Appendix N

Preliminary Bird and Bat Management Plan

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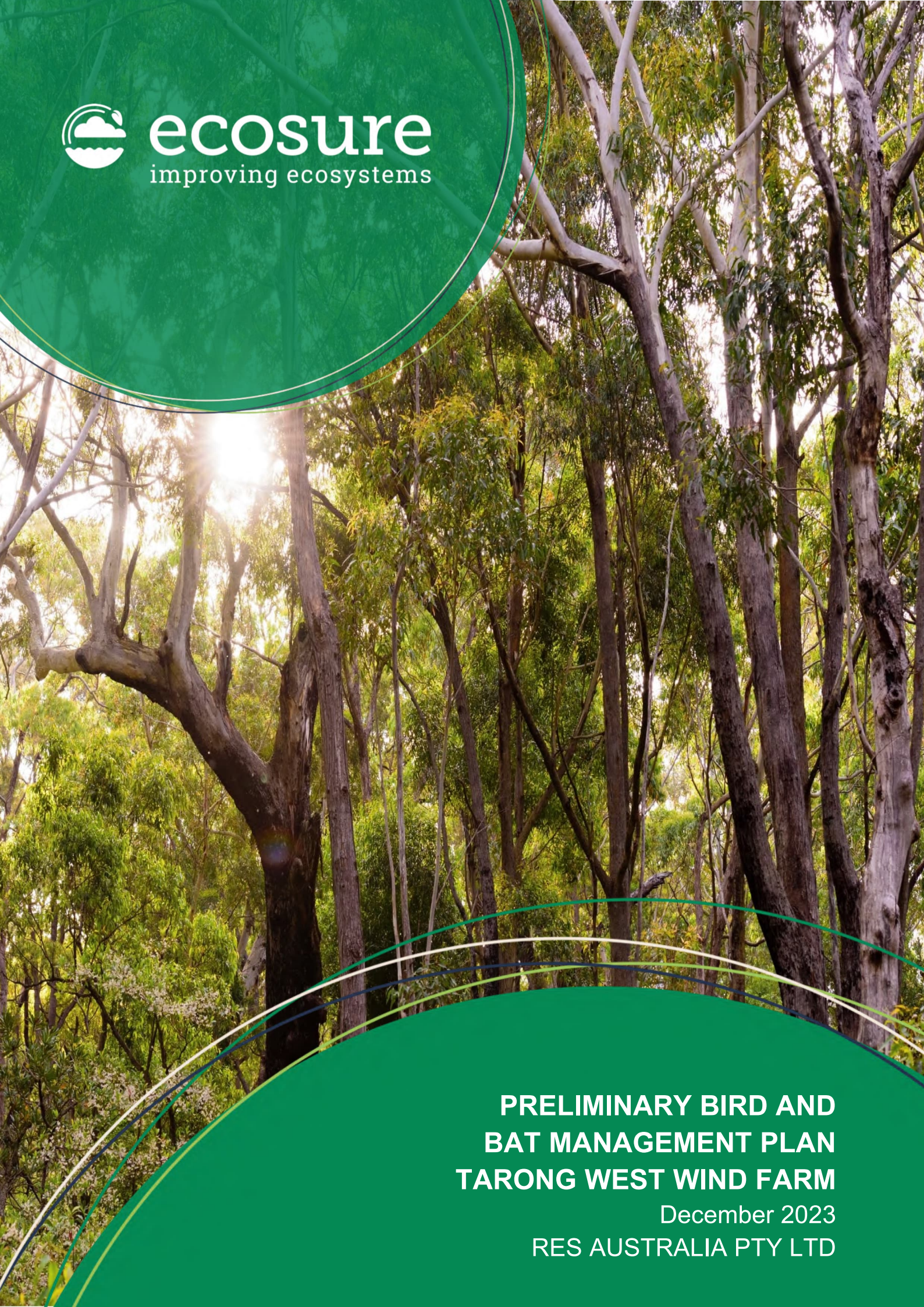
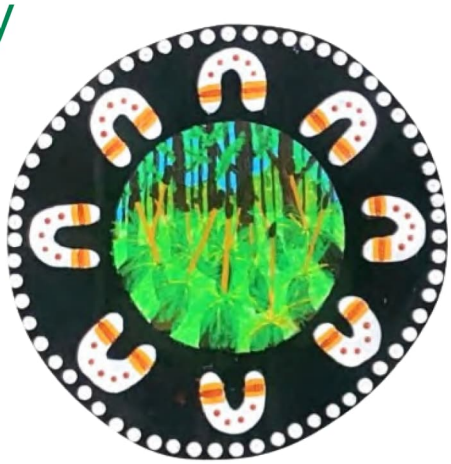


PRELIMINARY BIRD AND BAT MANAGEMENT PLAN TARONG WEST WIND FARM

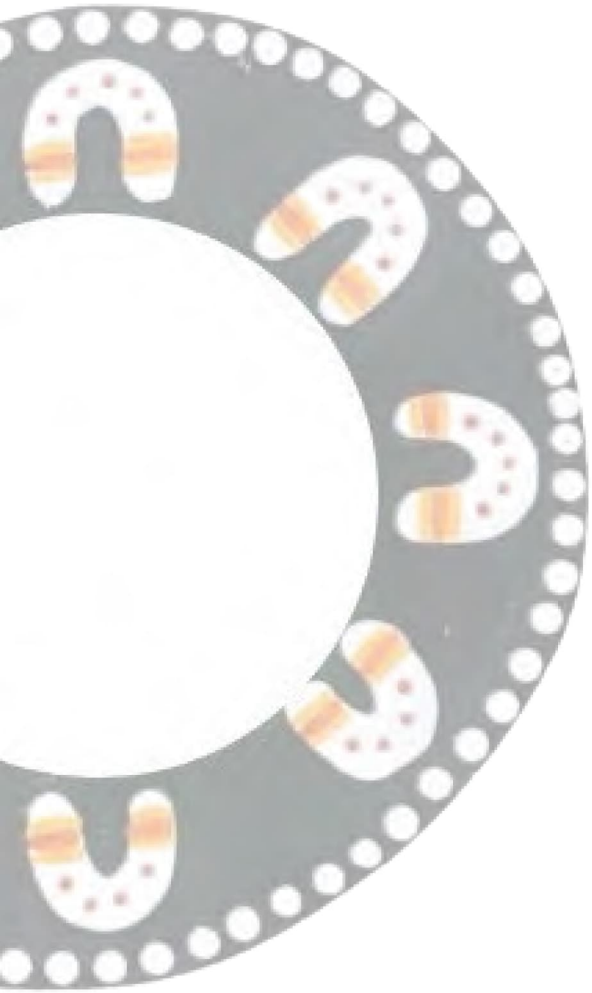
December 2023

RES AUSTRALIA PTY LTD

Acknowledgement of Country



Ecosure acknowledge the Traditional Custodians of the lands and waters where we work. We pay deep respect to Elders past and present who hold the Songlines and Dreaming of this Country. We honour and support the continuation of educational, cultural and spiritual customs of First Nations peoples.



Acknowledgements

Ecosure would like to acknowledge the project team that has collaboratively contributed knowledge over the course of the project to produce this Preliminary Bird and Bat Management Plan, including staff from icubed Consulting Pty Ltd, AECOM Australia Pty Ltd and RES Australia Pty Ltd.

Glossary, acronyms and abbreviations

BACI	Before, After, Control, Input
BBMP	Bird and Bat Management Plan
BBUS	Bird And Bat Utilisation Survey report
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DES	Department of Environment and Science (Queensland)
DoE	Department of Environment (now DCCEEW) (Commonwealth)
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
LC	Least concern
MNES	Matters of national environmental significance
NC Act	Queensland Nature Conservation Act 1999
RSA	Rotor Swept Area
SARA	State Assessment Referral Agency
SDAP	State Development Assessment Provisions
SEVT	Semi-evergreen vine thicket
SLC	Special least concern
SMP	Species Management Program
TNT	Threatened (critically endangered, endangered or vulnerable) and near threatened
VM Act	Queensland Vegetation Management Act 1999
WTG	Wind turbine generator

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1 Introduction

1.1 Background

This preliminary Bird and Bat Management Plan (BBMP) has been prepared to guide the management of potential impacts on bird and bat species, primarily during the operational phase of the Tarong West Wind Farm, Ironpot, Queensland. Some bird and bat species are known to be at risk of impacts from wind farm infrastructure, predominantly collisions with wind turbine generators (WTGs). Factors that influence the risk of collision include the nature of the environment and landscape, the species present and the layout of the proposed infrastructure (Jenkins et al. 2010).

Field surveys have been undertaken to confirm environments and associated habitats on site and to identify those avian and bat species present. These have helped inform the wind farm layout and assessment of potential impacts on fauna. The BBMP seeks to minimise and mitigate potential impacts on bird and bat species at risk of collision due to their flying behaviour, habitat requirements, size or feeding strategy (Langston and Pullan 2003).

This BBMP focuses on threatened species, although the risk of impact for common and least concern species is also considered. This BBMP aims, through a robust monitoring strategy involving bird utilisation surveys, targeted surveys and carcass monitoring, to identify opportunities to respond to the project's potential impacts.

The preliminary BBMP provides an adaptive management and monitoring program to document bird and bat mortalities to allow the effectiveness and implementation of controls to be assessed as required. This will ensure that alternative mitigation strategies can be employed if there is reason to do so. The preliminary BBMP has been prepared in accordance with the guidance and requirements of the following documents and other relevant references:

- Wind Farms and Birds: Interim Standards for Risk Assessment (Brett Lane & Associates and Aria Professional Services 2005)
- EPBC Act Policy Statement 2.3: Wind farm industry
- State Development Assessment Provisions v3.0 State code 23: Wind farm development Performance Outcome 5 (PO5)
- State code 23: Wind farm development – Planning guideline (Department of State Development, Infrastructure, Local Government and Planning 2022) – Appendix 3 – Ecological assessment methodology.

This BBMP is an adaptive management plan and will be updated as the monitoring data detailed in this BBMP becomes available and as the project design progresses (i.e. WTG design is finalised). The BBMP will also be updated in the future to include a compliance summary in response to conditions of approval on the project and discussions with the Wind Farm Developer and the Department of Environment and Science (DES).

1.2 Proposed development

The proposed development is the construction and operation of a wind farm located at Ironpot, near Kingaroy in south east Queensland (Figure 1). The wind farm will have up to 97 wind turbine generators (WTG) connected by access tracks and supported by other infrastructure. The development and construction of the site will involve significant ground disturbing work and will include the construction of the following key components:

- up to 97 WTGs
- wind turbine foundations and hardstand areas (approximately 270 m by 110 m, plus a 30 m buffer around the perimeter, to allow construction and crane placement)
- three permanent and four temporary (during construction period only) meteorological masts
- internal electrical reticulation consisting of overhead lines (OHL) and underground (UG) cabling
- access tracks including widening sections of Ironpot Road
- planning corridor containing a maximum clearing footprint of 1,062.14 ha. The planning corridor allows scope to micro-site project infrastructure within the planning corridor, with the disturbance capped at the area of the clearing footprint
- on-site connection to existing 275 kilovolt (kV) transmission line
- electrical substations to facilitate connection of the project to the grid
- one battery energy storage system
- construction compounds and laydown areas
- site compounds
- operations and maintenance facilities
- batching plant
- borrow pits
- washdown areas.

A candidate WTG has been selected for the proposed development and is based on the following assumptions:

- up to 90 m turbine blades
- up to 180 m rotor diameter
- up to 190 m hub height
- maximum upper tip height of 280 m above ground level
- minimum lower tip height of 65 m above ground level.
- up to 26,015 m^2 rotor swept area (RSA).

