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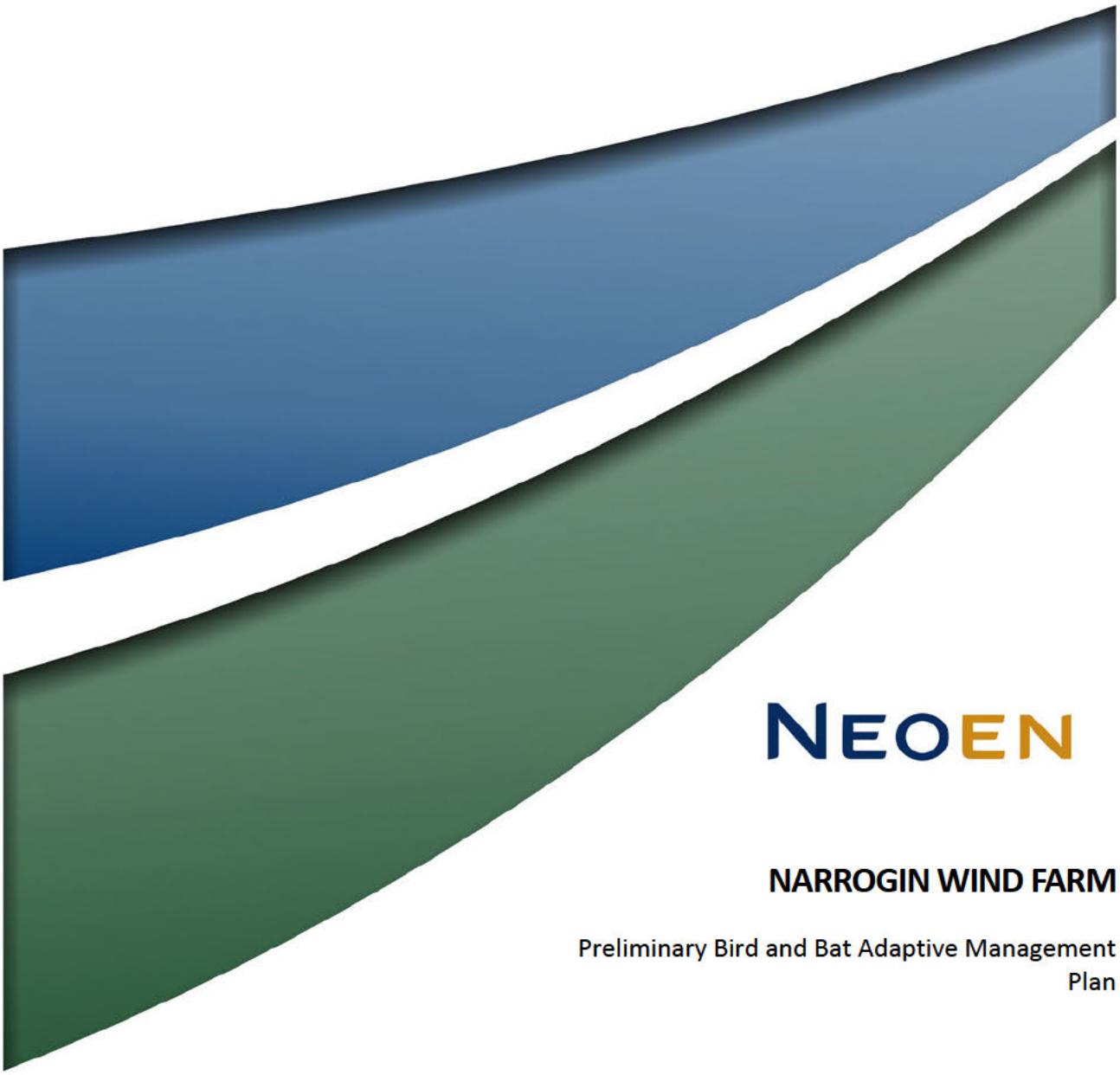

NEOEN

NARROGIN WIND FARM

Preliminary Bird and Bat Adaptive Management Plan

FINAL

September 2024

NEOEN

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Preliminary Bird and Bat Adaptive Management Plan

FINAL

Prepared by

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umwelt
Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

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Abbreviations

Abbreviation	Definition
AGL	Above Ground Level
AHD	Australian Height Datum
BBAMP	Bird and Bat Adaptive Management Plan
BBUA	Bird and Bat Utilisation Assessment
BBUS	Bird and Bat Utilisation Survey
BC Act	*Biodiversity Conservation Act 2016* (WA)
DAWE	Department of Agriculture, Water and the Environment (now DCCEEW)
DBCA	Department of Biodiversity, Conservation and Attraction
DCCEEW	Department Climate Change, Energy, the Environment and Water
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
EP Act	*Environmental Protection Act 1986* (WA)
EPA	Environmental Protection Authority
EPBC Act	*Environmental Protection Biodiversity and Conservation Act 1999* (Cth)
kV	Kilovolts
MNES	Matters of National Environmental Significance
RSA	Rotor Swept Area
WTG	Wind Turbine Generator

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1.0 Introduction

Umwelt is supporting Neoen Australia Pty Ltd (Neoen) in seeking project approvals for the Narrogin Wind Farm (the Project). The Project is located approximately 9 km west of Narrogin township and 160 km southeast of Perth, within the Western Australian Wheatbelt Region. Throughout the iterative project design, avoidance of actions with direct impacts to biodiversity values has been adopted as the primary mitigation measure such that the final project area and layout has the lowest impact achievable.

This Preliminary Bird and Bat Adaptive Management Plan (BBAMP) seeks to support the Project's referral under the *Environment Protection and Biodiversity Act 1999* (Cth) (EPBC Act) and *Environment Protection Act 1986* (WA) and provide an overview of the management and mitigation of risks to bird and bat species occurring within the Project area. This primarily relates to species listed under either the EPBC Act or *Biodiversity Conservation Act 2016* (WA) (BC Act) (i.e. conservation significant species), but also includes non-listed species considered to be at-risk of collision. This BBAMP will also support the Development Application under the *Planning and Development Act 2005*.

This BBAMP has been informed by baseline Bird and Bat Utilisation Surveys (BBUS) (completed between Spring 2023 and Summer 2024), as well as bird and bat data collected as part of the baseline ecology assessment. Additional BBUS are currently planned for Spring 2024 and Summer 2025.

1.1 Purpose

The purpose of this Preliminary BBAMP is to provide a framework regarding the adaptive management of potential impacts, attributable to the operation of the Project, to birds and bats.

The BBAMP will be updated to consider further survey data collected prior to construction and to address any Commonwealth and State approval requirements.

This Preliminary BBAMP seeks to provide an overview of the mitigation and management procedures undertaken at the Narrogin Wind Farm, with the ultimate outcome of having no significant impact to bird and bat species as a result of the Narrogin Wind Farm. To achieve this outcome, this BBAMP:

- Provides an overview of pre-referral survey results for the Project.
- Presents the outcomes of the collision risk assessment, focusing on species which were deemed at risk of collision impacts or are otherwise of interest due to factors such as their conservation significance or dearth of information regarding collision potential.
- Presents an overview of proposed post-commissioning survey programs including further bird and bat utilisation surveys, as well as a carcass detection program.
- Provides proposed impact trigger thresholds for species listed under the EPBC Act or BC Act, as well as non-listed species deemed to be at-risk of collision.
- Presents the management response framework to be initiated in the event that a trigger threshold is reached or exceeded.

- Outlines ongoing and preventative mitigation and management measures, as well as reporting requirements.
- Aims to further the understanding of the impacts to birds and bats associated with the construction and operation of the Project by assessing pre and post commissioning bird and bat data.

1.2 Project Description

The Project is located approximately 160 km south-east of Perth, Western Australia, in the Wheatbelt South region spanning across the Shires of Williams and Narrogin. The Project is expected to comprise a battery energy storage system and up to 25 wind turbines with associated ancillary infrastructure. A 220 kV line intersects the southern boundary of the proposed area that the Project will connect to. The number of turbines has been reduced from 44 to 25 in specific locations as a key mitigation measure to reduce the potential for impacts to bird and bat species.

The primary infrastructure of the Project is likely to be the battery compound, wind turbines, an electrical substation, switchyards, access roads, operation and maintenance facilities, overhead and underground cabling, as well as other types of ancillary construction and operational infrastructure. Additionally, temporary facilities including construction compounds and laydown areas, and temporary activities such as concrete batching, may also be required.

At this stage in the Project, turbine specifications have not been confirmed by Neoen, however, the bird and bat utilisation assessment (**Appendix B**) used the following specifications to inform the assessment:

- a maximum overall height (tip height) of 291 metres (m) above ground level (AGL)
- a three-blade rotor with maximum blade length of 91 m
- a maximum hub height of 200 m AGL
- a rotor swept area (RSA) of between 49 m and 291 m AGL.

Results from studies to date, including BBUS and fauna surveys, have been used to inform the Project design and mitigation of impacts. In applying the mitigation hierarchy, avoidance of impacts through changes to the Project area, turbine layout, and turbine specifications has been the primary mitigation measure. This has included:

- Reducing the Project area by 3,023 ha to avoid the most intact and largest patch of vegetation (in the Additional Study Area) where most secondary evidence of black-cockatoos was recorded and the only direct observation was recorded.
- Reducing the number of turbines from 44 to 25 to reduce the potential for collision or impacting regional movement, including removing turbines:
    - From around the most intact large patch of vegetation in the Additional Study Area.
    - From around larger patches of vegetation under DBCA management in the eastern part of the Study Area.

- From the lots north of Clayton Road near Rosedale House, where Forest Red-tailed Black Cockatoos are anecdotally noted as travelling from Dryandra National Park to forage.

- Having a minimum turbine tip height of 49 metres AGL, above the typical flight height for black-cockatoos.

1.2.1 Study Area

The Study Area refers to the boundaries of all freehold land parcels which encompass the infrastructure that has been designed for the proposed wind farm as well as connection corridor that crosses south across Narrogin-Williams Road to the 220 kV transmission line.

The area covers approximately 6,344 hectares (ha) and extends approximately 14 km north-south at the longest point and 12 km east-west at the widest point. The Study Area represents the limit of the vegetation and habitat mapped for the Project. However, it should be noted that this boundary does not represent the complete spatial bounds in which all Project field surveys have been undertaken (this area being larger and including areas outside of the Study Area, otherwise referred to as the Additional Survey Area). As part of the mitigation of impacts through design iterations for the Project, the Study Area was reduced to remove a large patch of relatively intact vegetation. Removing this area and the proposed turbines around the intact vegetation patch has reduced the potential for bird and bat impacts from turbine strike or direct habitat loss.

The Study Area is primarily cleared for agriculture and sheep grazing with interspersed patches of remnant and regrowth woodland, generally associated with hills and slopes, with elevations between 280 m and 380 m Australian Height Datum (AHD). Dryandra National Park and Lol Gray State Forest are located to the north of the Study Area.

The Project Study Area and regional context are illustrated on **Figure 1.1**.

FIGURE 1.1
Project Study Area

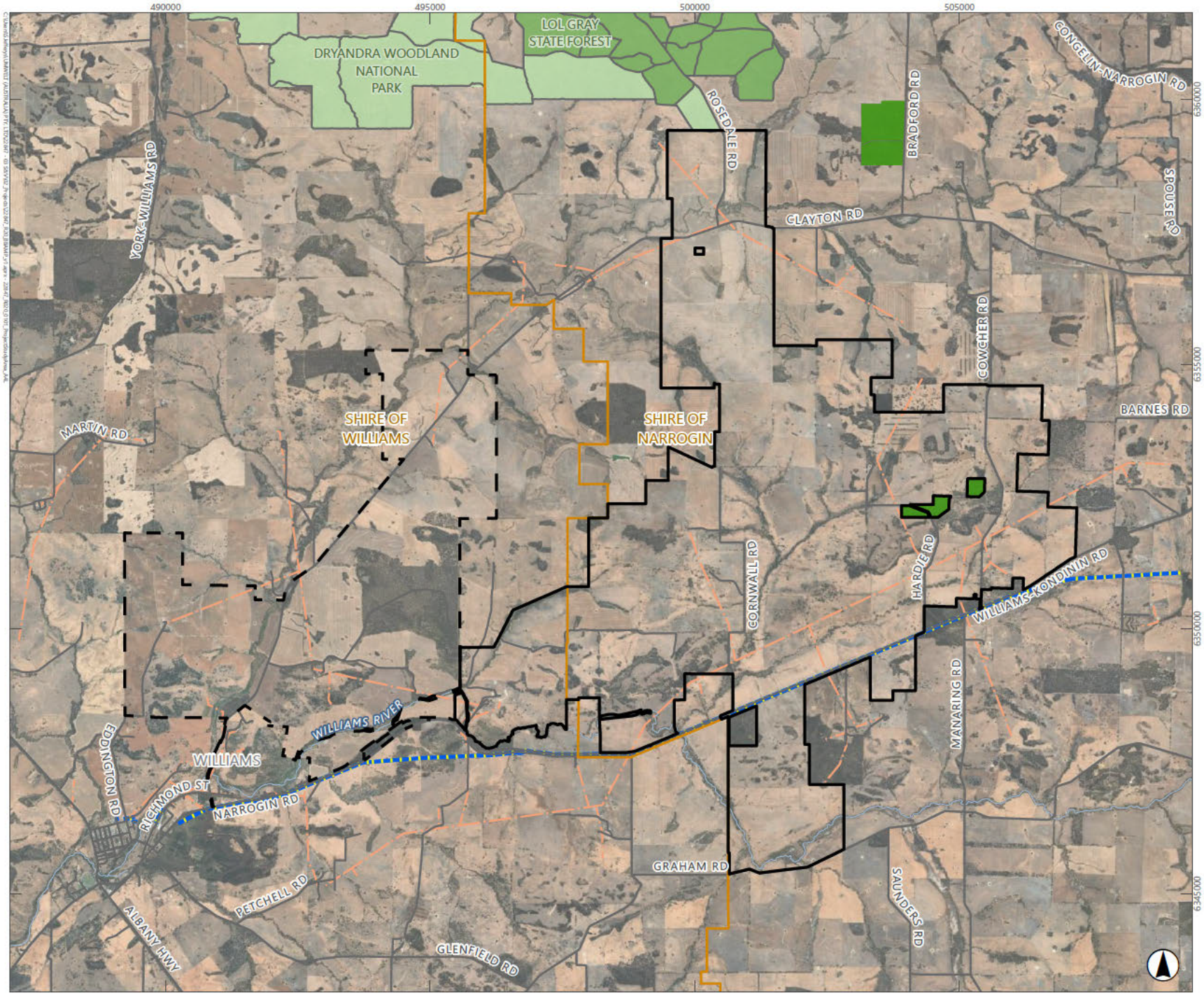

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023), WP (2023), WCORP (2023)

2.0 Baseline Surveys

2.1 Desktop Assessment

An initial desktop assessment was undertaken for the Project to review the potential occurrence of conservation significant bird and bat species. The desktop assessment identified 19 conservation significant bird species and 2 conservation significant bat species that have the potential to occur within the Study Area. The desktop review undertaken to support this assessment is provided in the Narrogin Wind Farm Bird and Bat Utilisation Risk Assessment (BBUA) Report (**Appendix B**).

2.2 Baseline Survey Methodology

Baseline bird and bat utilisation surveys (BBUS) were conducted within the Study Area between 2023/24 with additional surveys planned for 2024/25 to provide 24 months of monitoring. This corresponds to a total of two BBUS events completed and two more to be undertaken.

All BBUS have been timed to coincide with the seasonal migration/movement of EPBC Act and BC Act listed bird species that are likely to occur in the area, including fork-tailed swift (*Apus pacificus*) and black-cockatoo species (Forest Red-tailed Black-Cockatoo, *Calyptorhynchus banksia naso;* Baudin's Black-Cockatoo, *Zanda baudinii*; and Carnaby's Black-Cockatoo, *Z. latirostris*). Survey timing also aimed to coincide with peak seasonal activity for State listed bat species such as the Western False Pipistrelle (*Falsistrellus mackenziei*) (listed as Priority 4 under the BC Act). Fauna surveys were undertaken more broadly for terrestrial fauna which involved the use of passive acoustic monitors, opportunistic searches, and camera traps to search and record bird and bat species across the Study Area. Survey methods were developed and undertaken in accordance with the EPA (2020) *Technical Guidance—Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* and the Department of Environment (now DCCEEW) (2015) *Draft Referral guideline for 14 birds listed as migratory species under the EPBC Act*.

Targeted habitat assessments for black-cockatoo species were completed for the Project's disturbance footprint in 2024. The habitat assessments for the three Threatened black cockatoo species with a potential to occur in the Study Area were undertaken in accordance with the DAWE (now DCCEEW) (2022) *Referral Guideline for 3 WA Threatened Black Cockatoo Species* and the Bamford (2020) method for mapping and characterising foraging and breeding habitat.

A full report detailing the methods and results of the BBUS is provided in **Appendix A** and the BBUA in **Appendix B**.

Fauna surveys were conducted within representative locations of all fauna habitat types and techniques employed included:

- Vantage point surveys across 8 locations within the Study Area which provided 64 cumulative hours of sampling for diurnal birds. An additional 3 vantage points were sampled in the Additional Survey Area which provided 24 cumulative hours of sampling. This method used a fixed-point count method involving timed 30-minute intervals where the following was recorded:
    - species and abundance

- observation type (visual or aural)
- distance and direction from the observer (to the nearest 10 m and 10° respectively)
- approximate height AGL of the observed bird/s (to the nearest 10 m)
- direction of flight (to the nearest 10°)
- flight pattern (i.e., not flying, local movement, directional flight, circling, swooping, varied, other)
- behaviour (i.e., flight, foraging, perching, mating, aggressive interactions, hollow inspection, nesting, on station).

- Acoustic monitoring for bats using Anabat passive bat detector devices was undertaken across 9 sites with a total of 36 trap-nights within the Study Area. A further 6 Anabat detectors were deployed for 4 nights each within the Additional Survey Area, giving a total of 21 trap-nights.
- Songmeter 4 passive acoustic detectors were deployed at 2 locations across 18 nights each within the Study Area providing a total of 36 trap-nights. Within the Additional Survey Area, 2 Songmeter 4 detectors were deployed for 18 nights, giving a total of 36 trap-nights.
- A total of 21 camera traps were deployed in vegetated parts of the Study Area for a month (totalling 685 trap-nights) with bird species recorded. A further 18 camera traps were deployed in the Additional Survey Area for a month totalling 591 trap-nights.
- Black Cockatoo Habitat Assessment, aimed at assessing the presence and extent of breeding, foraging, and roosting habitat, and scoring these habitats using the DAWE (2022) referral guideline for broad-scale mapping across the Study Area. Breeding and foraging habitat was assessed at a finer-scale using the Bamford (2020) method for an early iteration of the Project clearing footprint, which covered approximately 60% of the final indicative Project clearing footprint. The finer-scale assessment of breeding and foraging habitat will be completed for the final Project clearing footprint.
- Incidental observations of fauna were noted during all fauna surveys where they contributed to the accumulation of information on fauna of the Study Area.

The locations of sample points (vantage locations, passive acoustic detectors, Anabat detectors, camera traps, and fauna habitat assessments) are displayed on **Figure 2.1**.

2.3 Baseline Findings

2.3.1 Bird Utilisation

Field surveys identified the presence of four bird species listed under the EPBC Act and/or BC Act. An additional four listed species were identified as having a Moderate likelihood of occurrence within the Study Area. Carnaby's Cockatoo and Forest Red-Tailed Black Cockatoo were both recorded via secondary evidence in the Study Area however no individuals were recorded.

These results are presented in **Table 2.1.**

Table 2.1 Known and Potentially Occurring Conservation Significant Species

Common Name	Scientific Name	EPBC Act Status (Cth)	BC Act Status (WA)
Known			
Carnaby's Cockatoo	*Zanda latirostris*	Endangered	Endangered
Forest Red-Tailed Black Cockatoo	*Calyptorhynchus banksii naso*	Vulnerable	Vulnerable
Peregrine Falcon	*Falco peregrinus*	Not listed	Other specially protected
Western Rosella (inland)	*Platycercus icterotis xanthogenys*	Not listed	Priority 4
Moderate			
Barking Owl (southwest subpop.)	*Ninox connivens connivens* (southwest subpop.)	Not listed	Priority 3
Baudin's Cockatoo	*Zanda baudinii*	Endangered	Endangered
Fork-tailed Swift	*Apus pacificus*	Migratory	Migratory
Masked Owl (southern subspecies)	*Tyto novaehollandiae novaehollandiae*	Not listed	Priority 3

A total of 90 bird species were recorded within the Study Area during all field surveys conducted. A brief summary of flight behaviours recorded for conservation significant species is provided below where available.

No flight height data was recorded for the Carnaby's Black-Cockatoo within the Study Area as the species was only recorded via secondary (foraging) evidence here. The species was visually recorded on one occasion in the Additional Survey Area of the Project (outside of the current Project Area) with a flock of three individuals flying at a height between 20 and 40 m AGL through eucalypt woodland habitat.

No flight height data was recorded for the Forest Red-tailed Black-Cockatoo as the species was only recorded via foraging evidence or aurally within either the Study Area or Additional Survey Area.

