>	black falcon		C		4
animals	birds	Falconidae	<i>Falco longipennis</i>	Australian hobby		C		3
animals	birds	Falconidae	<i>Falco cenchroides</i>	nankeen kestrel		C		10
animals	birds	Falconidae	<i>Falco peregrinus</i>	peregrine falcon		C		1
animals	birds	Halcyonidae	<i>Dacelo novaeguineae</i>	laughing kookaburra		C		198
animals	birds	Halcyonidae	<i>Todiramphus sanctus</i>	sacred kingfisher		C		50

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animals	birds	Hirundinidae	<i>Cheramoeca leucosterna</i>	white-backed swallow		C		2
animals	birds	Hirundinidae	<i>Petrochelidon ariel</i>	fairy martin		C		22
animals	birds	Hirundinidae	<i>Petrochelidon nigricans</i>	tree martin		C		27
animals	birds	Hirundinidae	<i>Hirundo neoxena</i>	welcome swallow		C		92
animals	birds	Laridae	<i>Chroicocephalus novaehollandiae</i>	silver gull		C		1
animals	birds	Maluridae	<i>Malurus sp.</i>			C		6
animals	birds	Maluridae	<i>Malurus lamberti sensu lato</i>	variegated fairy-wren		C		78
animals	birds	Maluridae	<i>Malurus melanocephalus</i>	red-backed fairy-wren		C		1
animals	birds	Maluridae	<i>Malurus cyaneus</i>	superb fairy-wren		C		226/1
animals	birds	Megaluridae	<i>Cincloramphus cruralis</i>	brown songlark		C		3
animals	birds	Megaluridae	<i>Cincloramphus mathewsi</i>	rufous songlark		C		36
animals	birds	Megaluridae	<i>Megalurus timoriensis</i>	tawny grassbird		C		1
animals	birds	Megapodiidae	<i>Alectura lathamii</i>	Australian brush-turkey		C		5
animals	birds	Meliphagidae	<i>Melithreptus gularis</i>	black-chinned honeyeater		C		91
animals	birds	Meliphagidae	<i>Melithreptus lunatus</i>	white-naped honeyeater		C		227
animals	birds	Meliphagidae	<i>Nesoptilotis leucotis</i>	white-eared honeyeater		C		125
animals	birds	Meliphagidae	<i>Philemon corniculatus</i>	noisy friarbird		C		333
animals	birds	Meliphagidae	<i>Ptilotula penicillata</i>	white-plumed honeyeater		C		126
animals	birds	Meliphagidae	<i>Lichenostomus melanops</i>	yellow-tufted honeyeater		C		225
animals	birds	Meliphagidae	<i>Manorina melanocephala</i>	noisy miner		C		263
animals	birds	Meliphagidae	<i>Myzomela sanguinolenta</i>	scarlet honeyeater		C		123
animals	birds	Meliphagidae	<i>Philemon citreogularis</i>	little friarbird		C		119
animals	birds	Meliphagidae	<i>Anthochaera carunculata</i>	red wattlebird		C		20
animals	birds	Meliphagidae	<i>Anthochaera chrysoptera</i>	little wattlebird		C		1
animals	birds	Meliphagidae	<i>Acanthagenys rufogularis</i>	spiny-cheeked honeyeater		C		34
animals	birds	Meliphagidae	<i>Melithreptus albogularis</i>	white-throated honeyeater		C		10
animals	birds	Meliphagidae	<i>Plectorhyncha lanceolata</i>	striped honeyeater		C		152
animals	birds	Meliphagidae	<i>Melithreptus brevirostris</i>	brown-headed honeyeater		C		188
animals	birds	Meliphagidae	<i>Acanthorhynchus tenuirostris</i>	eastern spinebill		C		4
animals	birds	Meliphagidae	<i>Melithreptus gularis gularis</i>	black-chinned honeyeater (eastern)		C		2
animals	birds	Meliphagidae	<i>Lichmera indistincta</i>	brown honeyeater		C		106
animals	birds	Meliphagidae	<i>Manorina melanophrys</i>	bell miner		C		3
animals	birds	Meliphagidae	<i>Gavicalis virescens</i>	singing honeyeater		C		2
animals	birds	Meliphagidae	<i>Epthianura tricolor</i>	crimson chat		C		1
animals	birds	Meliphagidae	<i>Anthochaera phrygia</i>	regent honeyeater		CR	CE	37
animals	birds	Meliphagidae	<i>Purnella albifrons</i>	white-fronted honeyeater		C		2
animals	birds	Meliphagidae	<i>Manorina flavigula</i>	yellow-throated miner		C		3
animals	birds	Meliphagidae	<i>Entomyzon cyanotis</i>	blue-faced honeyeater		C		106
animals	birds	Meliphagidae	<i>Sugomel niger</i>	black honeyeater		C		6
animals	birds	Meliphagidae	<i>Ptilotula fusca</i>	fuscous honeyeater		C		304
animals	birds	Meliphagidae	<i>Grantiella picta</i>	painted honeyeater		V	V	2
animals	birds	Meliphagidae	<i>Meliphaga lewinii</i>	Lewin's honeyeater		C		1
animals	birds	Meliphagidae	<i>Caligavis chrysops</i>	yellow-faced honeyeater		C		343
animals	birds	Meropidae	<i>Merops ornatus</i>	rainbow bee-eater		C		35
animals	birds	Monarchidae	<i>Myiagra cyanoleuca</i>	satin flycatcher		SL		1
animals	birds	Monarchidae	<i>Monarcha melanopsis</i>	black-faced monarch		SL		1

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animals	birds	Monarchidae	<i>Myiagra inquieta</i>	restless flycatcher		C		138
animals	birds	Monarchidae	<i>Myiagra rubecula</i>	leaden flycatcher		C		60
animals	birds	Monarchidae	<i>Grallina cyanoleuca</i>	magpie-lark		C		141
animals	birds	Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian pipit		C		24
animals	birds	Nectariniidae	<i>Dicaeum hirundinaceum</i>	mistletoebird		C		197
animals	birds	Neosittidae	<i>Daphoenositta chrysoptera</i>	varied sittella		C		59
animals	birds	Oriolidae	<i>Oriolus sagittatus</i>	olive-backed oriole		C		79
animals	birds	Pachycephalidae	<i>Falcunculus frontatus</i>	crested shrike-tit		C		83
animals	birds	Pachycephalidae	<i>Pachycephala rufiventris</i>	rufous whistler		C		170
animals	birds	Pachycephalidae	<i>Pachycephala pectoralis</i>	golden whistler		C		68
animals	birds	Pachycephalidae	<i>Colluricincla harmonica</i>	grey shrike-thrush		C		269
animals	birds	Pardalotidae	<i>Pardalotus punctatus</i>	spotted pardalote		C		236
animals	birds	Pardalotidae	<i>Pardalotus striatus</i>	striated pardalote		C		218
animals	birds	Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian pelican		C		2
animals	birds	Petroicidae	<i>Microeca fascinans</i>	jacky winter		C		125
animals	birds	Petroicidae	<i>Petroica rosea</i>	rose robin		C		11
animals	birds	Petroicidae	<i>Petroica goodenovii</i>	red-capped robin		C		4
animals	birds	Petroicidae	<i>Eopsaltria australis</i>	eastern yellow robin		C		222
animals	birds	Petroicidae	<i>Petroica boodang</i>	scarlet robin		C		3
animals	birds	Petroicidae	<i>Melanodryas cucullata</i>	hooded robin		C		26
animals	birds	Phalacrocoracidae	<i>Phalacrocorax carbo</i>	great cormorant		C		7
animals	birds	Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	little black cormorant		C		7
animals	birds	Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	little pied cormorant		C		26
animals	birds	Phasianidae	<i>Coturnix ypsilophora</i>	brown quail		C		17
animals	birds	Phasianidae	<i>Coturnix pectoralis</i>	stubble quail		C		2
animals	birds	Podargidae	<i>Podargus strigoides</i>	tawny frogmouth		C		25
animals	birds	Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian grebe		C		25
animals	birds	Pomatostomidae	<i>Pomatostomus temporalis</i>	grey-crowned babbler		C		101
animals	birds	Pomatostomidae	<i>Pomatostomus superciliosus</i>	white-browed babbler		C		30
animals	birds	Psittacidae	<i>Aprosmictus erythropterus</i>	red-winged parrot		C		56
animals	birds	Psittacidae	<i>Trichoglossus chlorolepidotus</i>	scaly-breasted lorikeet		C		101
animals	birds	Psittacidae	<i>Trichoglossus moluccanus</i>	rainbow lorikeet		C		111
animals	birds	Psittacidae	<i>Melopsittacus undulatus</i>	budgerigar		C		1
animals	birds	Psittacidae	<i>Psephotus haematonotus</i>	red-rumped parrot		C		30
animals	birds	Psittacidae	<i>Glossopsitta concinna</i>	musk lorikeet		C		20
animals	birds	Psittacidae	<i>Platycercus sp.</i>			C		3
animals	birds	Psittacidae	<i>Lathamus discolor</i>	swift parrot		E	CE	6
animals	birds	Psittacidae	<i>Neophema pulchella</i>	turquoise parrot		C		69
animals	birds	Psittacidae	<i>Parvipsitta pusilla</i>	little lorikeet		C		296/1
animals	birds	Psittacidae	<i>Platycercus eximius</i>	eastern rosella		C		101
animals	birds	Psittacidae	<i>Alisterus scapularis</i>	Australian king-parrot		C		70
animals	birds	Psittacidae	<i>Platycercus adscitus</i>	pale-headed rosella		C		32
animals	birds	Psittacidae	<i>Polytelis swainsonii</i>	superb parrot		C	V	1
animals	birds	Psophodidae	<i>Cinclosoma punctatum</i>	spotted quail-thrush		C		11
animals	birds	Rallidae	<i>Porphyrio melanotus</i>	purple swamphen		C		2
animals	birds	Rallidae	<i>Gallinula tenebrosa</i>	dusky moorhen		C		11

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animals	birds	Rallidae	<i>Fulica atra</i>	Eurasian coot		C		6
animals	birds	Recurvirostridae	<i>Himantopus himantopus</i>	black-winged stilt		C		1
animals	birds	Rhipiduridae	<i>Rhipidura leucophrys</i>	willie wagtail		C		301
animals	birds	Rhipiduridae	<i>Rhipidura albiscapa</i>	grey fantail		C		123
animals	birds	Rhipiduridae	<i>Rhipidura rufifrons</i>	rufous fantail		SL		3
animals	birds	Strigidae	<i>Ninox strenua</i>	powerful owl		V		2
animals	birds	Strigidae	<i>Ninox boobook</i>	southern boobook		C		12
animals	birds	Sturnidae	<i>Acridotheres tristis</i>	common myna	Y			5
animals	birds	Sturnidae	<i>Sturnus vulgaris</i>	common starling	Y			7
animals	birds	Threskiornithidae	<i>Threskiornis spinicollis</i>	straw-necked ibis		C		24
animals	birds	Threskiornithidae	<i>Threskiornis molucca</i>	Australian white ibis		C		8
animals	birds	Threskiornithidae	<i>Platalea regia</i>	royal spoonbill		C		2
animals	birds	Timaliidae	<i>Zosterops lateralis</i>	silveryeye		C		108
animals	birds	Turnicidae	<i>Turnix velox</i>	little button-quail		C		2
animals	birds	Turnicidae	<i>Turnix varius</i>	painted button-quail		C		21
animals	birds	Tytonidae	<i>Tyto delicatula</i>	eastern barn owl		C		2
animals	insects	Aeshnidae	<i>Austrogynacantha heterogena</i>	Australian duskhawker				1
animals	insects	Aeshnidae	<i>Anax papuensis</i>	Australian Emperor				6
animals	insects	Coenagrionidae	<i>Pseudagrion aureofrons</i>	gold-fronted riverdamsel				1
animals	insects	Coenagrionidae	<i>Austroagrion watsoni</i>	eastern billabongfly				3
animals	insects	Coenagrionidae	<i>Xanthagrion erythroneurum</i>	red & blue damsel				2
animals	insects	Coenagrionidae	<i>Ischnura heterosticta heterosticta</i>	common bluetail				2
animals	insects	Coenagrionidae	<i>Ischnura aurora</i>	aurora bluetail				1
animals	insects	Corduliidae	<i>Hemicordulia australiae</i>	Australian emerald				4
animals	insects	Formicidae	<i>Iridomyrmex purpureus</i>					1
animals	insects	Hesperiidae	<i>Taractrocera papyria papyria</i>	white-banded grass-dart				1
animals	insects	Hesperiidae	<i>Ocybadistes walkeri sothis</i>	green grass-dart				1
animals	insects	Hesperiidae	<i>Trapezites eliena</i>	orange ochre				1
animals	insects	Hesperiidae	<i>Toxidia parvula</i>	banded grass-skipper				1
animals	insects	Lestidae	<i>Austrolestes leda</i>	wandering ringtail				5
animals	insects	Libellulidae	<i>Pantala flavescens</i>	wandering glider				1
animals	insects	Libellulidae	<i>Diplacodes bipunctata</i>	wandering percher				4
animals	insects	Libellulidae	<i>Orthetrum caledonicum</i>	blue skimmer				12
animals	insects	Libellulidae	<i>Diplacodes haematodes</i>	scarlet percher				6
animals	insects	Lindenidae	<i>Ictinogomphus australis</i>	Australian tiger				1
animals	insects	Lycaenidae	<i>Theclinesstes miskini miskini</i>	wattle blue (Australian subspecies)				1
animals	insects	Lycaenidae	<i>Nacaduba biocellata biocellata</i>	two-spotted line-blue				1
animals	insects	Lycaenidae	<i>Theclinesstes serpentatus serpentatus</i>	salt-bush blue				1
animals	insects	Lycaenidae	<i>Ogyris sp.</i>					1
animals	insects	Lycaenidae	<i>Zizina otis labradus</i>	common grass-blue (Australian subspecies)				3
animals	insects	Lycaenidae	<i>Zizula hylax attenuata</i>	dainty grass-blue				1
animals	insects	Lycaenidae	<i>Candalides xanthospilos</i>	yellow-spotted blue				1
animals	insects	Nymphalidae	<i>Euploea corinna</i>	common crow				7
animals	insects	Nymphalidae	<i>Charaxes sempronius sempronius</i>	tailed emperor				1
animals	insects	Nymphalidae	<i>Acraea andromacha andromacha</i>	glasswing				7