For the purposes of this BBMP, the worst case scenario (minimum to maximum possible

height) has been considered as such in terms of assessing risk to birds and bats.

Figure 2 shows the proposed planning corridor and clearing footprint to accommodate WTGs, access tracks and other associated infrastructure. The clearing footprint represents the maximum proposed clearing area (as provided in July 2023) and may be reduced by ongoing refinement in the design and micro-siting of infrastructure throughout the development phase of the project. In the planning corridor presented in this preliminary plan, no WTGs or hardstands are proposed to be placed in ecologically significant areas (e.g. areas of remnant vegetation).

The project is currently planned to be constructed in a single stage, however the development may be constructed in multiple stages. Construction is proposed to start in the third quarter of 2024 and last approximately 30 months.

Construction

The construction methodology will generally include:

- marking out areas for infrastructure installation
- clearing the areas of vegetation
- scraping off the topsoil and stockpiling for later use in rehabilitation
- construction of access tracks
- widening sections of Ironpot Road to allow transport of WTGs
- creating a level pad for infrastructure construction
- installing the infrastructure
- rehabilitating disturbed surfaces that are not required for operations.

Operation

The project is expected to have an operational life of at least 30 years excluding construction and decommissioning. The operational parameters of the project have not been finalised at this stage. However, it has been assumed that all WTGs will be operating continuously when wind speeds are sufficient, apart from occasional shut-down periods for maintenance.

Decommissioning

Decommissioning or repowering of the site is expected to occur at the end of the project's useful life. The decommissioning methodology has not been finalised at this stage.

1.3 Aim and Objectives

Impacts to birds and bats from wind farm operation can be classified as direct (collisions with moving turbine blades or other infrastructure) or indirect (creation of a soft barrier or alienation of habitat around operating WTGs) (Langston and Pullan 2003). Collisions, in the context of this management plan, include birds and bats directly striking the turning blades or other

structures (e.g. nacelle, tower) and barotrauma whereby microchiropteran bats (microbats) experience sudden and severe pressure changes from the blade sweep leading to tissue damage within the sensitive air sacs in their lungs (Baerwald et al. 2008). The aim of the BBMP is to identify the direct and indirect impacts associated with the operating project and ensure measures are appropriately monitored and managed to ensure the risk to birds and bats is as low as reasonably practicable.

The objectives of the BBMP to support this aim are to:

- assess potential impacts to bird and bat species associated with the operation of the project, as identified in the Bird and Bat Utilisation Survey (BBUS) report (Ecosure 2023a)
- identify potential mitigation measures and other strategies to reduce impacts on birds and bats
- develop a monitoring program to:
  - detect changes in utilisation of habitat at the project site by birds
  - detect mortality of birds and bats around the project that can be attributed to direct impacts from the project operation
  - provide a framework for management response to changes in habitat utilisation or mortality of birds and bats beyond a defined trigger level
- detail the reporting requirements to implement this BBMP.

The duration of the monitoring program within the BBMP will be conditioned through the project's development approval and will be determined through consultation between the Wind Farm Developer, DES and consultant ecologist. Other BBMPs for Australian wind farm projects have been conditioned to operate for between two and five years. Smallwood and Thelander (2008) identified that carcass monitoring should be completed over three years in order to detect all species directly impacted by wind farm operation.

1.4 Document context

The Preliminary BBMP is supported by, and should be read in conjunction with, the following documents:

- Bird and Bat Utilisation Survey Report for Tarong West Wind Farm (Ecosure 2023a)
- Ecological Assessment Report for Tarong West Wind Farm (Ecosure 2023b)
- Preliminary Fauna Management Plan for Tarong West Wind Farm (Ecosure 2023c)
- Preliminary Vegetation Management Plan for Tarong West Wind Farm (Ecosure 2023d).

The BBMP is an adaptive management plan and will be updated as the monitoring data detailed in this BBMP becomes available and as the project design progresses (i.e. WTG design is finalised).

1.5 Report conventions

The following conventions are used throughout the report:

- The project site comprises 15 properties with an approximate combined area of 17,500 ha (including reserves and easements). The project boundary defines the outer perimeter of the project site.
- The proposed development comprises the spatial data presented in the shapefiles provided by RES in July 2023.
- The planning corridor is the area for all infrastructure and development to occur within the project site and contains the clearing footprint.
- The clearing footprint represents the maximum disturbance footprint of the project, with the flexibility to move this via micro siting within the planning corridor.
- The study area used in desktop searches comprises the project site and a buffer around the site. Two buffer distances were used:
  - a 10 km buffer which contains similar vegetation and habitat to the project site
  - a 20 km buffer that includes the Bunya Mountains, which contains high altitude rainforest habitat not occurring within the project site.
- Conservation significant species include flora and fauna species that are listed as:
  - threatened (critically endangered, endangered or vulnerable) and/or migratory under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
  - threatened or near threatened (TNT) or special least concern (SLC) under the Queensland *Nature Conservation Act 1992* (NC Act).
- Common and scientific names of flora and fauna species follow the Department of Environment and Science (DES) WildNet database (DES 2022a).

1.6 Legislative context

The legislation outlined in Table 1 is relevant to identifying the bird and bat fauna values likely to be present on the site and provides guidance for the assessment of potential project impacts, and the avoidance and mitigation of those impacts based on the operational project activities.

Table 1 Legislation relevant to the proposed development and impacts on birds and bats

Jurisdiction	Legislation / Guideline	Brief description
Commonwealth	*Environment Protection and Biodiversity Conservation Act 1999* Significant Impact Guidelines 1.1 - Matters of National Environmental Significance	The EPBC Act provides the legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, and heritage places identified as matters of national environmental significance (MNES). MNES are defined in the EPBC Act and include: · Ramsar wetlands of international importance · World Heritage properties · National Heritage places · Commonwealth Marine areas · the Great Barrier Reef Marine Park · nationally listed threatened species and ecological communities · nationally listed migratory species · nuclear actions (including uranium mining) · water resources in relation to coal seam gas and large coal mining development. A project or action which is likely to have a significant impact on a MNES is a 'controlled action' and must be submitted to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) for assessment and determination by the Minister. The EPBC Act processes allow voluntary referral of a project to seek confirmation as to whether a significant impact on MNES is likely and to confirm any approval pathway. The Significant Impact Guidelines 1.1 - Matters of National Environmental Significance were released to assist proponents with the assessment of the significance of impacts on MNES and are relevant to fauna and this site. A referral for assessment and determination by the Minister of DCCEEW is underway for this project, including the details of threatened bird and bat species considered likely to occur within the project site.
State	*Planning Act 2016*	The *Planning Act 2016* establishes the framework for the Queensland planning system. The purpose of the legislation is to establish an efficient and accountable system of land-use planning and development assessment that will lead to ecological sustainability. The *Planning Act* defines

Jurisdiction	Legislation / Guideline	Brief description
		ecological sustainability as a balance between: · the protection of ecological processes and natural systems at local, regional, state and national levels · economic development · the cultural, economic, physical and social wellbeing of Queenslanders. The Planning Regulation (2017) and the State Planning Policy (2017) are to guide local and state government in land use planning and development by defining the Queensland Government policies relating to matters of State interest. Applications for development approval are lodged with either the local council or the State Assessment Referral Agency (SARA), depending on the nature of the proposed development, the zoning of the land and the location. The SARA provides expert assessment of specific aspects of the proposed development and can be either the assessment manager (determining the application) or a referral agency. This BBMP along with an accompanying Ecological Assessment (Ecosure 2023b), will be lodged as part of the assessment process for the development application to SARA.
State	State Development Assessment Provisions State code 23: Wind farm development State code 23: Wind farm development – Planning guideline	When the SARA is involved in the assessment process, the State Development Assessment provisions (SDAP) are enacted to provide assessment benchmarks and consistency in assessment. The SDAP contain the state codes, which are specific to particular development proposals or impacts. Each code includes a purpose and performance outcomes. Some include acceptable outcomes which identify one way to achieve the relevant performance outcome. The State code relevant to the proposed development is State code 23: Wind farm development. Performance outcome PO5 of the code requires that "*wind farm development is designed, sited and operated to ensure that flora, fauna and associated ecological processes are protected from adverse impacts*". The Guidelines accompanying the state code indicate the following is required as a minimum to demonstrate that a proposal is consistent with Performance Outcome 5: · an ecological assessment which includes identification of risks to flora, fauna and ecological processes, bird and bat flight paths, fauna habitat and corridors and worst case vegetation impacts · assessment of alternatives and mitigation measures where impacts are likely · a preliminary vegetation management plan, fauna management plan and bird and bat management plan. To address PO5 the following documents relevant to flora and fauna matters have been developed: · an Ecological Assessment (Ecosure 2023b) · a preliminary Fauna Management Plan (Ecosure 2023c)

Jurisdiction	Legislation / Guideline	Brief description
		· a Preliminary Vegetation Management Plan (Ecosure 2023d) · this BBMP.
State	*Nature Conservation Act 1999* Nature Conservation (Animal) Regulation 2020	The NC Act aims to conserve nature through strategies such as dedicating and declaring protected areas for those parts of Queensland with outstanding biological diversity, natural features and wilderness values. The NC Act provides for the conservation of native fauna through restriction of activities such as taking, keeping or interfering with animals or their breeding places. The act also contains provisions relating to the management of non-native wildlife. Unless authorised, it is an offence under the NC Act to take, keep, use, or move protected animals for commercial, recreational or other purposes. Protected animal is defined as an animal that is prescribed under this Act as threatened, near threatened or least concern wildlife. Where a proposed development will result in such impacts to fauna protected under the NC Act, authorisation from DES will be required. **Nature Conservation (Animal) Regulation 2020** In support of the purpose and the provisions of the NC Act, this regulation identifies all native fauna species as either 'extinct in the wild', 'endangered', 'vulnerable, 'near threatened' and 'least concern (LC)' which includes SLC wildlife. Wildlife listed as SLC includes echidna (*Tachyglossus aculeatus*), platypus (*Ornithorhynchus anatinus*) and migratory birds listed under international conservation agreements with Japan, Korea or China or the Bonn Convention. Under *s335* Tampering with animal breeding place, a person must not, without a reasonable excuse, tamper with an animal breeding place that is being used by a protected animal to incubate or rear the animal's offspring. A high-risk Species Management Program (SMP) is required for near threatened, vulnerable, endangered, critically endangered, SLC species and colonial breeders (bats, some wetland bird species). A low-risk SMP is required for other LC species. Note that due to the mobility of koala (with young in the pouch), this species is excluded from this requirement (DES 2020). The Ecological Assessment (Ecosure 2023b) details the threatened fauna species listed under the NC Act confirmed or likely to occur within the project site.
State	*Vegetation Management Act 1999*	The *Vegetation Management Act 1999* (VM Act) is the planning initiative underlying regional management of vegetation in Queensland. The VM Act aims to conserve remnant endangered and of concern REs, prevent land degradation and further loss of biodiversity, manage the environmental impacts of clearing vegetation and reduce greenhouse emissions. In addition to provisions related to the protection and management of native vegetation and regrowth, the VM Act contains provisions for the regulation of essential habitat for species of state significance. Essential habitat (mapped by DES) is vegetation in which a species listed as endangered or vulnerable under the NC Act has been known to occur. Clearing or disturbance to areas of essential habitat will require compensatory habitat measures to be developed.

Jurisdiction	Legislation / Guideline	Brief description
		The Ecological Assessment (Ecosure 2023b) details the regulated vegetation and regional ecosystems ground truthed across the project site to provide habitat for the bird and bat species detailed in the BBMP.