Peregrine Falcons were recorded on three occasions within the Study Area with flight height data available for all observations. Two observations consisted of lone individuals and the third observation comprised a pair with one circling and the other remaining perched potentially at a nest. Only one of the observations (lone individual) recorded a maximum flight height (50 m AGL) above the lower limit of the RSA height.

The Western Rosella (inland subspecies) was recorded within both the Additional Survey Area and the Study Area. The species was observed twice either perched on a tree or other structure and identified aurally on the two other occasions in eucalypt woodland and creek-line habitats. Only one of the observations had flight height data recorded where one individual was observed flying below the lower RSA height limit at approximately 3 m AGL.

2.3.2 Bat Utilisation

A total of 8 bat species were acoustically recorded by Anabat bat detector devices within the Study Area throughout the field survey program. One of the recorded bat species is listed under the BC Act (Western False Pipistrelle – Priority 4) and none are listed under the EPBC Act.

One other bat species returned from the desktop assessment (Central Long-eared Bat – Priority 3 under the BC Act) was considered to have a high likelihood of occurrence in the Study Area.

Flight height data is not available for any bat species recorded during field surveys due to the nature of the survey method (passive acoustic monitoring).

The full list of bat species identified during the field surveys is provided in **Appendix A**.

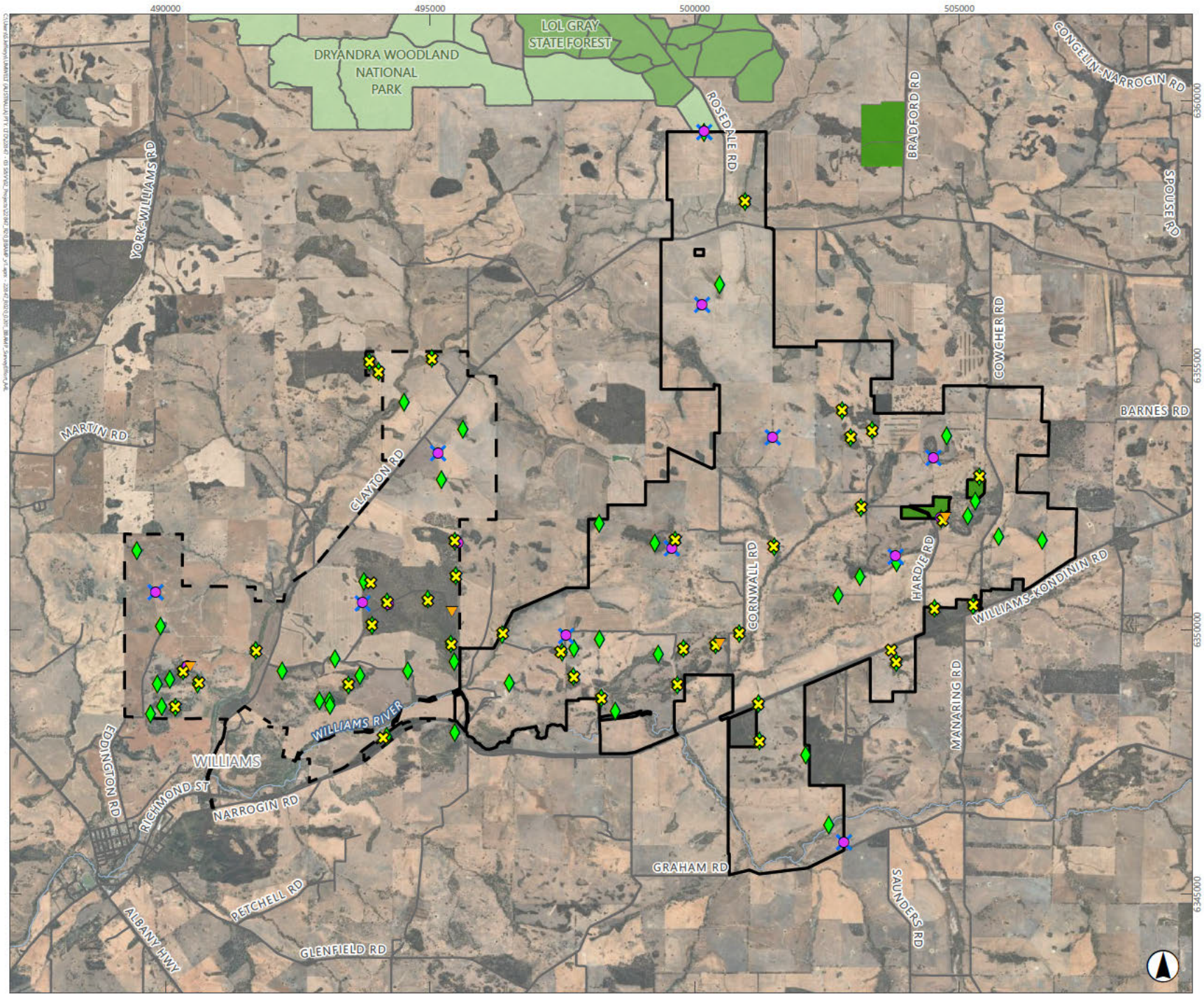

FIGURE 2.1

Bird and Bat Survey Sampling Effort

Legend

- Study Area
- Additional Survey Area
- Road
- Major Watercourse
- Nature Reserve
- National Park
- State Forest

Survey Effort

- Bat Detector
- Camera Trap
- Passive Acoustic Detector
- Vantage Point
- Habitat Assessment

0 2 4

Kilometres

Scale 1:100,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023), DPIRD (2022)

3.0 Bird and Bat Risk Assessment

Mortality at wind farms can result from birds or bats colliding with wind turbine blades, towers, nacelles, guy cabling, power lines, and meteorological masts and the majority of fatalities appear to result from such collisions (Grodsky et al., 2011). Drewitt & Langston (2008) identified a range of factors that may influence the risk of collisions with such infrastructure, including:

- physical attributes of a WTG (i.e. turbine dimensions, and lighting)
- species-specific variables (i.e. abundance, flight behaviour, turbine avoidance capacity)
- biophysical attributes (i.e. landscape position, topography, vegetation type).

Factors falling under the latter two points are often interrelated and generally highly spatially and temporally variable. Proximity to roost locations, migratory flight pathways, and wetlands appear to be particularly important factors that influence bird and bat utilisation.

Data from Australia, Europe, and North America indicate that the risk of collision is likely to be highest in any given area or landscape where species most susceptible to collision (i.e. migratory species, raptors, swifts, waterbirds, high flying microbats) most frequently occur. The consequence of mortality resulting from collision for any given species is largely influenced by the species' population size and life history traits such as longevity and fecundity which combine to determine a species' capacity to replace individuals lost.

A collision risk assessment was undertaken for conservation significant and "at-risk" non-listed bird and bat species (as well as two groups of species) to assess the level of risk for collision with WTGs based on their likelihood and consequence of collision. The methodology used for the risk assessment was adapted from Lumsden et al. (2019), with the overall risk ranking determined from six criteria; two criteria utilised to assess the likelihood of collision and four criteria utilised to assess the consequence. The application of criteria in the methodology results in a qualitative risk rating which is used to inform surveys and management measures. The full risk assessment and detailed methodology is provided in **Appendix B**.

3.1 Summary of Findings

The risk assessment determined a Moderate overall risk ranking for all conservation significant bird and bat species with a Moderate or greater likelihood to occur within the Study Area that were assessed. No species were found to have a Very High risk of collision and one group of species (microbats) was ranked as a High risk, but did not include any conservation significant species. All remaining species and groups received an overall Moderate or Minor risk rating.

Findings from the risk assessment are summarised in **Table 3.1**.

Table 3.1 Collision Risk Assessment Summary

Common Name	Scientific Name	EPBC Act Status (Cth)	BC Act Status (WA)	Overall Risk Rating
Conservation Significant Bird Species				
Barking Owl (Southwest subpop.)	*Ninox connivens connivens* (southwest subpop.)	Not listed	Priority 3	Minor
Baudin's Cockatoo	*Zanda baudinii*	Endangered	Endangered	Moderate
Carnaby's Cockatoo	*Zanda latirostris*	Endangered	Endangered	Moderate
Forest Red-Tailed Black Cockatoo	*Calyptorhynchus banksii naso*	Vulnerable	Vulnerable	Moderate
Fork-tailed Swift	*Apus pacificus*	Migratory	Migratory	Moderate
Masked Owl (Southern subspecies)	*Tyto novaehollandiae novaehollandiae*	Not listed	Priority 3	Minor
Peregrine Falcon	*Falco peregrinus*	Not listed	Other specially protected	Moderate
Western Rosella (inland)	*Platycercus icterotis xanthogenys*	Not listed	Priority 4	Moderate
Conservation Significant Bat Species				
Central Long-eared Bat	*Nyctophilus major tor*	Not listed	Priority 3	Moderate
Western False Pipistrelle	*Falsistrellus mackenziei*	Not listed	Priority 4	Moderate
At-risk Bird Species				
Australian Raven	*Corvus coronoides*	Not listed	Not listed	Moderate
Nankeen Kestrel	*Falco cenchroides*	Not listed	Not listed	Moderate
Tree Martin	*Petrochelidon nigricans*	Not listed	Not listed	Moderate
Wedge-tailed Eagle	*Aquila audax*	Not listed	Not listed	Moderate
Grouped Species				
Microbats	*Microchiroptera*	Not listed	Not listed	High
Raptors	*Strigiformes, Accipitriformes, & Falconiformes*	Not listed	Not listed	Moderate

4.0 Bird and Bat Monitoring Program

Two bird and bat utilisation surveys were undertaken within the Study Area between 2023 and 2024, with another two scheduled for Spring 2024 and Summer 2025. Surveys undertaken to date have been completed in accordance with the methodology detailed in **Appendix A** and summarised in **Section 2.0**.

Further to the avoidance measures described in Section 1.2, the Project commits to minimising potential impacts through preparing a final BBAMP following detailed design of the Project and prior to the operation of the wind farm. The methodology for post-commissioning phase surveys is provided below and based on current information and industry guidelines. However, given the preliminary and adaptive nature of this BBAMP, methodologies or approaches to survey may require adjustment, with any divergences from the below provided in the final BBAMP.

Bird and bat monitoring conducted during the post-commissioning phase will incorporate field survey results collected via both the BBUS and carcass detection program. These are discussed in further detail below.

A desktop assessment of relevant database searches and literature will be completed prior to each survey to inform the survey approach based on the current status of threatened and Migratory bird and bat species in the Project region.

4.1 Survey Schedule

An overview of the survey schedule for the different components of the bird and bat monitoring program is provided below in **Table 4.1**. Scheduling of the bird monitoring program has been timed to coincide with the seasonal migration/movement of conservation significant bird species that are likely to occur in the area, including Fork-tailed Swift (*Apus pacificus*) and black-cockatoo species (Forest Red-tailed Black-Cockatoo, *Calyptorhynchus banksia naso*; Baudin's Black-Cockatoo, *Zanda baudinii*; and Carnaby's Black-Cockatoo, *Z. latirostris*). Timing of the bat monitoring program has been provided to coincide with the bird monitoring program, as well as the flowering of eucalypts in spring. This timing also coincides with the optimal seasonality for surveying for microbats based on an increase in bat activity during warmer weather.

Table 4.1 Survey Schedule

Survey	Timing	Duration
Bird Utilisation Survey	Twice annually, in October/November and February/March following commencement of operation.	2 years
Bat Utilisation Survey	Twice annually, in October/November and February/March following commencement of operation.	2 years
Carcass search surveys	Four carcass searches will be conducted quarterly to capture equal coverage across the year, with key months in spring (October), Summer (February), and the higher-rainfall season (June) being captured. Timing of carcass search surveys has been provided in **Section 4.3.2**.	2 years
Carcass persistence trial	Once every 6 months following commencement of operation.	2 years

Survey	Timing	Duration
Carcass detectability trial	Once every 6 months following commencement of operation.	1 year

4.2 BBUS Program

4.2.1 Bird Utilisation Surveys

Bird utilisation surveys are to be conducted within 12 months of commencement of wind farm operation and will continue for a period of two years. To ensure the site is safe and accessible, surveys will not be permitted to commence until the following conditions are satisfied:

- All turbines are commissioned and tested (including testing dependent on wind conditions).
- All turbines have been handed over from the EPC Contractor to the Developer.
- Australian Energy Market Operator testing is complete (grid compliance testing).

Prior to this occurring, the Project will be considered to be in the construction phase with the site containing exclusion zones due to construction and/or testing work.

Post-commissioning bird utilisation surveys will be conducted using a variety of survey techniques aligning with those undertaken during pre-commissioning surveys. These methods are discussed in detail below.

The scope and timing of post-commissioning bird utilisation surveys will be reviewed based on the results of all pre-commissioning BBUS completed between 2023 and 2025.The survey approach and method should align with that of the bird surveys conducted between 2023 and 2025 to allow robust comparison of results. For the purpose of reporting, any observation of a bird or birds flying at RSA height constitutes 'at risk behaviour'. An outline of the survey approach is provided below.

4.2.1.1 Vantage Point Surveys

Post-commissioning vantage point surveys will be conducted as per the methodology described in **Appendix A**, including the undertaking of point based visual and aural counts of bird species using the Study Area.

During each vantage point survey, a single observer will record the following information for each observation:

- Species and abundance.
- Observation type (visual or aural).
- Distance and direction from the observer (to the nearest 10 m and 10° respectively).
- Approximate height AGL of the observed bird/s (to the nearest 10 m).
- Direction of flight (to the nearest 10°).

- Flight pattern (i.e. not flying, local movement, directional flight, circling, swooping, varied, other).
- Behaviour (i.e. flight, foraging, perching, mating, aggressive interactions, hollow inspection, nesting, on station).

Vantage Point Sampling locations

Vantage point surveys should ideally be located at the same vantage points utilised during baseline surveys (**Figure 5.1**). Where vantage points are unable to be accessed, a review of the vantage points will be undertaken prior to surveys and they will be located as close as possible to those used during baseline surveys.

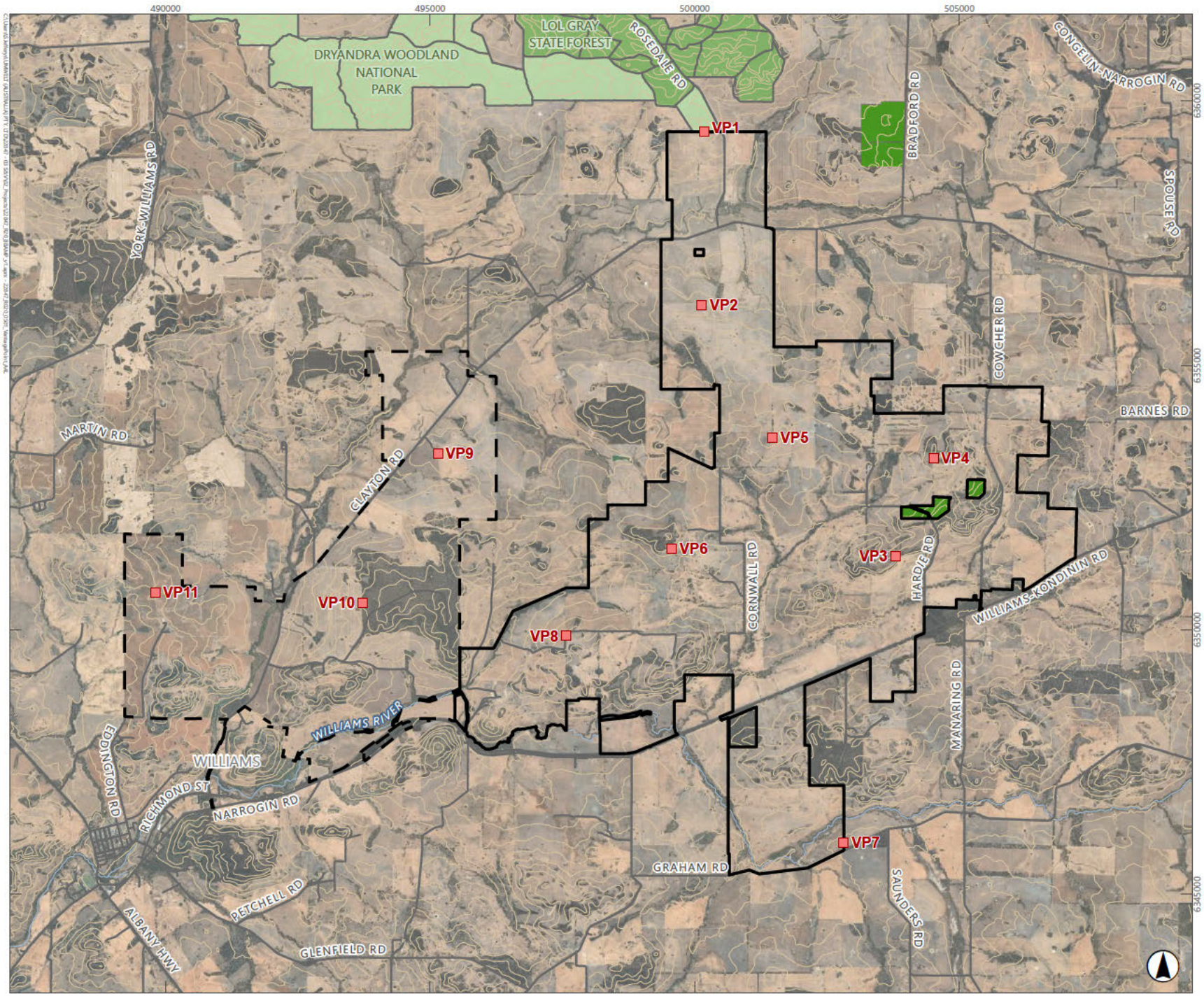

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FIGURE 4.1 Vantage Point Survey Locations

Legend

- Study Area
- Additional Survey Area
- Road
- 10m Contours
- Major Watercourse
- Nature Reserve
- National Park
- State Forest
- Vantage Point

0 2 4

Kilometres

Scale 1:100,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023), Western Wildlife (2024)

4.2.1.2 Diurnal Bird Searches

Diurnal bird searches may be employed in post-commissioning BBUS. The objective of the searches is to collect data on relative abundance and diversity, and to a lesser degree, flight behaviour, of bird species across different habitat patches within the Study Area. This would allow an assessment of changes in habitat utilisation and presence for conservation significant species following wind farm operation and inform suitable mitigation and management measures. The searches would mostly likely comprise of a method adapted from the standard 20-minute, two hectare survey plot (Watson, 2004) commonly adopted by bird researchers in Australia. Potential variances to the commonly adopted method include:

- The two-hectare area will comprise of a 200m transect with birds recorded 50m either side of the centre line (making a 200 x 100m, or 2ha survey plot) rather than a random walk through the patch. This variation allows for greater accuracy and consistency in density estimates.
- Birds observed outside of the 200 x 100m plot will be noted, but not included as part of density estimates.
- The 20-minute survey period will be split into 4 x 5minutes survey blocks. This allows for species accumulation curves to be created from the survey data.

Survey locations should be positioned within habitat patches in proximity to turbine locations, and ideally using the same habitat patches sampled during baseline surveys. Control sites in equivalent habitat types to those surveyed in the Study Area may also be surveyed (where suitable control sites are present and access is granted) to act a s a control for regional level changes in bird abundances over time. Where all habitat patches cannot be surveyed in a single survey period, at least 50% will be sampled and then alternated between survey periods (at least two per year).

4.2.1.3 Bird Utilisation Surveys Timing

Post-commissioning bird utilisation surveys will be conducted for the first two years of operation and are to be conducted twice annually to coincide with peak timing for the occurrence of black-cockatoo species and the seasonal migration of conservation significant birds where relevant. Surveys should be conducted between October and April to align with the migration timing of the Fork-tailed Swift and peak activity of black-cockatoo species, with preferred timing being October to November and February to March.

The requirement for ongoing post-commissioning bird utilisation surveys will be reviewed after the initial two years of surveying.

4.2.2 Bat Utilisation Surveys

Post-commissioning bat utilisation surveys will be conducted using a variety of survey techniques including but not limited to those undertaken in the pre-commissioning surveys. These methods are discussed further below.

4.2.2.1 Bat Call Detector Surveys

Bat call detectors will be placed at previously selected vantage points and turbines at approximately 2 m AGL and left for between two to five nights. Site selection will be determined prior to post-commissioning surveys being undertaken.

Where possible, bat call detectors will be placed at hub height on turbines by an appropriately qualified person with guidance provided by an ecologist.

4.2.2.2 Bat Utilisation Survey Timing

Post-commissioning bat utilisation surveys will be conducted within 12 months of commissioning for a period of 2 years and are to be conducted twice annually, in conjunction with bird utilisation surveys. The requirement for further post-commissioning bat utilisation surveys will be reviewed after the initial 2 years of surveying.