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animals	insects	Nymphalidae	<i>Heteronympha merope merope</i>	common brown				4
animals	insects	Nymphalidae	<i>Vanessa itea</i>	yellow admiral				2
animals	insects	Nymphalidae	<i>Danaus petilia</i>	lesser wanderer				10
animals	insects	Nymphalidae	<i>Danaus plexippus</i>	monarch	Y			7
animals	insects	Nymphalidae	<i>Vanessa kershawi</i>	Australian painted lady				4
animals	insects	Nymphalidae	<i>Hypocysta pseudirius</i>	grey ringlet				1
animals	insects	Nymphalidae	<i>Tirumala hamata hamata</i>	blue tiger				6
animals	insects	Nymphalidae	<i>Junonia villida villida</i>	meadow argus				19
animals	insects	Nymphalidae	<i>Hypolimnas bolina nerina</i>	varied eggfly				4
animals	insects	Papilionidae	<i>Cressida cressida cressida</i>	clearwing swallowtail				1
animals	insects	Papilionidae	<i>Papilio anactus</i>	dainty swallowtail				2
animals	insects	Papilionidae	<i>Papilio aegaeus aegaeus</i>	orchard swallowtail (Australian subspecies)				5
animals	insects	Papilionidae	<i>Papilio demoleus sthenelus</i>	chequered swallowtail				4
animals	insects	Pieridae	<i>Eurema hecabe</i>	large grass-yellow				2
animals	insects	Pieridae	<i>Eurema smilax</i>	small grass-yellow				1
animals	insects	Pieridae	<i>Elodina parthia</i>	striated pearl-white				1
animals	insects	Pieridae	<i>Belenois java teutonia</i>	caper white				22
animals	insects	Pieridae	<i>Appias paulina ega</i>	yellow albatross				1
animals	insects	Pieridae	<i>Catopsilia pomona</i>	lemon migrant				1
animals	insects	Pieridae	<i>Cepora perimale</i>					1
animals	insects	Pieridae	<i>Elodina padusa</i>	narrow-winged pearl-white				1
animals	insects	Pieridae	<i>Elodina angulipennis</i>	southern pearl-white				1
animals	insects	Pieridae	<i>Delias argentona argentona</i>	scarlet jezebel				2
animals	insects	Pieridae	<i>Catopsilia pyranthe crokera</i>	white migrant				2
animals	insects	Synthemistidae	<i>Parasyntemis regina</i>	royal tigertail				7
animals	malacostracans	Parastacidae	<i>Cherax destructor</i>	common yabbie				1
animals	mammals	Bovidae	<i>Bos sp.</i>	cattle	Y			3
animals	mammals	Bovidae	<i>Capra hircus</i>	goat	Y			2
animals	mammals	Canidae	<i>Canis sp.</i>		Y			1
animals	mammals	Canidae	<i>Vulpes vulpes</i>	red fox	Y			5
animals	mammals	Canidae	<i>Canis familiaris (dingo)</i>	dingo				2
animals	mammals	Canidae	<i>Canis familiaris</i>	dog	Y			6
animals	mammals	Cervidae	<i>Dama dama</i>	fallow deer	Y			2/1
animals	mammals	Cervidae	<i>Cervus elaphus</i>	red deer	Y			1
animals	mammals	Dasyuridae	<i>Sminthopsis murina</i>	common dunnart			C	7/1
animals	mammals	Dasyuridae	<i>Antechinus flavipes flavipes</i>	yellow-footed antechinus (south-east Queensland)			C	10
animals	mammals	Emballonuridae	<i>Saccolaimus flaviventris</i>	yellow-bellied sheath-tail bat			C	3
animals	mammals	Felidae	<i>Felis catus</i>	cat	Y			11
animals	mammals	Leporidae	<i>Lepus europaeus</i>	European brown hare	Y			2
animals	mammals	Leporidae	<i>Oryctolagus cuniculus</i>	rabbit	Y			3
animals	mammals	Macropodidae	<i>Notamacropus rufogriseus</i>	red-necked wallaby			C	75
animals	mammals	Macropodidae	<i>Notamacropus dorsalis</i>	black-striped wallaby			C	8
animals	mammals	Macropodidae	<i>Osphranter robustus</i>	common wallaroo			C	16
animals	mammals	Macropodidae	<i>Notamacropus parryi</i>	whiptail wallaby			C	13

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animals	mammals	Macropodidae	<i>Macropus giganteus</i>	eastern grey kangaroo		C		84
animals	mammals	Macropodidae	<i>Wallabia bicolor</i>	swamp wallaby		C		67
animals	mammals	Molossidae	<i>Mormopterus ridei</i>	eastern free-tailed bat		C		2
animals	mammals	Molossidae	<i>Mormopterus sp.</i>			C		1
animals	mammals	Molossidae	<i>Austronomus australis</i>	white-striped freetail bat		C		5
animals	mammals	Molossidae	<i>Mormopterus norfolkensis</i>	east coast freetail bat		C		2
animals	mammals	Muridae	<i>Rattus fuscipes</i>	bush rat		C		1
animals	mammals	Ornithorhynchidae	<i>Ornithorhynchus anatinus</i>	platypus		SL		1
animals	mammals	Peramelidae	<i>Isodon macrourus</i>	northern brown bandicoot		C		1
animals	mammals	Petauridae	<i>Petaurus notatus</i>	Kreff's glider		C		10
animals	mammals	Petauridae	<i>Petaurus norfolcensis</i>	squirrel glider		C		3
animals	mammals	Phalangeridae	<i>Trichosurus sp.</i>			C		1
animals	mammals	Phalangeridae	<i>Trichosurus vulpecula</i>	common brushtail possum		C		22
animals	mammals	Phascolarctidae	<i>Phascolarctos cinereus</i>	koala		V	V	20/2
animals	mammals	Potoroidae	<i>Aepyprymnus rufescens</i>	rufous bettong		C		1
animals	mammals	Pseudocheiridae	<i>Petauroides armillatus</i>	central greater glider		V	V	4
animals	mammals	Pseudocheiridae	<i>Pseudocheirus peregrinus</i>	common ringtail possum		C		9
animals	mammals	Pteropodidae	<i>Pteropus poliocephalus</i>	grey-headed flying-fox		C	V	1
animals	mammals	Pteropodidae	<i>Pteropus scapulatus</i>	little red flying-fox		C		3
animals	mammals	Pteropodidae	<i>Pteropus sp.</i>			C		2
animals	mammals	Suidae	<i>Sus scrofa</i>	pig	Y			95
animals	mammals	Tachyglossidae	<i>Tachyglossus aculeatus</i>	short-beaked echidna		SL		20
animals	mammals	Vespertilionidae	<i>Scotorepens orion</i>	south-eastern broad-nosed bat		C		1
animals	mammals	Vespertilionidae	<i>Chalinolobus morio</i>	chocolate wattled bat		C		5
animals	mammals	Vespertilionidae	<i>Nyctophilus gouldi</i>	Gould's long-eared bat		C		9/3
animals	mammals	Vespertilionidae	<i>Scotorepens greyii</i>	little broad-nosed bat		C		6/1
animals	mammals	Vespertilionidae	<i>Vespadelus regulus</i>	southern forest bat		C		1
animals	mammals	Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's wattled bat		C		6
animals	mammals	Vespertilionidae	<i>Chalinolobus picatus</i>	little pied bat		C		7/2
animals	mammals	Vespertilionidae	<i>Scotorepens balstoni</i>	inland broad-nosed bat		C		1
animals	mammals	Vespertilionidae	<i>Vespadelus vulturnus</i>	little forest bat		C		17/7
animals	mammals	Vespertilionidae	<i>Nyctophilus geoffroyi</i>	lesser long-eared bat		C		5
animals	mammals	Vespertilionidae	<i>Scotorepens sp. (Parnaby)</i>	central-eastern broad-nosed bat		C		1/1
animals	mammals	Vespertilionidae	<i>Vespadelus darlingtoni</i>	large forest bat		C		1
animals	mammals	Vespertilionidae	<i>Vespadelus troughtoni</i>	eastern cave bat		C		1
animals	mammals	Vespertilionidae	<i>Chalinolobus nigrogriseus</i>	hoary wattled bat		C		2
animals	mammals	Vespertilionidae	<i>Scotorepens sp.</i>			C		13
animals	mammals	Vespertilionidae	<i>Myotis macropus</i>	large-footed myotis		C		2
animals	mammals	Vespertilionidae	<i>Nyctophilus sp.</i>			C		2
animals	ray-finned fishes	Eleotridae	<i>Mogurnda adspersa</i>	southern purplespotted gudgeon				1
animals	ray-finned fishes	Melanotaeniidae	<i>Melanotaenia fluviatilis</i>	Murray River rainbowfish				2
animals	ray-finned fishes	Plotosidae	<i>Tandanus tandanus</i>	freshwater catfish				2
animals	ray-finned fishes	Terapontidae	<i>Leiopotherapon unicolor</i>	spangled perch				2
animals	reptiles	Agamidae	<i>Lophognathus gilberti sensu lato</i>	Gilbert's dragon		C		2
animals	reptiles	Agamidae	<i>Amphibolurus muricatus</i>	jacky lizard		C		6/1
animals	reptiles	Agamidae	<i>Diporiphora australis</i>	tommy roundhead		C		2

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animals	reptiles	Agamidae	<i>Amphibolurus burnsi</i>	Burns's dragon		C		4
animals	reptiles	Agamidae	<i>Pogona barbata</i>	bearded dragon		C		9
animals	reptiles	Agamidae	<i>Diporiphora nobbi</i>	nobbi		C		11/1
animals	reptiles	Carphodactylidae	<i>Uvidicolus sphyrurus</i>	border thick-tailed gecko		C	V	9/1
animals	reptiles	Chelidae	<i>Chelodina sp.</i>			C		1
animals	reptiles	Chelidae	<i>Chelodina longicollis</i>	eastern snake-necked turtle		C		4
animals	reptiles	Colubridae	<i>Dendrelaphis punctulatus</i>	green tree snake		C		8
animals	reptiles	Diplodactylidae	<i>Oedura tryoni</i>	southern spotted velvet gecko		C		24/6
animals	reptiles	Diplodactylidae	<i>Oedura marmorata sensu lato</i>	marbled velvet gecko		C		1
animals	reptiles	Diplodactylidae	<i>Lucasium steindachneri</i>	Steindachner's gecko		C		3
animals	reptiles	Diplodactylidae	<i>Diplodactylus vittatus</i>	wood gecko		C		45/3
animals	reptiles	Diplodactylidae	<i>Strophurus williamsi</i>	soft-spined gecko		C		9/2
animals	reptiles	Diplodactylidae	<i>Nebulifera robusta</i>	robust velvet gecko		C		7/2
animals	reptiles	Diplodactylidae	<i>Amalosa rhombifer</i>	zig-zag gecko		C		6/4
animals	reptiles	Diplodactylidae	<i>Amalosa lesueurii</i>	Lesueur's velvet gecko		C		1
animals	reptiles	Elapidae	<i>Pseudechis porphyriacus</i>	red-bellied black snake		C		7
animals	reptiles	Elapidae	<i>Suta dwyeri</i>	Dwyer's snake		C		2
animals	reptiles	Elapidae	<i>Pseudechis guttatus</i>	spotted black snake		C		4/1
animals	reptiles	Elapidae	<i>Demansia psammophis</i>	yellow-faced whipsnake		C		3
animals	reptiles	Elapidae	<i>Pseudonaja textilis</i>	eastern brown snake		C		2
animals	reptiles	Elapidae	<i>Hoplocephalus bitorquatus</i>	pale-headed snake		C		2/1
animals	reptiles	Elapidae	<i>Brachyuropsis australis</i>	coral snake		C		2/1
animals	reptiles	Elapidae	<i>Furina diadema</i>	red-naped snake		C		6
animals	reptiles	Elapidae	<i>Vermicella annulata</i>	bandy-bandy		C		1
animals	reptiles	Gekkonidae	<i>Gehyra dubia</i>	dubious dtella		C		7/1
animals	reptiles	Gekkonidae	<i>Heteronotia binoei</i>	Bynoe's gecko		C		30/1
animals	reptiles	Pygopodidae	<i>Delma plebeia</i>	common delma		C		2/2
animals	reptiles	Pygopodidae	<i>Delma sp.</i>			C		1
animals	reptiles	Scincidae	<i>Carlia sp.</i>			C		2
animals	reptiles	Scincidae	<i>Carlia munda</i>	shaded-litter rainbow-skink		C		1/1
animals	reptiles	Scincidae	<i>Carlia vivax</i>	tussock rainbow-skink		C		7/1
animals	reptiles	Scincidae	<i>Ctenotus sp.</i>			C		2
animals	reptiles	Scincidae	<i>Eulamprus sp.</i>			C		1
animals	reptiles	Scincidae	<i>Lerista timida</i>	timid slider		C		4/1
animals	reptiles	Scincidae	<i>Egernia mcphreei</i>	eastern crevice-skink		C		5/3
animals	reptiles	Scincidae	<i>Concinnia tenuis</i>	bar-sided skink		C		3
animals	reptiles	Scincidae	<i>Eulamprus quoyii</i>	eastern water skink		C		10
animals	reptiles	Scincidae	<i>Lerista fragilis</i>	eastern mulch slider		C		3/2
animals	reptiles	Scincidae	<i>Carlia pectoralis</i>	open-litter rainbow skink		C		3
animals	reptiles	Scincidae	<i>Egernia striolata</i>	tree skink		C		21/1
animals	reptiles	Scincidae	<i>Ctenotus spaldingi</i>	straight-browed ctenotus		C		4/1
animals	reptiles	Scincidae	<i>Carlia tetradactyla</i>	southern rainbow-skink		C		5
animals	reptiles	Scincidae	<i>Cryptoblepharus sp.</i>			C		5
animals	reptiles	Scincidae	<i>Egernia cunninghami</i>	Cunningham's skink		C		10/1
animals	reptiles	Scincidae	<i>Lygisaurus foliorum</i>	tree-base litter-skink		C		26/3
animals	reptiles	Scincidae	<i>Morethia boulengeri</i>	south-eastern morethia skink		C		27/4