Figure 1: Project site location

Legend

- Existing 275kV transmission line
- Road
- Watercourse
- Project boundary
- Land parcel

RES Australia

Preliminary Bird and Bat Management Plan for Tarong West Wind Farm, Ironpot, Queensland

0 1 2 4
Kilometers

Job number: PR3713
Revision: 0
Author: KF
Date: 10/26/2023

GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

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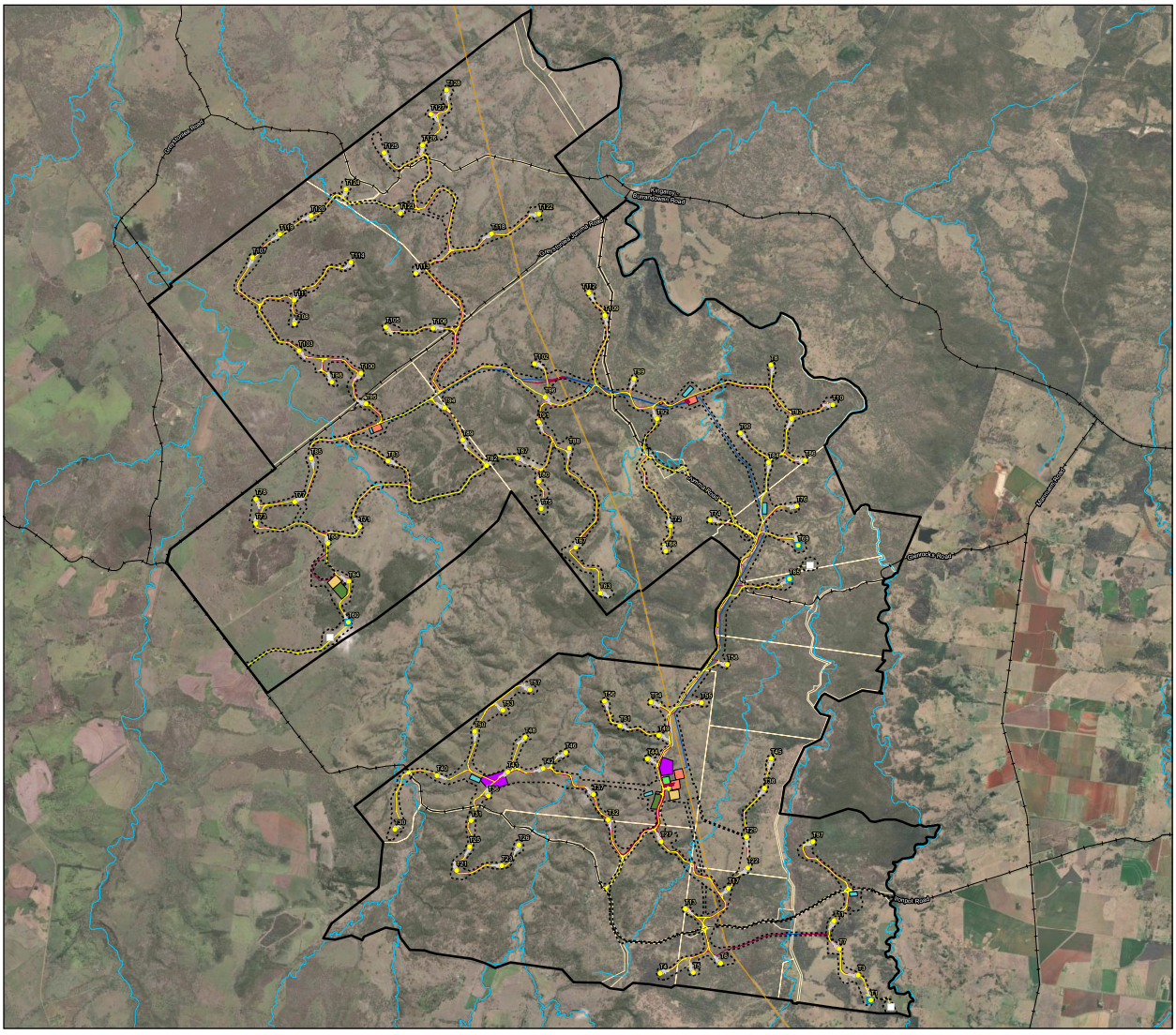

Figure 2a: Proposed development layout

Legend

- WTG
- Meteorological mast (permanent)
- Meteorological mast (temporary)
- Turbine hardstand
- Access track
- Existing 275kV transmission line
- Overhead line reticulation
- Underground reticulation
- Watercourse
- Road
- Batch plant
- Battery energy storage system area
- Laydown
- Operations and maintenance building
- Potential borrow pit
- Site compound
- Substation
- Washdown area
- Planning corridor
- Project boundary
- Land parcel

RES Australia

Preliminary Bird and Bat Management Plan for Tarong West Wind Farm, Ironpot, Queensland

0 1 2 4
Kilometers

Job number: PR3713
Revision: 0
Author: KF
Date: 11/1/2023

GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

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PR3504_VMP_MP2a_ProposedLayout
A3

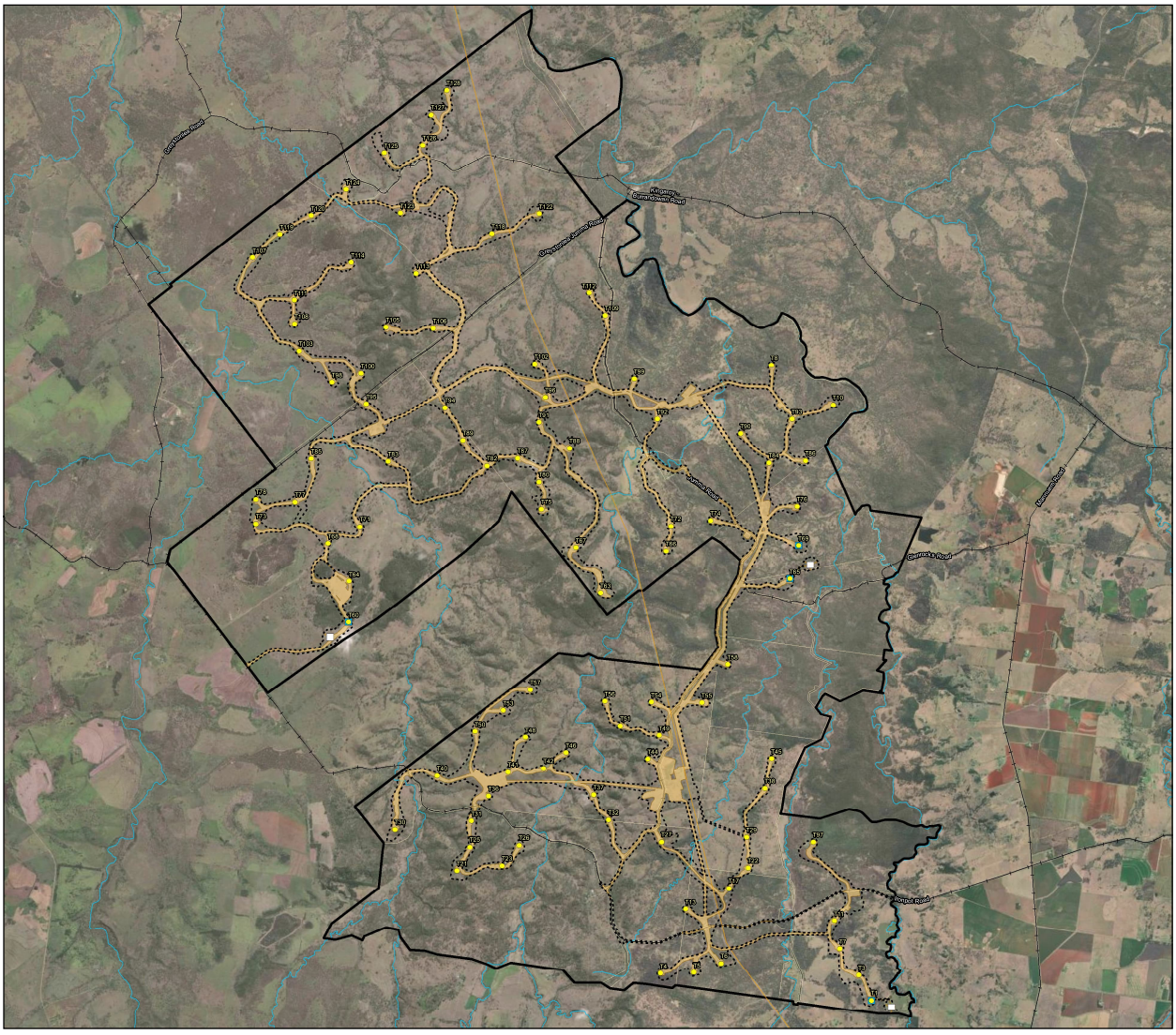

Figure 2b: Proposed clearing footprint

Legend

- WTG
- Meteorological mast (permanent)
- Meteorological mast (temporary)
- Watercourse
- Road
- Existing 275kV transmission line
- Clearing footprint
- Planning corridor
- Project boundary
- Land parcel

RES Australia

Preliminary Bird and Bat Management Plan for Tarong West Wind Farm, Ironpot, Queensland

0 1 2 4
Kilometers

Job number: PR3713
Revision: 0
Author: KF
Date: 11/1/2023

GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

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PR3344_VMP_MP2L_ProposedLayout_ClearingAreaA3

2 Existing environment

2.1 Landscape values and climate

The project site covers an area of approximately 17,500 ha within the South Burnett Regional Council area and lies approximately 30 km west of Kingaroy and approximately 85 km east of Chinchilla. It is currently used for cattle grazing with areas of cleared paddocks and standing vegetation. Access to the site is via Ironpot Road (Figure 1).

The site is located approximately 20 km to the north of the Bunya Mountains National Park, 7 km to the east of Diamondy State Forest and 7 km to the south of Dangore State Forest. It lies to the north, but outside, of a mapped state significant biodiversity corridor (DES 2018) and regionally significant corridors are mapped along the Boyne River and Jumma Creek.

The site is located on the southern border of the Brigalow Belt (South) bioregion in the Banana-Auburn Ranges subregion. Landforms present are primarily undulating plains and hillslopes. Large patches of vegetation occur along the ranges on the eastern boundary of the site, which extends to vegetation north-east of the site and eventually connects to Dangore State Forest to the north. A large patch of vegetation in the western portion connects to vegetation near Kingaroy-Burrandowan Road connecting to Diamondy State Forest to the west. Linear strips of vegetation provide some connectivity along Kingaroy-Burrandowan Road along the northern boundary of the project site. Riparian vegetation along larger watercourses (e.g. Boyne River, Jumma Creek) provide connectivity along the lower portions of the project site.

Eight flyway sites, part of the East Asian-Australasian Flyway, are registered in Queensland (DES 2022b). Of these, five are Ramsar listed wetlands and/or protected areas. The three remaining sites are located in the Gulf of Carpentaria. There are no known flyways, migratory routes or significant bird habitats within or adjacent to the site.

Natural wetlands do not occur within the site and there are no significant wetlands in close proximity to the site (Ecosure 2023b). There are, however, temporary wetlands to the north and north-west of site, including one palustrine wetland (Ecosure 2023b). Landholders have also constructed numerous farm dams throughout the site. These dams may provide habitat for wetland birds and waterfowl and a water source for other birds and bats. It is expected that wetland birds have the potential to traverse between farm dams and these temporary wetlands and ponded pastures after rainfall.

The project site occurs within the Boyne-Auburn Rivers drainage sub-basin in the Burnett drainage basin, which drains to the Great Barrier Reef lagoon. One major mapped watercourse flows generally south to north within the site. The Boyne River begins as a second order stream in the south of the site, increasing in size before exiting the site along the north-western boundary. The Boyne River feeds into Boondooma Lake and the Burnett River before discharging at Bargara near Bundaberg. Other large streams that flow into Boyne River, either within or north of the site, include Mannuem Creek on the eastern boundary, Middle Creek in the south-eastern portion, Jumma Creek in the central portion, Boughyard Creek in the western portion and Ironpot Creek in the north-western portion of the site.