4.2.3 Surrounding landscape and species movement assessments

From an industry perspective, there are few data sources available to inform collision risk for black-cockatoos and their potential change in behaviour following development of a wind farm. There may be the potential to include some form of broader landscape and species movement assessments aimed at addressing these gaps (pending availability of relevant information). Additional surveys or methods in the broader landscape to inform species movements, flight height variations, and movement patterns may include:

- Flock-follows or setting up passive acoustic monitors to verify species occurrence or absence at locations within the Study Area and at known or likely/potential roosting sites in the surrounding region This may also provide opportunity to record flight behaviours and heights of individuals or flocks when travelling between roosts. This data are not readily available as Birdlife Australia's "Great Cocky Count" does not extend to the Study Area.
- Desktop application of spatial modelling approaches in peer-reviewed literature to evaluate distribution patterns of black-cockatoos around the Study Area, utilising existing public datasets containing spatial-temporal data primarily collected by citizen scientists.
- Funding or collaboration with organisations currently undertaking research on black-cockatoo occurrences and movements across the landscape such as the Western Australia Museum, Murdoch University's Black Cockatoo Conservation Management Project/Karaakin Black Cockatoo Conservation Centre, and Birdlife Australia.

Surveys to study species movements and flight behaviours will require further investigation to identify feasible survey methods and potential collaborators.

4.3 Carcass Search Program

The key objective of the carcass detection program is to estimate the frequency of bird and bat mortality due to collision associated with the Project from which the total number of collisions can be estimated. The methods to be employed as part of this program are detailed below. Reporting requirements relevant to the mortality assessment program are described in **Section 7.0**.

4.3.1 Turbine Search Selection

All turbines within the Project are regarded as equal risk of collision for identified species. On this basis, all turbines will be surveyed for carcasses equally over the course of the two-year program.

4.3.2 Survey Timing and Frequency

The carcass detection program will run for an initial 2 years starting within three months of commencement of operation of the wind farm. The timing and frequency of the carcass detection surveys is shown in **Table 5.2**. Surveys will be undertaken quarterly to provide equal coverage across all seasons including times of peak activity for conservation significant species that may or are known to occur, as well as higher rainfall periods which may attract additional species to the area.

The search program will be reviewed for efficacy after 2 years, with the possibility of extension for a further 3 years (potential total of 5 years). The efficacy requirement for extension will be based on frequency of bird and bat mortality due to collision from the operation of the wind turbines associated with the Project.

Incidental encounters with carcasses during operational activities will also be recorded appropriately as per **Section 4.3.5** and contribute to data on bird and bat collisions.

Table 4.2 Carcass search survey timing and frequency

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
No survey		No survey	No survey	No survey		No survey		No survey		No survey	No survey

4.3.3 Search Area

The final search area engaged for the carcass detection program will be determined based on the confirmation of final specifications of the proposed turbines. Based on the proposed RSA used in the risk assessment as well as the findings of Hull and Muir (2010), Huso and Dalthorp (2014), and Prakash and Markfort (2020), an indicative area with a radius of 200 m from the base of each turbine comprising an inner and outer search area (100 m and 200 m radii respectively) will be surveyed at each of the turbines.

Carcass searches will be conducted as follows:

- The inner and outer search areas will be surveyed at each turbine.
- If a survey event identifies any carcass or feather spot of a conservation significant species, a follow up survey of the inner search area will be undertaken to bolster detection rates. Best endeavours will be used to complete this survey within 2 weeks after the first survey event.

The frequency of carcass search surveys may be altered if the findings of the carcass persistence trial indicate that it would be necessary or appropriate.

4.3.4 Search Method

Two potential search methods being considered, being the use of detection dogs and a human detection search method are provided for below.

4.3.4.1 Detection Dog Method

Trained detection dogs will be used where available and where the climatic conditions of the Project and the terrain of the search areas are suitable for a safe and effective search. Detection dog teams are often a superior method to human detection alone as they can cover larger areas more quickly, while locating carcasses and feather spots at a rate higher than humans. Surveys conducted during summer months may need to be scheduled around hot weather, with early starts preferable on days expected to be >30°C to allow sufficient search time prior to the hottest part of the day. The vegetation of search areas may present some limitation to the detection dog and handler, such as where active cropping is being undertaken.

During each turbine search, a dog and handler would traverse the search area along paths spaced by approximately 20–30 m from one another depending on wind speed (high winds potentially impacting scent detection). The spacing of the paths within this range would be determined by the handler. The dog would be fitted with a GPS unit to provide a measure of coverage completed during each survey. Dog handlers will be trained and experienced in identification of all bird and bat species that may occur within the Project site.

4.3.4.2 Human Detection Survey Method

If a trained detection dog is unavailable, carcass searches will be conducted by ecologists experienced in identification of carcasses of bird and bat species that may occur within the Project site. At each turbine search area, the observer will walk transects spaced by 6 m within the inner search area and 12 m within the outer search area. The observer will record their movement along transects using a handheld GPS device.

4.3.5 Data Collection and Carcass Find Protocol

During the carcass search surveys and the carcass persistence trials (**Section 4.3.7**), data will be collected and recorded on predefined survey sheets, including online applications if appropriate. The data will include general information such as basic survey and weather information and will include other location specific factors such as the estimation and ongoing consideration throughout each individual turbine search, namely, the extent of different ground substrates and the extent of the search area that is accessible/searchable.

If a bird or bat carcass or feather spot is detected during a carcass search survey, the carcass or feather spot must be collected, photographed and stored (if a carcass), its location must be recorded on a GPS device and the relevant data collection form completed. Handling and collection of carcasses should consider the following:

- The carcass must be removed from the site by a person wearing rubber gloves, and double bagged in plastic bags.
- The carcass must be photographed in such a way that it can be further identified, i.e. on a white background with an item or measure for scale and adequate lighting.
- A label with the date, turbine number, species name (if known) and a unique specimen code must be placed in the second bag to allow cross-reference to the corresponding completed datasheet.
- The carcass will be transported to a freezer where it will be retained for the purpose of either a second opinion on its identification, or for use in carcass persistence trials or carcass detectability trials.

- In cases where feather spots or carcasses are not able to be identified, the following process will be undertaken:
    - Photos of the feather spot or carcass will be analysed by the lead ecologist (including any colleagues) to definitively identify the find.
    - Methods to further definitively identify the feather spot or carcass could then involve sending photos of the find and/or the find itself to a species specialist or museum or send for DNA testing. DNA swabs are not proposed to be used for carcasses or feather spots unless there is a potential it could be a threatened species or would trigger a non-threatened species impact trigger.

All data collected during the carcass search program will be entered into a database. Data pertaining to incidental findings must also be retained in this database. A second database which will serve as an inventory of carcasses collected is to be maintained by the Environmental Representative within which records detailing whether carcasses are retained, disposed of, or sent off-site (i.e. to an authority such as DBCA or the Western Australian Museum) will be managed.

4.3.6 Carcass Detectability Trial

The efficacy of carcass detection program will be investigated using carcass detectability trials which aim to detect the degree of error present as a calibration factor.

The detectability of carcasses under turbines can vary depending on a range of factors such as efficacy of the observer, size of the carcass, and type of ground cover (particularly given the presence of cropping which is likely to impact carcass detectability and accessibility to search areas). To address these factors, carcass detectability trials will be undertaken to determine the efficacy of the dog and handler or the ecologist undertaking searches at finding carcasses within the Project site.

The broad methodology to be followed is listed below and includes:

- Carcasses of previously deceased birds and bats collected during the carcass detection program will be stored in a suitably designated freezer and used in the carcass detectability trial.
- Five carcasses of varying size and species (both bird and bat) will be placed around a turbine, across the varying types of groundcover present (e.g. bare-ground, cropping, and native vegetation cover) and their location captured using a GPS.
- The ecologists or detector dog team, without the knowledge of the calibration survey, will undertake the carcass detection program as per the methodology outlined.

This method enables results of the carcass detection program to be corrected using a calibration factor, derived from the number of placed carcasses found, divided by the number of carcasses placed. For example, if three carcasses of the original five are found by the surveying team, the calibration factor of 0.6 (3/5) would apply to the results of the carcass detection program. In this example, it is assumed at 40% of the carcasses were missed and should be accounted for. As more trails are completed, the level of certainty in the calibration will increase.

Carcass detection trials will be undertaken once every 6 months during the first year following operation of the wind farm. The trial can be undertaken concurrently with the carcass persistence trials and/or the carcass search surveys to maximise survey efficiency.

4.3.7 Carcass Persistence Trial

Birds and bats injured or killed through collision with turbines may be removed from search areas by scavengers such as raptors, ravens, and a suite of introduced mammals. To estimate persistence rates of different sized carcasses beneath turbines within the Study Area (to aid estimation of mortality rates of birds and bats impacted by turbines) a carcass persistence trial will be undertaken.

The types of carcasses used in the persistence trials should vary between large animals such as raptors or waterbirds, and small animals such as parrots and microbats. The various carcasses will be placed within a defined distance of a selection of turbines within the Study Area. Each carcass will have a motion detecting camera placed nearby to identify the species potentially scavenging on the carcass and record the date and time that the carcass is removed. The use of motion detecting cameras may be replaced with another suitably efficient and accurate method if one should become available.

Quantifying the mean and confidence interval of the time to removal of carcasses is required for input into calculation of mortality estimates. Carcass persistence would be examined through survival analysis using statistical software to estimate the survival function.

The methodology and timing proposed for the carcass persistence trials is expected to be reviewed and developed in further detail once the operational phase of the Project has begun.

4.4 Incidental find of bird carcasses

During the lifetime of the wind farms, there is a possibility that bird carcasses may be found by site personnel. All site personnel will receive training on the procedures to follow if they come across dead or injured birds. When a carcass or feather spot is incidentally discovered, it must be photographed in its original location. However, the carcass and feather spot should not be moved from where it was found to avoid affecting the quarterly Carcass Search Program's detection rates. Any site personnel finding a bird carcass must fill out the appropriate carcass datasheet. Copies of carcass datasheets should be accessible on-site for use by all site staff.

5.0 Impact Triggers and Management Responses

This section defines impact trigger levels for threatened and migratory species, as well as the process which is to be engaged to inform the management response (where trigger levels are met or exceed).

The main objective of setting an impact trigger level is to prevent the operation of the wind farm resulting in significant impacts on threatened or at-risk bird and bat species.

5.1 Non-listed Species Impact Trigger

An impact trigger has been defined for bird and bat species which are not conservation listed but are considered to have a higher potential for collision with turbines (e.g. raptors and microbats).

The impact trigger for non-listed species is the confirmation of a carcass or injured individuals as recorded during the carcass detection program or detected within 200 m of turbines incidentally during other activities a total of four or more times at the same or adjacent turbine within two successive searches.

Should the impact trigger for non-listed species be reached or exceeded, Neoen will complete an investigation of the significance of impact on the species. Where species' population data or extent of occurrence is known within the region, the definition of a significant impact is any impact that is likely to reduce the viability or extent of occurrence of the affected species. Should the assessment indicate that there is a significant impact then the DBCA will be engaged on suitable mitigation measures. This assessment will be determined by a suitably qualified ecologist.

5.2 Conservation Significant Species Impact Trigger

The impact trigger for a EPBC Act or BC Act listed bird or bat species is the confirmation of 1 carcass or injured individual as recorded during the carcass detection program or detected within 200 m of project infrastructure as part of carrion removal procedures or incidentally during other activities.

5.2.1 Response and Reporting Requirements

If identification (including DNA testing) is required to determine the species of a carcass, then the impact trigger will occur from the date the species of the carcass is confirmed as a threatened species.

If an impact trigger level for a conservation significant species is met or exceeded, a further investigation and reporting response is required. It is the responsibility of the person who discovered the carcass, injured individual or feather spot to notify the site Environmental Representative upon discovery, so the response can be initiated. As part of the response plan, Neoen will initially notify DBCA of the event within five business days. Following the initial notification event, a report will be compiled by a suitable qualified ecologist and provided to regulators where required or appended to annual compliance reports.

The adaptive management process depicted in Figure 5.1 will then be followed.

5.3 Migratory Species Impact Trigger

Impact trigger levels for species listed under the EPBC Act as migratory have been developed using the Department of Environment (2015) *Referral guideline for 14 birds listed as migratory species under the EPBC Act*. The referral guidelines document that an important population of these species is 0.1% of the national population. For this Project, 0.05% of the national population has been used as the trigger level. The only Migratory bird species which has a Moderate or higher likelihood of occurrence within the Study Area is the Fork-tailed Swift. The trigger level for the Fork-tailed Swift (0.05% of the national population) would be 50 carcasses discovered within a 12-month period.

If carcasses for other Migratory bird species assessed as having an Unlikely or Low likelihood of occurrence within the Study Area are detected, the BBAMP will be revised and a trigger level of 0.05% will also apply.

5.3.1 Response and Reporting Requirements

If identification (including DNA testing) is required to determine the species of a carcass, then the impact trigger will occur from the date the species of the carcass is confirmed as a migratory species.

If an impact trigger level for a migratory species is met or exceeded within a 12-month period, a further investigation and reporting response is required. It is the responsibility of the person who discovered the carcass, injured individual or featherspot to notify the site Environmental Representative upon discovery, so the response can be initiated. As part of the response plan, a report will be compiled by the contracted ecologist, and provided to regulators where required or appended to annual compliance reports.

The adaptive management process depicted in **Figure 5.1** will then be followed.

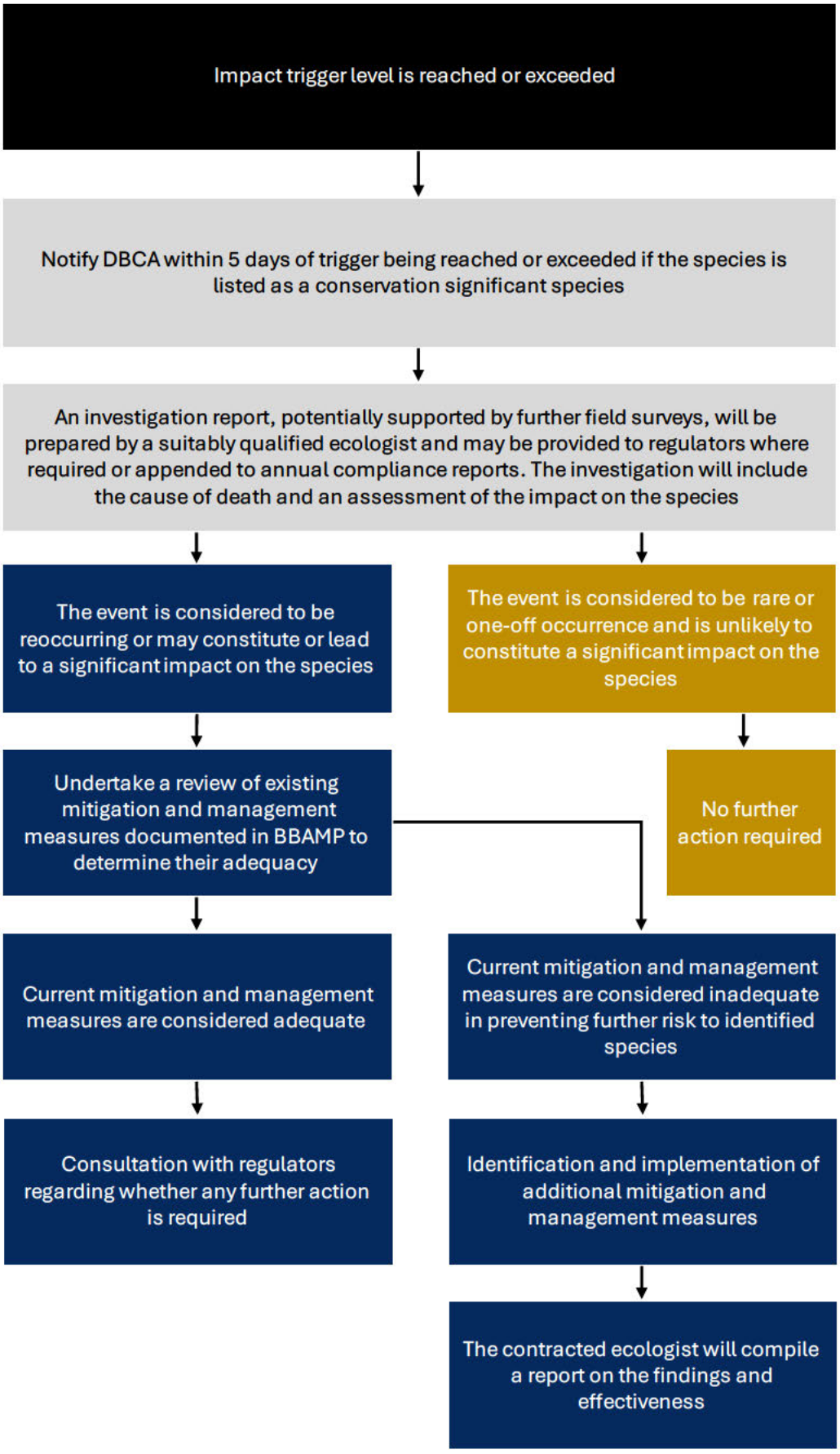

Figure 5.1 Species Impact Adaptive Management Procedure

5.4 Species with Revised Risk Rating Impact Trigger

Data collected during the bird and bat monitoring program will be assessed in accordance with the bird and bat risk assessment methodology outlined in **Appendix B** to improve the understanding of the risk of turbine collision and barotrauma impacts. The bird and bat risk assessment will be updated upon the two-year review and, where required, incorporated into the annual monitoring report as specified in **Section 7.0**

If bird and bat data collected during the monitoring program changes a likelihood rating of a species such that the overall risk rating is increased to a High or Very High, the following process will be followed:

- Commissioning of a Collision Risk Assessment for the species to determine the estimated number of collisions per year based on current Project operation. This may be undertaken using a Collision Risk Model should there be sufficient data available.
- Undertake a review of the current mitigation and management measures identified in the BBAMP and determine their adequacy to prevent impact to the species.
- Engage in consultation with regulators where relevant to identify further mitigation and management measures to reduce the risk to the species based on turbine collision and barotrauma.

6.0 Mitigation and Management Measures

The purpose of this section is to provide details of mitigation measures to manage risk of the Project leading to a significant impact on birds and bats. The ongoing, preventative mitigation measures proposed to be implemented in this plan are provided in **Table 6.1**.

Additional measures may be implemented following the investigation of triggers being reached or exceeded and the BBAMP reviewed. These measures are not currently proposed as the BBUS completed to date have indicated low utilisation of the Study Area by listed species. These adaptive management responses will be dependent on the impact and the species, and might include:

- Employing temporary shutdown periods during periods of high bird and bat activities and where impact triggers are exceeded.
- Installation of automatic detection systems (ADS), which trigger a shutdown of turbines when a bird considered at risk of collision is identified nearby.
- Increasing cut-in speed of wind turbines.
- Contribution to broader conservation efforts for specific species if required.

Table 6.1 Ongoing, Preventative Mitigation Measures

Mitigation Measure	Description	Timing
Carrion removal program	The presence of carrion around wind turbines attracts many bird species, particularly raptors, placing them at an elevated risk of collision with turbine blades. A carrion removal program will run for the operational lifetime of the Project and will apply to any carcass found within 200 m of turbines in accessible areas, of carcasses other than those of birds and bats. The following procedure will be adopted: • The Environmental Representative or another suitable person will be appointed as the carrion removal coordinator. This person will be responsible for the organisation of monthly inspections by appointed staff. Inspections will be completed by vehicle and/or on foot of accessible areas up to 200 m of turbines. All full-time employed site personnel will be trained on the carrion removal procedure. • All bird or bat carcasses should be stored in a double-wrapped plastic bag and placed in a freezer located on site with the appropriate information labelled for identification. • The following information will be collected for each bird or bat carcass: specimen number, GPS location, species, date and time, visible signs of injury, photographs of the carcass, weather conditions. • The location and date of discovery and date of removal of all non-bird or bat carcasses will be recorded and maintained in a database by the carrion removal coordinator. • Any feral or overabundant native animal control program implemented must include the removal of all carcasses from the Project.	The operational life of the Project, to be reviewed after 2 years from the commencement of the BBAMP

Mitigation Measure	Description	Timing
	• Any carrion detected incidentally outside the carrion removal inspection is to be removed in a timely manner. Following two years of operation, the carrion removal program may be adjusted as necessary, and in consultation with regulators where suitable. An annual summary of carcass detection and removal will be provided in each Annual Report. Carcasses stored in the on-site freezer will be left until a suitably qualified person (ecologist undertaking carcass detection surveys) is present to complete the identification of the species. Photos collected of the carcass during carrion removal will be used to aid identification. Carcasses will be kept in the on-site freezer for the initial two years of operation of the wind farm for use in the mortality count calibration surveys.	
Black-cockatoo nests	Pre-clearance hollow nest surveys will be undertaken for black-cockatoo species within the Disturbance Footprint. Searches will be undertaken during fauna spotter catcher pre-clearance surveys whereby suitably qualified fauna spotter catchers will actively search for hollow nests. Where a potential nest is identified, clearance activities within the area will cease and a suitably qualified ecologist will undertake an investigation to determine the species that the nest belongs to. If the nest does not belong to a black-cockatoo species, or any other threatened or migratory fauna species, clearance activities will only continue if it is confirmed that the nest is not actively being used by a native species. Where the nest is in active use by a non-listed native species, a fauna spotter may relocate the nest if suitable in accordance with any conditions of their licence. In the event that a black-cockatoo nest is identified within the Study Area, the tree will not be cleared and a follow-up survey undertaken in the subsequent month for both the active black-cockatoo nest and any potential new nests in proximity. A review of the current mitigation measures and or monitoring frequency outlined in the BBAMP, and recommendation of additional actions will be made where necessary.	During construction

7.0 Reporting Requirements

The proposed reporting requirements of this BBAMP are identified in **Table 7.1** below.