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animals	reptiles	Scincidae	<i>Ctenotus taeniolatus</i>	copper-tailed skink		C		2
animals	reptiles	Scincidae	<i>Lampropholis delicata</i>	dark-flecked garden sunskink		C		1
animals	reptiles	Scincidae	<i>Cyclodomorphus gerrardii</i>	pink-tongued lizard		C		1
animals	reptiles	Scincidae	<i>Carlia pectoralis sensu lato</i>			C		3
animals	reptiles	Scincidae	<i>Cryptoblepharus pulcher pulcher</i>	elegant snake-eyed skink		C		18/2
animals	reptiles	Scincidae	<i>Cryptoblepharus virgatus sensu lato</i>			C		2
animals	reptiles	Typhlopidae	<i>Anilius ligatus</i>	robust blind snake		C		2
animals	reptiles	Varanidae	<i>Varanus varius</i>	lace monitor		C		53
animals	reptiles	Varanidae	<i>Varanus panoptes</i>	yellow-spotted monitor		C		2
animals	reptiles	Varanidae	<i>Varanus sp.</i>	goanna		C		1
animals	reptiles	Varanidae	<i>Varanus gouldii</i>	sand monitor		C		1
animals	uncertain	Indeterminate	<i>Indeterminate</i>	Unknown or Code Pending				44
fungi	Agaricomycetes	Amanitaceae	<i>Amanita</i>			C		1/1
fungi	Agaricomycetes	Boletaceae	<i>Boletus</i>					1/1
fungi	Agaricomycetes	Hymenochaetaceae	<i>Fomitiporia robusta</i>			C		1/1
fungi	Agaricomycetes	Hymenochaetaceae	<i>Phellinus badius</i>			C		1/1
fungi	Agaricomycetes	Hysterangiaceae	<i>Hysterangium affine</i>			C		1/1
fungi	Agaricomycetes	Panaeolaceae	<i>Panaeolus rickenii</i>			C		1/1
fungi	Agaricomycetes	Panaeolaceae	<i>Panaeolus papilionaceus</i>			C		1/1
fungi	Agaricomycetes	Polyporaceae	<i>Laetiporus portentosus</i>			C		1/1
fungi	Agaricomycetes	Polyporaceae	<i>Polyporus arcularius</i>			C		1/1
fungi	Agaricomycetes	Polyporaceae	<i>Pycnoporus coccineus</i>			C		1/1
fungi	Agaricomycetes	Stereaceae	<i>Stereum ostrea</i>			C		1/1
fungi	lecanoromycetes	Cladoniaceae	<i>Cladia muelleri</i>			C		1/1
fungi	lecanoromycetes	Parmeliaceae	<i>Parmotrema subsumptum</i>			C		1/1
fungi	lecanoromycetes	Parmeliaceae	<i>Flavoparmelia rutidota</i>			C		1/1
fungi	lecanoromycetes	Parmeliaceae	<i>Xanthoparmelia incerta</i>			C		1/1
fungi	lecanoromycetes	Parmeliaceae	<i>Usnea subciliata</i>			C		1/1
fungi	lecanoromycetes	Parmeliaceae	<i>Xanthoparmelia semiviridis</i>			C		1/1
fungi	lecanoromycetes	Parmeliaceae	<i>Xanthoparmelia ballingalliana</i>			C		1/1
fungi	lecanoromycetes	Parmeliaceae	<i>Austroparmelina subtiliacea</i>			C		1/1
fungi	lecanoromycetes	Parmeliaceae	<i>Usnea scabrada subsp. elegans</i>			C		1/1
fungi	lecanoromycetes	Ramboldiaceae	<i>Ramboldia laeta</i>			C		1/1
fungi	lecanoromycetes	Teloschistaceae	<i>Caloplaca rexfilsonii</i>			C		1/1
plants	land plants	Acanthaceae	<i>Rostellularia adscendens</i>			C		1
plants	land plants	Acanthaceae	<i>Brunoniella australis</i>	blue trumpet		C		2/1
plants	land plants	Amaranthaceae	<i>Alternanthera</i>					1/1
plants	land plants	Amaranthaceae	<i>Nyssanthes diffusa</i>	barbed-wire weed		C		1/1
plants	land plants	Anacardiaceae	<i>Schinus molle var. areira</i>	pepper tree	Y			1/1
plants	land plants	Apiaceae	<i>Platysace ericoides</i>	heath platysace		C		2/1
plants	land plants	Apiaceae	<i>Cyclospermum leptophyllum</i>		Y			1/1
plants	land plants	Apiaceae	<i>Centella asiatica</i>			C		1
plants	land plants	Apiaceae	<i>Actinotus gibbonsii</i>	dwarf flannel flower		C		1/1
plants	land plants	Apocynaceae	<i>Carissa ovata</i>	currantbush		C		1
plants	land plants	Apocynaceae	<i>Parsonsia straminea</i>	monkey rope		C		1
plants	land plants	Apocynaceae	<i>Asclepias curassavica</i>	red-head cottonbush	Y			2/2

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plants	land plants	Apocynaceae	<i>Vincetoxicum forsteri</i>			E	E	1/1
plants	land plants	Apocynaceae	<i>Gomphocarpus fruticosus</i>	narrow-leaved cotton bush	Y			1/1
plants	land plants	Apocynaceae	<i>Gomphocarpus physocarpus</i>	balloon cottonbush	Y			1
plants	land plants	Apocynaceae	<i>Parsonsia eucalyptophylla</i>	gargaloo		C		1/1
plants	land plants	Araliaceae	<i>Hydrocotyle acutiloba</i>			C		1/1
plants	land plants	Araliaceae	<i>Hydrocotyle peduncularis</i>			C		1/1
plants	land plants	Aspleniaceae	<i>Asplenium subglandulosum subsp. subglandulosum</i>			C		2/2
plants	land plants	Asteraceae	<i>Cymbonotus lawsonianus</i>	bear's ear		C		1/1
plants	land plants	Asteraceae	<i>Senecio quadridentatus</i>	cotton fireweed		C		1/1
plants	land plants	Asteraceae	<i>Sigesbeckia orientalis</i>	Indian weed		C		1/1
plants	land plants	Asteraceae	<i>Ambrosia artemisiifolia</i>	annual ragweed	Y			1/1
plants	land plants	Asteraceae	<i>Isoetopsis graminifolia</i>	grass cushion		C		1/1
plants	land plants	Asteraceae	<i>Ozothamnus diosmifolius</i>	white dogwood		C		1
plants	land plants	Asteraceae	<i>Triptilodiscus pygmaeus</i>			C		1/1
plants	land plants	Asteraceae	<i>Senecio madagascariensis</i>	fireweed	Y			1/1
plants	land plants	Asteraceae	<i>Chrysocephalum apiculatum</i>	yellow buttons		C		5/3
plants	land plants	Asteraceae	<i>Sigesbeckia australiensis</i>			C		1/1
plants	land plants	Asteraceae	<i>Sphaeromorphaea australis</i>			C		1/1
plants	land plants	Asteraceae	<i>Centipeda minima subsp. minima</i>			C		2/2
plants	land plants	Asteraceae	<i>Vittadinia dissecta var. hirta</i>			C		1/1
plants	land plants	Asteraceae	<i>Coronidium oxylepis subsp. lanatum</i>			C		1/1
plants	land plants	Asteraceae	<i>Leucochrysum albicans var. albicans</i>			C		1/1
plants	land plants	Asteraceae	<i>Cassinia laevis subsp. rosmarinifolia</i>			C		1/1
plants	land plants	Asteraceae	<i>Senecio pinnatifolius var. pinnatifolius</i>			C		1/1
plants	land plants	Asteraceae	<i>Carduus pycnocephalus</i>		Y			1/1
plants	land plants	Asteraceae	<i>Brachyscome multifida</i>			C		1/1
plants	land plants	Asteraceae	<i>Calotis</i>					1
plants	land plants	Asteraceae	<i>Brachyscome</i>					4
plants	land plants	Asteraceae	<i>Bidens pilosa</i>		Y			3
plants	land plants	Asteraceae	<i>Calotis dentex</i>	white burr daisy		C		4/3
plants	land plants	Asteraceae	<i>Cassinia laevis</i>			C		2
plants	land plants	Asteraceae	<i>Cirsium vulgare</i>	spear thistle	Y			2/1
plants	land plants	Asteraceae	<i>Olearia fulgens</i>			C		4/4
plants	land plants	Asteraceae	<i>Bidens bipinnata</i>	bipinnate beggar's ticks	Y			1
plants	land plants	Asteraceae	<i>Olearia ramulosa</i>			C		1/1
plants	land plants	Asteraceae	<i>Zinnia peruviana</i>	wild zinnia	Y			1/1
plants	land plants	Asteraceae	<i>Chondrilla juncea</i>	skeleton weed	Y			1/1
plants	land plants	Asteraceae	<i>Helianthus annuus</i>		Y			1/1
plants	land plants	Asteraceae	<i>Olearia elliptica</i>			C		2
plants	land plants	Asteraceae	<i>Calotis lappulacea</i>	yellow burr daisy		C		2/2
plants	land plants	Asteraceae	<i>Vittadinia sulcata</i>	native daisy		C		2/2
plants	land plants	Asteraceae	<i>Calotis glabrescens</i>			CR		1/1
plants	land plants	Asteraceae	<i>Glossocardia bidens</i>	native cobbler's pegs		C		1
plants	land plants	Asteraceae	<i>Olearia microphylla</i>			C		1/1
plants	land plants	Asteraceae	<i>Senecio tenuiflorus</i>			C		1/1
plants	land plants	Asteraceae	<i>Soliva anthemifolia</i>	dwarf jo jo weed	Y			1/1

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plants	land plants	Asteraceae	<i>Centaurea melitensis</i>	Maltese cockspur	Y			3/3
plants	land plants	Asteraceae	<i>Coreopsis lanceolata</i>		Y			1/1
plants	land plants	Asteraceae	<i>Erigeron bonariensis</i>		Y			1/1
plants	land plants	Asteraceae	<i>Vittadinia pustulata</i>			C		1/1
plants	land plants	Asteraceae	<i>Xanthium occidentale</i>		Y			1/1
plants	land plants	Asteraceae	<i>Gnaphalium polycaulon</i>		Y			1/1
plants	land plants	Asteraceae	<i>Vittadinia constricta</i>			C		1/1
plants	land plants	Asteraceae	<i>Centaurea solstitialis</i>	St. Barnaby's thistle	Y			1/1
plants	land plants	Boraginaceae	<i>Heliotropium amplexicaule</i>	blue heliotrope	Y			5/2
plants	land plants	Brassicaceae	<i>Sisymbrium officinale</i>	hedge mustard	Y			1/1
plants	land plants	Brassicaceae	<i>Sisymbrium orientale</i>	Indian hedge mustard	Y			1/1
plants	land plants	Cactaceae	<i>Opuntia tomentosa</i>	velvety tree pear	Y			9
plants	land plants	Cactaceae	<i>Harrisia martinii</i>		Y			2
plants	land plants	Cactaceae	<i>Opuntia stricta</i>		Y			12/1
plants	land plants	Cactaceae	<i>Opuntia</i>					4
plants	land plants	Caesalpiniaceae	<i>Senna aciphylla</i>	Australian senna		C		4/4
plants	land plants	Caesalpiniaceae	<i>Senna barclayana</i>			C		1/1
plants	land plants	Caesalpiniaceae	<i>Senna artemisioides subsp. coriacea</i>			C		1
plants	land plants	Caesalpiniaceae	<i>Senna artemisioides subsp. zygophylla</i>			C		1/1
plants	land plants	Campanulaceae	<i>Isotoma fluviatilis subsp. borealis</i>			C		1/1
plants	land plants	Campanulaceae	<i>Wahlenbergia gracilis</i>	sprawling bluebell		C		6/1
plants	land plants	Campanulaceae	<i>Lobelia</i>					1
plants	land plants	Campanulaceae	<i>Lobelia purpurascens</i>	white root		C		3/1
plants	land plants	Capparaceae	<i>Capparis canescens</i>			C		1/1
plants	land plants	Capparaceae	<i>Capparis mitchellii</i>			C		2/2
plants	land plants	Caryophyllaceae	<i>Stellaria angustifolia subsp. angustifolia</i>			C		1/1
plants	land plants	Casuarinaceae	<i>Allocasuarina luehmannii</i>	bull oak		C		5
plants	land plants	Casuarinaceae	<i>Allocasuarina</i>					1
plants	land plants	Casuarinaceae	<i>Allocasuarina torulosa</i>			C		1
plants	land plants	Casuarinaceae	<i>Allocasuarina inophloia</i>			C		1
plants	land plants	Casuarinaceae	<i>Casuarina cunninghamiana subsp. cunninghamiana</i>			C		1/1
plants	land plants	Celastraceae	<i>Denhamia silvestris</i>			C		1
plants	land plants	Chenopodiaceae	<i>Einadia</i>					1
plants	land plants	Chenopodiaceae	<i>Maireana microphylla</i>			C		3/2
plants	land plants	Chenopodiaceae	<i>Einadia trigonos subsp. stellulata</i>			C		1/1
plants	land plants	Chenopodiaceae	<i>Dysphania glomulifera subsp. glomulifera</i>			C		1/1
plants	land plants	Clusiaceae	<i>Hypericum gramineum</i>			C		3
plants	land plants	Colchicaceae	<i>Wurmbea biglandulosa subsp. biglandulosa</i>			C		1/1
plants	land plants	Commelinaceae	<i>Commelina</i>					1
plants	land plants	Crassulaceae	<i>Bryophyllum delagoense</i>		Y			2/1
plants	land plants	Cupressaceae	<i>Callitris endlicheri</i>	black cypress pine		C		9/1
plants	land plants	Cupressaceae	<i>Callitris glaucophylla</i>	white cypress pine		C		6/1
plants	land plants	Cupressaceae	<i>Callitris glaucophylla x Callitris verrucosa</i>			C		2
plants	land plants	Cyperaceae	<i>Cyperus gracilis</i>			C		1/1
plants	land plants	Cyperaceae	<i>Cyperus difformis</i>	rice sedge		C		1/1
plants	land plants	Cyperaceae	<i>Cyperus aggregatus</i>		Y			1/1