The climate is defined as sub-tropical with warm, humid summers and cool and dry winters. Average maximum temperatures range from 19.6°C in July to 30.9°C in January (Bureau of Meteorology [BoM], Kingaroy Airport Station 040922, approximately 30 km east of the site). The average annual rainfall is 663.3 mm (BoM 2023).

Landforms and features of the site influence interactions between birds and bats and WTGs in the following ways:

- movement along vegetated corridors and movement between habitat areas (eg Boyne River)
- movement between wetland areas and farm dams
- movement along ridgelines
- creation of updrafts which are used for soaring
- caves and overhangs may provide roost areas for microbats and influence the direction and height of flyouts.

2.2 Vegetation and habitats

The vegetation within the site is relatively homogenous comprising narrow bands of riparian vegetation along larger watercourses and dry sclerophyll forests and woodlands dominated by lemon-scented gum (*Corymbia citriodora*) and narrow-leaved ironbark (*Eucalyptus crebra*) on ridges and slopes. One small patch of semi-evergreen vine thicket (SEVT) occurs in the south-western corner.

Non-remnant vegetation covers most of the site (15,843.79 ha or 90.56% of the site). The ground layer is sparse to dense and is dominated by grasses, including native and exotic species. A variety of native and exotic forbs are common in non-remnant areas. Tree cover is variable.

Field-verified remnant vegetation occurs within 1,331.08 ha (7.61%) of the site and HVR within 321.35 ha (1.84%). Field surveys confirmed seven (11.3.25, 11.5.20, 11.7.6, 11.8.3, 11.11.15, 11.12.3, 11.12.6) mapped regional ecosystems (REs) within the project site and one other RE (11.11.4) that was not mapped within the site by the Queensland Herbarium. One other RE (11.3.4) may possibly occur on the project site outside of the planning corridor but was not detected during ground truthing surveys.

The fauna habitats and component REs identified during field survey are outlined in Table 2.

Table 2 Fauna habitats recorded within site

Habitat type	Component REs	Habitat description	Area (ha)
Pasture / exotic grassland	Non-remnant	Isolated trees and shrubs. Ground layer sparse to dense and dominated by grasses and forbs. Rare hollows in large remnant paddock trees.	15,843.79 (90.6%)

Habitat type	Component REs	Habitat description	Area (ha)
Eucalypt woodland/forest	11.5.20, 11.7.6, 11.11.4, 11.11.15, 11.12.3, 11.12.6	Sparse to mid-dense canopy of trees. Shrub layer absent to mid-dense. Ground layer sparse to mid-dense and dominated by grasses and forbs. Numerous small hollows and occasional large hollows.	1,628.56 (9.3%)
Riparian forest	11.3.25 and non-remnant wooded	Sparse to mid-dense canopy of trees. Shrub layer absent to mid-dense. Ground layer sparse to dense with diverse range of grasses, forbs, sedges and rushes. Numerous small hollows and occasional large hollows.	23.30 (0.13%)
Vine thicket	11.8.3, patches of RE 11.12.6 with developing vine thicket mid storey	Scattered emergent trees over sparse to dense canopy containing a diverse variety of vine thicket tree species. Shrub layer absent to mid-dense. Ground layer very sparse to sparse (may be denser in patches with reduced tree cover), numerous vines. Numerous small hollows and occasional large hollows in emergent eucalypts.	0.63 (0.004%)
Farm dam	Non-remnant	Banks have scattered trees and shrubs. Ground layer varies from bare dirt to dense layer of grasses, forbs and sedges. Shallow water may support sparse to dense aquatic plants including forbs, sedges and rushes. Deeper water generally open with scattered lilies or floating aquatic plants. Occasional hollows in large remnant paddock trees.	Scattered throughout site

Cleared grassland is the main habitat type, by area, across the project site. Isolated trees provide limited food, roosting and nesting/denning resources. The sparse to dense grassy ground layer provides shelter and food resources for suitable species.

Remnant eucalypt woodland/forest is the main remnant fauna habitat within the site. It is generally dominated by *Eucalyptus crebra* or *Corymbia citriodora*. Mature individuals of these species typically contain numerous small hollows suitable for nesting or denning by small arboreal fauna, including microbats and occasional large hollows suitable for larger arboreal mammals and large birds. These species also provide important seasonal nectar resources for birds and bats. Some small areas have rock outcrops (e.g. granite, metamorphic, conglomerate and laterite outcrops) that provide shelter and habitat for fauna such as reptiles and small mammals.

Riparian forest occurs on riparian soils along major watercourses. These areas provide a sparse to mid-dense canopy of trees usually containing scattered large and numerous small hollows, providing nesting and denning habitat for arboreal fauna, including greater gliders. Trees also provide important seasonal nectar resources. Scattered pools provide drinking and bathing water for numerous species and riparian areas can be valuable refuges during droughts and provide important corridors for wildlife travelling between remnant habitat blocks.

Vine thicket has a sparse to dense canopy of trees and shrubs that provide shelter as well as important seasonal fruit and nectar resources. The shrub layer is often mid-dense to dense, providing cover for reptiles and ground dwelling mammals and birds. Leaf litter, logs and rocks provide shelter and foraging habitat for small fauna such as reptiles and small mammals.

Farm dams are scattered throughout the site and provide drinking and bathing water and dense fringing vegetation on some dams provide shelter and food resources for small animals such as wetland birds.

A small area of weathered outcropping occurs between Jumma Road and Middle Creek within the central eastern portion of the project site. The outcrops provide a variety of overhangs and recessed areas that were found to have been used by microbats (dropping piles). No microbats were observed during inspection of the outcrops, however several species detected during surveys are known to use overhangs and crevices as roosts, including little pied bat (*Chalinolobus picatus*), eastern cave bat (*Vespadelus troughtoni*), and little bentwing bat (*Miniopterus australis*). The little bentwing bat in particular uses such roosts as over-wintering sites and some species are known to frequent several roosts over time (Churchill 2008).

3 Risk assessment process

Figure 3 provides a conceptual overview of the risk assessment process and methods that will be employed for managing risks to birds and bats over the operational life of the wind farm. The pre- construction or pre-approval phase allows for the collection of baseline data on bird utilisation and the distribution of microbat species across the project site and determines at risk species. This phase also allows for the detection of threatened bird and bat species.

The operational phase provides for continuation of the bird utilisation surveys and, combined with carcass monitoring, enables detection of impacts on bird and bat species (such as avoidance behaviour, and collisions). Targeted species surveys are continued in this phase for threatened species known or likely to occur within the site.

Where an impact has occurred or is suspected to have occurred, a process is provided to determine the nature of the impact, the significance of the impact and whether corrective actions are required.

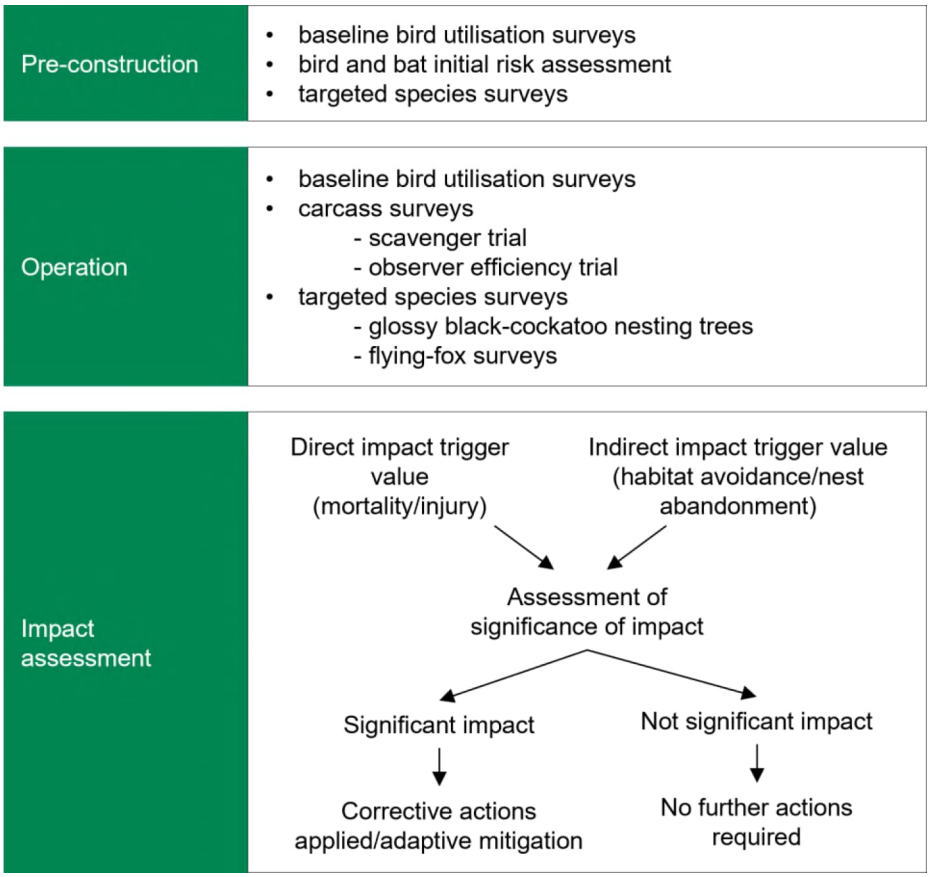

Figure 3 Conceptual risk assessment process

Consistent with this model, a Level One assessment was undertaken as part of the Bird and Bat Utilisation Survey report (BBUS, Ecosure 2023a) which included:

- compilation of bird and bat data for the project site including:
  - species diversity

  - occurrence of conservation significant species
  - critical fauna resource habitats within turbine footprints and adjacent areas
- assessment of risk to birds and bats including:
  - species susceptible to collision impacts
  - qualitative and semi-quantitative estimate of risk
- recommended risk mitigation measures
- recommended further investigations and monitoring.

The outcomes of that investigation are presented in this BBMP.

4 Baseline data

Previous assessments to inform this BBMP involve desktop analysis, targeted and roaming bird surveys and seasonal field surveys. Desktop analysis provided data on known bird and bat species presence, threatened or listed species that may be affected by the development and known significant bird and bat aggregations and habitats within the area. Each significant species return in database searches was assessed for its likelihood of occurrence based on:

- records in the local area (DES 2023, Atlas of Living Australia 2022, survey results)
- presence of suitable habitat (determined using both desktop and field-verified data)
- presence of essential habitat (Department of Resources 2022)
- species abundance, distribution and behaviour (sourced from published field guides, DCCEEW species profiles and threats database and scientific journal articles).

The final assessment of the likelihood of species occurring was refined by field surveys that included targeted searches for possible and likely species and ground-truthing of suitable habitat for these species. Marine species were excluded from the table, but migratory species were included where relevant. Likelihood of occurrence was classified into four categories:

- confirmed – the species or signs of their presence were observed during the field survey
- likely – the site contains habitat that is suitable for the species and Wildnet has recent records of the species (i.e. since 1980) within 10 km of the site
- possible – the site contains habitat that is suitable for the species but Wildnet has no recent records of the species within 10 km of the site; or the site contains marginal / low quality habitat for the species and Wildnet has recent records of the species within 10 km of the site
- unlikely – the site does not contain habitat for the species and Wildnet has no recent records of the species within 10 km of the site.