Table 7.1 Reporting Requirements

Report	Description	Timing
Carcass Search Program	Following each year of the carcass search program, the program findings will be compiled and recorded. The report should detail the species impacted including: • Total carcasses/feather spots detected of each species. • Locations of carcasses/feather spots detected. • Dates carcasses/feather spots were detected. • Details of any carcass/feather spots detections that triggered impact levels. The number of carcasses of each species identified during the carcass search program which are utilised in the detectability trials will also be reported. Statistical analysis should be undertaken to provide estimates of the annual total number of collisions for each species in consideration of the carcass search area and effort and the observed carcass persistence times and observer detectability rates. A second report detailing the findings of the entire carcass search program will also be prepared and may be provided to regulators within completion of 24 months of surveys where required.	Annually for 2 years, within 2 months of survey completion.
Impact Trigger Reporting	DBCA will be notified within five days from when the impact triggers are met for conservation significant species. The report compiled by the contracted ecologist may then be submitted to DBCA and any additional regulators, as required. The impact trigger report will include: • the impact trigger level that was reached • the species and number of individuals involved in the impact trigger • the date/s and location/s of recovered carcasses/feather spot • any identified ecological factors contributing to the impact trigger such as climate, presence of prey species/foraging opportunities, seasonal factors (i.e. migration) • whether the event is likely to be rare or regular or may constitute an adverse impact on the species at the local, regional or total population scale. In cases where further monitoring or implementation of mitigation measures is deemed necessary through consultation with regulators, the findings and effectiveness of such measures may be reported within specified timeframe as determined through consultation with the regulator.	If an impact trigger occurs in accordance with **Section 5.0**.

Report	Description	Timing
Annual Report	Annual compliance reporting will include a summary of any bird and bat monitoring program implemented throughout the year. It is anticipated that relevant information may comprise: • provision of information regarding all turbine strikes, including method of detection, factors regarding the presence of a species, prevailing conditions at the time of collision • estimations of annual mortality and injury for each relevant threatened and migratory species • conservation significant species occurrence records • evaluation regarding the effectiveness of measures implement to avoid and mitigate mortality and or injury to threatened and migratory species. Annual compliance reports will be provided to regulators where deemed necessary and if so, for an initial period of up to 2 years with the possibility of extension for a further three years (potential total of 5 years). The requirement for extension will be based on the frequency and significance of bird and bat mortality due to the turbine collision from the Project.	Annually
	Following the completion of 24 months monitoring, the annual report will include discussion of the following items based on ongoing bird and bat monitoring data: • The development and implementation of tangible, on-ground management measures and corrective actions to promote a long-term reduction in the risk of turbine collision and barotrauma impacts on conservation significant bird and bat species • The identification of any changes to site utilisation by conservation significant bird and bat species • An updated bird and bat risk assessment to continually develop the understanding of risk to birds and bats species from Project operation • An improved understanding of whether or how Project site usage changes as a result of wind farm construction and operation. The 24-month annual compliance report will be provided to regulators where deemed necessary.	Upon completion of 24 months of monitoring.

8.0 Adaptive Management and Review

8.1 Adaptive Management Framework

The adaptive management framework is a structured, iterative process that is used to facilitate flexible decision-making and improve management practices and outcomes over time. Adaptive management is particularly useful in an environmental management context where there are uncertainties and dynamic conditions. The key components of adaptive management are:

- **Plan:** Develop a clear plan with specific objectives, actions, and expected outcomes.
- **Do:** Implement the plan while monitoring key indicators.
- **Evaluate:** Assess the outcomes against the objectives.
- **Respond:** Adjust the plan based on the evaluation to improve outcomes.

This BBAMP includes the four key components of adaptive management.

8.2 Review of the BBAMP

This BBAMP will be reviewed to ensure it is effective in achieving the environmental outcomes and remains responsive to changing conditions. A review may occur as a result of the following:

- As part of the adaptive management and reporting process, following from the initial reporting after 24 months and then as specified in the revised BBAMP.
- Amendments to the proposal or operations.

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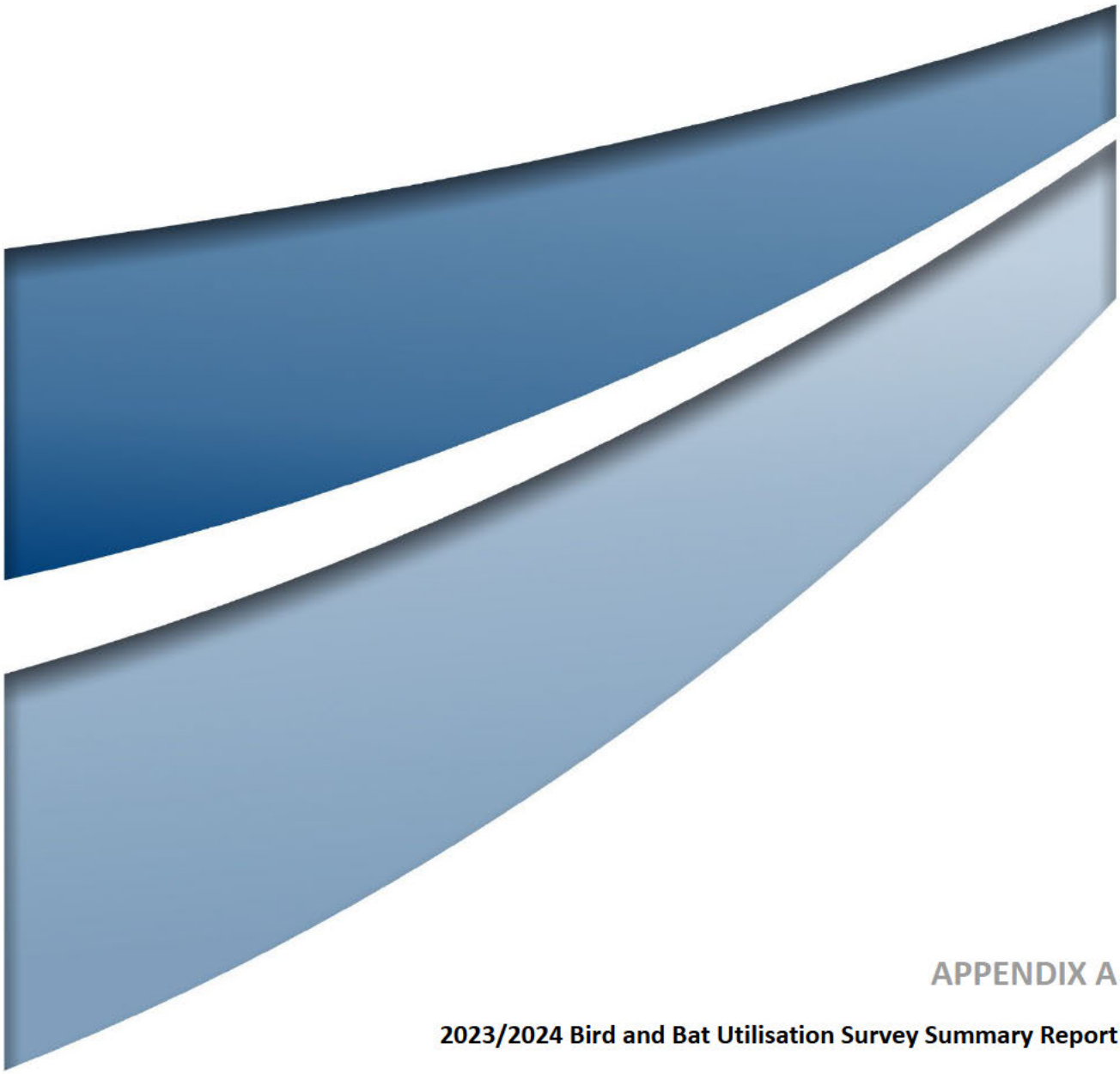

APPENDIX A

2023/2024 Bird and Bat Utilisation Survey Summary Report

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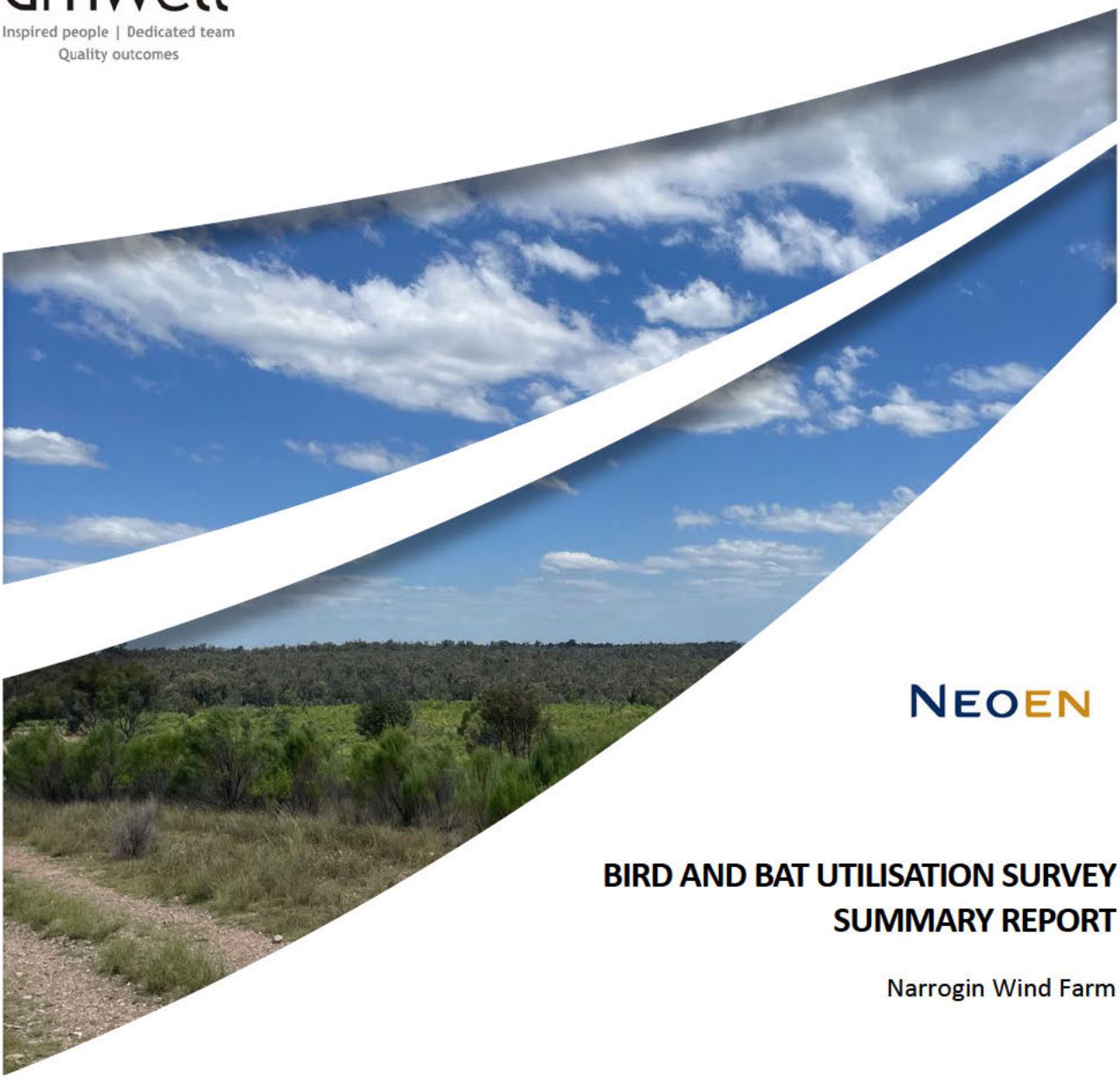
Inspired people | Dedicated team
Quality outcomes



NEOEN

BIRD AND BAT UTILISATION SURVEY SUMMARY REPORT

Narrogin Wind Farm

FINAL

September 2024

NEOEN

BIRD AND BAT UTILISATION SURVEY SUMMARY REPORT

Narrogin Wind Farm

FINAL

[redacted]

umwelt
Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V1	[redacted]	21/03/2024	[redacted]	08/04/2024
V2		22/07/2024		22/07/2024
V3		08/08/2024		15/08/2024
V4		15/09/2024		17/09/2024
V5		20/09/2024		20/09/2024

Abbreviations

Abbreviations	Description
AGL	above ground level
AHD	Australian Height Datum
ALA	Atlas of Living Australia
BBUS	Bird and Bat Utilisation Survey
BC Act	*Biodiversity Conservation Act 1992* (WA)
BOM	Bureau of Meteorology
DBCA	Department of Biodiversity, Conservation, and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment, and Water
EP Act	*Environmental Protection Act 1986* (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
kV	kilovolt
m/s	meters per second
MW	megawatt
PMST	EPBC Act Protected Matters Search Tool
RSA	rotor swept area
Umwelt	Umwelt (Australia) Pty Ltd

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Appendices

1.0 Introduction

Umwelt was engaged by Neoen Australia Pty Ltd (Neoen) to undertake Bird and Bat Utilisation Surveys (BBUS) for the proposed Narrogin Wind Farm (the Project) to support primary approvals under the *Environmental Protection Act 1986* (WA) (EP Act) and *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). This summary report presents the findings of the Umwelt Spring 2023 and Summer 2024 Bird and Bat Utilisation Surveys.

1.1 Scope of Works

The aim of this assessment is to summarise the results of BBUS undertaken for the Project. In particular, this report documents the bird and bat species that are present or likely to occur in the Study Area, and assesses which species, based on flight data, have the potential for turbine collision.

Specific objectives for the scope of work include:

- Determining the status of bird and bat species in the Study Area through a desktop assessment of relevant database searches, published and unpublished literature, and ecological reports.
- Identification of bird and bat species which are known to the Study Area based on field survey data.
- Identifying which bird and bat species are susceptible to blade strike with wind turbines in the Study Area through analysis of flight behaviour recorded on site and any available published literature.

1.2 Project Description

The Project is located approximately 160 km south-east of Perth, Western Australia, in the Wheatbelt South region spanning across the Shires of Williams and Narrogin. The Project is expected to comprise a battery energy storage system (BESS) and up to 25 wind turbines with associated ancillary infrastructure. A 220 kV line intersects the southern boundary of the proposed area that the Project will connect to.

The primary infrastructure of the Project is likely to be the wind turbines, BESS compound, an electrical substation, switchyards, access roads, operation and maintenance facilities, overhead and underground cabling, as well as other types of ancillary construction and operational infrastructure. Additionally, temporary facilities including construction compounds and laydown areas, and temporary activities such as concrete batching and quarrying to win construction materials, may also be required.

1.2.1 Ecological Study Boundaries

There are two distinct boundaries that are relevant to this assessment, including:

- **Study Area**: refers to the boundaries of all involved land parcels where consent has been granted for development of the Project.
- **Additional Survey Area**: refers to the land parcels west of the current Study Area that were surveyed as part of the early conceptual layout of the Project. This area no longer forms part of the Project Area or current Study Area. This boundary is discussed where appropriate in context of the survey effort applied and species utilisation of the Study Area environs.

1.2.1.1 Study Area

The Study Area (**Figure 1.1**) covers approximately 6,344 ha at elevations between approximately 274 m and 386 m Australian Height Datum (AHD). The Study Area is located across numerous freehold properties approximately 5 km northeast of the township of Williams and 7 km west of the township of Narrogin.

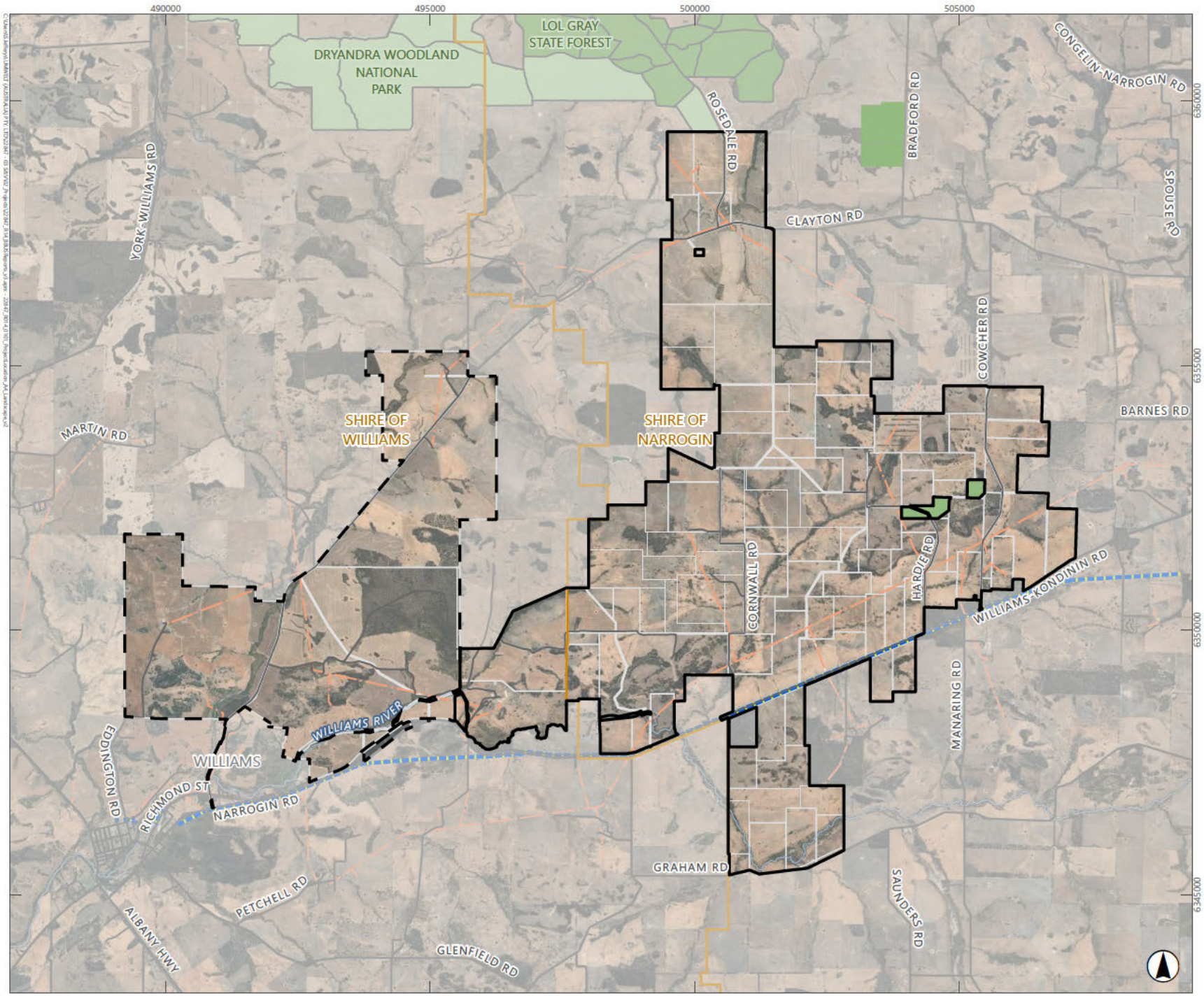
The Study Area is primarily cleared for agriculture and sheep grazing with interspersed patches of remnant and regrowth woodland, generally associated with hills and associated slopes, and watercourses. Dryandra National Park and Lol Gray State Forest are located to the north of the Study Area.

1.2.1.2 Additional Survey Area

The early conceptual layout of the Project was originally developed in 2023 and included an Additional Survey Area of approximately 3,023 ha which primarily extended further into the Shire of Williams (**Figure 1.1**).

Following phase 1 surveys and preliminary assessments of ecological values and sensitive receptors, Neoen determined that avoidance of impacts to areas of high ecological value could be achieved by reducing the Study Area to the current boundary and reducing the total number of wind turbines from 44 down to 25. This amounted to a total reduction of 32% in the Project area. Data gathered from surveys undertaken within the Additional Survey Area have been utilised where possible to inform the potential occurrence of conservation significant species, characterise the utilisation of the Study Area by bird and bat species, and to understand fauna assemblages in the wider region.

FIGURE 1.1
Study Area



Legend

- Study Area
- Additional Survey Area
- Local Government Area Boundary
- Road
- Water Pipeline
- NCMT HV Distribution Line
- Major Watercourse
- Property Boundary
- Nature Reserve
- National Park
- State Forest

0 2 4

Kilometres

Scale 1:100,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023), WP (2023), WCORP (2023)

1.2.2 Wind Turbine Dimensions

There are currently three potential turbine models being considered for the Project, each with separate specifications. Accounting for all models, there is a maximum overall height (tip height) of 291 m above ground level (AGL) and a lowest blade tip option of 49 m AGL. The turbines will have a horizontal axis, with a rotor consisting of three blades with a maximum blade length of up to 91 m and a maximum hub height of 200 m AGL. A summary of the turbine specifications, including maximum and minimum tip blade heights, is provided in **Table 1.1**

Table 1.1 Turbine Specifications

Feature	Maximum Specification
Turbine electrical output	7,200 kilowatts (kW)
Number of turbines	Up to 25
Maximum tip height	Up to 291 m AGL
Maximum hub height	Up to 200 m AGL
Minimum lower blade height (clearance between ground and lowest blade tip option)	49 m
Blade length	Up to 91 m
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s

1.2.2.1 Rotor Swept Area

The rotor swept area (RSA) refers to the physical area swept by the rotating blades during operation. Based on the specifications provided by Neoen for three different turbine models, the RSA will be located between 49 m AGL to 291 m AGL and is between 23,235 m^2 to 26,015 m^2 in area. A visual representation of these specifications according to model is illustrated on **Figure 1.2**, **Figure 1.3**, and **Figure 1.4**. The maximum hub height for each model has been used in these illustrations where relevant.