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plants	land plants	Cyperaceae	<i>Cyperus eragrostis</i>		Y			1/1
plants	land plants	Cyperaceae	<i>Cyperus brevifolius</i>	Mullumbimby couch	Y			1/1
plants	land plants	Cyperaceae	<i>Lepidosperma laterale</i>			C		2/1
plants	land plants	Cyperaceae	<i>Carex appressa</i>			C		1/1
plants	land plants	Cyperaceae	<i>Cyperus gunnii</i> subsp. <i>gunnii</i>			C		1/1
plants	land plants	Cyperaceae	<i>Cyperus polystachyos</i> var. <i>polystachyos</i>			C		1/1
plants	land plants	Cyperaceae	<i>Fimbristylis</i> sp. (Thargomindah D.E.Boyland 3094)			C		3
plants	land plants	Cyperaceae	<i>Gahnia aspera</i>			C		2
plants	land plants	Cyperaceae	<i>Cyperus</i>					1
plants	land plants	Cyperaceae	<i>Carex</i>					2
plants	land plants	Cyperaceae	<i>Fimbristylis dichotoma</i>	common fringe-rush		C		2/1
plants	land plants	Dilleniaceae	<i>Hibbertia linearis</i> var. <i>obtusifolia</i>			C		2/1
plants	land plants	Droseraceae	<i>Drosera hookeri</i>			C		1/1
plants	land plants	Elatinaceae	<i>Elatine gratioloides</i>	waterwort		C		1/1
plants	land plants	Ericaceae	<i>Leucopogon</i>					1
plants	land plants	Ericaceae	<i>Lissanthe pluriloculata</i>			C		3/2
plants	land plants	Ericaceae	<i>Brachyloma daphnoides</i>			C		1
plants	land plants	Ericaceae	<i>Melichrus urceolatus</i>	honey gorse		C		4/1
plants	land plants	Ericaceae	<i>Lissanthe strigosa</i> subsp. <i>subulata</i>			C		2/2
plants	land plants	Ericaceae	<i>Styphelia mutica</i>			C		3/2
plants	land plants	Euphorbiaceae	<i>Beyeria viscosa</i>			C		1/1
plants	land plants	Euphorbiaceae	<i>Manihot grahamii</i>		Y			1/1
plants	land plants	Euphorbiaceae	<i>Euphorbia peplus</i>	petty spurge	Y			1/1
plants	land plants	Euphorbiaceae	<i>Euphorbia hirta</i>		Y			2/2
plants	land plants	Fabaceae	<i>Pultenaea foliolosa</i>			C		4/4
plants	land plants	Fabaceae	<i>Pultenaea boormanii</i>	durikai bush pea		C		1/1
plants	land plants	Fabaceae	<i>Swainsona reticulata</i>			C		1/1
plants	land plants	Fabaceae	<i>Chorizema parviflorum</i>	eastern flame pea		C		1/1
plants	land plants	Fabaceae	<i>Daviesia genistifolia</i>	broom bitter pea		C		3/2
plants	land plants	Fabaceae	<i>Desmodium brachypodium</i>	large ticktrefoil		C		1/1
plants	land plants	Fabaceae	<i>Hardenbergia violacea</i>			C		2/1
plants	land plants	Fabaceae	<i>Swainsona galegifolia</i>	smooth Darling pea		C		6/6
plants	land plants	Fabaceae	<i>Templetonia stenophylla</i>	leafy templetonia		C		1/1
plants	land plants	Fabaceae	<i>Gompholobium aspalathoides</i>			C		1/1
plants	land plants	Fabaceae	<i>Zornia dyctiocarpa</i> var. <i>dyctiocarpa</i>			C		1/1
plants	land plants	Fabaceae	<i>Trifolium tomentosum</i> var. <i>tomentosum</i>	woolly clover	Y			1/1
plants	land plants	Fabaceae	<i>Daviesia ulicifolia</i> subsp. <i>ulicifolia</i>			C		2/2
plants	land plants	Fabaceae	<i>Indigofera australis</i> subsp. <i>australis</i>			C		2/2
plants	land plants	Fabaceae	<i>Trifolium angustifolium</i> var. <i>angustifolium</i>		Y			1/1
plants	land plants	Fabaceae	<i>Hovea</i>					1
plants	land plants	Fabaceae	<i>Glycine</i>					2
plants	land plants	Fabaceae	<i>Desmodium</i>					1
plants	land plants	Fabaceae	<i>Swainsona</i>					2
plants	land plants	Fabaceae	<i>Hovea lorata</i>			C		1/1
plants	land plants	Fabaceae	<i>Lotus australis</i>	Australian trefoil		C		2/2
plants	land plants	Fabaceae	<i>Glycine tabacina</i>	glycine pea		C		1/1

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plants	land plants	Fabaceae	<i>Hovea lanceolata</i>			C		1
plants	land plants	Fabaceae	<i>Dillwynia sieberi</i>			C		6/6
plants	land plants	Fabaceae	<i>Hovea heterophylla</i>			C		1/1
plants	land plants	Fabaceae	<i>Indigofera baileyi</i>			C		1/1
plants	land plants	Fabaceae	<i>Jacksonia scoparia</i>			C		2
plants	land plants	Fabaceae	<i>Pultenaea paleacea</i>			C		1/1
plants	land plants	Fabaceae	<i>Swainsona oroboides</i>	variable swainsona		C		1/1
plants	land plants	Gentianaceae	<i>Centaurium</i>					1
plants	land plants	Gentianaceae	<i>Centaurium tenuiflorum</i>		Y			2/1
plants	land plants	Gentianaceae	<i>Centaurium erythraea</i>	common centaury	Y			2/2
plants	land plants	Geraniaceae	<i>Geranium</i>					3
plants	land plants	Goodeniaceae	<i>Goodenia pinnatifida</i>			C		1/1
plants	land plants	Goodeniaceae	<i>Velleia paradoxa</i>	spur velleia		C		2/2
plants	land plants	Goodeniaceae	<i>Goodenia sp. (Mt Castletower M.D.Crisp 2753)</i>			C		5
plants	land plants	Goodeniaceae	<i>Goodenia bellidifolia subsp. argentea</i>			C		1/1
plants	land plants	Goodeniaceae	<i>Goodenia rotundifolia</i>			C		1
plants	land plants	Haloragaceae	<i>Myriophyllum crispatum</i>			C		1/1
plants	land plants	Hemerocallidaceae	<i>Stypandra glauca</i>	nodding blue lily		C		2/2
plants	land plants	Hemerocallidaceae	<i>Dianella brevipedunculata</i>			C		1/1
plants	land plants	Hemerocallidaceae	<i>Dianella</i>					1
plants	land plants	Hemerocallidaceae	<i>Dianella revoluta var. revoluta</i>			C		1
plants	land plants	Hydrocharitaceae	<i>Vallisneria nana</i>			C		1
plants	land plants	Hydrocharitaceae	<i>Ottelia ovalifolia subsp. ovalifolia</i>			C		1/1
plants	land plants	Hydrocharitaceae	<i>Ottelia ovalifolia subsp. chrysobasis</i>			C		1
plants	land plants	Juncaceae	<i>Juncus usitatus</i>			C		1/1
plants	land plants	Juncaceae	<i>Juncus sp. (Nindigully R.Roe AQ139509)</i>			C		3
plants	land plants	Juncaceae	<i>Juncus psammophilus</i>			C		1/1
plants	land plants	Juncaceae	<i>Juncus homalocaulis</i>	wiry rush		C		1/1
plants	land plants	Lamiaceae	<i>Salvia reflexa</i>		Y			1/1
plants	land plants	Lamiaceae	<i>Ajuga australis</i>	Australian bugle		C		2
plants	land plants	Lamiaceae	<i>Mentha satureioides</i>	native pennyroyal		C		1
plants	land plants	Lamiaceae	<i>Prostanthera cryptandroides subsp. euphrasioides</i>			C		4/3
plants	land plants	Lamiaceae	<i>Teucrium corymbosum</i>	forest germander		C		3/3
plants	land plants	Lamiaceae	<i>Marrubium vulgare</i>	white horehound	Y			2/1
plants	land plants	Laxmanniaceae	<i>Thysanotus tuberosus</i>			C		1
plants	land plants	Laxmanniaceae	<i>Lomandra longifolia</i>			C		2/1
plants	land plants	Laxmanniaceae	<i>Lomandra filiformis</i>			C		1/1
plants	land plants	Laxmanniaceae	<i>Laxmannia gracilis</i>	slender wire lily		C		2/1
plants	land plants	Laxmanniaceae	<i>Lomandra</i>					11/6
plants	land plants	Laxmanniaceae	<i>Lomandra multiflora</i>			C		1
plants	land plants	Leucobryaceae	<i>Campylopus introflexus</i>			C		1/1
plants	land plants	Loranthaceae	<i>Amyema linophylla subsp. orientalis</i>			C		1/1
plants	land plants	Loranthaceae	<i>Amyema miraculosa subsp. boormanii</i>			C		1/1
plants	land plants	Loranthaceae	<i>Amyema miquelii</i>			C		2/2
plants	land plants	Malvaceae	<i>Pavonia hastata</i>	pink pavonia	Y			2/2
plants	land plants	Malvaceae	<i>Sida sp. (Aramac E.J.Thompson+ JER192)</i>			C		1/1

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plants	land plants	Malvaceae	<i>Sida hackettiana</i>			C		2/2
plants	land plants	Malvaceae	<i>Malva parviflora</i>	small-flowered mallow	Y			1/1
plants	land plants	Mimosaceae	<i>Acacia</i>					3
plants	land plants	Mimosaceae	<i>Acacia crassa</i>			C		20
plants	land plants	Mimosaceae	<i>Acacia deanei</i>			C		4/3
plants	land plants	Mimosaceae	<i>Acacia implexa</i>	lightwood		C		2/1
plants	land plants	Mimosaceae	<i>Acacia lineata</i>	streaked wattle		C		11/9
plants	land plants	Mimosaceae	<i>Acacia montana</i>			C		11/7
plants	land plants	Mimosaceae	<i>Acacia caroleae</i>			C		4/3
plants	land plants	Mimosaceae	<i>Acacia irrorata</i>			C		1
plants	land plants	Mimosaceae	<i>Acacia fimbriata</i>	Brisbane golden wattle		C		8/6
plants	land plants	Mimosaceae	<i>Acacia leiocalyx</i>			C		1
plants	land plants	Mimosaceae	<i>Acacia monticola</i>			C		1
plants	land plants	Mimosaceae	<i>Acacia flexifolia</i>			C		2/2
plants	land plants	Mimosaceae	<i>Acacia ixiophylla</i>			C		6/5
plants	land plants	Mimosaceae	<i>Acacia neriifolia</i>	pechey wattle		C		1/1
plants	land plants	Mimosaceae	<i>Acacia polybotrya</i>	western silver wattle		C		5/4
plants	land plants	Mimosaceae	<i>Acacia pravifolia</i>	coil-pod wattle		C		1
plants	land plants	Mimosaceae	<i>Acacia semilunata</i>	crescent-leaved wattle		C		1/1
plants	land plants	Mimosaceae	<i>Acacia harpophylla</i>	brigalow		C		1/1
plants	land plants	Mimosaceae	<i>Acacia verniciflua</i>	varnished wattle		C		2/1
plants	land plants	Mimosaceae	<i>Acacia resinicostata</i>			C		3/3
plants	land plants	Mimosaceae	<i>Acacia chinchillensis</i>			C		1/1
plants	land plants	Mimosaceae	<i>Acacia crassa subsp. crassa</i>			C		1/1
plants	land plants	Mimosaceae	<i>Acacia irrorata subsp. irrorata</i>			C		1/1
plants	land plants	Mimosaceae	<i>Acacia leiocalyx subsp. leiocalyx</i>			C		1/1
plants	land plants	Mimosaceae	<i>Acacia penninervis var. penninervis</i>			C		10/8
plants	land plants	Mimosaceae	<i>Acacia leucoclada subsp. argentifolia</i>			C		1
plants	land plants	Myrsinaceae	<i>Lysimachia arvensis</i>		Y			1/1
plants	land plants	Myrtaceae	<i>Corymbia citriodora</i>	spotted gum		C		1
plants	land plants	Myrtaceae	<i>Eucalyptus dealbata</i>	tumble-down red gum		C		12/5
plants	land plants	Myrtaceae	<i>Eucalyptus populnea</i>	poplar box		C		1
plants	land plants	Myrtaceae	<i>Eucalyptus rhombica</i>			C		4/4
plants	land plants	Myrtaceae	<i>Eucalyptus youmanii</i>	Youman's stringybark		C		1/1
plants	land plants	Myrtaceae	<i>Angophora floribunda</i>	rough-barked apple		C		5
plants	land plants	Myrtaceae	<i>Eucalyptus moluccana</i>	gum-topped box		C		13/7
plants	land plants	Myrtaceae	<i>Leptospermum madidum</i>			C		1
plants	land plants	Myrtaceae	<i>Eucalyptus melliodora</i>	yellow box		C		20/11
plants	land plants	Myrtaceae	<i>Eucalyptus microcarpa</i>	inland grey box		C		1
plants	land plants	Myrtaceae	<i>Leptospermum brevipes</i>			C		2/2
plants	land plants	Myrtaceae	<i>Eucalyptus chloroclada</i>	Baradine red gum		C		3/1
plants	land plants	Myrtaceae	<i>Eucalyptus tereticornis</i>			C		5
plants	land plants	Myrtaceae	<i>Melaleuca diosmatifolia</i>	mauve honey myrtle		C		2/1
plants	land plants	Myrtaceae	<i>Melaleuca trichostachya</i>			C		1/1
plants	land plants	Myrtaceae	<i>Eucalyptus apothalassica</i>			C		3/3
plants	land plants	Myrtaceae	<i>Leptospermum microcarpum</i>	small-fruited tea-tree		C		4/3