The bird utilisation survey was based on the Standard Bird Management Guideline for the Australian Wind Energy Association for initial site risk assessment, Level One Investigation (Brett Lane & Associates and Aria Professional Services 2005). Full details of surveys and results are provided in the BBUS (Ecosure 2023a). Bird and bat surveys detailed in the BBUS include:

- 2018 spring survey from 29 October 2018 to 9 November 2018
- 2019 autumn survey from 25 March to 5 April 2019 (included targeted bat surveys and fixed point count bird surveys for the bird utilisation survey)
- 2020 spring survey from 23 November to 28 November 2020 (included targeted bat surveys and fixed point count bird surveys for the bird utilisation survey)
- 2021 spring survey from 25 October to 7 November 2021.

Modified seasonal survey design was employed whereby roaming surveys were undertaken during the 2018 spring survey, and the 2019 autumn, 2020 spring, and 2021 spring surveys targeted TNT species and migratory birds, using fixed point counts, feeding searches, dam and nocturnal surveys instead of seasonal roaming surveys. Microbat surveys focused on acoustic recording and harp trapping, while flying-fox surveys included nocturnal surveys for foraging and flyouts, and habitat searches for signs of roosts.

4.1 Bird survey results

Field surveys from 2018 – 2021 detected 163 identified bird species, plus an additional seven unidentified bird species (by sighting or call). Targeted surveys were undertaken for glossy black-cockatoo (*Calyptorhynchus lathami lathami*), powerful owl (*Ninox strenua*) and black-breasted button-quail (*Turnix melanogaster*).

A total of 6,021 individual birds were detected during fixed point counts with 27 species comprising around 80% of sightings. These 27 species are all common in agricultural landscapes. Large individual groups of bird sightings included:

- 86 unidentified woodswallows that were predating on flying insects above the canopy level
- 75 rainbow lorikeets, 74 sulphur-crested cockatoos and 35 galahs
- one flock of crested pigeons (50), one flock of Australian wood ducks (42) and two flocks of Torresian crows (46 and 40).

Torresian crows, galahs, Australian magpies, and noisy miners comprised just over 30% of the sightings and were found uniformly across the project site, often in small foraging flocks.

Field surveys from 2018 – 2021 detected two TNT species, white-throated needletail (*Hirundapus caudacutus*) and glossy black-cockatoo, and three migratory species, rufous fantail (*Rhipidura rufifrons*), satin flycatcher (*Myiagra cyanoleuca*), and white-throated needletail (also TNT). The glossy black-cockatoo was further detected via chewed cones (orts) underneath their preferred *Allocasuarina* feed trees during targeted feeding and habitat searches across the site.

No powerful owl were detected during targeted or other surveys, however this species is considered to possibly occur on site. No black-breasted button-quail were recorded and only a small area of vine thicket habitat is present on site, which is outside of the planning corridor. This habitat will not be impacted by the project.

One additional conservation significant species, fork-tailed swift (*Apus pacificus*), was detected across the project site in summer 2023, during seasonal surveys (Ecosure 2023b).

4.2 Bat survey results

Field surveys, (including acoustic recording and harp trapping) detected 16 confirmed microbat species and an additional six possible microbat species. Nocturnal and opportunistic

surveys recorded three flying-fox species, black flying-fox (*Pteropus alecto*), little red flying-fox (*P. scapularis*) and the EPBC Act-listed vulnerable grey-headed flying-fox (*P. poliocephalus*). No bat species listed as conservation significant under the NC Act were positively confirmed during surveys.

The survey program targeted grey-headed flying-fox and the EPBC listed vulnerable Corben's long-eared bat (*Nyctophilus corbeni*). Corben's long-eared bats are uncommon and sparsely distributed throughout their range and as positive species identification can only be made through capture there are limited records for this species in Queensland. Corben's long-eared bat was identified as potentially occurring in the project area through the Protected Matters Search Tool search. Although species of the genus *Nyctophilus* were acoustically detected during surveys, individual species within this genus cannot be distinguished by call. Harp trapping in 2021 captured several lesser long-eared bats (*Nyctophilus geoffroyi*), a species which is not listed under the EPBC Act or NC Act. Although it cannot be confirmed whether calls detected in acoustic surveys are from the threatened Corben's long eared bat or another unlisted *Nyctophilus* species, it is most likely to be the least concern *N. geoffroyi*, which is confirmed to occur on the project site.

4.3 Use of baseline data

The bird utilisation surveys completed to date have complied with a BACI (Before, After, Control, Impact) survey design. This decision was taken early in the project development to ensure that baseline data could be used for operational monitoring of impacts to birds and a BACI designed survey is also required by the Wind Farm State Code. Although survey sites were randomly selected, due to the large size and accessibility of the site, sites were adjusted to suit a survey program that could be reasonably achieved within a set survey period. However, it is recognised that changes will occur from early project design to the final design and survey site selection choices made early in the design phase may not be appropriate in the operational phase. The survey data and methods used to date will be reviewed and operational phase surveys may be adjusted accordingly. As with all experimental designs, the larger the changes made to an experiment, the larger the reduction in statistical power of the results. Therefore, any changes to the survey design proposed must be considerate of the analysis to be completed and confidence in the results.

5 Level One Investigation

The Interim standards for assessing the risks to birds from wind farms in Australia (Brett Lane & Associates and Aria Professional Services 2005) recommends a hierarchical approach with three levels of investigation, where the outcome of each level determines if the assessment is required to move to the next level of investigation.

The Level One Investigation aims to:

1. provide a preliminary risk assessment of significant impacts to birds and bats
2. determine if proposed mitigation measures are likely to minimise risk of all bird and bats to “low risk”
3. determine if further Level Two Investigations are required
4. identify target bird and bat groups or species to be considered during any subsequent site surveys or monitoring.

A Level One Investigation was undertaken by Ecosure as part of the BBUS (Ecosure 2023a). The assessment prioritises occurrence and susceptibility of species of national and state conservation significance. The level one risk assessment is a qualitative assessment based on the following elements:

- regional overview - identify species presence in the area and any threatened or listed species that may be affected; significant bird and bat aggregations; and habitats known to occur in the area
- roaming surveys and fixed point counts
- targeted surveys.

The probability (likelihood) of an impact for a species was based on the likelihood of occurrence at the site and the height at which a species is known to fly. Table 3 provides a probability scoring matrix (high, medium, low) based on species occurrence and flight height criteria.

Table 3 Probability matrix for risk of collision

Probability	Occurrence	Flight height
High	Reside / regularly traverse site	Regularly fly at RSA height
Medium	Reside / regularly traverse site	Occasionally fly at RSA height
	Rarely traverse site	Regularly fly at RSA height
Low	Reside / regularly traverse site	Rarely to never fly at RSA height
	Unlikely to occur	Not applicable

A semi-quantitative risk assessment was completed for species that were recorded most commonly during surveys. The assessment at this level also considered the number of individuals of the species recorded flying between 40 m and 305 m above ground level (incorporating the RSA and a conservative risk assessment area). The consequence of WTG collision to an individual bird or bat is considered equal, resulting in death. However, the consequence to the species is dependent on population size. For example, the loss of one individual would be greater for a TNT species or species where the local population is low in numbers.

5.1 At risk species

Some bird and bat species and groups are more at risk of direct and indirect impacts than other species or groups (Smales 2015). Species identified as high risk of direct impacts by Smales (2015) and confirmed present at the Tarong West Wind Farm project site include a number of least concern species in addition species listed as vulnerable and migratory under the EPBC Act identified as likely to utilise the RSA across the project area and confirmed during surveys (white-throated needletail, fork-tailed swift). It is important to note that many of the studies on bird and bat collision with WTGs involve older, operating wind farms with much smaller turbines installed than proposed for the project. Consequentially, the RSA of older turbines is much closer to the ground level than the WTGs proposed for the project and changes the risk profile for birds and bats flying above the canopy.

At risk species are characterised by morphological, ecological (feeding strategies, habitat preference, airspace usage) and behavioural traits that mean that they regularly fly significantly above the canopy and are likely to occur within the RSA. These traits can be described as:

- aerial hunters – raptors and predominantly aerial species that search and/or hunt for prey at RSA height
- forest / woodland occupiers – generally medium to large species traversing between habitat areas
- wetland species – species traversing between habitat areas and congregating at wetland habitats
- shorebirds / pelagics – species soaring around coastal areas or coming into land after hunting in the open ocean
- high-flying / open air hunting microbats.

Smales (2015) notes that not all species that are present at wind farm sites are involved with collisions with WTGs. There is a poor correlation between a species frequency and abundance at a site and number of collisions, which means that even though a species may be abundant at a site, that abundance does not translate into a high risk of collision.

As part of the qualitative assessment, probability of collision for bird and bat groups based on species' known flight behaviour (e.g. flight height, flight distance, vigilance) and preferred habitat was completed for species known or considered likely to use the project site, including

microbats and flying-foxes (Table 22 of BBUS report, Ecosure 2023a). An extract from this table, identifying species of Commonwealth and state conservation significance recorded on site, is provided in Table 4. Each group has been assigned a qualitative risk category of high, medium, or low probability of collision with project infrastructure, including WTG blades.

Table 4 Probability of collision for conservation significant bird and bat groups

Species group	Conservation significant species	Behaviour	RSA probability
Raptors	Least concern (LC) only recorded	· soaring above canopy level to hundreds of metres above ground level · searching for carrion · actively hunting prey above canopy level · includes territorial and nomadic species · occur within forests/woodlands and open plains · low vigilance	**High probability** · species may fly at RSA height · territorial species at greater risk of blade strike · occur above ridgelines where air currents are favourable for soaring · species may be attracted to carcasses at base of WTGs · large mass species (e.g. wedge-tailed eagle, black-breasted buzzard) can damage turbine blades if struck
Aerial foragers	· white-throated needletail (vulnerable EPBC Act and NC Act, and migratory EPBC Act) · fork-tailed swift (migratory EPBC Act)	· soaring above canopy level to hundreds of metres above ground level · includes territorial and migratory species · low vigilance	**High probability** · species may fly at RSA height
Cockatoos (excluding glossy black-cockatoo)	LC only recorded	· fly from hub height to ground level, within forests/woodlands and open plains · locally nomadic · low vigilance	**High probability** · do not soar · may fly at RSA height when moving between roosts and food sources
Wetland birds	LC only recorded	· soaring above canopy level to hundreds of metres above ground level while moving between wetland areas · may fly between temporary ponded pastures and wetlands after rainfall events · generally nomadic · low vigilance	**High probability** · species may fly at hub height and within the RSA · large mass species (e.g. Australian pelican) can damage turbine blades if struck
Microbats (above canopy foragers)	LC only recorded	· fly from above canopy level to many tens of metres above canopy height · fast-flying, with limited manoeuvrability	**High probability** · do not soar, fly between roosts or actively hunting flying insect prey · if operational lighting is considered, then higher risk of barotrauma when microbats are hunting insects

Species group	Conservation significant species	Behaviour	RSA probability
Flying-fox species	· grey-headed flying-fox (vulnerable EPBC Act)	· fly from hub height to below canopy level, within forests/woodlands and open plains · flying-foxes follow food sources and may congregate if major flowering event occurs · moderate vigilance	**High probability** · do not soar, species may fly at RSA height between camps and food sources · many flying-foxes could be attracted to site if major flowering event occurs
Owls and other species	· glossy black-cockatoo (vulnerable EPBC Act and NC Act)	· fly from hub height to ground level, within forests/woodlands and open plains · occasionally fly at hub height · includes territorial and locally nomadic species · moderate vigilance	**Medium probability** · do not soar, generally fly between roosts and food sources · moderate vigilance · territorial species at greater risk of blade strike
Microbats (below canopy foragers)	LC only recorded	· generally occur below canopy · moderate vigilance	**Low probability** · generally fly below hub height · generally fly between vegetated patches
Migratory forest/ woodland/ grassland birds	· rufous fantail (migratory EPBC Act and SLC NC Act) · satin flycatcher (migratory EPBC Act and SLC NC Act)	· includes territorial and migratory species · generally occur below canopy · moderate vigilance · black-breasted button-quail rarely flies	**Low probability** · generally fly below hub height · generally fly between vegetated patches

LC = least concern under the NC Act; **SLC** = special least concern under NC Act.