The minimum (49 m AGL) and maximum (291 m AGL) turbine blade heights have been used to represent the potential 'RSA height range' in this assessment to identify bird or bat species which may be at risk of turbine strike across a range of potential hub height and blade length combinations. This is considered a conservative assessment as the actual RSA will be less.

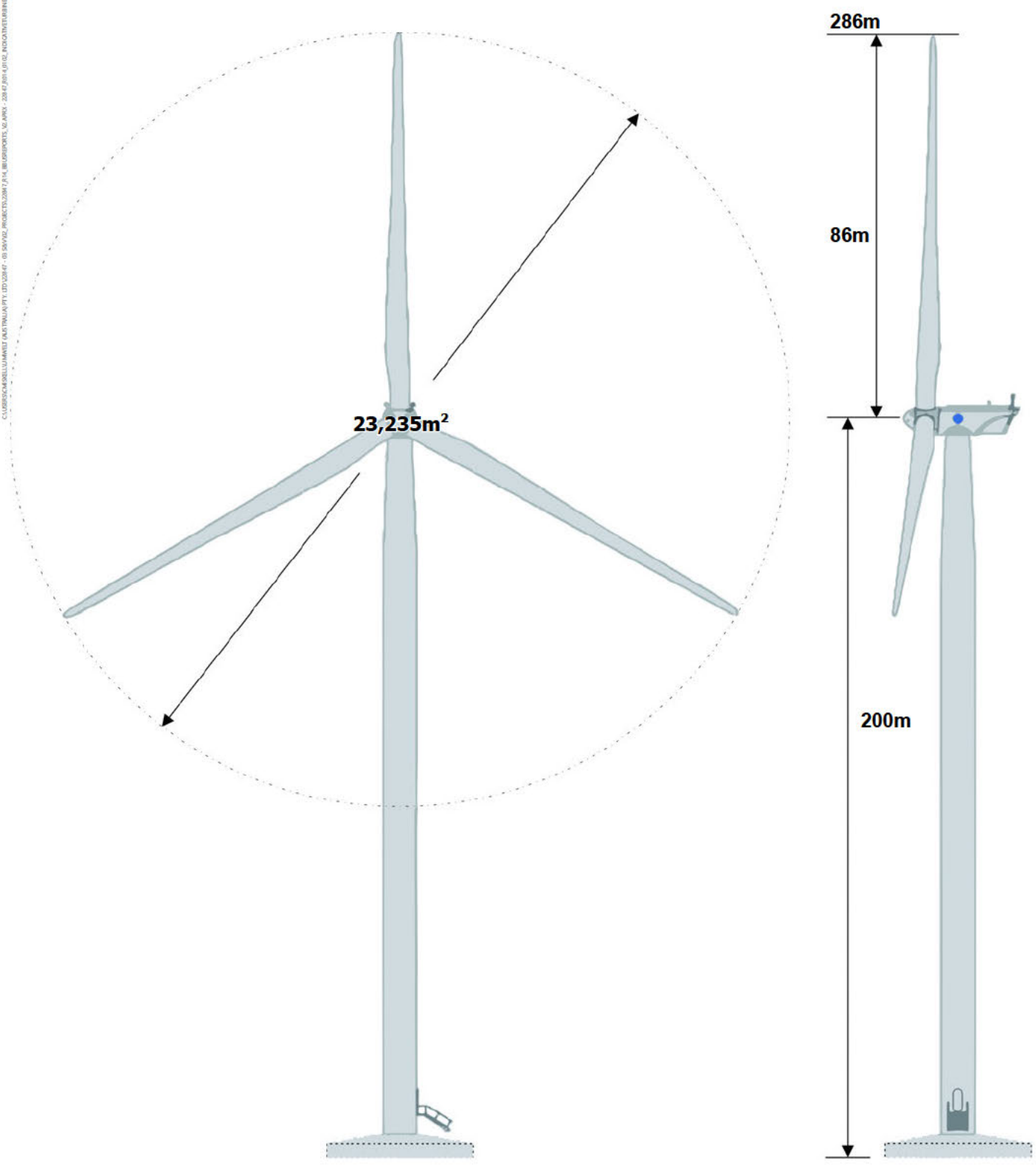


FIGURE 1.2

Indicative Turbine Rotor Swept Area
(V172-7.2 MW Model)

Data source: Turbine design company (2024)

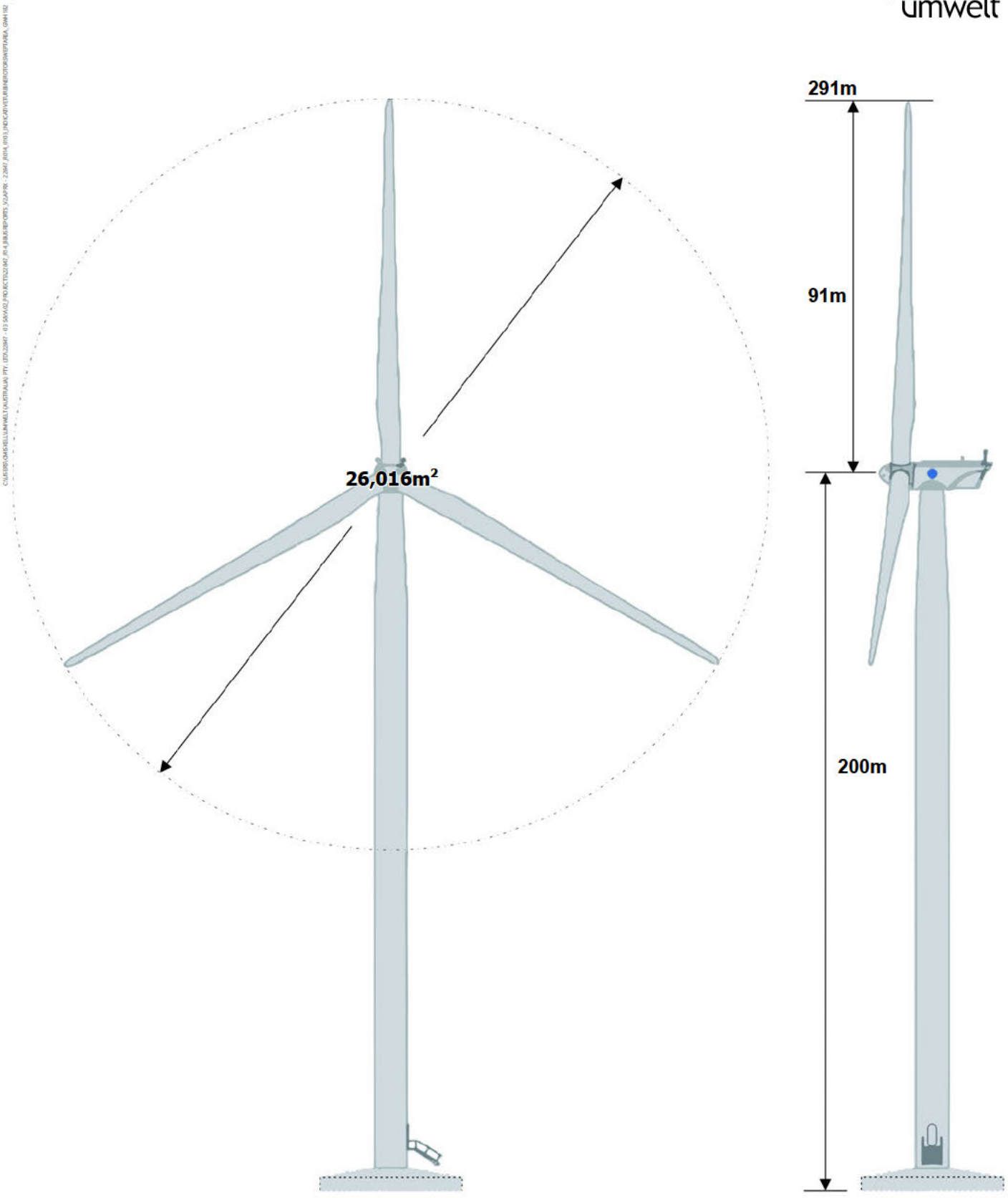


FIGURE 1.3

Indicative Turbine Rotor Swept Area
(GWH182/7.2 MW Model)

Data source: Turbine design company (2024)

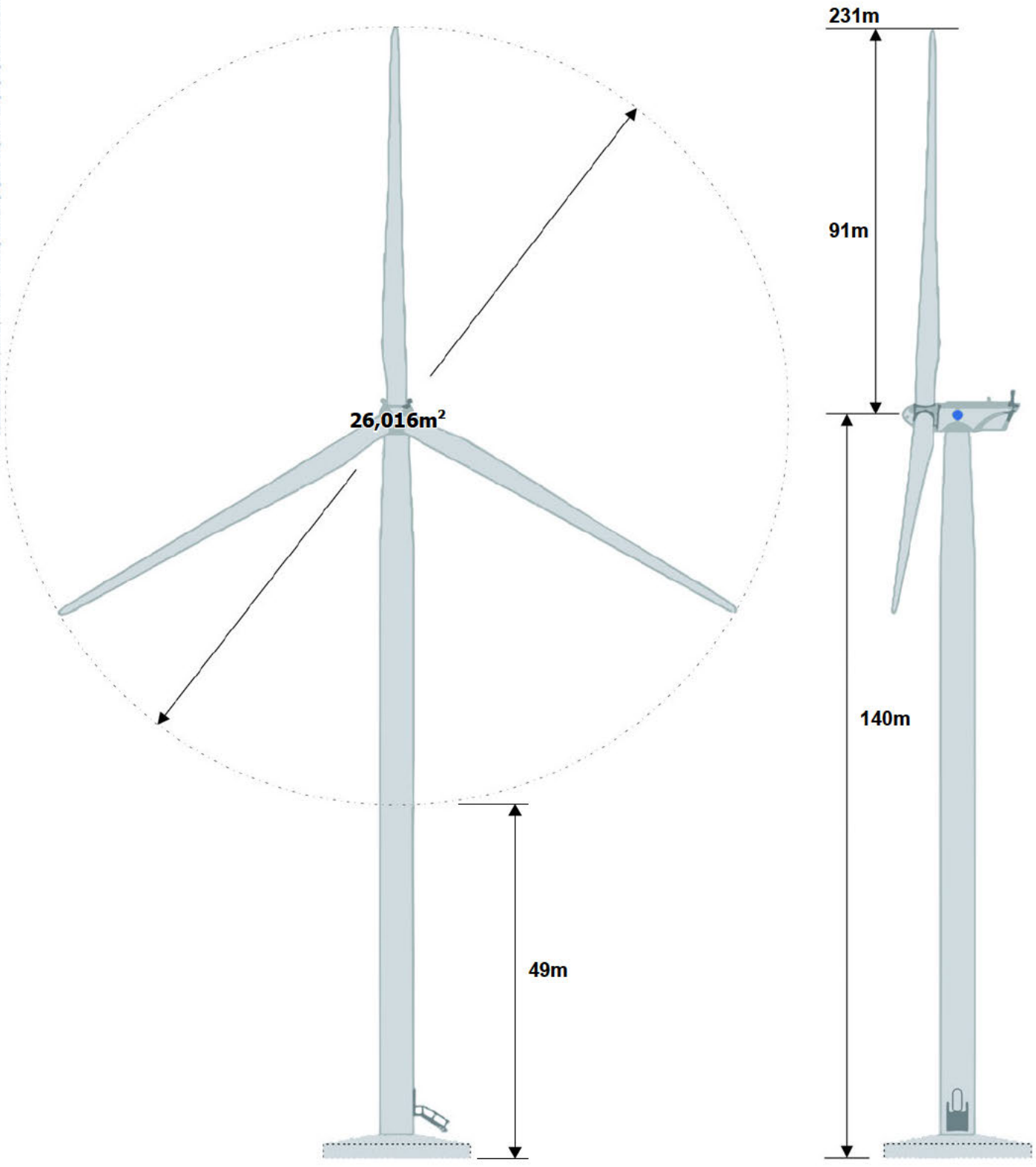


FIGURE 1.4

Indicative Turbine Rotor Swept Area
(GWH182/7.2 MW Low Hub Height Model)

Data source: Turbine design company (2024)

2.0 Methods

2.1 Desktop Assessment

A desktop assessment and literature review was undertaken prior to field survey. The objective of the desktop search was to identify which bird and bat species listed under the EPBC Act and/or the *Biodiversity Conservation Act 2016* (WA) (BC Act) may occur in the Study Area. The results of the desktop assessment were also utilised to select the most appropriate timing for surveys based on seasonal movements and behaviours of species of interest (i.e. listed species expected to occur within the Study Area). The following databases and reports were reviewed:

- Department of Climate Change, Energy, the Environment, and Water (DCCEEW) Protected Matters Search Tool (PMST) (20 km buffer around the Study Area and Additional Survey Area) (DCCEEW, 2024) (See **Appendix A**).
- Department of Biodiversity, Conservation and Attractions (DBCA) (2023) Threatened and Priority Fauna Database (30 km buffer around the Study Area and Additional Survey Area) (DBCA, 2023).
- Phase 1 Ecological Assessment: Narrogin Wind Farm (Umwelt, 2023).
- Phase 2 Basic Fauna Survey Report: Narrogin Wind Farm (Western Wildlife, 2024).
- The Cornell Lab of Ornithology (2024a) Birds of the World database.
- The Cornell Lab of Ornithology (2024b) eBird database.
- BirdLife Australia (2024) database.
- Black Cockatoo Habitat Assessment CPS 8731/1 Wandering-Narrogin/Springhill Road Intersection (Ecoedge, 2020).

2.1.1 Likelihood of Occurrence Assessment

A likelihood of occurrence for bird and bat species listed under the EPBC Act and/or the BC Act (i.e. conservation significant species) was determined by information derived from the desktop assessment which included a review of existing records, assessment of the habitat suitability of vegetation in the Study Area for species known from the region, and observations made during field surveys. Species were assigned to one of the following categories outlined in **Table 2.1**.

Table 2.1 Likelihood of occurrence categories

Category	Description
Known	The species has been recorded in the Study Area during the past decade (or during the Project-specific survey period).
High	Suitable habitat is present in the Study Area. Given the extent, quality and suitability of habitat in the Study Area, the location of the Study Area relative to existing contemporary records (past 20 years) of the species (with consideration of sampling effort in the region and the species' detectability) it is highly likely that the species occurs in the Study Area. Also includes species likely to regularly occur in the Study Area during migratory, short-distance seasonal or nomadic movements (including cases for which likelihood of occurrence is high regardless of the nature of habitat present in the Study Area).
Moderate	Potential or suitable habitat is present in the Study Area though given the species' status/the distribution of records in the surrounding region, a moderate rating for likelihood of occurrence is deemed more appropriate than a low or high rating. Includes species that may be present or may occasionally utilise the Study Area but for which there may be little information or those that are either cryptic or occur at low densities. Also includes species that may occasionally occur in the Study Area during migratory, short-distance seasonal or nomadic movements.
Low	The Study Area either contains no suitable habitat or potential/marginal habitat. The species is either very scarce or absent in the surrounding region in habitat similar to that present in the Study Area in the region. The species is deemed unlikely to occur in the Study Area based on the aforementioned factors. The species may disperse through or near the Study Area infrequently.

2.2 Field Survey

2.2.1 Survey Timing

Two pre-construction Bird and Bat Utilisation Surveys were undertaken by experienced fauna ecologists during the Spring 2023 and Summer 2024 seasons to coincide with the seasonal migration of EPBC Act listed bird species, including fork-tailed swift (*Apus pacificus*). Survey timing also aimed to coincide with peak seasonal activity for target bat species such as the Western False Pipistrelle (*Falsistrellus mackenziei*). Timing of each survey is detailed below:

- Spring 2023 season: 23rd October to 28th October 2023.
- Summer 2024 season: 5th February to 9th February 2024.

2.2.2 Site Selection

A total of eight vantage points were established on high points and clearings across the Study Area with best attempts made to position vantage points near proposed wind turbine locations. Three additional vantage points were also established in the Additional Survey Area. Vantage points were configured such that representativeness and coverage of the Study Area was maximised. The position of each vantage point is depicted in **Figure 2.1**. Photographs taken from each vantage point are presented in **Appendix C.**

Table 2.2 below provides an overview of the habitat present at each vantage point based on the habitat types of the Study Area described by Western Wildlife (2024). Five broad habitat types were described across the Study Area including: Eucalypt – Sheoak woodland with granites, Eucalypt woodland on laterite rise, Planted trees, Creek-line, and Cleared land. Vantage points were located in habitat types representative of those found across the Study Area where wind turbines are proposed. This was intended to allow for recording of bird assemblage and utilisation variations across those habitat types that may be impacted. Bat detectors were also deployed at each of the vantage points.

Table 2.2 Habitat Descriptions for Vantage Points

Vantage Point	Habitat
Study Area	
VP1	Cleared paddock surrounded by undulating hills. Lol Grey state forest to the North.
VP2	Cleared paddock surrounded by undulating hills. Planted trees approximately 300m to the North-East.
VP3	Cleared paddock surrounded by undulating hills. Adjacent to creek line to the North and Eucalypt woodland on laterite rise to the South.
VP4	Cleared paddock surrounded by undulating hills. Eucalypt woodland on laterite rise to the North and East. Eucalypt/sheoak woodland with granites to the West.
VP5	Cleared paddock surrounded by undulating hills.
VP6	Cleared paddock surrounded by undulating hills adjacent to eucalypt woodland on laterite rise to the North.
VP7	Cleared paddock surrounded by undulating hills. Creek line approximately 300m to the North.
VP8	Cleared paddock surrounded by undulating hills. Patch of planted trees to the North and patches of eucalypt woodland on laterite rise to the South.
Additional Survey Area	
VP9	Cleared paddock surrounded by undulating hills. Creek lines approximately 500m to the North and South.
VP10	Adjacent to cleared paddocks on the West, and eucalypt/sheoak woodland with granites and laterite rise to the East.
VP11	Cleared paddock surrounded by undulating hills.

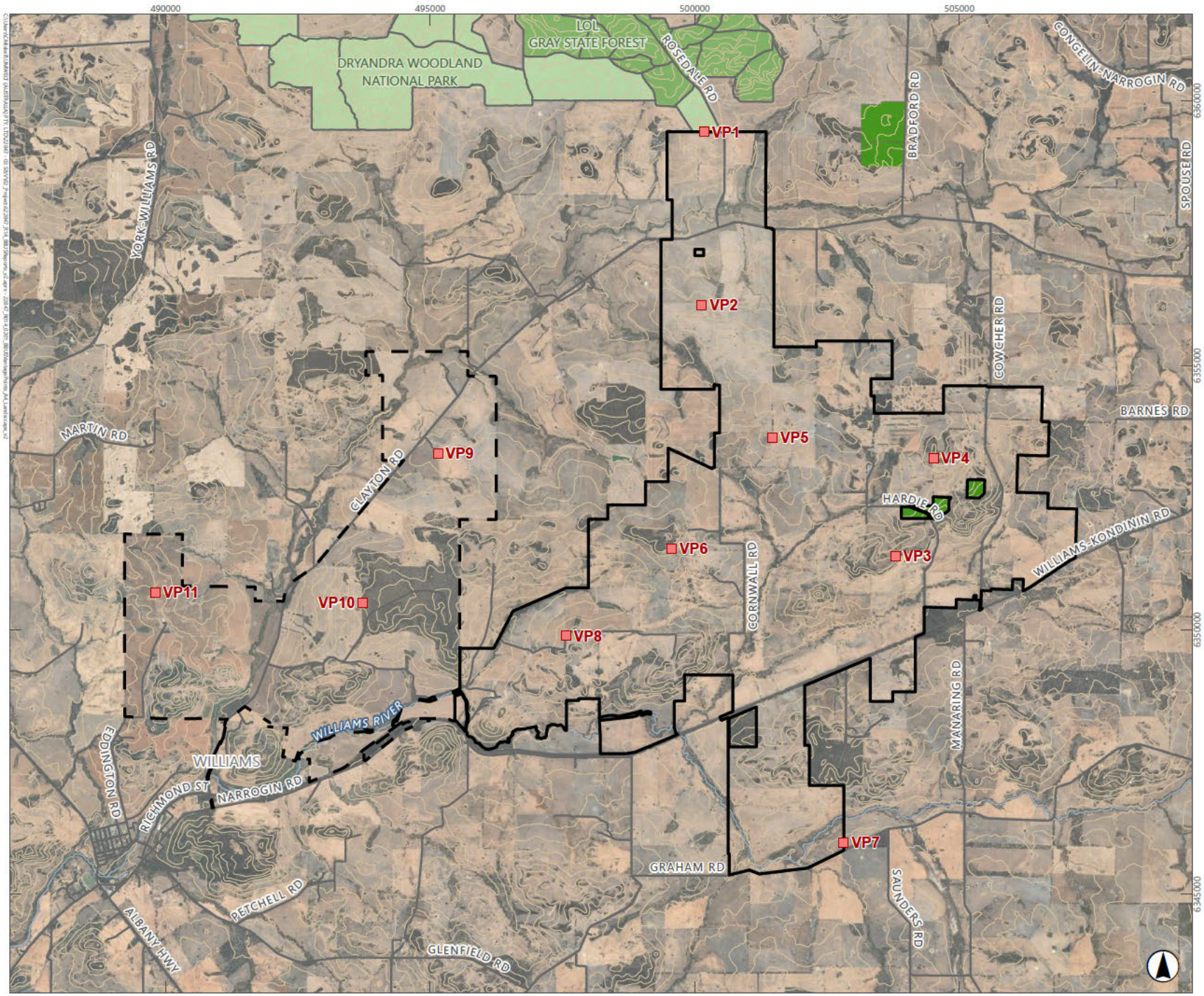


FIGURE 2.1
Vantage Point Survey Locations

Legend

- Study Area
- Additional Survey Area
- Road
- 10m Contours
- Major Watercourse
- Nature Reserve
- National Park
- State Forest
- Vantage Point

0 2 4

Kilometres

Scale 1:100,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023), DPIRD (2022)

2.2.3 Bird Utilisation Survey

2.2.3.1 Fixed-point count

The fixed-point count method involved an observer positioned at each of the 11 vantage points for 30 minutes. Fixed-point count surveys were conducted to assess site utilisation and flight behaviour of bird species in the Study Area. The period of 30 minutes adopted for the fixed-point counts is deemed adequate to generate representative data on the site utilisation and flight behaviour of bird species in the Study Area.