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plants	land plants	Myrtaceae	<i>Leptospermum brachyandrum</i>	weeping tea-tree		C		2/2
plants	land plants	Myrtaceae	<i>Leptospermum polygalifolium</i>	tantoon		C		1/1
plants	land plants	Myrtaceae	<i>Kunzea opposita</i> var. <i>opposita</i>			C		1/1
plants	land plants	Myrtaceae	<i>Eucalyptus caleyi</i> subsp. <i>caleyi</i>			C		9/8
plants	land plants	Myrtaceae	<i>Melaleuca linearis</i> var. <i>linearis</i>			C		1/1
plants	land plants	Myrtaceae	<i>Eucalyptus fibrosa</i> subsp. <i>fibrosa</i>			C		10/4
plants	land plants	Myrtaceae	<i>Eucalyptus fibrosa</i> subsp. <i>nubilis</i>			C		1
plants	land plants	Myrtaceae	<i>Corymbia citriodora</i> subsp. <i>variegata</i>			C		6/2
plants	land plants	Myrtaceae	<i>Eucalyptus sideroxylon</i> subsp. <i>sideroxylon</i>			C		6/2
plants	land plants	Myrtaceae	<i>Eucalyptus tereticornis</i> subsp. <i>tereticornis</i>			C		1/1
plants	land plants	Myrtaceae	<i>Leptospermum</i>					1
plants	land plants	Myrtaceae	<i>Melaleuca decora</i>			C		7/5
plants	land plants	Myrtaceae	<i>Melaleuca nodosa</i>			C		2/2
plants	land plants	Myrtaceae	<i>Eucalyptus albens</i>	white box		C		5/4
plants	land plants	Myrtaceae	<i>Eucalyptus bakeri</i>	Baker's mallee		C		10/8
plants	land plants	Myrtaceae	<i>Eucalyptus crebra</i>	narrow-leaved red ironbark		C		40/6
plants	land plants	Myrtaceae	<i>Eucalyptus infera</i>	Durikai mallee		V	V	27/23
plants	land plants	Myrtaceae	<i>Melaleuca sabrina</i>			C		3/3
plants	land plants	Myrtaceae	<i>Eucalyptus exserta</i>	Queensland peppermint		C		1
plants	land plants	Myrtaceae	<i>Eucalyptus terrica</i>			C		50/20
plants	land plants	Myrtaceae	<i>Eucalyptus viridis</i>			C		15/13
plants	land plants	Myrtaceae	<i>Melaleuca uncinata</i>			C		1
plants	land plants	Myrtaceae	<i>Angophora leiocarpa</i>	rusty gum		C		6
plants	land plants	Nyctaginaceae	<i>Boerhavia dominii</i>			C		1/1
plants	land plants	Oleaceae	<i>Ligustrum lucidum</i>	large-leaved privet	Y			1
plants	land plants	Oleaceae	<i>Notelaea microcarpa</i>			C		3
plants	land plants	Onagraceae	<i>Ludwigia peploides</i> subsp. <i>montevidensis</i>			C		1/1
plants	land plants	Orchidaceae	<i>Pterostylis bicolor</i>			C		1/1
plants	land plants	Orchidaceae	<i>Cymbidium canaliculatum</i>			C		4/2
plants	land plants	Orchidaceae	<i>Dipodium variegatum</i>			C		1/1
plants	land plants	Orchidaceae	<i>Diuris parvipetala</i>			V		1/1
plants	land plants	Orchidaceae	<i>Caladenia fuscata</i>			C		1/1
plants	land plants	Orchidaceae	<i>Pterostylis daintreana</i>			C		1/1
plants	land plants	Oxalidaceae	<i>Oxalis perennans</i>			C		1/1
plants	land plants	Papaveraceae	<i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	Mexican poppy	Y			2/1
plants	land plants	Phyllanthaceae	<i>Phyllanthus occidentalis</i>			C		2/1
plants	land plants	Phyllanthaceae	<i>Phyllanthus virgatus</i>			C		1/1
plants	land plants	Phytolaccaceae	<i>Phytolacca octandra</i>	inkweed	Y			1/1
plants	land plants	Pittosporaceae	<i>Pittosporum angustifolium</i>			C		2/1
plants	land plants	Pittosporaceae	<i>Bursaria spinosa</i> subsp. <i>spinosa</i>			C		2/1
plants	land plants	Plantaginaceae	<i>Callitriche sonderi</i>			C		1/1
plants	land plants	Plantaginaceae	<i>Plantago debilis</i>	shade plantain		C		1/1
plants	land plants	Plantaginaceae	<i>Veronica arenaria</i>			C		2/2
plants	land plants	Plantaginaceae	<i>Plantago cunninghamii</i>	sago weed		C		2/2
plants	land plants	Plantaginaceae	<i>Gratiola pedunculata</i>			C		2/2
plants	land plants	Poaceae	<i>Aristida echinata</i>			C		1/1

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plants	land plants	Poaceae	<i>Megathyrsus maximus var. pubiglumis</i>		Y			1/1
plants	land plants	Poaceae	<i>Austrostipa scabra subsp. falcata</i>			C		1/1
plants	land plants	Poaceae	<i>Austrostipa scabra subsp. scabra</i>			C		2/2
plants	land plants	Poaceae	<i>Cynodon dactylon var. dactylon</i>		Y			1/1
plants	land plants	Poaceae	<i>Aristida jerichoensis var. subspinulifera</i>			C		1/1
plants	land plants	Poaceae	<i>Panicum</i>					1
plants	land plants	Poaceae	<i>Poaceae</i>					1
plants	land plants	Poaceae	<i>Setaria</i>					3
plants	land plants	Poaceae	<i>Aristida</i>					7
plants	land plants	Poaceae	<i>Entolasia</i>					1
plants	land plants	Poaceae	<i>Eragrostis</i>					1
plants	land plants	Poaceae	<i>Avena fatua</i>	wild oats	Y			1/1
plants	land plants	Poaceae	<i>Eulalia aurea</i>	silky browntop		C		1/1
plants	land plants	Poaceae	<i>Aira cupaniana</i>		Y			1/1
plants	land plants	Poaceae	<i>Chloris gayana</i>	rhodes grass	Y			1/1
plants	land plants	Poaceae	<i>Melinis repens</i>	red natal grass	Y			1/1
plants	land plants	Poaceae	<i>Aristida vagans</i>				C	1/1
plants	land plants	Poaceae	<i>Digitaria minima</i>				C	1/1
plants	land plants	Poaceae	<i>Dichanthium sericeum subsp. sericeum</i>				C	1/1
plants	land plants	Poaceae	<i>Hyparrhenia hirta</i>	coolati grass	Y			5/5
plants	land plants	Poaceae	<i>Sorghum halepense</i>	Johnson grass	Y			1/1
plants	land plants	Poaceae	<i>Aristida personata</i>				C	1/1
plants	land plants	Poaceae	<i>Digitaria diminuta</i>				C	1/1
plants	land plants	Poaceae	<i>Echinopogon ovatus</i>				C	1/1
plants	land plants	Poaceae	<i>Eragrostis curvula</i>		Y			1/1
plants	land plants	Poaceae	<i>Paspalum dilatatum</i>	paspalum	Y			1/1
plants	land plants	Poaceae	<i>Paspalum distichum</i>	water couch	Y			1/1
plants	land plants	Poaceae	<i>Rostraria cristata</i>	annual cat's tail	Y			1/1
plants	land plants	Poaceae	<i>Dichelachne crinita</i>	longhair plumegrass			C	3
plants	land plants	Poaceae	<i>Eleusine tristachya</i>	goose grass	Y			1/1
plants	land plants	Poaceae	<i>Paspalidium distans</i>	shotgrass			C	1/1
plants	land plants	Poaceae	<i>Cymbopogon refractus</i>	barbed-wire grass			C	3
plants	land plants	Poaceae	<i>Rytidosperma tenuius</i>				C	2/2
plants	land plants	Poaceae	<i>Dichanthium aristatum</i>	angleton grass	Y			1/1
plants	land plants	Poaceae	<i>Dichelachne micrantha</i>	shorthair plumegrass			C	1/1
plants	land plants	Poaceae	<i>Entolasia minutifolia</i>				C	1/1
plants	land plants	Poaceae	<i>Aristida caput-medusae</i>				C	6/1
plants	land plants	Poaceae	<i>Enteropogon acicularis</i>	curly windmill grass			C	3/2
plants	land plants	Poaceae	<i>Eragrostis trichophora</i>		Y			2/2
plants	land plants	Poaceae	<i>Rytidosperma racemosum</i>				C	1/1
plants	land plants	Poaceae	<i>Ancistrachne uncinulata</i>	hooky grass			C	1
plants	land plants	Poaceae	<i>Aristida leichhardtiana</i>				C	2/2
plants	land plants	Poaceae	<i>Rytidosperma bipartitum</i>				C	1
plants	land plants	Poaceae	<i>Rytidosperma longifolium</i>				C	2/2
plants	land plants	Poaceae	<i>Sporobolus coromandelianus</i>		Y			1/1
plants	land plants	Polygonaceae	<i>Rumex brownii</i>	swamp dock			C	1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Potamogetonaceae	<i>Potamogeton tricarinatus</i>	floating pondweed		C		1/1
plants	land plants	Proteaceae	<i>Hakea eriantha</i>			C		1/1
plants	land plants	Pteridaceae	<i>Cheilanthes sieberi subsp. sieberi</i>			C		9/1
plants	land plants	Ptychomitriaceae	<i>Ptychomitrium australe</i>			C		1/1
plants	land plants	Ranunculaceae	<i>Clematis microphylla</i>			C		1/1
plants	land plants	Ranunculaceae	<i>Clematis decipiens</i>			C		2/2
plants	land plants	Ranunculaceae	<i>Ranunculus lappaceus</i>	common buttercup		C		1/1
plants	land plants	Ranunculaceae	<i>Ranunculus sessiliflorus var. sessiliflorus</i>			C		1/1
plants	land plants	Rhamnaceae	<i>Cryptandra longistaminea</i>			C		3/3
plants	land plants	Rhamnaceae	<i>Pomaderris coomingalensis</i>			E		3/3
plants	land plants	Rhamnaceae	<i>Cryptandra armata</i>			C		1/1
plants	land plants	Rosaceae	<i>Cydonia oblonga</i>		Y			1/1
plants	land plants	Rosaceae	<i>Malus domestica</i>		Y			1/1
plants	land plants	Rosaceae	<i>Prunus persica var. persica</i>		Y			1/1
plants	land plants	Rosaceae	<i>Prunus</i>					1/1
plants	land plants	Rosaceae	<i>Rosa canina</i>		Y			1/1
plants	land plants	Rubiaceae	<i>Asperula conferta</i>			C		1/1
plants	land plants	Rubiaceae	<i>Pomax umbellata</i>			C		4
plants	land plants	Rubiaceae	<i>Opercularia diphylla</i>			C		2/2
plants	land plants	Rutaceae	<i>Geijera parviflora</i>	wilga		C		1/1
plants	land plants	Rutaceae	<i>Cyanothamnus occidentalis</i>			C		1/1
plants	land plants	Rutaceae	<i>Cyanothamnus quadrangulus</i>			C		1
plants	land plants	Rutaceae	<i>Phebalium squamulosum subsp. gracile</i>			C		2/2
plants	land plants	Rutaceae	<i>Zieria aspalathoides subsp. aspalathoides</i>			C		1/1
plants	land plants	Santalaceae	<i>Exocarpos aphyllus</i>	leafless ballart		C		1/1
plants	land plants	Santalaceae	<i>Exocarpos cupressiformis</i>	native cherry		C		3/1
plants	land plants	Sapindaceae	<i>Dodonaea viscosa subsp. spatulata</i>			C		1/1
plants	land plants	Sapindaceae	<i>Dodonaea triangularis</i>			C		4/1
plants	land plants	Sapindaceae	<i>Dodonaea viscosa subsp. angustissima</i>			C		1
plants	land plants	Sapindaceae	<i>Dodonaea</i>					1
plants	land plants	Sapindaceae	<i>Dodonaea sinuolata subsp. sinuolata</i>			C		1/1
plants	land plants	Sapindaceae	<i>Dodonaea viscosa subsp. angustifolia</i>			C		2/2
plants	land plants	Sapindaceae	<i>Dodonaea heteromorpha</i>			C		2/2
plants	land plants	Simaroubaceae	<i>Ailanthus altissima</i>	tree-of-heaven	Y			1/1
plants	land plants	Solanaceae	<i>Solanum pseudocapsicum</i>	Madeira winter cherry	Y			1/1
plants	land plants	Solanaceae	<i>Solanum nemophilum</i>			C		12/4
plants	land plants	Solanaceae	<i>Solanum americanum</i>		Y			1/1
plants	land plants	Solanaceae	<i>Solanum amblymerum</i>			C		3/3
plants	land plants	Solanaceae	<i>Solanum aviculare</i>	kangaroo apple		C		1/1
plants	land plants	Solanaceae	<i>Solanum cinereum</i>	Narrawa burr		C		2/2
plants	land plants	Solanaceae	<i>Solanum opacum</i>	green berry nightshade		C		1/1
plants	land plants	Solanaceae	<i>Solanum nigrum</i>		Y			1/1
plants	land plants	Solanaceae	<i>Solanum</i>					1
plants	land plants	Tamaricaceae	<i>Tamarix aphylla</i>	athel pine	Y			1
plants	land plants	Thymelaeaceae	<i>Pimelea neoanglica</i>	poison pimelea		C		10/2
plants	land plants	Thymelaeaceae	<i>Pimelea linifolia</i>			C		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records	
plants	land plants	Ulmaceae	<i>Celtis sinensis</i>	Chinese elm	Y			1	
plants	land plants	Verbenaceae	<i>Lantana camara</i>	lantana	Y			2	
plants	land plants	Verbenaceae	<i>Phyla canescens</i>		Y			1/1	
plants	land plants	Verbenaceae	<i>Verbena incompta</i>		Y			1/1	
plants	land plants	Verbenaceae	<i>Verbena bonariensis</i>	purpletop	Y			1	
plants	land plants	Verbenaceae	<i>Verbena litoralis var. litoralis</i>		Y			1/1	
plants	land plants	Violaceae	<i>Pigea stellarioides</i>				C	1	
plants	land plants	Xanthorrhoeaceae	<i>Xanthorrhoea johnsonii</i>				C	2	
plants	land plants	Zamiaceae	<i>Macrozamia conferta</i>				V	V	55/21
plants	land plants	Zamiaceae	<i>Macrozamia pauli-guilielmi</i>				E	E	1
plants	land plants	Zamiaceae	<i>Macrozamia machinii</i>				V	V	1/1