5.2 Project specific risk assessment

5.2.1 Turbine layout

WTGs have been placed to avoid impacts to remnant and high value regrowth vegetation. However, some WTGs are located adjacent to habitat patches and/or are located between large patches of vegetation, which places them within potential flight paths for forest and woodland birds traversing between habitat patches. The majority of WTGs are located on ridges and hills where they may present a risk to soaring birds utilising updrafts and thermals consistent with these features.

5.2.2 Threatened birds and habitats

The project site supports known populations of two threatened bird species, namely:

- white-throated needletail (*Hirundapus caudacutus*), listed as vulnerable under the NC Act and the EPBC Act

- glossy black-cockatoo (*Calyptorhynchus lathami lathami*), listed as vulnerable under the NC Act and the EPBC Act.

Profiles of these species are provided in Appendix 1.

Qualitative assessment of white-throated needletail determined the species to be at high risk of collision with WTGs as they are known to utilise airspace from above canopy level to many hundreds of metres above ground level. White-throated needletails have been identified as previously colliding with operating wind farms (Hull et al. 2013, Smales 2015) and are likely to spend some time within the RSA while foraging for insects. Although they range over a wide area they have the potential to remain within the project site for extended periods if foraging conditions are suitable.

Glossy black-cockatoo was assessed to be at medium risk of collision in the qualitative assessment. The species is present on the project site, is likely to traverse the site and occasionally fly at RSA height. Due to their low reproductive success (one chick every two years) and vulnerable status, the consequence of occasional loss of an individual is also a factor in determining the level of risk. A precautionary approach has been applied with a minimum risk rating of 'moderate' for the glossy black-cockatoo. However, mitigating measures as outlined in this BBMP have been designed to reduce the likelihood of collision. Provided that ongoing monitoring confirms impact mitigation for this species, the risk rating may be changed to 'low' for the glossy black-cockatoo.

No other threatened bird species are considered likely to be present on site based on the likelihood of occurrence assessment conducted in the BBUS (Ecosure 2023a).

5.2.3 Threatened bats and habitats

One threatened bat species has been identified within the project site:

- grey-headed flying-fox (*Pteropus poliocephalus*), listed as vulnerable under the EPBC Act.

Grey-headed flying-foxes were observed foraging within the site during the spring 2021 surveys when food species were in flower. While the site does contain eucalypt species suitable for feeding, no habitats within the project area are considered to be critical food sources for this species. The nearest known grey-headed flying-fox camp is near Cooyar (38 km south-east of site) and is a nationally important camp. Most recently, the camp was estimated to contain 500 – 2,500 grey-headed flying-foxes in 2022 (DAWE 2022). Grey-headed flying-foxes are reported to fly long distances from camps to food sources (up to 50 km per night [Tidemann et al. 2008]) and traverse open country. It is possible that grey-headed flying-foxes will occupy the project area during times of food availability generally between July and December (Ecosure 2023a and 2023b). The species was determined through the qualitative assessment to be at high risk of collision with WTGs owing to their tendency to congregate around feeding sources and their ability to fly at RSA height. Further surveys should be conducted during the construction and operational phase of the project when mass flowering events are identified.

Microbats, where foraging above the canopy, were determined through qualitative assessment to be a high risk of collision with WTGs. Those foraging below the canopy were determined to be at low risk. Bats are also prone to barotrauma injuries from flying in close proximity to turbine blades (Baerwald et al. 2008). Impacts associated with barotrauma are only likely to occur in the immediate area around the turbine blade.

No other threatened bat species are considered likely to be present on site given the location and habitats present.

5.2.4 Migratory species and habitats

The project site supports known populations of migratory bird species, namely:

- white-throated needletail (*Hirundapus caudacutus*), listed as migratory and vulnerable under the EPBC Act
- rufous fantail (*Rhipidura rufifrons*), listed as migratory under the EPBC Act
- satin flycatcher (*Myiagra cyanoleuca*), listed as migratory under the EPBC Act
- fork-tailed swift (*Apus pacificus*), listed as migratory under the EPBC Act.

The rufous fantail was determined through qualitative and semi-quantitative assessment to be at low risk of collision with WTGs. On the project site, potential habitat for rufous fantail is limited to areas of vine thicket, and patches of riparian vegetation or eucalypt forest with a dense understorey. This species generally forages in the lower and mid strata and rarely flies above the canopy (Department of the Environment (DoE) 2019) and is unlikely to collide with WTGs during operation.

The satin flycatcher was determined through qualitative and semi-quantitative assessment to be at low risk of collision with WTGs. Satin flycatchers are arboreal feeders and generally forage in the canopy and subcanopy, rarely flying above the canopy, and are unlikely to collide with WTGs during operation. Given the low number of observations across the site and the preferred habitat of this species, WTG collisions are considered unlikely to result in a significant impact to a nationally significant population of satin flycatcher.

Fork-tailed swift was determined through qualitative assessment to be at medium of collision with WTGs as they have only been observed in low numbers across the site, even though they are considered high risk of occurring within the RSA. Survey results (Ecosure 2023b) indicate that the project site does not support an ecologically significant proportion of the fork-tailed swift population. In Australia, fork-tailed swifts are believed to be exclusively aerial, flying at heights up to 1,000 m above the ground (DoE 2015). The species migrates to Australia in October and November and departs in April to breed in east Asia (DoE 2015). Fork-tailed swifts occur mostly over inland plains, but are also seen above vegetated areas, coastal habitats and urban environments, where they forage ahead of storm fronts to feed on aerial insects (DCCEEW 2023b). The project site is highly unlikely to provide roosting habitat for fork-tailed swifts, however, they may forage aerially and roost on the wing over the entire site. Given the low number of observations across the site WTG collisions are considered to be infrequent for this species.

5.2.5 Least concern birds and bats

Of all species observed during the bird count surveys from 2018 - 2021, 83% (n = 141) were only observed to fly outside of the RSA risk assessment area (40 – 305 m above ground level). The risk to species was determined based on if they were observed at RSA height and their avoidance values. The least concern species considered most likely to collide with WTG (based on qualitative risk assessment determining them as high probability of collision, number of individuals and frequency observed in the RSA risk assessment area) included wood swallows, cockatoos (galahs, little corella, sulphur-crested cockatoo), raptors (wedge-tailed eagle, Australian hobby, nankeen kestrel) and red-rumped parrot.

Least concern and non-EPBC listed species such as wedge-tailed eagle, nankeen kestrel, sulphur-crested cockatoo and wood swallows have been previously recorded as colliding with turbines at operating wind farms in Australia (Smales 2015).

Three species of microbats (Eastern bent-wing bat, white-striped freetail bat and yellow-belled sheathtail bat) and two species of least concern flying-fox species are known to exhibit behaviour that places them at risk of collisions with WTGs. Although these species are known to be present at the project site, comprehensive utilisation data is not available for these species and so it has been assumed that the species regularly or seasonally utilise the project site. All of these species are listed as least concern under the NC Act, with broad geographical distributions (Churchill 2008) and therefore any potential loss of a number of individuals from the wind farm operation in isolation is unlikely to affect their local or regional populations. Therefore, the collision risk has been assessed as low (likelihood of impact is likely, and the consequence is low).

Two least concern flying-fox species, black flying-fox and little red flying-fox were observed at the site and were considered a high collision risk species in the qualitative assessment. These species were observed in low numbers, possibly because there were no food trees in mass flower during the surveys. Further surveys during flowering season would provide data on the flight paths and use of the site by flying-fox species.

6 Monitoring and reporting

6.1 Introduction

It is important that data is collected in a robust and statistically meaningful way to ensure that the results gained are able to be interpreted and conclusions reached. The monitoring program must be designed for the site with a clear idea of the statistical analysis to be used (Brett Lane & Associates and Arial Professional Services 2005). A preliminary monitoring program is presented in this BBMP with the intent that a suitably qualified ecologist with experience in data analysis will be engaged to refine the proposed methods for the final BBMP.

As is provided in Section 1.3, the objectives of the BBMP and monitoring program are to:

- detect changes in utilisation of habitat at the project site by birds
- detect mortality of birds and bats around the project that can be attributed to direct impacts from the project operation
- provide a framework for response to unacceptable changes in habitat utilisation or mortality of birds and bats.

In order to determine the potential direct and indirect impacts on birds and bats from the operating wind farm, the following surveys will be performed:

1. quarterly seasonal bird utilisation surveys for two years prior to construction to detect any changes in the number of species and/or individuals utilising the site
2. surveys within the glossy black-cockatoo breeding season during adaptive management period of wind farm operations
3. flying-fox surveys during the adaptive management period of wind farm operations if mass flowering and fruiting events (as confirmed by a suitably qualified ecologist) occur across the project site, providing foraging resources for flying-foxes
4. microbat surveys using microbat call recording devices to detect any changes of number of species and/or distribution across the site
5. carcass surveys at the base of WTGs to determine direct impacts (collisions with WTGs)
6. carcass monitoring to determine the potential under estimation of impacts from collisions due to removal of carcasses by scavengers.

Incidental observations of conservation significant bird or bat species will be recorded during all monitoring events by suitably qualified ecologists on site. Key species will include:

- glossy black-cockatoo
- grey-headed flying-fox
- white-throated needle-tail

- migratory species.

Sightings will be documented with each record including the following information:

- date and time of sighting
- location of sighting
- species
- number of birds (approximate)
- proximity to turbines.

6.2 Bird utilisation surveys

Quarterly preconstruction bird utilisation surveys will occur seasonally each quarter for two years at the 15 fixed point count survey locations previously assessed in 2020 and 2021 (Ecosure 2023a). Sites will be surveyed using the same fixed point count methodology as detailed in the BBUS report (Ecosure 2023a).

6.3 Targeted post-construction glossy black-cockatoo surveys

Targeted bird surveys during the adaptive management period will be used to monitor wind farm operation to glossy black-cockatoo behaviour, including avoidance of feeding habitat and avoidance of roosting and nesting trees. As glossy black-cockatoos are unlikely to be detected during standard bird utilisation surveys, targeted surveys for their feeding activity will be completed at known feeding sites. Glossy black-cockatoo exhibit fidelity to feed trees and patches and so these will be monitored to detect change. Glossy black-cockatoos also require large, deep hollows in which to nest. Searches of such hollow resources will also be completed to determine nesting activity within 500 m of WTGs.

Monitoring for glossy black-cockatoo will be conducted for a minimum of two years or two breeding seasons, whichever is longer, during the adaptive management period. As this species may only breed every second year, due to the significant investment made by the parents in successfully raising a chick, continuation of the monitoring program must occur over two breeding seasons to determine whether a chick has been successfully raised.

6.4 Post- construction flying-fox surveys

Evening flyout and nocturnal surveys will be conducted during the adaptive management periods if high food (flowering and fruiting) availability occurs across the project site (generally during spring) to gather data on the use of the project area and flight behaviours of the grey-headed flying-fox. Periods of high food availability (i.e. mass flowering and fruiting events) are to be identified by suitably qualified ecologist. Incidental observations of any roost sites on or adjacent to the project site during the operational phase of the project will be recorded and investigated by a suitability qualified ecologist for species identification and flyout direction.

6.5 Carcass survey methods

The key focus of monitoring will be carcass surveys to detect mortality from collisions with WTGs. It is noted that some of the carcasses found within the vicinity of WTGs may not be as a result of collision with project infrastructure, however it will be assumed for the purposes of monitoring that carcasses are the result of WTG collision. Feather-spots will also be recorded during carcass surveys.