During each 30-minute survey period, a single observer recorded the following information for each bird observation:

- species and abundance
- observation type (visual or aural)
- distance and direction from the observer (to the nearest 10 m and 10° respectively)
- approximate height AGL of the observed bird/s (to the nearest 10 m)
- direction of flight (to the nearest 10°)
- flight pattern (i.e. not flying, local movement, directional flight, circling, swooping, varied, or other)
- behaviour (i.e. flight, foraging, perching, mating, aggressive interactions, hollow inspection, nesting, or on station).

Each vantage point was surveyed for 30 minutes during four sampling windows per day (early morning, late morning, early afternoon, and late afternoon) to minimise sampling bias. Vantage points were visited at different times of day and across different days to allow for time-of-day differences in bird movements and activity to be recorded. A fixed-point count survey at each vantage point was completed eight times during each of the survey events (Spring 2023 and Summer 2024 surveys).

The sampling windows are outlined below and tables detailing survey effort at each vantage point are presented in **Appendix B**.

- early morning (between 6:00 am and 10:00 am)
- late morning (between 10:00am and 12:30 am)
- early afternoon (between 12:30 pm and 3:00 pm)
- late afternoon (between 3:00 pm and 6:00 pm).

2.2.3.2 Incidental Observations

In addition to observations during fixed-point count surveys, incidental bird observations were recorded at various locations throughout the Study Area during travel between vantage points. For each record the following were noted where available: species, location of the observation recorded, abundance, flight behaviour, flight height and flight direction. Emphasis was placed on observations of birds of concern (listed Threatened, Priority, and Migratory species, and raptors) as well as birds moving through the Study Area at RSA height.

2.2.3.3 Other Bird Observations

Whilst bird utilisation survey was the primary method in determining bird assemblages and flight heights on-site, detection of bird species and occurrence was collected throughout the entirety of the Project ecology program via the following additional methods:

- incidental observations
- acoustic recorders
- active searches.

These methods were undertaken by Western Wildlife as part of a vertebrate fauna survey (Western Wildlife, 2024).

2.2.4 Bat Surveys

Microbat (microchiropteran) echolocation calls were sampled using Anabat Swift recording devices at 11 vantage point locations within the Study Area and Additional Survey Area (**Figure 2.1**). Devices were placed approximately two metres above ground level (AGL) facing a cleared area or flyway and left in-situ for two nights. Call data collected from each device was sent to Balance! Environmental and Bob Bullen (Bat Call WA) for identification. The total number of detector nights during the BBUS was 22 during the Spring 2023 survey and 22 during the Summer 2024 survey. The number of sampling nights for each detector location is provided in **Appendix D.**

2.2.5 Field Survey Limitations

Exact counts of birds are limited to visual observations. As such and for the purposes of this report and data analysis, all aural observations have been assigned a count of one individual.

There were access limitations to some of the vantage point locations originally selected via aerial imagery for the 2023 Spring survey. These were relocated once on-site to suitable locations nearby with sufficient visual coverage of the surrounding landscape. The same locations were then utilised for the 2024 Summer survey.

Temperatures reached 40°C on the final day (February 9th) of the summer BBUS. This may have led to a decrease in bird activity across the site during the hottest part of the day.

Bat surveys were limited to use of stationary bat-detector devices for recording calls of bat species. No active trapping was undertaken. Bat species density is impossible to estimate from echolocation records. Bat presence at a series of sites is therefore substituted as an approximate guide to the relative numbers of each species using the Study Area (Bat Call WA, 2024).

No other survey limitations were present.

3.0 Results

3.1 Desktop Assessment

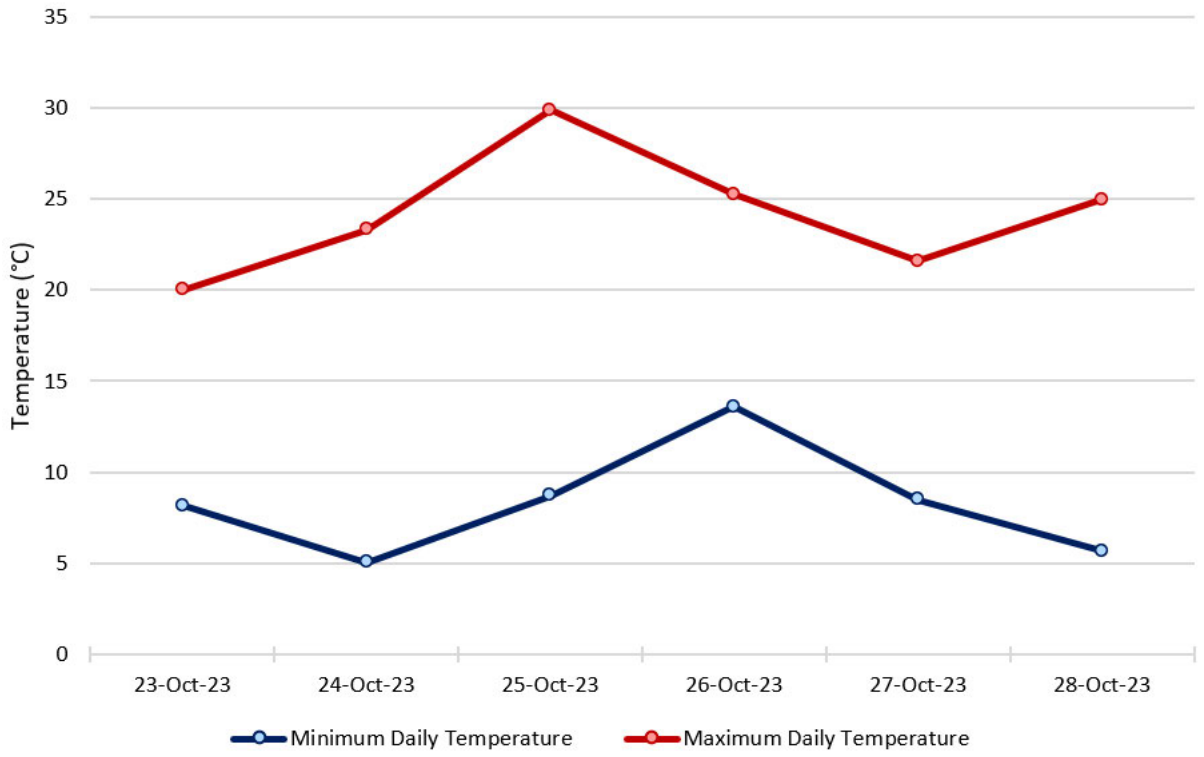
A review of database searches and those sources listed in **Section 2.1.1** identified 19 conservation significant bird species and two conservation significant bat species that have the potential to occur within the Study Area. These results were combined with field observations (detailed in the following sections) to develop the Likelihood of Occurrence Assessment for species with a Moderate or greater likelihood of occurrence presented in **Section 3.3** using the criteria described in **Table 2.1**.

3.2 Field Survey

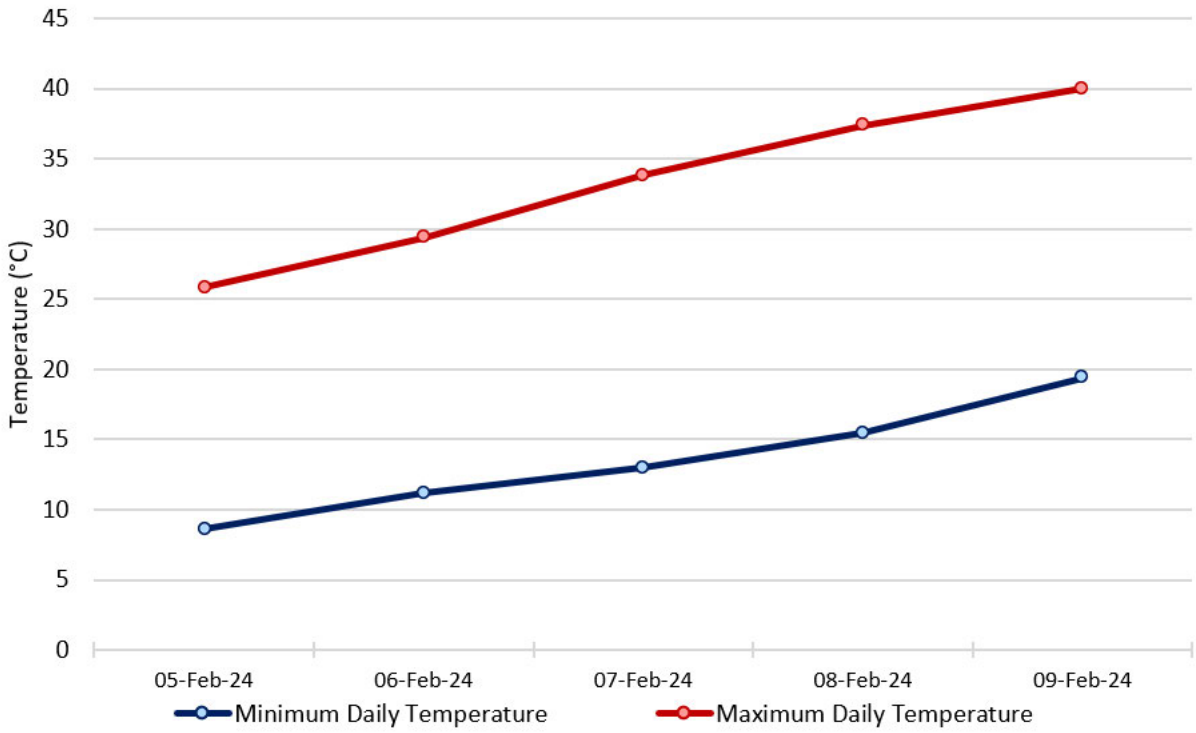
3.2.1 Site Conditions

Climatic conditions during the BBUS surveys were typical for the Narrogin region. Temperatures during the summer BBUS were particularly variable with daily maximums ranging from 26 °C to 40 °C and minimums ranging from 9 °C to 19 °C. Conditions during the BBUS were considered appropriate to capture the bird and bat species present on site.

Weather data throughout the survey was collected from the closest weather stations to the Study Area. Weather data was recorded from the Bureau of Meteorology (BOM) weather station at Narrogin (station number 010614) which is considered representative of the Study Area (BOM, 2024). No rain fell during either of the survey events (Spring or Summer). A maximum temperature of 30 °C was observed in the Spring survey event, with a higher maximum of 40 °C observed in the Summer survey event. Daily weather observations during the Spring 2023 and Summer 2024 BBUS are illustrated on **Graph 3.1** and **Graph 3.2.**



Graph 3.1 Field Survey Daily Weather Observations for Spring 2023 Survey



Graph 3.2 Field Survey Daily Weather Observations for Summer 2024 Survey

3.2.2 Birds

3.2.2.1 Species Diversity

A total of 70 unique bird species were recorded within the Study Area during the Spring 2023 and Summer 2024 BBUS. Vantage point surveys detected a total of 61 species while the remaining 9 species were recorded incidentally during travel between vantage points. Where available, flight data was collected from incidental observations taken throughout the field surveys. A list of all species recorded at each vantage point is presented in **Appendix E.**

An additional 19 species were recorded during other ecological surveys by Western Wildlife (2024), bringing the total bird species recorded to 89.

3.2.2.2 Species by Record and Count

A total of 29 species were recorded frequently (i.e. >10 times) throughout the BBUS, both during vantage point surveys and incidentally. The 10 most recorded (visually and aurally) bird species within the Study Area are provided in **Table 3.1**.

Table 3.1 Top 10 Species by Number of Observations in the Study Area

Rank	Common Name	Scientific Name	Total Observations
1	Australian Ringneck	*Barnardius zonarius*	66
2	Tree Martin	*Petrochelidon nigricans*	51
3	Striated Pardalote	*Pardalotus striatus*	49
4	Australian Raven	*Corvus coronoides*	44
5	Little Crow	*Corvus bennetti*	40
6	Wedge-tailed Eagle	*Aquila audax*	37
7	Australian Magpie	*Gymnorhina tibicen*	36
8	Willie Wagtail	*Rhipidura leucophrys*	31
9	Western Gerygone	*Gerygone fusca*	30
10	Grey Shrike-thrush	*Colluricincla harmonica*	29
10	Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	29

The top 10 species by count, calculated using visual observations made both during vantage point surveys and incidentally, is provided in **Table 3.2**. The Tree Martin was the most abundant species.

Table 3.2 Top 10 Species by Number of Individuals in the Study Area

Rank	Common Name	Scientific Name	Total Count
1	Tree Martin	*Petrochelidon nigricans*	215
2	Australian Ringneck	*Barnardius zonarius*	152
3	Little Crow	*Corvus bennetti*	102
4	Australian Raven	*Corvus coronoides*	70
5	Black-faced Woodswallow	*Artamus cinereus*	61

Rank	Common Name	Scientific Name	Total Count
6	Welcome Swallow	*Hirundo neoxena*	53
7	Wedge-tailed Eagle	*Aquila audax*	49
8	Grey Teal	*Anas gracilis*	46
9	Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	45
10	Striated Pardalote	*Pardalotus striatus*	44

3.2.2.3 Listed Species Observed

Three listed species were recorded within the Study Area during BBUS and fauna surveys. The Peregrine Falcon and the Western Rosella (inland) were visually recorded, and the Carnaby's Black-Cockatoo was recorded via secondary evidence. One other listed bird species was recorded within the Additional Survey Area, being the Forest Red-tailed Black Cockatoo.

These species are detailed in **Table 3.3** and their locations are provided in **Figure 3.1**.

Table 3.3 Listed Species Recorded During All Surveys in the Study Area

Common name	Scientific Name	EPBC Act Status	WA Status
Carnaby's Black-Cockatoo	*Zanda latirostris*	Endangered	Endangered
Peregrine Falcon	*Falco peregrinus*	Not listed	Other Specially Protected
Western Rosella (inland)	*Platycercus icterotis xanthogenys*	Not listed	Priority 4

Carnaby's Black-Cockatoo

The Carnaby's Black-Cockatoo was recorded at VP10 within the Additional Survey Area during the summer BBUS flying through eucalypt woodland habitat. Three individuals were recorded flying at a height of between 20 and 40 m AGL.

The Carnaby's Black-Cockatoo was also recorded during the fauna survey conducted by Western Wildlife. These records were through secondary evidence and once via calls, with the records of secondary evidence being recorded within the Study Area and the remainder being outside of the Study Area within the Additional Survey Area. These records were within eucalypt woodland habitat (Western Wildlife, 2024).

There is a dearth of published information on the flight heights for black-cockatoos, with no mention made in key references such as Johnstone & Storr (2004), Rycken (2019), or Rycken et al. (2021, 2024). Additionally, the only pertinent information provided in the *Handbook of Australian, New Zealand and Antarctic Birds* (BirdLife Australia, 2023b, 2023a, 2023c) for those black-cockatoo species listed in this report was limited to:

- "Mainly arboreal but often come to ground to feed ... flight agile, with fast twists and turns while manoeuvring between trees; groups moving between feeding areas generally fly high over treetops" (for Carnaby's Black-Cockatoo).

- "Usually fly above treetops, typically spiralling down to feeding trees, though can also descend in sustained glide on strongly bowed wings" (for Forest Red-tailed Black-Cockatoo; noting the species account is also general for all subspecies).

Generally, however, black-cockatoos are considered to fly at or below canopy height (i.e. tree- or shrub-height, where applicable) when foraging, and at or just above canopy height when in longer-distance transit such as between foraging, roosting and watering areas (W. Bancroft, pers. obs). It is rare that these species fly more than c. 10 m above canopy height in these instances (W. Bancroft, pers. obs). When crossing areas of expansive open ground (or low vegetation such as heaths) black-cockatoos tend to fly close to the ground surface. In circumstances where birds are passing across less-expansive cleared areas between patches of remnant trees or isolated individual trees (as is present throughout much of the Study Area) they usually maintain a 'canopy height' flight path (W. Bancroft, pers. obs). Instances where black-cockatoos may exceed 50 m AGL in flight height are likely restricted to evading large predatory raptors such as eagles or when congregating in large numbers. Flight height data collected for the Badgingarra wind farm for Carnaby's Black-Cockatoo recorded the species flying between 20-150 m AGL on five occasions, or 20% of records with flight height data (Ecoscape, 2019); however, post-construction mortality monitoring in 2019 found no instances of blade strike with the species and it is unclear the specific flight heights being utilised by the species within this height range. Data for mortality monitoring after 2019 is not available.

Peregrine Falcon

The Peregrine Falcon was recorded on two occasions at vantage points within the Study Area, and once incidentally. This species was observed at VP1 flying at a height of between 15 and 25 m AGL, and at VP4 flying at a height of between 15 and 50 m AGL. The incidental observation was of a breeding pair at a nest made in a large jarrah tree. The pair exhibited territorial behaviour. This species was also observed during field surveys within the Study Area by Western Wildlife (2024).

Peregrine Falcons have a large home range (c. 20-30 km^2) and may, therefore, contemporarily utilise the Study Area and surrounds. The Study Area likely provides foraging habitat for this species and if breeding occurs within the Study Area, it is likely to be confined to vegetation remnants that contain tall trees.

Western Rosella (inland)

The Western Rosella (inland subspecies) was recorded at VP10 within the Additional Survey Area and VP8 within the Study Area, and twice more incidentally. The species was observed twice either perched on a tree or other structure and identified aurally on the two other occasions. The species was detected in eucalypt woodland and creek-line habitats. Only one of the observations had flight height data recorded where one individual was observed flying below the lower RSA height limit at approximately 3 m AGL. This species was also observed during field surveys within the Study Area by Western Wildlife (2024).

Western Rosellas (inland) are known to primarily occupy eucalypt and casuarina woodlands and scrubs, particularly those comprising wandoo, flooded gum, salmon gum, tall mallees and/or *Allocasuarina huegliana*. In the Narrogin–Katanning area, BirdLife Australia (2023) noted that this taxon usually inhabits *Acacia–Allocasuarina* scrubland. Western Rosellas (inland) breed in tree hollows and show a preference for marri, wandoo, York gum, flooded gum, and salmon gums for nesting (Johnstone & Storr, 2004); almost all of which are present within the Study Area. The species tends to be sedentary in breeding pairs or family groups and often feeds on the ground but also in trees where it is attracted to food sources such as seeding wandoo and *Allocasuarina huegliana*, and flowering *Melaleuca acuminata* and *Euclalyptus eremophila* (Johnstone & Storr, 2004; Menkhorst, et al., 2019).

No published information on typical flight behaviours (particularly heights) is available for the Western Rosella (inland). When foraging or transiting, this taxon is generally observed passing between trees by flying at or below tree canopy height (W. Bancroft, pers. obs.). It is unlikely that birds will fly much above the height of the canopy and, thus, move into the RSA. However, there have been two occurrences of blade strike recorded for the Crimson Rosella in the available literature from Victoria (Lumsden, Moloney, & Smales, 2019; Wood, 2020) and one recorded for the Green Rosella in the available literature from Tasmania (Hull, Stark, Peruzzo, & Sims, 2013). Additional research into the flight behaviours of Western Rosellas, or potentially how they differ from other species of the genus, may provide some indication on the potential for this species to occur within the RSA.