CODES

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

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

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

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

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

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

Appendix C

**Fauna species identified during field
survey**

Species name	Common name	Status		Survey		
		NC Act	EPBC Act	AECOM 2011/12	EHP 2017	GHD 2018/19
Amphibians						
<i>Crinia signifera</i>	Common eastern froglet	LC	-			2
<i>Litoria rubella</i>	Desert tree frog	LC				4
<i>Litoria fallax</i>	Eastern dwarf tree frog	LC	-			2
<i>Litoria caerulea</i>	Green tree frog	LC	-			2
<i>Litoria peronii</i>	Peron's tree frog	LC	-			3
<i>Limnodynastes peronii</i>	Striped marsh frog	LC	-			4
Birds						
<i>Struthxidea cinerea</i>	Apostlebird	LC	-		X	8
<i>Sphecotheres viridis</i>	Australasian figbird	LC	-			4
<i>Tachyxbaptus novaehollandiae</i>	Australasian grebe	LC	-		X	1
<i>Cracticus tibicen</i>	Australian magpie	LC	-		X	6
<i>Aegotheles cristatus</i>	Australian owl-nightjar	LC	-			1
<i>Anthus novaeseelandiae</i>	Australasian pipit	LC	-		X	3
<i>Geopelia humeralis</i>	Bar-shouldered dove	LC	-		X	1
<i>Melithreptus gularis</i>	Black-chinned honeyeater	LC	-	X		
<i>Coracina novaehollandiae</i>	Black-faced cuckoo-shrike	LC	-			2
<i>Artamus cinereus</i>	Black-faced woodswallow	LC	-			12
<i>Entomyzon cyanotis</i>	Blue-faced honeyeater	LC	-			4
<i>Lichmera indistincta</i>	Brown honeyeater	LC	-			5
<i>Melithreptus brevirostris</i>	Brown-headed honeyeater	LC	-			8
<i>Cincloramphus cruralis</i>	Brown songlark	LC	-			4
<i>Acanthiza pusilla</i>	Brown thornbill	LC	-			5
<i>Climacteris picumnus</i>	Brown treecreeper	LC	-			4
<i>Coturnix ypsilophora</i>	Brown quail	LC	-			2
<i>Cacomantis variolosus</i>	Brush cuckoo	LC	-			1
<i>Acanthiza reguloides</i>	Buff-rumped thornbill	LC	-			8
<i>Scythrops novaehollandiae</i>	Channel-billed cuckoo	LC	-			1
<i>Coracina tenuirostris</i>	Cicadabird	LC	-		X	2
<i>Phaps chalcoptera</i>	Common bronzewing	LC	-		X	8
<i>Ocyphaps lophotes</i>	Crested pigeon	LC	-		X	4
<i>Platycercus elegans</i>	Crimson rosella	LC	-			2
<i>Geopelia cuneata</i>	Diamond dove	LC	-			6
<i>Stagonopleura guttata</i>	Diamond firetail	LC	-		X	
<i>Eurystomus orientalis</i>	Dollarbird	LC	-			1
<i>Taeniopygia bichenovii</i>	Double-barred finch	LC	-		X	5
<i>Platycercus eximius</i>	Eastern rosella	LC	-		X	4
<i>Eopsaltria australis</i>	Eastern yellow robin	LC	-		X	1

Species name	Common name	Status		Survey		
		NC Act	EPBC Act	AECOM 2011/12	EHP 2017	GHD 2018/19
<i>Cacomantis flabelliformis</i>	Fan-tailed cuckoo	LC	-			2
<i>Todiramphus macleayii</i>	Forest kingfisher	LC	-			2
<i>Lichenostomus fuscus</i>	Fuscous honeyeater	LC	-			4
<i>Eolophus roseicapilla</i>	Galah	LC	-		X	5
<i>Pachycephala pectoralis</i>	Golden whistler	LC				2
<i>Cracticus torquatus</i>	Grey butcherbird	LC	-		X	10
<i>Pomatostomus temporalis</i>	Grey crowned babbler	LC	-		X	4
<i>Rhipidura albiscapa</i>	Grey fantail	LC	-		X	1
<i>Colluricincla harmonica</i>	Grey shrike-thrush	LC	-		X	3
<i>Coracina maxima</i>	Ground cuckoo-shrike	LC				2
<i>Chalcites basalis</i>	Horsfield's bronze cuckoo	LC	-			2
<i>Microeca fascinans</i>	Jacky winter	LC	-		X	2
<i>Dacelo novaeguineae</i>	Laughing kookaburra	LC	-		X	6
<i>Myiagra rubecula</i>	Leaden flycatcher	LC	-			6
<i>Meliphaga lewinii</i>	Lewin's honeyeater	LC	-			6
<i>Philemon citreogularis</i>	Little friarbird	LC	-		X	7
<i>Glossopsitta pusilla</i>	Little lorikeet	LC	-			25
<i>Grallina cyanoleuca</i>	Magpie-lark	LC	-		X	4
<i>Vanellus miles</i>	Masked lapwing	LC	-		X	2
<i>Artamus personatus</i>	Masked woodswallow	LC	-			6
<i>Dicaeum hirundinaceum</i>	Mistletoebird	LC	-			5
<i>Philemon corniculatus</i>	Noisy friarbird	LC	-		X	8
<i>Manorina melanocephala</i>	Noisy miner	LC	-		X	10
<i>Anas superciliosa</i>	Pacific black duck	LC	-		X	2
<i>Platycercus adscitus</i>	Pale-headed rosella	LC	-			4
<i>Cacomantis pallidus</i>	Pallid cuckoo	LC	-		X	2
<i>Geopelia striata</i>	Peaceful dove	LC	-		X	7
<i>Centropus phasianinus</i>	Pheasant coucal	LC	-			2
<i>Cracticus nigrogularis</i>	Pied butcherbird	LC	-			2
<i>Trichoglossus haematodus</i>	Rainbow lorikeet	LC	-			15
<i>Malurus melanocephalus</i>	Red-backed fairy-wren	LC	-			4
<i>Myiagra inquieta</i>	Restless flycatcher	LC	-			2
<i>Rhipidura rufifrons</i>	Rufous fantail	SLC	Ma, Mi		X	
<i>Cincloramphus mathewsi</i>	Rufous songlark	LC	-	X		2
<i>Pachycephala rufiventris</i>	Rufous whistler	LC	-		X	4
<i>Myiagra cyanoleuca</i>	Satin flycatcher	SLC	Ma, Mi		X	
<i>Trichoglossus chlorolepidotus</i>	Scaly-breasted lorikeet	LC	-			22
<i>Myzomela sanguinolenta</i>	Scarlet honeyeater	LC	-			6
<i>Zosterops lateralis</i>	Silveryeye	LC	-			2

Species name	Common name	Status		Survey		
		NC Act	EPBC Act	AECOM 2011/12	EHP 2017	GHD 2018/19
<i>Lichenostomus virescens</i>	Singing honeyeater	LC	-		X	
<i>Ninox novaeseelandiae</i>	Southern boobook	LC	-			1
<i>Dicrurus bracteatus</i>	Spangled drongo	LC	Ma			2
<i>Pyrrholaemus sagittatus</i>	Speckled warbler	LC	-			2
<i>Pardalotus striatus</i>	Striated pardalote	LC	-		X	4
<i>Malurus cyaneus</i>	Superb fairy-wren	LC	-		X	3
<i>Podargus strigoides</i>	Tawny frogmouth	LC	-		X	1
<i>Corvus orru</i>	Torresian crow	LC	-			10
<i>Petrochelidon nigricans</i>	Tree martin	LC	-		X	4
<i>Smicromnis brevirostris</i>	Weebill	LC	-		X	10
<i>Aquila audax</i>	Wedge-tailed eagle	LC	-		X	5
<i>Hirundo neoxena</i>	Welcome swallow	LC	Ma			2
<i>Haliastur sphenurus</i>	Whistling kite	LC	-			2
<i>Pomatostomus superciliosus</i>	White-browed babbler	LC	-			4
<i>Nesoptilotis leucotis</i>	White-eared honeyeater	LC	-		X	6
<i>Gerygone albogularis</i>	White-throated gerygone	LC	-		X	2
<i>Melithreptus albogularis</i>	White-throated honeyeater	LC	-			7
<i>Corcorax melanorhamphos</i>	White-winged chough	LC	-		X	6
<i>Rhipidura leucophrys</i>	Willy wagtail	LC	-			2
<i>Lichenostomus chrysops</i>	Yellow-faced honeyeater	LC	-			4
<i>Lichenostomus melanops</i>	Yellow-tufted honeyeater	LC	-			4
Mammals						
<i>Setirostris eleryi</i>	Bristle-faced freetail bat	LC				2
<i>Trichosurus vulpecula</i>	Common brushtail possum	LC	-		X	3
<i>Ozimops ridei</i>	Eastern freetail bat	LC	-	4		4
<i>Macropus giganteus</i>	Eastern grey kangaroo	LC	-		X	5
<i>Capra hircus</i>	Feral goat	*	-		X	5
<i>Nyctophilus gouldi</i>	Gould's long-eared bat	LC	-			1
<i>Chalinolobus gouldii</i>	Gould's wattled bat	LC	-	5		3
<i>Phascolarctos cinereus</i>	Koala	V	V			3
<i>Miniopterus orianae</i>	Large bent-wing bat	LC				6
<i>Nyctophilus geoffroyi</i>	Lesser long-eared bat	LC	-			2
<i>Scotorepens greyii</i>	Little broad-nosed bat	LC	-	5		14
<i>Vespadelus vulturnus</i>	Little forest bat	LC	-	5		15
<i>Chalinolobus picatus</i>	Little pied bat	LC	-	5		6
<i>Pteropus scapulatus</i>	Little red flying-fox	LC	-			4
<i>Nyctophilus sp.</i>	Long-eared bat			5		18
<i>Sus scrofa</i>	Pig	*	-		X	6
<i>Oryctolagus cuniculus</i>	Rabbit	*	-		X	5

Species name	Common name	Status		Survey		
		NC Act	EPBC Act	AECOM 2011/12	EHP 2017	GHD 2018/19
<i>Macropus rufogriseus</i>	Red-necked wallaby	LC	-		X	25
<i>Tachyglossus aculeatus</i>	Short-beaked echidna	SLC	-			1
<i>Vespadelus regulus</i>	Southern forest bat	LC	-			5
<i>Wallabia bicolor</i>	Swamp wallaby	LC	-		X	10
<i>Macropus parryi</i>	Whiptail wallaby	LC	-			2
<i>Austronomus australis</i>	White-striped mastiff bat	LC	-	4		18
<i>Canis lupus familiaris</i>	Wild dog	*	-			1
<i>Saccolaimus flaviventris</i>	Yellow-bellied sheathtail bat	LC	-	4		4
Reptiles						
<i>Heteronotia binoei</i>	Bynoe's gecko	LC	-			2
<i>Dendrelaphis punctulatus</i>	Common tree snake	LC	-			1
<i>Egernia cunninghami</i>	Cunningham's skink	LC	-			2
<i>Pogona barbata</i>	Eastern bearded dragon	LC	-			1
<i>Intellagama lesueurii</i>	Eastern water dragon	LC	-			2
<i>Cryptoblepharus pulcher</i>	Elegant snake-eyed skink	LC	-			4
<i>Lygisaurus foliorum</i>	Iridescent litter-skink	LC	-			1
<i>Varanus varius</i>	Lace monitor	LC	-		X	4
<i>Carlia pectoralis</i>	Open-litter rainbow-skink	LC	-			3
<i>Varanus gouldii</i>	Sand monitor	LC	-			4
<i>Egernia striolata</i>	Tree skink	LC	-			2