Carcass surveys will be designed in consultation with the Project Owner, DES and a suitably qualified ecologist to ensure a robust, statistically powerful method of data collection. The following points are considered:

- An area of a circle with radius equal to the hub height of the turbine will be searched. The search area will be determined once final selection of the WTG model has been completed. The search area will include an inner circle, where smaller birds and bats are typically found, and an outer circle, where carcasses of larger species typically fall (Hull and Muir 2010).
- A representative sample of WTGs will be searched during each monitoring period. In addition, WTGs considered high risk to birds and bats (for example, those located within 500 m of suitable habitat areas for birds and bats) will also be searched during each monitoring period.
- It is recognised that carcasses will be lost from scavenger activity and natural decomposition. This can impact the number of mortalities recorded. To ensure the results of carcass surveys are representative of impacts, scavenger trials will be completed. Scavenger trials are important as overseas scavenger surveys have shown that 50-75% of carcasses can be removed after 4 weeks (Morrison 2002) and wild dogs are prevalent within the locality (Ecosure 2023b).

It is also recognised that observers may not find all carcasses within a search area as quickly or at all compared with other observers. Observer efficiency trials may be completed to determine the proportion of carcasses that observers find within a set amount of effort expended. Any find of glossy black-cockatoo or other TNT species carcass outside of the search area will be investigated to determine the possible cause for mortality and be recorded as such. If WTG collision cannot be reasonably excluded as a cause of mortality, the carcass will be included in calculations of impact triggers and mortalities.

6.5.1 Scavenger trials

Scavenger trials will be developed following the protocols within Brett Lane & Associates and Aria Professional Services (2005). Scavenger trials are important to determine the rate of loss of carcasses within the site to attempt to correct for the rate of carcasses detected.

Scavenger trials will be completed within the first two years of the monitoring program at a frequency to be determined through consultation with the regulator and a suitably qualified ecologist.

6.5.2 Observer efficiency trials

The number of carcasses found by an observer over a set length of search effort is termed observer efficiency. Observer efficiency differs by observers and therefore, trials may be required to understand observer efficiency. If observer efficiency is known, i.e. from other operating wind farm projects within the region, then trials may not be required.

The observer efficiency trial, if required, will be completed within the first year of carcass monitoring and include two trials over different seasons (wet season and dry season). The decision to perform a trial will be determined following discussions with the Project Owner and DES.

6.6 Post-construction monitoring schedule

The commencement date of the monitoring program will be at the start of the operation period, post-construction for all surveys except the quarterly pre-construction utilisation surveys. The monitoring program may commence at any time of the year. The final BBMP will include the commencement date, monitoring duration and monitoring schedule for the monitoring period.

As has been implemented for other wind farm projects in Victoria and New South Wales, monitoring programs typically occur over the first two years of operation and up to five years of operation. The final monitoring program is highly dependent upon a range of factors such as:

- monitoring effort and duration is appropriate to the final project design and the associated risk to conservation significant birds and bats, to be determined through statistical design
- monitoring is related to the timing and specifications of the operational phase of the project, such as whether a staged start-up approach is selected or soft starts employed
- monitoring is adaptive to the findings of the surveys and can be adjusted as needed.

6.7 Records and reporting

Accurate records must be gained from the monitoring program to ensure that statistically powerful analyses can be undertaken. Data must be recorded using standardised forms that are consistent between observers and reduce potential for errors. Electronic data capture systems are preferred to reduce transcription errors from paper forms and can be configured from the outset to ensure data is recorded to allow efficient analysis.

A suitably qualified ecologist will be engaged to determine how survey data will be collected and analysed in order to meet the monitoring aims. This is important considering that the ability to detect changes in bird and bat abundance from direct and indirect impacts is unlikely to be obvious from inspection of raw data alone. Various models have been developed over time to detect such changes. The critical outcome of these analyses is to determine whether an impact has occurred and what is an appropriate management response.

The monitoring program must include regular reporting of results. The following reports will be completed:

- Threatened species report – detection of injured or killed threatened bird or bat. This involves preparation of a formal report and generally follows initial notification (within 24 hours of the incident occurring) to the regulator.
- Post-survey report – provided to the Project Owner at the end of a survey. May be formal or informal.
- Annual report – provided at the end of the survey year (generally upon the anniversary of the commencement of the monitoring program). This will involve preparation of a formal report and include estimates of bird and bat mortality as a result of WTG collision. This report will be provided to DES during the monitoring program.
- Final monitoring report – provided at the end of the formal monitoring program. Preparation of a formal report.
- Informal correspondence – by email.

Regular reports will be updated at the end of each monitoring survey to ensure that management strategies can adapt to changed circumstances. All reports will be provided to the Project Owner and may be provided to the relevant regulators, as required by any future approval/s.

A summary of the proposed monitoring schedule for birds and bats is provided in Table 5.

Table 5 Proposed monitoring schedule

Monitoring Method	Schedule	When	Responsibility
Bird utilisation surveys	Quarterly for two years	Pre-construction Operations	Project Owner
Glossy black-cockatoo surveys · feeding areas · nest trees	Twice yearly during adaptive management period	Pre-construction Operations	Project Owner
Grey-headed flying-fox surveys	Annual during adaptive management period – spring when foraging species are flowering	Pre-construction Operations	Project Owner
Microbat surveys	Twice yearly	Pre-construction Operations	Project Owner
Carcass surveys	Frequency to be determined	Operations	Project Owner
Observer efficiency trials (if required)	During first year of carcass monitoring – to include wet season and dry season trials, or as required	Operations	Project Owner

Monitoring Method	Schedule	When	Responsibility
Scavenger trials	For the first two years of monitoring – frequency to be determined	Operations	Project Owner
Reporting			
Threatened species report	Within 24 hours of an incident occurring	Operations	Project Owner
Post-survey report	On completion of survey	Pre-construction / Operations	
Annual report	On anniversary of monitoring period	Operations	
Final monitoring report	On completion of final monitoring	Operations	
Informal correspondence	As required	All phases	

7 Adaptive management

7.1 Risk assessment tool

In order to implement an effective management plan, there must be a clear connection between an impact that has occurred and a management response. The risk assessment tool is recommended by Brett Lane & Associates and Aria Professional Services (2005) as the way to ensure appropriate decision making is made in response to a potential impact on birds or bats. Given that birds and bats exist in a natural state and are subject to impacts outside of the Project Owner's control, the risk assessment tool will be viewed as a guide to decision making and responses to medium and high risks will be made on a case-by-case basis.

The risk assessment tool provided in this section has the following purposes:

1. to assist with determining the significance of an impact (i.e. collision, carcass) detected by the monitoring program
2. to assist with developing an appropriate management response to a breach of a trigger level.

The qualitative risk assessment tool is provided in Table 3.

7.2 Triggers for corrective action

The trigger levels for situations requiring corrective action are discussed in this section. Triggers signify that a threshold condition or impact has been reached and that the threshold is of a level requiring a management response. Generally, an impact trigger is where a monitoring survey identifies mortality or injury of conservation significant species or a number of at-risk species. Consequently, triggers may be reviewed regularly depending upon the significance ascribed to various situations and the adaptive management approach employed throughout this management plan.

Triggers for corrective action would be reviewed prior to the final BBMP and the list of triggers agreed between the Project Owner, DES, and a suitably qualified ecologist. Draft triggers are provided in Table 6.

Table 6 Draft triggers for corrective action

Species	Location	Number of individuals per annum	Evidence of avoidance behaviour
Death or injury of a species listed as threatened (critically endangered, endangered, vulnerable) under the NC Act and/or EPBC Act	Within a radius equal to the hub height of the turbine from the base of a WTG	Mortality or injury of 1	
	Point count survey location		Resident species not detected over two years of bird utilisation surveys

Species	Location	Number of individuals per annum	Evidence of avoidance behaviour
	Glossy black-cockatoo - feeding trees		Evidence of feeding (chewed cones of *Allocasuarina*/*Casuarina* species) not detected in known feeding areas during the adaptive management period
	Glossy black-cockatoo - nesting tree(s)#	Mortality or injury of 1	Abandonment of any confirmed nesting trees during operation (no evidence of nesting after confirmed nesting event during the adaptive management period)
Species listed as near threatened, special least concern under the NC Act or migratory under the EPBC Act	Within a radius equal to the hub height of the turbine from the base of a WTG	Mortality or injury of 10^	No trigger
*Raptors or owls	Within a radius equal to the hub height of the turbine from the base of a WTG	Mortality or injury of 3	No trigger
Bats (LC flying-foxes or microbats)	Within a radius equal to the hub height of the turbine from the base of a WTG	Mortality or injury of 10	No trigger

^ 10 individuals represent a small percentage of the migratory species population in Australia for the species known or likely to occur within the site. Nationally important proportions of populations of satin flycatcher and rufous fantail are 1,700 and 1,100 individuals respectively and 100 individuals for fork-tailed swift (DoE 2015)

* Where there is a conflict between a species conservation status and its functional group, the lower trigger value shall prevail. For example, the trigger value for a grey-headed flying-fox will be as for threatened species and not bats, similarly for white-throated needletail.

Contingent upon locating known nesting tree(s) during baseline surveys.

The following procedure may be used once a trigger value has been reached:

1. The suitably qualified ecologist will report the result to the Project Owner and commence an investigation.
2. The suitably qualified ecologist and Project Owner will complete a risk assessment to determine the significance of the event and whether further action is required.
3. Depending upon the project's approval conditions, a report to the regulator may be required.
4. If the event is determined to be a significant impact, then this will either:
    a. require corrective action to adapt management strategies to attempt to reduce further impacts; or
    b. require further investigation/survey to determine level of impact.

7.3 Mitigation measures

Additional mitigation measures may be considered when trigger values are breached. These measures would be an addition to those committed to in this BBMP. It is recognised that the wind farm will be developed within a functioning and dynamic ecological community and that alternative mitigation measures may be required to adequately address risk to birds and bats. Should a risk assessment process identify a significant impact, there are a number of additional mitigation measures that can be implemented as part of the adaptive management response.

These measures are presented below in increasing level of response:

1. Increase survey effort – this will provide additional data that supports a trigger level breach. The frequency of point count surveys and/or targeted surveys will be increased depending on the species targeted, the behaviour and ecology of the species and the location of the trigger.
2. Investigate activities or events – this provides contextual data that may have contributed to a species mortality or absence from the site. This may include such events as bushfires, mass flowering events, severe storms, drought or heat waves that will influence species utilisation of the site.
3. Anthropogenic activities not related to this project may also require investigation to determine whether those activities have contributed to species mortality or absence (e.g., baiting for wild dogs causing attraction of carrion-foraging wedge-tailed eagles, new stock watering point constructed attracting birds, planting of crops that provide foraging resources).
4. Investigate attractants such as artificial lighting, which attracts both birds and bats and their food sources such as insects (Longcore et al. 2008). Artificial lighting may also temporarily blind birds, particularly nocturnal species such as owls or other species used to flying at night or in low light conditions. Birds may then fly towards the lights and / or collide with physical structures such as WTGs or other infrastructure such as buildings and powerlines (Gauthreaux and Belser 2006). At this time proposed WTGs will not require obstacle lighting to maintain an acceptable level of safety to aircraft (Aviation Projects Pty Ltd 2023).
5. Investigate deterrents – where it has been shown that a species mortality has been caused by collision with a WTG and the risk assessment has determined a significant impact has occurred, a variety of deterrents may be investigated to attempt to direct birds away from WTGs. Deterrents may involve physical objects or aural cues that attempt to scare birds away.
6. Onsite habitat modification – this mitigation response seeks to manage habitats to minimise the risk birds and bats utilising the habitat. This generally applies to management of regrowth around WTG pads to ensure birds are not attracted to the regrowth habitat. This mitigation does not imply that additional habitats will be cleared over and above the approved clearing for the project.