3.2.2.4 Listed species with a moderate or greater likelihood of occurrence

Forest Red-tailed Black-Cockatoo

The Forest Red-tailed Black-Cockatoo was recorded in the Additional Survey Area outside of the Study Area during the fauna survey conducted by Western Wildlife, with a small flock of probably two birds heard in the southern part of the Additional Survey Area in Eucalypt Sheoak woodland. No evidence of foraging was recorded despite the abundance of Marri, a favoured food-plant (Western Wildlife, 2024). This species has been assigned a High likelihood of occurrence of occurring in the Study Area.

It is not expected that black-cockatoos, including the Forest Red-tailed Black-Cockatoo, will regularly exceed c. 5-15 m above canopy height. This is likely to be below the 49 m minimum of the RSA.

Literature on Forest Red-tailed Black Cockatoos behaviour and biology in the Wheatbelt is limited, with most studies focusing on the Swan Coastal Plain. Flight speed for the Forest Red-tailed Black-Cockatoos has been found to be generally low (at or below 1m/s), with birds appearing to move slowly through the landscape while either foraging, day roosting, or resting (Shephard & Warren, 2019). Larger home-ranges for the species have been associated with the flock moving between multiple smaller foraging sites, often travelling along and making use of vegetation in road verges (Rycken et al., 2022). Daily movements averaged 16.41 km for the flock with the larger home-range, with several days showing a movement of more than 20 km. A flock with a smaller home-range of 6.02 km^2, based in larger areas of remnant vegetation, travelled only 4.96 km per day on average. Further field observations, such as dedicated flock-following, may provide additional information on the movements and flight heights of Forest Red-tailed Black-Cockatoo within the Study Area, and may also help to establish the presence/likelihood of breeding and roosting locations in proximity to the Study Area.

Baudin's Black-Cockatoo

The Baudin's Black-Cockatoo (*Zanda baudinii*) was not recorded during the Spring and Summer BBUS, or fauna surveys undertaken by Western Wildlife (2024). The Baudin's Black-Cockatoo has therefore been ranked as a Moderate likelihood of occurrence within the Study Area based on numerous historical records within a 20 km radius of the Study Area, with the most recent being in 2018. The Study Area is not within the known breeding range of the species but there is potential that it may offer potential foraging habitat during the non-breeding season.

It is expected that Baudin's Black-Cockatoos will fly at heights similar to the other two species of black-cockatoos, as described above.

In a study that compared the movement ecology of Baudin's Black-Cockatoos in urban/peri-urban regions and the forest region, Rycken et al. (2021) found that flock sizes were significantly larger in forested areas. While the study did not consider movement within the agricultural matrix (such as the Study Area investigated here) it might be expected that, given the fragmentation of native vegetation, agricultural areas would more likely reflect the urban/peri-urban landscape structure and, therefore, generally support smaller black cockatoo flock sizes than the forested areas to the west.

Other species

A further three species have a Moderate likelihood of occurrence in the Study Area. These include the Barking Owl (Southwest subpop.) (*Ninox connivens connivens*), Masked Owl (Southern subspecies) (*Tyto novaehollandiae novaehollandiae*), and Fork-tailed Swift (*Apus pacificus*).

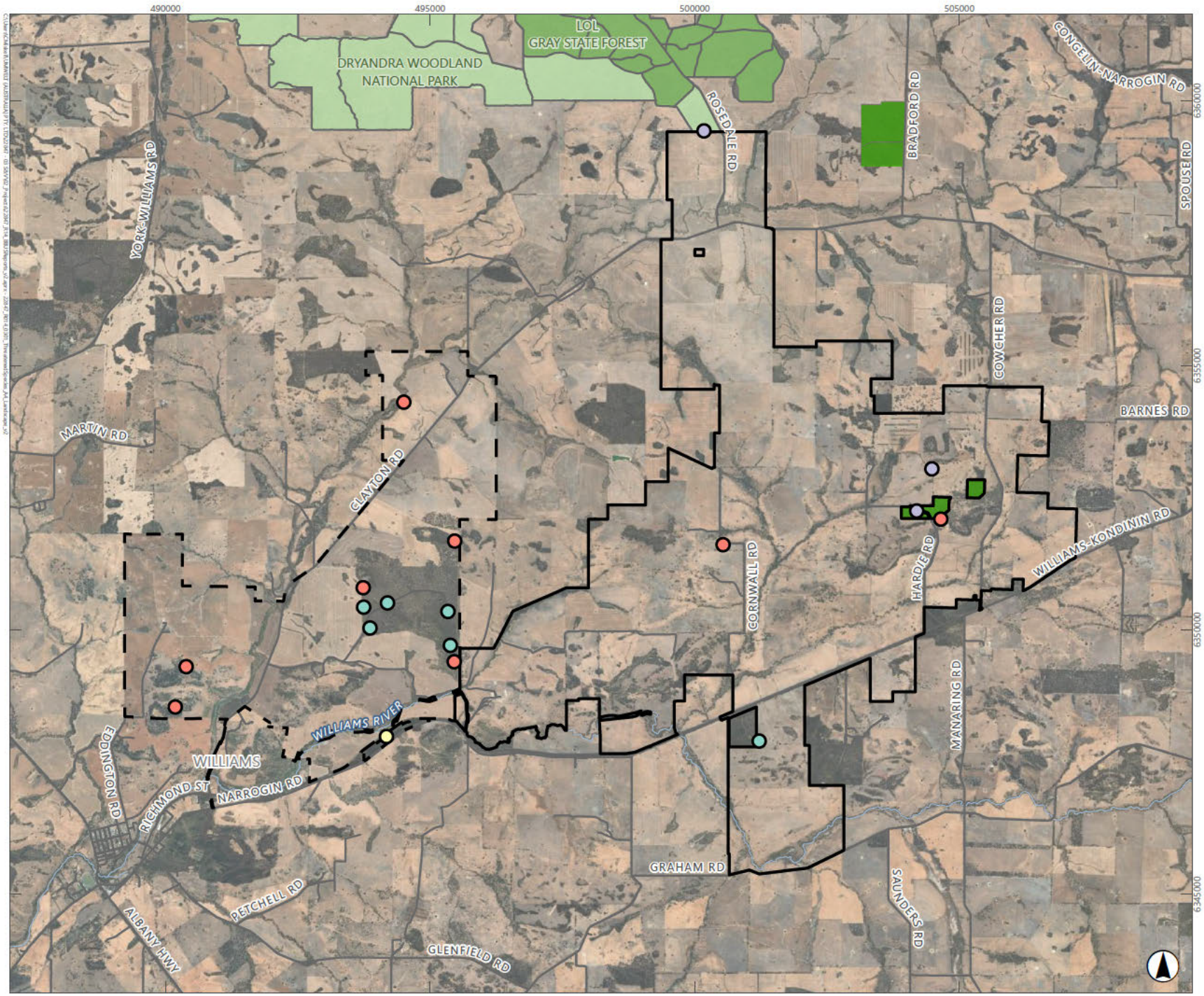


FIGURE 3.1
Threatened and Listed Species Observations

Legend

- Study Area
- Additional Survey Area
- Road
- Major Watercourse
- Major Watercourse
- Nature Reserve
- National Park
- State Forest
- Carnaby's Black-Cockatoo (*Zanda latirostris*)
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)
- Peregrine Falcon (*Falco peregrinus*)
- Western Rosella (*Platycercus icterotis*)

0 2 4
Kilometres

Scale 1:100,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023), Western Wildlife (2024)

3.2.2.5 At-risk Species

A total of 22 species were observed flying within or higher than the RSA height range (49 m – 291 m AGL) within both the Study Area and Additional Survey Area, placing them at risk of turbine blade strike. Flight height data is presented for both areas so long as a species was recorded on at least one occasion within the Study Area only. A summary of these species and their minimum and maximum flight heights are presented in **Table 3.4.**

One species, Peregrine Falcon, which was recorded flying within the RSA height range on one occasion, is listed as Other Specially Protected under the BC Act. This species was recorded flying between 15 m and 50 m AGL (**Table 3.4**).

Table 3.4 At-risk Species

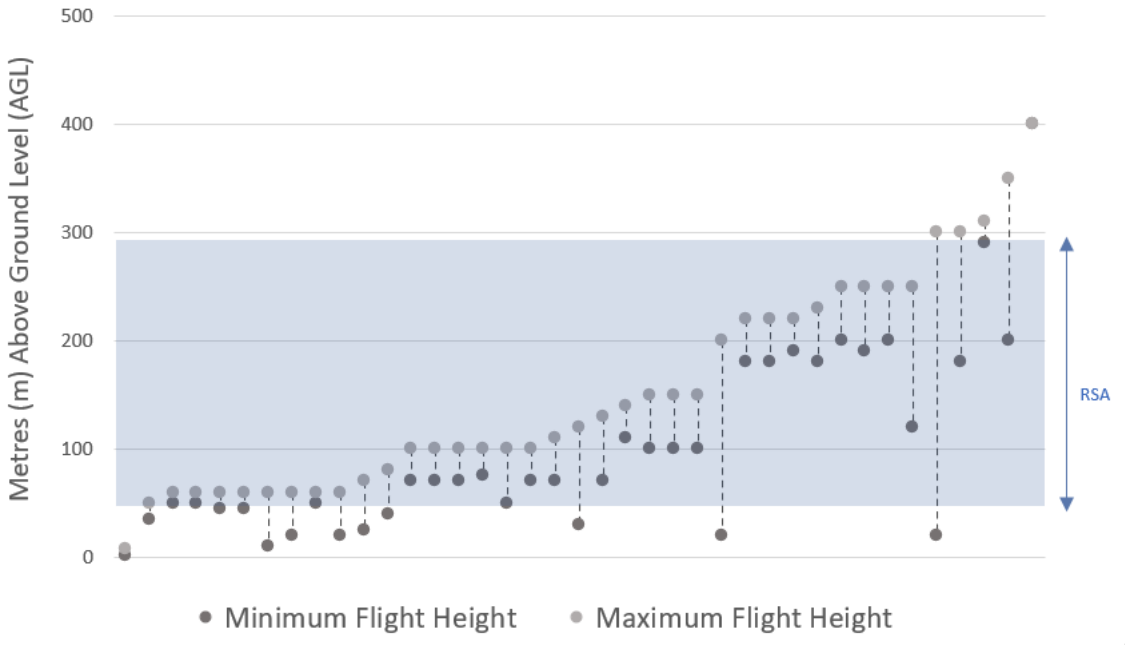
Common Name	Scientific Name	Observed Flight Height (m AGL)	
		Minimum	Maximum
Wedge-tailed Eagle	*Aquila audax*	2	400
Black-shouldered Kite	*Elanus axillaris*	20	220
Welcome Swallow	*Hirundo neoxena*	1	160
Tree Martin	*Petrochelidon nigricans*	1	150
Brown Falcon	*Falco berigora*	9	120
Nankeen Kestrel	*Falco cenchroides*	1	120
Australian Magpie	*Gymnorhina tibicen*	0	110
Little Crow	*Corvus bennetti*	0	100
Whistling Kite	*Haliastur sphenurus*	70	100
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	5	90
Australian Raven	*Corvus coronoides*	1	85
Black-faced Woodswallow	*Artamus cinereus*	1	70
Dusky Woodswallow	*Artamus cyanopterus*	1	70
Regent Parrot	*Polytelis anthopeplus*	2	70
White-faced Heron	*Egretta novaehollandiae*	0	55
Australian Ringneck	*Barnardius zonarius*	0	50
Australian Shelduck	*Tadorna tadornoides*	15	50
Elegant Parrot	*Neophema elegans*	0	50
Galah	*Eolophus roseicapilla*	0	50
Peregrine Falcon*	*Falco peregrinus*	15	50
Spotted Harrier	*Circus assimilis*	25	50
White-winged Triller	*Lalage tricolor*	0	50

*Species listed as Other Specially Protected under the BC Act.

Whilst 22 species were identified as 'at-risk', five at-risk species are highlighted due to a combination of number of occurrences of observed flights within the RSA height range, total count of individuals observed, and/or their status as a listed threatened or migratory species. This includes the Wedge-tailed Eagle, Tree Martin, Nankeen Kestrel, Australian Raven, and Peregrine Falcon. A summary of observations for these species across both the Study Area and Additional Survey Area is provided below.

Wedge-tailed Eagle

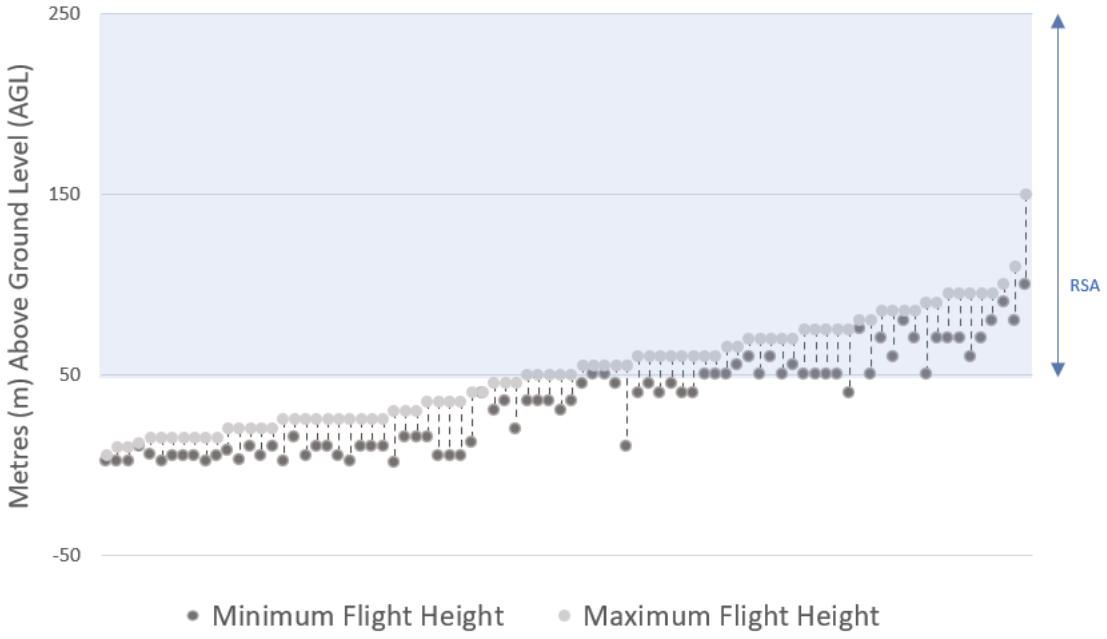
A total of 55 Wedge-tailed Eagles were recorded on 42 occasions within the Study Area and Additional Survey Area. Of these observations, 39 had flight data recorded, of which 38 (97%) occurred within the RSA height range. The maximum recorded flight height of this species was 400 m AGL and was the highest flying species recorded during the BBUS. A total of 30 observations (71%) were of individual birds, while 11 observations (26%) were of pairs circling or hunting across the Study Area. The remaining observation was of birds in a group of three, possibly two adults and a juvenile. Flight heights of Wedge-tailed Eagles within the Study Area and Additional Survey Area respective of the Project's RSA height range are provided in **Graph 3.3**.



Graph 3.3 Wedge-tailed Eagle Minimum and Maximum Flight Heights

Tree Martin

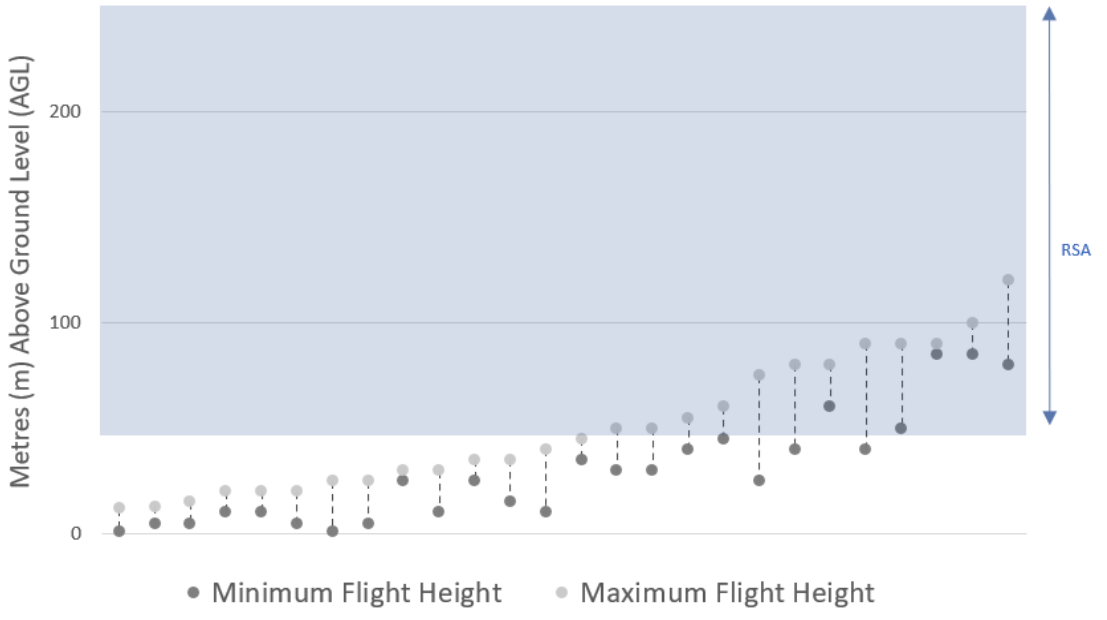
Tree Martins were observed transiting through and foraging at a number of vantage points within the Study Area and Additional Survey Area on 85 occasions, with flight height data available for 84 observations. Flight heights across all observations varied from a minimum of 1 m AGL to 150 m AGL. The largest flock size observed consisted of an estimated 30 individuals with the majority of observations consisting of lone birds (23%), or groups of 2 (26%) or 3 (18%). Flight heights of Tree Martins within the Study Area and Additional Survey Area respective of the Project's RSA height range are provided in **Graph 3.4**.



Graph 3.4 Tree Martin Minimum and Maximum Flight Heights

Nankeen Kestrel

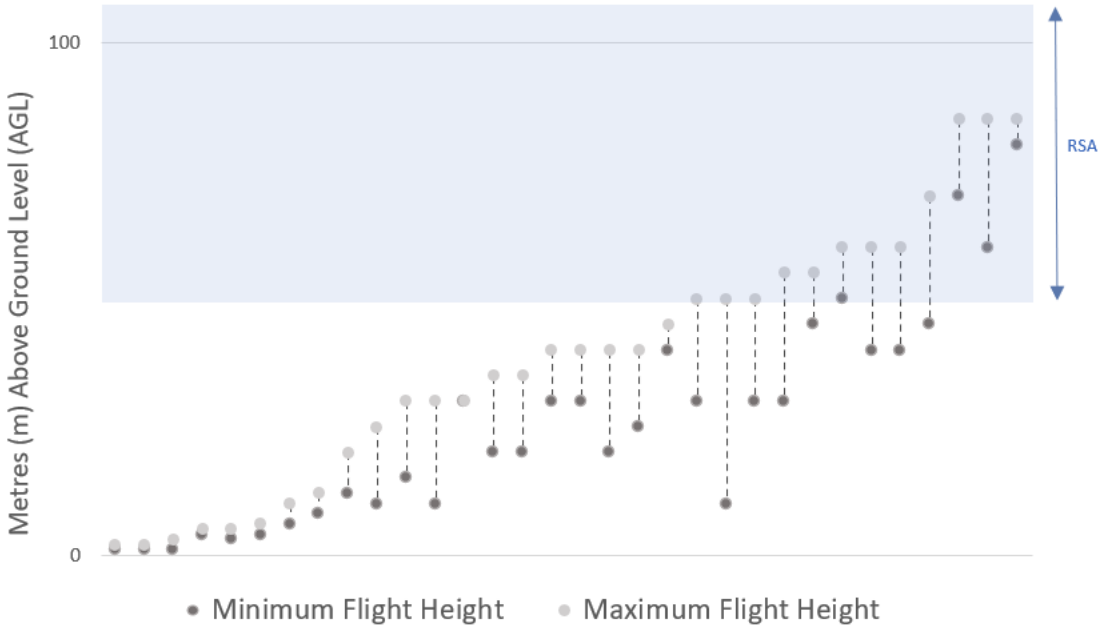
Nankeen Kestrels were recorded on 27 occasions within the Study Area and Additional Survey Area with flight height data available for 26 observations. This species was most commonly recorded individually (85% of observations). Approximately half (12) of the observations recorded a maximum flight height at RSA height. The remaining observations of this species were not within the RSA height range and recorded the species flying at a maximum height of 45 m AGL. Flight heights of Nankeen Kestrels within the Study Area and Additional Survey Area respective of the Project's RSA height range are provided in **Graph 3.5**.