Appendix D

Likelihood of occurrence

Species name	EPBC Act status	Source	Habitat requirements	Likelihood of occurrence
Plants				
<i>Acacia lauta</i> Tara wattle	V	PMST	This species occurs in locations characterised by a gently undulating to flat landform (DAWE, 2021a). The vegetation varies from open forest to low woodland with a dense or moderately dense shrub layer, with species present including <i>Callitris glaucophylla</i> and <i>Allocasuarina luehmannii</i> .	Unlikely to occur No suitable habitat for this species was recorded and no known records were identified within the desktop search extent. The closest record is approximately 35 km west of the Project area.
<i>Arthraxon hispidus</i> Hairy-joint grass	V	PMST	Found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps, as well as woodland (DAWE, 2020). In the South-East Queensland Bioregion, <i>A. hispidus</i> has also been recorded growing around freshwater springs on coastal foreshore dunes, in shaded small gullies, on creek banks, and on sandy alluvium in creek beds in open forests (DAWE, 2020).	Unlikely to occur Optimal habitat is absent from the Project area. Marginally suitable habitat is present along some of the watercourses; however the nearest record is located approximately 85 km east of the central point of the Project area.
<i>Cadellia pentastylis</i> Ooline	V	PMST	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 above sea level (DAWE, 2020).	Unlikely to occur No suitable habitat for this species was recorded and no known records were identified within the desktop search extent.
<i>Callistemon pungens</i> (<i>Melaleuca williamsii</i> subsp. <i>fletcheri</i>)	V	PMST	Occurs along rocky watercourses usually with sandy granite (or occasionally basalt) creek beds, and generally among naturalised species (DEWHA, 2006).	Unlikely to occur No suitable habitat for this species was recorded and no known records were identified within the desktop search extent.
<i>Dichanthium setosum</i> Bluegrass	V	PMST	Recorded on heavy basaltic black soils and red-brown loams with clay subsoil (DAWE, 2020).	Unlikely to occur No suitable habitat for this species was recorded and no known records were identified within the desktop search extent.
<i>Eucalyptus infera</i> Durikai mallee	V	PMST; WO	Grows in small drainage lines, in association with Grey Box (<i>E. moluccana</i>), Broad-leaved Ironbark (<i>E. fibrosa</i> subsp. <i>fibrosa</i>) and Spotted Gum (<i>Corymbia citriodora</i> subsp. <i>variegata</i>) in undulating terrain. Occurs in sandy duplex soils derived from metamorphosed sediments (DEWHA, 2008a).	Likely to occur Recorded by GHD in local landscape (3 km from the Project area). No habitat critical to survival of the species was mapped within the Project area as per the mapping methodology described herein; however, potentially suitable vegetation types to support the species are present.

Species name	EPBC Act status	Source	Habitat requirements	Likelihood of occurrence
<i>Eucalyptus mckieana</i>	V	PMST	Identified in three general types of habitat: Rocky, basaltic hills Flat to gently undulating alluvial areas with intermittent inundation. Drainage lines supporting <i>Casuarina cristata</i> and sandy country dominated by Cypress Pine-Bloodwood-Ironbark-She-Oak Forest. At an altitude in Queensland 342–500 m (DAWE, 2020).	Unlikely to occur This species has only been recorded from land zone 12 within Qld, which is absent from the Project area. The nearest record is approximately 50 km south east of the central point of the Project area.
<i>Homopholis belsonii</i> Belson's panic	V	PMST	Occurs in undulating to hilly terrain at altitudes between 600-750 m above sea level. It grows on flat areas or low ridges in ash-grey to white silty loam and on stony or skeletal grey-white soils on steep slopes. The species occurs in open eucalypt forest communities (DAWE, 2020).	Unlikely to occur Marginally suitable habitat for this species was recorded but no known records were identified within the desktop search extent. The closest record is located approximately 43 km north-west of the Project area.
<i>Lepidium monoplocoides</i> Winged pepper-cress	E	PMST	This species occurs predominantly in mallee scrub in semi-arid areas (DAWE, 2021a). Sites are seasonally moist to water-logged with heavy, fertile soils and a mean annual rainfall of around 300 to 500 mm (DAWE, 2021a).	Unlikely to occur No suitable habitat for this species was recorded and no known records were identified within the desktop search extent. The closest record is approximately 80 km west of the Project area.
<i>Lepidium peregrinum</i> Wondering pepper-cress	E	PMST	Occurs at 320-460 m above sea level in deep sandy soils in flat areas of open forest, one population occurs on a red lateritic ridge with Black Cypress-pine (<i>Callitris endlicheri</i>) (DAWE, 2020).	May occur Suitable habitat occurs but no known records were identified within the desktop search extent. The nearest record is located approximately 60 km south of the Project area.
<i>Macrozamia conferta</i>	V	PMST; WO	Occurs in undulating to hilly terrain at altitudes between 600-750 m above sea level. It grows on flat areas or low ridges in ash-grey to white silty loam and on stony or skeletal grey-white soils on steep slopes (Forster, 2009).	May occur The species was not recorded within the Project area despite extensive survey effort. The closest individuals were recorded approximately 1 km to the north-east of the Project area boundary. No habitat critical to survival of the species was mapped within the Project area as per the mapping methodology described herein; however, RE 13.11.5 is a mandatory essential habitat factor for the species and its presence within the mapped polygon of RE 13.11.5 within the northern extent of the Project area cannot be discounted.

Species name	EPBC Act status	Source	Habitat requirements	Likelihood of occurrence
<i>Macrozamia cranei</i>	E	PMST	This species grows in small colonies on the lower parts of the sheltered slopes of steep ridges, in shallow, skeletal soil or on alluvium, along ephemeral watercourses (DAWE, 2021a). Both soil types are associated with limestone outcrops at 400–600 m above sea level (DAWE, 2021a). The plants are found in open forest (in hilly terrain) dominated by eucalypts or fragmented semi-evergreen vine thicket (DAWE, 2021a).	Unlikely to occur The Project area is located outside the known distribution of this species. No suitable habitat for this species was recorded and no known records were identified within the desktop search extent.
<i>Macrozamia machinii</i>	V	WO	Most <i>M. machinii</i> populations occur in deep sandy soils in flat areas of open forest dominated by <i>Angophora leiocarpa</i> , <i>Allocasuarina inophloa</i> , <i>Callitris glaucophylla</i> , <i>Lysicarpus angustifolius</i> and <i>Acacia conferta</i> ; and one population occurs on a red lateritic ridge with <i>Callitris endlicheri</i> , <i>Eucalyptus panda</i> and <i>E. apothalassica</i> (DAWE, 2021a).	Unlikely to occur The Project area is located outside the known distribution of this species. The closest record is located approximately 40 km to the west of the Project area (date not supplied), noting however that the data was generalised to 0.1 degrees due to the sensitivity of the species such that there may be a margin of error up to 11 km. No suitable habitat for this species was recorded.
<i>Macrozamia pauli-guilielmi</i> Pineapple zamia	E	WO	The species occurs in lowland (5 m – 230 m altitude) open forest or woodland (wallum) dominated by banksias or eucalypts, or in shrub land or heath land, generally on stabilised sand dunes (DAWE, 2021a).	Unlikely to occur The Project area is located outside the known distribution of this species. The closest record is located approximately 212 km to the north-east of the Project area and is from 1964, noting however that the data was generalised to 0.1 degrees due to the sensitivity of the species such that there may be a margin of error up to 11 km. No suitable habitat for this species was recorded.
<i>Rhaponticum australe</i> Austral cornflower	V	PMST	Grows in eucalypt open forest with a grassy understory and in grasslands on black clay soil. It is often found on roadsides and on road or rail reserves associated with <i>Chloris gayana</i> , <i>Cirsium vulgare</i> , <i>Eucalyptus tereticornis</i> and <i>Angophora floribunda</i> (DAWE, 2020).	Unlikely to occur Habitat is absent from the Project area and no records are present within bioregion 13. The nearest record is located 44 km north east of the Project area.
<i>Thesium australe</i> Austral toadflax	V	PMST	Occurs in shrubland, grassland or woodland, often on damp sites. Vegetation types include open grassy heath and grassland surrounded by <i>Eucalyptus</i> woodland. Semi-parasitic on roots of a range of grass species, notably <i>Themeda triandra</i> . It occurs in subtropical, temperate and subalpine climates over a wide range of altitudes. It occurs on soils derived from sedimentary, igneous and metamorphic geology on a range of soils including black clay loams to yellow podzolics and peaty loams (DAWE, 2020).	May occur Potentially suitable habitat occurs but no known records were identified within the desktop search extent. The closest record is located approximately 50 km east of the Project area.

Species name	EPBC Act status	Source	Habitat requirements	Likelihood of occurrence
<i>Tylophora linearis</i> (<i>Vincetoxicum forsteri</i>) Slender tylophora	E	PMST; WO	Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The population when in Australia is concentrated in northern and western Australia (Blakers et al., 1984; Higgins & Davies, 1996).	Likely to occur The species was recorded by GHD at two locations within the Project area (not within the Project footprint). No habitat critical to survival of the species was mapped within the Project area as per the mapping methodology described herein; however, potentially suitable vegetation types to support the species are present.
Birds				
<i>Actitis hypoleucos</i> Common sandpiper	Mig	PMST	In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. 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. The sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines (DAWE 2020).	Unlikely to occur This species has not been historically recorded from the desktop search extent. No suitable habitat was observed within the wind farm Project area.
<i>Anthochaera phrygia</i> Regent honeyeater	CE	PMST; WO	Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage (Cramp 1985; Higgins & Davies 1996). In Queensland, they are recorded in most regions, being widespread along much of the coast and are very sparsely scattered inland (DAWE 2020).	Likely to occur This species has been historically recorded from the desktop search extent. Targeted surveys mapped small areas of predicted habitat in the north, north-east and south of the Project area. Individuals may periodically occur within the Project area.
<i>Apus pacificus</i> Fork-tailed swift	Mig	PMST; WO	The sandpiper mainly occurs along the coastlines of Australia. They are in smaller numbers across inland water of Queensland. Known to inhabit sheltered intertidal mudflats, and ephemeral and permanent lakes and dams (Higgins and Davies 1996).	Likely to occur This species has been historically recorded from the desktop search extent and suitable habitat was recorded within the wind farm Project area during the field survey. Individuals may periodically occur within the wind farm Project area.

Species name	EPBC Act status	Source	Habitat requirements	Likelihood of occurrence
<i>Calidris acuminata</i> Sharp-tailed sandpiper	Mig	PMST	<p>Prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.</p> <p>The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation (DAWE 2020).</p>	<p>Unlikely to occur</p> <p>This species has not been historically recorded from the desktop search extent. No suitable habitat was observed within the Project area.</p>
<i>Calidris ferruginea</i> Curlew sandpiper	CE, Mig	PMST	<p>The species occurs in woodland and open sclerophyll forest with a stratum of <i>Allocasuarina</i> beneath <i>Eucalyptus</i>, <i>Corymbia</i> or <i>Angophora</i> (DES 2018).</p>	<p>Unlikely to occur</p> <p>This species has not been historically recorded from the desktop search extent, and the field survey did not record potentially suitable habitat.</p>
<i>Calidris melanotos</i> Pectoral sandpiper	Mig	PMST	<p>The species occurs in woodland and open sclerophyll forest with a stratum of <i>Allocasuarina</i> beneath <i>Eucalyptus</i>, <i>Corymbia</i> or <i>Angophora</i> (DES 2018).</p>	<p>Unlikely to occur</p> <p>This species has not been historically recorded from the desktop search extent. No suitable habitat was observed within the Project area.</p>
<i>Cuculus optatus</i> Oriental cuckoo	Mig	PMST	<p>The species inhabits permanent and ephemeral freshwater wetlands with low, dense vegetation (DAWE 2020). Species sometimes occurs in habitats that have saline or brackish water, such as saltmarshes, mangrove creeks, around bays and beaches (DAWE 2020).</p>	<p>Unlikely to occur</p> <p>This species has not been historically recorded from the desktop search extent. No suitable habitat was observed within the Project area.</p>
<i>Erythrotriorchis radiatus</i> Red goshawk	V	PMST	<p>The species occurs in open-forests to sparse, open-woodlands and scrub that are dominated by <i>Eucalyptus</i>, <i>Corymbia</i> and <i>Acacia</i> or <i>Callitris</i> species, remnant and regrowth within 3 km of water (DAWE 2018).</p>	<p>Unlikely to occur</p> <p>This species has not been historically recorded from the desktop search extent. The nearest historical record is located approximately 75 km north-east of the Project area according to the DES species profile records. No suitable habitat was observed within Project area.</p>