7. Carrion management – removal of carrion from the area around WTGs can reduce the incidence of raptor collision where these are attracted to an additional food resource on site.
8. Onsite habitat creation / improvement / protection – provides alternative habitat away from WTGs should avoidance of habitats be identified.
9. Radar detection systems and temporary turbine slowdown – several radar systems are available that are designed to detect birds and slow WTGs when birds approach the blades. Currently, these systems are most commonly implemented to detect large birds, in particular birds of prey. However, a recent study on the effectiveness of one radar detection system at a wind farm in Australia (Goldwind 2022) determined that smaller species, such as white-throated needletails, were able to be identified.

The risk assessment (Section 5.2) will be used to determine the significance of the observed impact and the appropriateness of the mitigation response(s). Multiple measures may be required in order to minimise further risk to as low as reasonably practicable.

8 Roles and responsibilities

8.1 Roles

Key roles and responsibilities, relevant to the implementation of the BBMP, are identified in Table 7.

Table 7 Key roles and responsibilities

Role	Responsibility	Frequency
Project Owner		
The Project Owner's role is to ensure that the BBMP is implemented in accordance with relevant approvals.	submit monitoring results to the regulator in accordance with the reporting schedule	as per reporting schedule
	submit non-conformances to the regulator in accordance with the compliance requirements	as required when triggers are breached
	ensure that the BBMP is being implemented in accordance with the BBMP and relevant approvals	ongoing
	contribute to monitoring for bird and bat mortalities in consultation with the ecologist	ongoing
Project Ecologist		
The ecologist's role is to undertake monitoring as per the BBMP and inform the Project Owner of non-conformances or improvements.	undertake bird utilisation surveys and carcass surveys in accordance with the BBMP	as per the monitoring schedule
	ensure timely and accurate reporting of survey results to the operator	as per the reporting schedule
	ensure timely and accurate reporting of non-conformances to the operator	as required when triggers are breached
	assess the performance of the BBMP and recommend adaptations for improvement to the operator	ongoing
	provide technical advice / notes / reports to the operator	as required

8.2 Qualifications and experience

A suitably qualified ecologist will implement and oversee the monitoring program, including carcass searches, searcher efficiency trials and scavenger trials. Searches will be conducted by personnel/dogs trained by suitably qualified ecologists experienced in these methods.

All site personnel will be inducted and informed of the conservation significant fauna on the project site and the requirement to report any bird or bat deaths observed.

Bird utilisation surveys and carcass surveys are specialised tasks that require a reasonable level of experience to be held by the project's suitably qualified ecologist. The project ecologist will hold the following:

- a degree in science, environmental science or ecology
- a minimum of 5 years' experience in completing bird surveys within South East Queensland and/or the Brigalow Belt bioregions
- experience in working on large-scale wind energy projects in Australia.

It is known that there is considerable observer bias in conducting bird surveys and results can varying between observers. To minimise observer bias, it is preferable that personnel remains consistent over the BBMP monitoring period, as far as practicable.

8.3 Record keeping

Records must be kept of the qualifications and experience of the project ecologist and other ecologists contributing to the monitoring program.

Records must be kept for a minimum of five years following the end of the monitoring program.

8.4 Audit and review

The BBMP will be reviewed to align with the monitoring reporting, or when triggered by an incident. A review will assess whether the plan is achieving its objectives and the requirements of any relevant approval conditions. A review will take into account environmental monitoring records, corrective actions and the results of any audits. During the review process, any reasons for varying the management plan will be documented.

The BBMP will be reviewed by the Project Owner, a suitability qualified ecologist and a qualified external auditor (i.e. technical area expert in bird and bat strike). Updated management plans will be provided to the regulator as required.

Review of a management plan would typically be undertaken:

- following significant environmental incidents
- when there is a need to improve performance in an area of environmental impact
- periodically for actions undertaken over long timeframes such as one, two or five years.

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Appendix 1 Species profiles

Glossy black-cockatoo *Calyptorhynchus lathami lathami*

EPBC Act status	Vulnerable
NC Act status	Vulnerable
Likelihood of occurrence	Known
Species description	· 460 – 510 mm body length · 422 – 480 g (males), 430 – 500 g (females) · Smallest of the black-cockatoos. They are generally black to sooty brown with bright red undertail coverts. The female has yellow feathers scattered through the head and neck. The beak is large and rounded. The crest is subdued (Glossy Black Conservancy 2010)
Habitat withing the site	Although no glossy black-cockatoos were observed during the spring or summer/autumn surveys, evidence of their feeding was detected throughout the site. Habitat preference was shown to be within coastal she-oak *Allocasuarina littoralis* patches within larger patches of vegetation. No evidence of feeding was detected within patches of belah or river oak *Casuarina cunninghamiana.*
Relevant biology / ecology	The glossy black-cockatoo is a habitat specialist that preferentially feeds on the seeds of oaks (Casuarina) and she-oaks (*Allocasuarina*) trees. They are essentially a temperate zone species and inhabits higher altitude sites in the north of their range. They prefer a range of woodland habitats where preferred food sources occur including *Eucalyptus, Corymbia* and Angophora woodlands or in patches dominated by oaks and she-oaks or brigalow *Acacia harpophylla*. Food trees can be identified by the presence of discarded seed cones (termed orts) at the base of trees. They breed within remnant woodland patches and require a hollow stump or limb (living or dead). Roosts are usually less than 1 km from reliable water (eg. dam). Glossy black-cockatoos lay a single egg from March to June and if a young is successfully raised, the parents will forgo the subsequent breeding season. Incubation of the egg lasts for 30 days and the chick fledges after 84-96 days. The chick is fed by both parents for 12 months following hatching and will roost with its parents (Glossy Black Conservancy 2010).


Photo (left): Glossy black-cockatoo (female), (right) chewed cones or orts. *Source: D. Fleming*

White-throated needletail *Hirundapus caudacutus*

EPBC Act status	Vulnerable and migratory
NC Act status	Vulnerable
Likelihood of occurrence	Known
Species description	· 19-21 cm body length · 93 grams · largest swift species. Heavy looking body tapering to a broad, short, square-cut tail · white forehead and throat, glossy dark green above, brown below
Habitat withing the site	White-throated needletails are almost entirely aerial, occurring within high, open airspaces above almost all habitats including oceans. They will roost occasionally in trees within any habitats.
Relevant biology / ecology	The species does not breed in Australia, migrating to their breeding grounds in northern Asia in May and returning in October. Like other swifts, the needletail at times gathers over ranges, headlands preceding thunderstorms when aerial insect activity is high.

Photo: White-throated needletail. *Source: Steve Burrows, via Atlas of Living Australia*

Grey-headed flying-fox *Pteropus poliocephalus*

EPBC Act status	Vulnerable
NC Act status	Least concern
Likelihood of occurrence	Potentially present
Species description	· 244 mm body length · 410 – 1270 (average 780) g · Large bat, has a mantle of rusty coloured fur completely encircling the neck. Fur on the back is dark grey, often with silver frosting. Fur extends down the legs to the toes.
Habitat withing the site	Habitat preferences include all remnant and HVR vegetation within the site as well as non-remnant vegetation where food trees are present.
Relevant biology / ecology	Feeds on a variety of nectar and blossom producing species as well as fruiting species. Their major food source is *Eucalyptus* blossom and are likely to feed within the site during infrequent large blossom events. Grey-headed flying-fox are seasonally nomadic and follow food resources throughout their range (central Qld to Victoria and South Australia). Camps occur in dense vegetation usually near water within paperbark *Melaleuca*, river oak *Casuarina cunninghamiana* or exotic trees. Individual bats can forage up to 50 km from camps (Churchill 2008). Male fertility peaks in March and females gestate for 6 months. Females congregate in maternity camps where a single young is born. The young is carried with the mother during early foraging trips and then is increasingly left in the maternity camp. The young bats leave the camp to forage with the females in January and February and are weaned by March.

Photo: Grey-headed flying-fox. *Source: National Park NSW* https://www.nationalparks.nsw.gov.au/plants-and-animals/grey- headed-flying-fox

Rufous fantail *Rhipidura rufifrons*

EPBC Act status	Migratory
NC Act status	Special least concern
Likelihood of occurrence	Known
Species description	· 15-16 cm body length · 10 grams · Orange-rufous eyebrow, lower back and base of fanned tail. Outer tail blackish with greyer tips. Head, mantle and wings grey-brown. White throat with black banding on the upper chest, lower chest black
Habitat withing the site	Prefers dense, often wetter habitats such as rainforest, dense wet forests, swamp woodlands and mangroves, preferring to be active in shaded areas. A seasonal migrant that flies to northern Australia for winter, during migrations, the species will traverse more open habitats. Within the site, the rufous fantail was observed within SEVT vegetation.
Relevant biology / ecology	The species feeds on insects that occur within the mid to lower levels of vegetation. The fantail breeds from October to February and constructs a small, compact cup nest of fine grasses held together with spider webs. The nest is usually suspended from a tree fork about 5 m above the ground. Both parents help build the nest and rear the clutch of 2-3 chicks.

Photo: Rufous fantail. *Source: D. Fleming*

Satin flycatcher (*Myiagra cyanoleuca*)

EPBC Act status	Migratory
NC Act status	Special least concern
Likelihood of occurrence	Known
Species description	· 17.5 cm body length · 17 g · species is characterised by an upright posture, short erectile crest, and a distinctive habit of quivering the tail when perched · males are glossy blue-black above, with a blue-black chest and white below, while females are duskier blue-black above, with a orange-red chin, throat and breast, and white underparts and pale-edged wing and tail feathers
Habitat withing the site	This species prefers Eucalypt forest and woodlands and they are particularly common in tall wet sclerophyll forest, often in gullies or along water courses. Within the site this species was mainly recorded within non-remnant open woodland with a grassy understory near the Boyne River. It could also utilise Eucalypt forest and woodland and riparian zones.
Relevant biology / ecology	Satin flycatchers are arboreal feeders and generally forage in the canopy and subcanopy, rarely flying above the canopy. They are mainly insectivorous, occasionally eating seeds. In Queensland this species has been known to breed in December, building a nest in a fork of the outer branches of trees. Pairs nest in loose colonies or nest can be clustered in small numbers.

Photo: (left) Male Satin flycatcher, (right) Female Satin flycatcher. Source: Charles Dove, via Atlas of Living Australia

Fork-tailed swift *Apus pacificus*

EPBC Act status	Migratory
NC Act status	Special least concern.
Likelihood of occurrence	Known
Species description	· 18-21 cm body length · 30 - 40 grams · medium sized swift species, with slim body · long scythe-shaped wings that taper to fine pointed tips · long deeply forked tail · mainly blackish with a white band across the rump.
Habitat withing the site	In Australia, fork-tailed swifts are believed to be exclusively aerial, flying at heights up to 1,000 m above the ground. Fork-tailed swifts occur mostly over inland plains, but are also seen above vegetated areas, coastal habitats and urban environments, where they forage ahead of storm fronts to feed on aerial insects.
Relevant biology / ecology	The species does not breed in Australia, and migrates to Australia in October and November and departs in April to breed in east Asia migrating. Like other swifts, the fork-tailed swift at times gathers over ranges, headlands preceding thunderstorms when aerial insect activity is high.

Photo: Fork-tailed swift. *Source: Sandy Horne, via Atlas of Living Australia*

Distribution List

Copy #	Date	Type	Issued to	Name
1	31/01/2024	Electronic	RES Australia Pty Ltd	Toby Coates

Citation: Ecosure, 2023, *Bird and Bat Management Plan for Tarong West Wind Farm*, Report to RES Australia Pty Ltd. Publication location – Brisbane.

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