Species name	EPBC Act status	Source	Habitat requirements	Likelihood of occurrence
<i>Falco hypoleucos</i> Grey falcon	V	PMST	The species is essentially confined to arid and semi-arid regions of Australia, predominantly in areas where annual rainfall is <500 mm (Schoenjahn 2018). Although the species has been recorded from coastal areas, records are extremely rare and often old historical records. Since the 1950's the species breeding range has contracted, with the species breeding now confined to areas within the 250 mm annual rainfall zone (Olsen and Olsen 1986). The species occurs in timbered lowland plains, particularly acacia shrublands crossed by tree-lined water courses (Garnet et al 2011). The species nests in tall trees along watercourses, particularly <i>Eucalyptus camaldulensis</i> and <i>E. coolabah</i> but also nests in telecommunications towers (Marchant and Higgins 1993).	Unlikely to occur The species has not been historically recorded within 20 km of the Project area. The species is largely restricted to arid and semi-arid regions. Coastal records are rare and represent rare vagrants to the region.
<i>Gallinago hardwickii</i> Latham's snipe	Mig	PMST	The species inhabits mistletoes in eucalypt forests and woodlands, riparian woodlands, Acacia dominated woodlands, <i>Melaleuca</i> , <i>Casuarina</i> , <i>Callitris</i> , and trees on farmland or gardens (DAWE 2018).	May occur This species has not been recorded in the desktop search extent. Very marginal value habitat is present within the Project area.
<i>Geophaps scripta</i> Squatter pigeon (southern)	V	PMST; WO	Almost exclusively aerial, it does prefer wooded, inland areas and heathland. In coastal areas they have been seen flying over mudflats and beaches. Widespread throughout eastern and south-eastern Australia. It has been recorded along all coastal regions of QLD and NSW (Barrett et al., 2003).	Likely to occur The species has been recorded from immediately south of the Project area in 2011. . Potentially suitable foraging habitat was identified within Project area.
<i>Grantiella picta</i> Painted honeyeater	V	PMST; WO	The species inhabits dry sclerophyll eucalypt forests and woodlands. Known to occur throughout the coastal regions of NSW when inland habitats are subjected to drought (DAWE 2018).	Likely to occur The species has been historically recorded 12 km north of the Project area in 2017. Targeted surveys mapped a small area of predicted habitat in the south of the Project area.
<i>Hirundapus caudacutus</i> White-throated needletail	V; Mig	WO; PMST	Species inhabits rainforest ecosystems that include semi-deciduous vine thickets, complex notophyll vine-forests, tropical rainforests, subtropical rainforests, mesophyll thicket/shrubland, warm and cool temperate rainforest, and dry rainforest (DAWE 2020).	Likely to occur The species was not recorded in surveys for the Project. However, recent historical records are located approximately 8 km east of the Project area and the species has the potential to forage aerially across the Project area.
<i>Lathamus discolor</i> Swift parrot	CE	PMST; WO	The species is found in highly variable habitats, but typically found in open grassy flats near water. Habitats include open areas of low vegetation such as grasslands, pastures, sport fields and damp open areas (DAWE 2020).	Likely to occur The desktop review confirmed records of the species within the search extent. The nearest record is located approximately 8 km north of Project area. Targeted surveys mapped small areas of predicted habitat in the north of the Project area.

Species name	EPBC Act status	Source	Habitat requirements	Likelihood of occurrence
<i>Monarcha melanopsis</i> Black-faced monarch	Mig	PMST; WO	The species occurs in heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, typically near wetlands and watercourses (DAWE 2020).	Unlikely to occur This species has not been historically recorded from the desktop search extent. No suitable habitat was observed within the Project area.
<i>Motacilla flava</i> Yellow wagtail	Mig	PMST	The species occurs in eucalypt forests, preferring tall wet forest of ranges where territories centre on densely vegetated gullies (Morecombe 2004).	Unlikely to occur This species has not been historically recorded from the desktop search extent. No suitable habitat was observed within the Project area.
<i>Myiagra cyanoleuca</i> Satin flycatcher	Mig	PMST; WO	The species occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands (DAWE 2020). They are mostly found in coastal areas but occasionally travel inland along major rivers (DAWE 2020). They require extensive areas of open fresh, brackish or saline water for foraging (DAWE 2020).	May occur This species has not been historically recorded from the desktop search extent. Marginally suitable habitat was observed within the Project area.
<i>Pandion haliaetus</i> Osprey	Mig	PMST	The species generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps, claypans and waterlogged grasslands (DAWE 2018).	May occur This species has not been historically recorded from the desktop search extent. Marginally suitable habitat was observed within the Project area.
<i>Rhipidura rufifrons</i> Rufous fantail	Mig	PMST; WO	The species requires a combination of sandstone cliff/escarpment to provide roosting habitat that is adjacent to higher fertility sites, particularly box gum woodlands or river/rainforest corridors which are used for foraging (DAWE 2018).	Likely to occur This species has been historically recorded from the desktop search extent. While habitats are generally too dry for the species, the species has the potential to move through the area and utilise local habitats on migration. Individuals may periodically occur within the Project area.
<i>Rostratula australis</i> Australian painted-snipe	E	PMST	The species inhabits a variety of habitats, ranging from eucalypt woodlands to rainforests. Prefers mature wet forest habitats, particularly in areas that receive 600 mm of annual rainfall. Species particularly prefers areas that contain hollow logs, hollow-bearing trees, rock crevices or caves (DAWE 2018).	Unlikely to occur This species has not been historically recorded from the desktop search extent, and the field survey did not record potentially suitable habitat.
<i>Polytelis swainsonii</i> Superb parrot	V	WO	Inhabits forests and woodlands dominated by Eucalypts, particularly <i>Eucalyptus camaldulensis</i> , <i>E. melliodora</i> , <i>E. microcarpa</i> . The species occurs seasonally in <i>Callitris</i> and <i>Acacia pendula</i> woodlands (Webster 1998).	May occur The Project area is not within the Commonwealth mapped distribution of the species. One record of the species has been recorded within the desktop search extent. While the habitats within the Project area are suitable, the species is not typically recorded within the region and has a reduced likelihood of occurrence on that basis.

Species name	EPBC Act status	Source	Habitat requirements	Likelihood of occurrence
Mammals				
<i>Chalinolobus dwyeri</i> Large-eared pied bat	V	PMST	Inhabit rivers, lagoons, and streams (Pasitschniak-Artsand Marinelli, 1998). They prefer areas with steep banks that contain roots, overhanging vegetation, reeds, and logs (Grant and Temple-Smith, 1998). The rivers and streams are usually less than 5 meters in depth (Grant and Temple-Smith, 1998). There have been records of them living in aquatic habitats at elevations above 1000 meters (Grant and Temple-Smith, 1998).	Unlikely to occur This species has not been historically recorded from the desktop search extent. The nearest record is located approximately 26 km south of the Project area according to the DES species profile records. No suitable habitat was observed within the Project area.
<i>Dasyurus maculatus maculatus</i> Spotted-tailed quoll (southern subspecies)	E	PMST	This species is largely restricted to eucalypt forests and woodlands (DAWE 2018). Modelling suggests that they require native forest patches of at least 160 km ² to maintain viable populations (Eyre 2002).	Unlikely to occur The species has not been historically recorded within the desktop search extent. The nearest historical record is located approximately 34 km east of Project area. No suitable habitat was observed within the Project area.
<i>Nyctophilus corbeni</i> Corben's long-eared bat	V	PMST	It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows (Andrews et al., 1994; Smith et al., 1994, 1995; Eyre 2004). The distribution may be patchy even in suitable habitat (Kavanagh 2000). The greater glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species (Kavanagh 1984).	May occur The species has not been historically recorded within the desktop search extent. The nearest confirmed record is located approximately 40 km west of the Project area. Harp trapping for the species did not detect any individuals. Woodland remnants at the north of the Project area represent suboptimal habitat for this species.
<i>Petauroides volans</i> Greater glider	V	PMST	Within the region, koalas occur in sub-humid <i>Eucalyptus</i> dominated forests and woodlands in riparian and non-riparian environments, and some <i>Acacia</i> dominated forests and woodlands in non-riparian environments (DAWE 2018).	Confirmed present The species has been historically recorded from the desktop search extent. The nearest historical record is located only 1 km east of the Project area within Durikai State Forest. Potential foraging and low-value denning habitat is located within the Project area. Targeted surveys for the species undertaken in December 2020 confirmed the species from one location, recorded in targeted faecal pellet searches using a variation of the SAT search technique.
<i>Petrogale penicillata</i> Brush-tailed rock-wallaby	V	PMST	The species roosts in rainforest patches, stands of <i>Melaleuca</i> , mangroves and riparian vegetation and forages widely in rainforests, open forests, closed and open woodlands, <i>Melaleuca</i> swamps and <i>Banksia</i> woodlands (DAWE 2018).	Unlikely to occur This species has not been historically recorded from the desktop search extent. The nearest historical record is located approximately 30 km south of the Project area. No suitable habitat is present within Project area.

Species name	EPBC Act status	Source	Habitat requirements	Likelihood of occurrence
<i>Phascolarctos cinereus</i> Koala	V	PMST; WO	Thrive in a variety of habitats including open woodlands, savanna, agricultural areas, semi-arid, and arid regions. Both coastal and highland areas within a range of ecosystems in Australia from mild coastal regions to above snowline. Short-beaked echidnas have a broad altitudinal range from sea level to at least 1,675 meters. (Aplin, et al., 2008; Nicol and Anderson, 2007a).	Confirmed present The koala was confirmed present from six locations within the Project area. Suitable koala habitat is broadly distributed along the northern boundary of the wind farm.
<i>Pteropus poliocephalus</i> Grey-headed flying-fox	V	PMST	The species is known to occur in both remnant and non-remnant woodlands and grasslands (DAWE 2020). In Queensland, the species occurs in bluegrass (<i>Dichanthium sericeum</i>) and/or Mitchell grass dominated grasslands or mixed grasslands dominated by other grass species (DAWE 2020).	Likely to occur The species has been historically recorded in the desktop search extent. The nearest historical record is located 12 km north of the Project area, recorded in 2017. Woodland remnants within the Project area represent suitable foraging habitat for the species.
Reptiles				
<i>Delma torquata</i> Collared delma	V	PMST	The species occurs in eucalypt and cypress-pine open forest or woodland on rocky outcrops and stony hills. Known to shelter under rock slabs, fallen logs, peeling bark and deep leaf litter (DAWE 2018).	May occur The species has not been historically recorded within the desktop search extent. The nearest record is located approximately 21 km east of the Project area. Suboptimal habitat occurs in spotted gum woodland on the Project area.
<i>Egernia rugosa</i> Yakka Skink	V	PMST	The species occurs in upland streams with shallow to deep permanent pools. Species prefers pools less than 3 m deep with underwater caverns formed by boulders, logs and overhanging banks (DAWE 2018).	May occur The species has not been historically recorded in the desktop search extent. Habitat within the Project area is generally considered of limited value for the species.
<i>Furina dunmalli</i> Dunmall's snake	V	PMST	The species is known from a broad range of habitats including <i>Corymbia citriodora</i> , <i>Eucalyptus crebra</i> , <i>Eucalyptus melanophloia</i> , <i>Callitris glaucophylla</i> and bulloak open forest and woodland associations on sandstone derived soils (DAWE 2018).	May occur The species has not been historically recorded within the desktop search extent. The nearest record is located approximately 36 km to the north-west of the Project area. Woodland remnants within the Project area represent potentially suitable habitat for this species.

Species name	EPBC Act status	Source	Habitat requirements	Likelihood of occurrence
<i>Uvidicolus sphyrurus</i> Border thick-tailed gecko	V	PMST; WO	The species is known to inhabit a range of aquatic habitats from clear rocky streams to turbid lowland rivers and billabongs. Species frequently occurs in main channels of rivers, containing complex structural features including rocks, woody debris, and overhanging stream banks and vegetation (DAWE 2018). Known to coincide with the White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland TEC.	May occur The species has been historically recorded from the desktop search extent, in woodland with outcropping granite in Durikai State Forest, north of the Project area. Habitat within the Project area was generally sub-optimal due to the relative lack of loose surface granite. Targeted searches were undertaken in areas of potential habitat within the Project area coinciding with White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland TEC. Habitat quality was low due to a lack of suitable microhabitat and cover. No individuals were found in targeted searches.
Fish				
<i>Maccullochella peelii</i> Murray cod	V	PMST	The species is known to inhabit a range of aquatic habitats from clear rocky streams to turbid lowland rivers and billabongs. Species frequently occurs in main channels of rivers, containing complex structural features including rocks, woody debris, and overhanging stream banks and vegetation (DAWE 2018).	May occur This species has not been historically recorded from the desktop search extent and the field survey did not record potentially suitable habitat. However the species is known to be stocked in the region with records 35 km downstream in Lake Coolmunda.

Appendix E

Risk assessment framework

Risk assessment framework for koala and squatter pigeon impact assessment

The relative risk of each impact was assessed based on the *likelihood* and the *consequence* of the impact. This is consistent with the ISO31000 Risk Assessment Standard.

Risk impact matrix

Likelihood	Consequence				
	Negligible	Low	Moderate	High	Severe
Certain	Negligible	Low	High	Severe	Severe
Almost certain	Negligible	Low	Moderate	High	Severe
Likely	Negligible	Low	Moderate	High	High
Unlikely	Negligible	Negligible	Low	Moderate	High
Rare	Negligible	Negligible	Negligible	Low	Low

Criteria used to define the likelihood of impact

Likelihood	Criteria used to define likelihood
Certain	It is very probable that the risk event could occur in any year (>95%)
Almost certain	It is more probable than not that the risk event could occur in any year (>50%)
Likely	It is equally probable that the risk event could or could not occur in any year (50%)
Unlikely	It is less probable than not that the risk event could occur in any year (<50%)
Rare	It is improbable that the risk event could occur in any year (<5%). The risk event is only theoretically possible or would require exceptional circumstances to occur.

Criteria used to define severity of consequence

Magnitude	Criteria used to define magnitude of impact
Severe	Permanent impacts AND/OR extreme intensity AND/OR regional extent (i.e. impact at a population level)
High	Long duration AND/OR high intensity AND/OR large extent (i.e. major impact to individuals with minor impacts at a population level)
Moderate	Moderate duration AND/OR moderate intensity AND/OR localised extent (i.e. moderate level impacts to individuals with no impact at a population level)
Low	Short duration AND/OR low intensity AND/OR very localized extent (i.e. low level impacts to individuals that have no impact at a population level)
Negligible	Very short duration AND/OR negligible intensity AND/OR (i.e. negligible impact to individuals)



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