Graph 3.5 Nankeen Kestrel Minimum and Maximum Flight Heights

Australian Raven

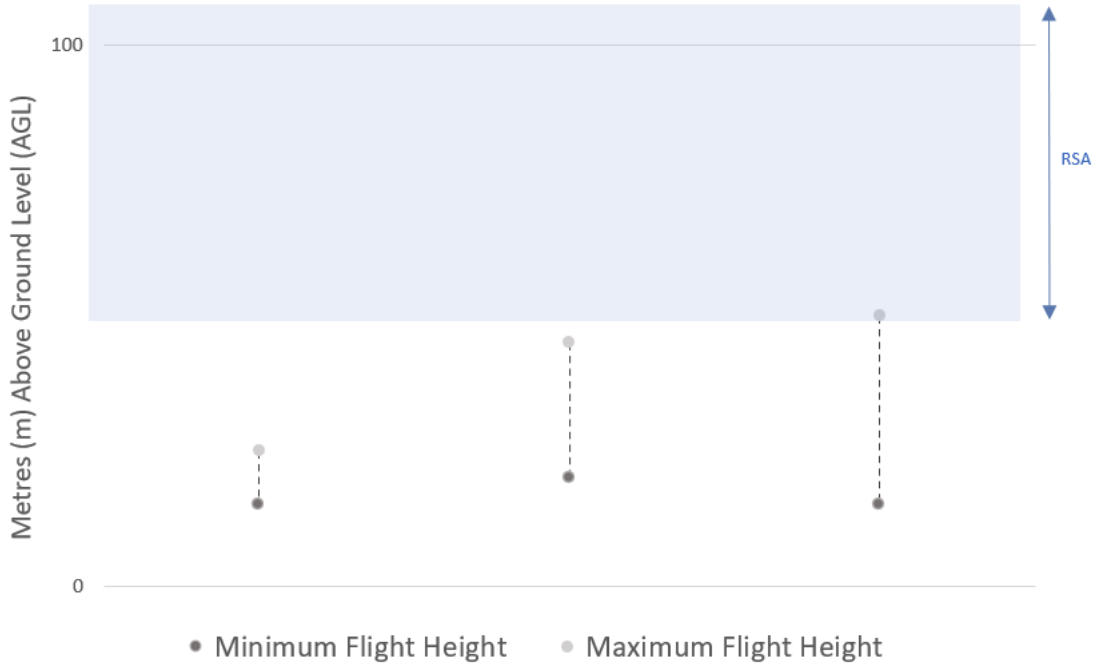
Australian Ravens were recorded on 64 occasions within the Study Area and Additional Survey Area with flight height data available for 32 observations. A total of 12 observations recorded this species flying to within the lower limit of the RSA height range with a maximum flight height of 85 m AGL. The remaining observations with flight data were below RSA height with 63% of maximum flight heights recorded below 45 m AGL. The maximum group size recorded was 7 individuals with most group sizes (85%) being observed between one and three individuals. Flight heights of Australian Ravens within the Study Area and Additional Survey Area respective of the Project's RSA height range are provided in **Graph 3.6**.



Graph 3.6 Australian Raven Minimum and Maximum Flight Heights

Peregrine Falcon

Peregrine Falcons were recorded on three occasions within the Study Area with flight height data available for all observations. Two observations consisted of lone individuals and the third observation comprised a pair with one circling and the other remaining perched potentially at a nest. Only one of the observations (lone individual) recorded a maximum flight height (50 m AGL) above the lower limit of the RSA height. Flight heights of Peregrine Falcons within the Study Area respective of the Project's RSA height range are provided in **Graph 3.7**.



Graph 3.7 Peregrine Falcon Minimum and Maximum Flight Heights

3.2.3 Bats

3.2.3.1 Species Diversity

Up to eight microbat species (Bat Call WA, 2024; Balance! Environmental, 2023) were identified via call. One of these species was only recorded within the Additional Survey Area during the Spring and Summer BBUS, but was detected within the Study Area by Western Wildlife (2024) during fauna surveys (Chocolate Wattled Bat). The results of all deployments within the Study Area and Additional Survey Area during the Spring 2023 and Summer 2024 BBUS are provided in **Appendix F**.

Species detected included:

- White-striped Free-tailed Bat (*Austronomus australis*)
- Gould's Wattled Bat (*Chalinolobus gouldii*)
- Lesser Long-eared Bat (*Nyctophilus geoffroyi*)
- Western Greater Long-eared Bat (*Nyctophilus major major*)
- Chocolate Wattled Bat (*Chalinolobus morio*)
- Western False Pipistrelle (Priority 4 under the BC Act) (*Falsistrellus mackenziei*)
- South-western Free-tailed Bat (*Ozimops kitcheneri*)
- Southern Forest Bat (*Vespadelus regulus*).

3.2.3.2 Listed Species Observed (via call)

The following species that are conservation significant under the BC Act were identified via call:

- Western False Pipistrelle (Priority 4) (*Falsistrellus mackenziei*).

Western False Pipistrelle

The Western False Pipistrelle was recorded at VP1, 4, 5, 6, 7, 9 and 10 representing all habitats within the Study Area and Additional Survey Area including Eucalypt woodland, Eucalypt sheoak woodland with granites, and Creeklines. The detection rate of this species was unexpected. The results potentially indicate that there is a seasonal presence in the area attracted by flowering vegetation (Bat Call WA, 2024).

The Western False Pipistrelle prefers tall mature forests of Karri, Jarrah and Tuart but has also been recorded from Banksia woodland on the Swan Coastal Plain (Armstrong, Woinarksi, & Burbidge, 2017). Flying-insects are a preferred food source often caught in the spaces between the canopy and understorey of tall forest trees. They are fast, direct, high-fliers which have been caught in the forest 8 m above the ground (Australian Museum, 2020).

No information currently exists on the breeding biology of this species (Armstrong, Woinarksi, & Burbidge, 2017). This species is vulnerable to the loss of roost sites in tree hollows through habitat removal and competition for hollows from introduced European Honeybees and Rainbow Lorikeets (Armstrong, Woinarksi, & Burbidge, 2017). The loss of feeding grounds through clearing is also a significant threat (Australian Museum, 2020). This species is considered likely to utilise the Study Area for foraging and may also utilise tree hollows within Jarrah/Marri woodland habitats for roosting.

No other listed bats were recorded during field surveys.

3.2.3.3 Other species with a high or moderate likelihood of occurrence

One other bat species returned from the desktop assessment (Central Long-eared Bat – Priority 3 under the BC Act) was considered to have a high likelihood of occurrence in the Study Area and is detailed further in **Appendix G**.

3.2.3.4 At-risk Species

Due to the nature of survey methods (bat call detectors) no flight heights were recorded during the field surveys. However, of the eight species determined to occur on site and based on the known ecology of the species, three are likely to fly at RSA heights. These include:

- White-striped Free-tailed Bat
- South-western Free-tailed Bat
- Gould's Wattled Bat.

While there is no publicly available information on blade strike from the majority of wind farms located in these species' range, including Western Australia, a review of available published literature from wind farms in Australia has found the following mortality data for microbats recorded during field surveys (Bennett et al., 2022; Hull & Cawthen, 2012; Moloney et al., 2019; Nature Advisory, 2021; Symbolix, 2020):

- Chocolate Wattled Bat – 5 in Victoria, 1 in South Australia, and 1 in New South Wales
- Gould's Wattled Bat – 126 in Victoria, 9 in South Australia, 38 in Tasmania (with another 14 likely strikes), and 20 in New South Wales
- Lesser Long-eared Bat – 6 in Victoria, and 2 in South Australia
- Southern Forest Bat – 2 in Victoria, 2 in South Australia, and 6 in New South Wales
- White-striped Free-tailed Bat – 525 in Victoria, 24 in South Australia, and 10 in New South Wales
- *Vespadalus* sp. – 2 in Tasmania.

Therefore, due to data deficiency on the flight heights of microbats recorded during field surveys, the precautionary principle has been applied and it is assumed that all eight species of microbat may fly at RSA at some periods during their lifecycle.

3.3 Likelihood of Occurrence

The likelihood of occurrence assessment for conservation significant bird and bat species includes four which are known to occur within the Study Area. The results of the assessment are summarised in **Table 3.5** for those species identified as having a Moderate or greater likelihood of occurring.

The assessment is based on that provided in Western Wildlife (2024) and has been revised against the desktop assessment results and any records obtained during the BBUS surveys (see **Appendix G** for the full table of results). Likelihood of occurrence categories have also been updated to match those provided in **Table 2.1**.

Table 3.5 Likelihood of Occurrence Summary

Common Name	Scientific Name	EPBC Act Status (Cth)	BC Act Status (WA)
Known			
Carnaby's Black-Cockatoo	*Zanda latirostris*	Endangered	Endangered
Peregrine Falcon	*Falco peregrinus*	Not listed	Other specially protected
Western Rosella (inland)	*Platycercus icterotis xanthogenys*	Not listed	Priority 4
Western False Pipistrelle	*Falsistrellus mackenziei*	Not listed	Priority 4
High			
Forest Red-Tailed Black-Cockatoo	*Calyptorhynchus banksii naso*	Vulnerable	Vulnerable
Central Long-eared Bat	*Nyctophilus major tor*	Not listed	Priority 3
Moderate			
Barking Owl (southwest subpop.)	*Ninox connivens connivens* (southwest subpop.)	Not listed	Priority 3
Baudin's Black-Cockatoo	*Zanda baudinii*	Endangered	Endangered
Fork-tailed Swift	*Apus pacificus*	Migratory	Migratory
Masked Owl (southern subspecies)	*Tyto novaehollandiae novaehollandiae*	Not listed	Priority 3

4.0 Conclusion and Recommendations

To date, two BBUS have been undertaken by Umwelt within the Study Area including:

- Spring 2023 BBUS (October 2023)
- Summer 2024 BBUS (February 2024).

A total of 70 bird species and 7 bat species were recorded within the Study Area during the BBUS; 3 of which are listed as conservation significant under the BC Act and/or the EPBC Act:

- Peregrine Falcon (Other Specially Protected under the BC Act)
- Western Rosella (Inland) (Priority 4 under the BC Act)
- Western False Pipistrelle (Priority 4 under the BC Act).

During previous fauna surveys, one conservation significant bird species was recorded via secondary evidence within the Study Area.

- Carnaby's Black-Cockatoo (Endangered under the BC Act and EPBC Act) – secondary evidence in Study Area.

The same fauna survey also recorded one other bird species visually within the Additional Survey Area and as a result of this recording, the species has been assigned a High likelihood of occurrence within the Study Area (Western Wildlife, 2024):

- Forest Red-tailed Black-Cockatoo (Vulnerable under the BC and EPBC Act) – recorded in Additional Survey Area.

A total of 89 bird species were recorded during both the BBUS and Fauna surveys within the Study Area. Of these 89 recorded bird species, 22 visually observed species, including the BC Act listed Peregrine Falcon, were recorded flying within the Project's RSA height range.

The likelihood of occurrence assessment for conservation significant bird species identified three bird species known to occur within the Study Area, one species with a high likelihood of occurrence and four bird species with a moderate likelihood of occurrence in the Study Area. A list of these bird species is provided in **Section 3.3**.

A total of 8 bat species were recorded during the BBUS and Fauna surveys, including the Western False Pipistrelle (listed as Priority 4 under the BC Act). One of these species was only recorded within the Additional Survey Area during BBUS but was found within the Study Area during fauna surveys by Western Wildlife (2024), and is not listed as conservation significant (Chocolate Wattled Bat). One additional conservation significant bat species, the Central Long-eared Bat (Priority 3 under the BC Act), was found to have a High likelihood of occurring in the Study Area based on the desktop assessment results. A list of these bird species is provided in **Section 3.3**.

Spring 2024 BBUS and Summer 2025 BBUS are recommended to further assess the movement patterns, frequency and behaviour of bird and bat species using the Study Area, as well as to better understand the potential risks associated with the development of the Project. Undertaking an additional two BBUS is align with DCCEEWs expectation that BBUS are undertaken over a 24-month period pre-construction.

It is further recommended that the Project's bird and bat utilisation assessment (BBUA) which was completed at a desktop level in July 2023, is updated to include a risk assessment for each 'at risk 'species identified in this BBUS report. The BBUA should also be reviewed and updated (if required) following the Spring 2024/Summer 2025 BBUS.

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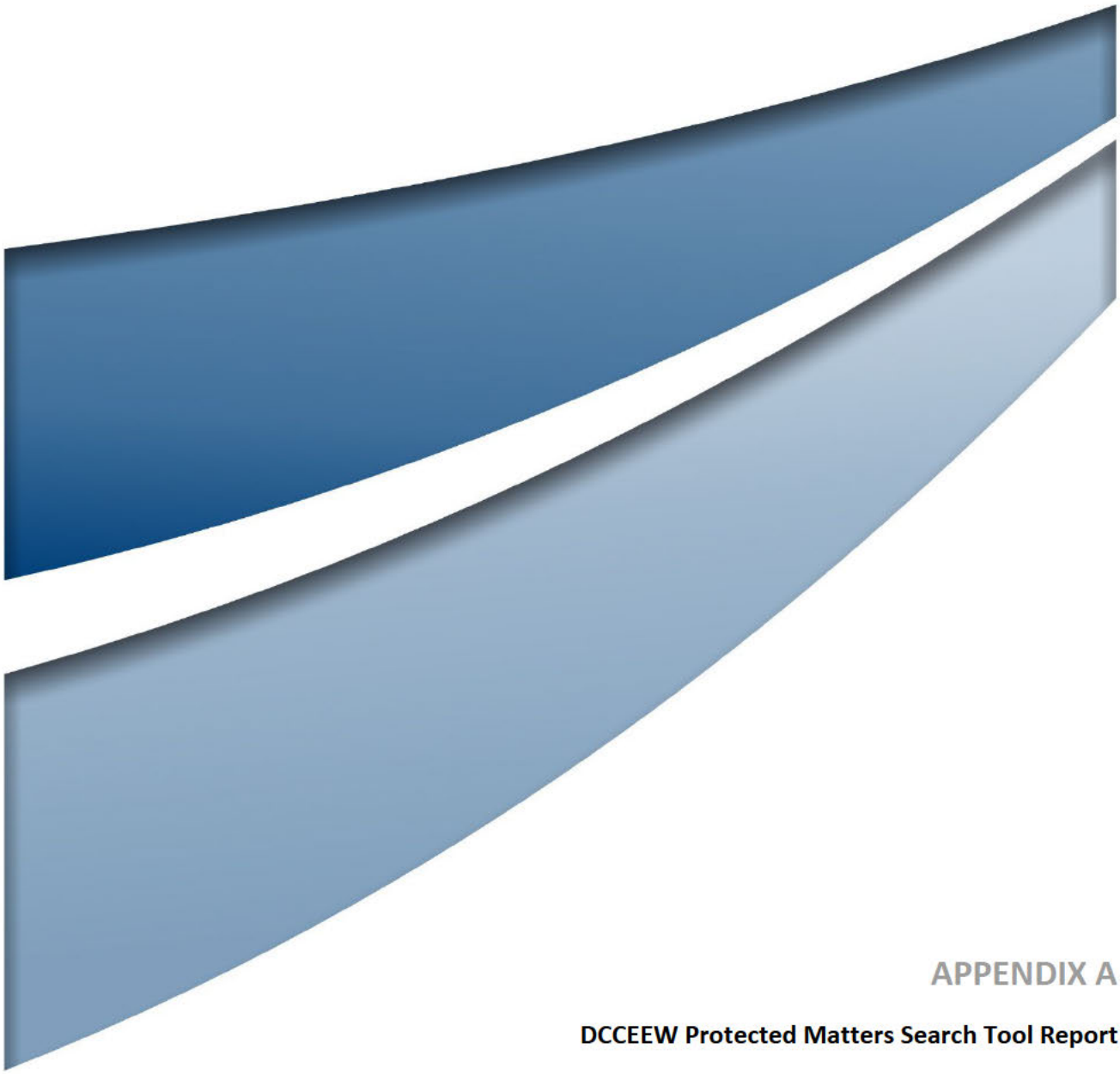

APPENDIX A

DCCEEW Protected Matters Search Tool Report

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 15-Mar-2024

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	28
Listed Migratory Species:	6

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Lands:	13
Commonwealth Heritage Places:	None
Listed Marine Species:	11
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	20
Regional Forest Agreements:	1
Nationally Important Wetlands:	None
EPBC Act Referrals:	5
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity	Buffer Status
Peel-yalgorup system	50 - 100km upstream from Ramsar site	In feature area

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Eucalypt Woodlands of the Western Australian Wheatbelt	Critically Endangered	Community likely to occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Aphelocephala leucopsis Southern Whiteface [529]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Leipoa ocellata](#) Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Zanda baudinii listed as Calyptorhynchus baudinii](#) Baudin's Cockatoo, Baudin's Black-Cockatoo, Long-billed Black-cockatoo [87736]	Endangered	Species or species habitat known to occur within area	In feature area
[Zanda latirostris listed as Calyptorhynchus latirostris](#) Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Species or species habitat known to occur within area	In feature area
MAMMAL			
[Bettongia penicillata ogilbyi](#) Woylie [66844]	Endangered	Species or species habitat known to occur within area	In feature area
[Dasyurus geoffroii](#) Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Macrotis lagotis](#) Greater Bilby [282]	Vulnerable	Translocated population known to occur within area	In buffer area only
[Myrmecobius fasciatus](#) Numbat [294]	Endangered	Species or species habitat known to occur within area	In feature area
[Phascogale calura](#) Red-tailed Phascogale, Red-tailed Wambenger, Kenngoor [316]	Vulnerable	Species or species habitat known to occur within area	In feature area
PLANT			
[Acacia insolita subsp. recurva](#) Yornaning Wattle [64495]	Endangered	Species or species habitat may occur within area	In buffer area only
[Andersonia gracilis](#) Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area	In feature area
[Banksia cuneata](#) Matchstick Banksia, Quairading Banksia [9827]	Endangered	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Banksia oligantha Wagin Banksia [20697]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Boronia capitata subsp. capitata a shrub [29156]	Endangered	Species or species habitat likely to occur within area	In feature area
Caladenia dorrienii Cossack Spider-orchid [6596]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Calectasia pignattiana Stilted Tinsel Lily [82018]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Conostylis drummondii Drummond's Conostylis [5885]	Endangered	Species or species habitat known to occur within area	In buffer area only
Darwinia carnea Mogumber Bell, Narrogin Bell [9736]	Endangered	Species or species habitat known to occur within area	In buffer area only
Daviesia euphorbioides Wongan Cactus [3477]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat may occur within area	In feature area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Pultenaea pauciflora Narrogin Pea [14013]	Vulnerable	Species or species habitat known to occur within area	In feature area
Roycea pycnophylloides Saltmat [21161]	Endangered	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Verticordia fimbrilepis subsp. fimbrilepis			
Shy Featherflower [24631]	Endangered	Species or species habitat known to occur within area	In buffer area only

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Motacilla cinerea			
Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Unknown		
Commonwealth Land - [50997]	WA	In buffer area only
Commonwealth Land - [50984]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [51610]	WA	In buffer area only
Commonwealth Land - [51611]	WA	In buffer area only
Commonwealth Land - [50993]	WA	In buffer area only
Commonwealth Land - [50995]	WA	In buffer area only
Commonwealth Land - [52042]	WA	In feature area
Commonwealth Land - [52050]	WA	In buffer area only
Commonwealth Land - [50996]	WA	In buffer area only
Commonwealth Land - [52032]	WA	In buffer area only
Commonwealth Land - [51609]	WA	In buffer area only
Commonwealth Land - [52037]	WA	In buffer area only
Commonwealth Land - [52130]	WA	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat may occur within area overfly marine area	In buffer area only

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State	Buffer Status
Bradford	Nature Reserve	WA	In buffer area only
Culbin	Nature Reserve	WA	In buffer area only
Dryandra	National Park	WA	In feature area
Fourteen Mile Brook	Nature Reserve	WA	In buffer area only
Highbury	Nature Reserve	WA	In buffer area only
Manning Road	Nature Reserve	WA	In buffer area only
Minniging	Nature Reserve	WA	In buffer area only
Rosedale	Nature Reserve	WA	In buffer area only

Protected Area Name	Reserve Type	State	Buffer Status
Sandalwood Block Timber Reserve	5(1)(g) Reserve	WA	In buffer area only
Unnamed WA15925	Nature Reserve	WA	In buffer area only
Unnamed WA20877	Nature Reserve	WA	In feature area
Unnamed WA20878	Nature Reserve	WA	In feature area
Unnamed WA20985	Nature Reserve	WA	In buffer area only
Unnamed WA30394	Nature Reserve	WA	In buffer area only
Unnamed WA50165	Nature Reserve	WA	In buffer area only
Unnamed WA53974	Nature Reserve	WA	In buffer area only
Unnamed WA53975	Nature Reserve	WA	In buffer area only
Wangeling Gully	Nature Reserve	WA	In buffer area only
Westmere	Nature Reserve	WA	In buffer area only
Williams	Nature Reserve	WA	In buffer area only

Regional Forest Agreements

[Resource Information]

Note that all areas with completed RFAs have been included. Please see the associated resource information for specific caveats and use limitations associated with RFA boundary information.

RFA Name	State	Buffer Status
South West WA RFA	Western Australia	In buffer area only

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Widening maintenance zones for 3 roads, Wheatbelt region, WA	2016/7698	Controlled Action	Post-Approval	In feature area
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In feature area
Narrogin Link Road Stage 3 - North Extension, WA	2016/7664	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action	Post-Approval	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action (particular manner)				
		(Particular Manner)		

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

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

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

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

Please feel free to provide feedback via the Contact us page.

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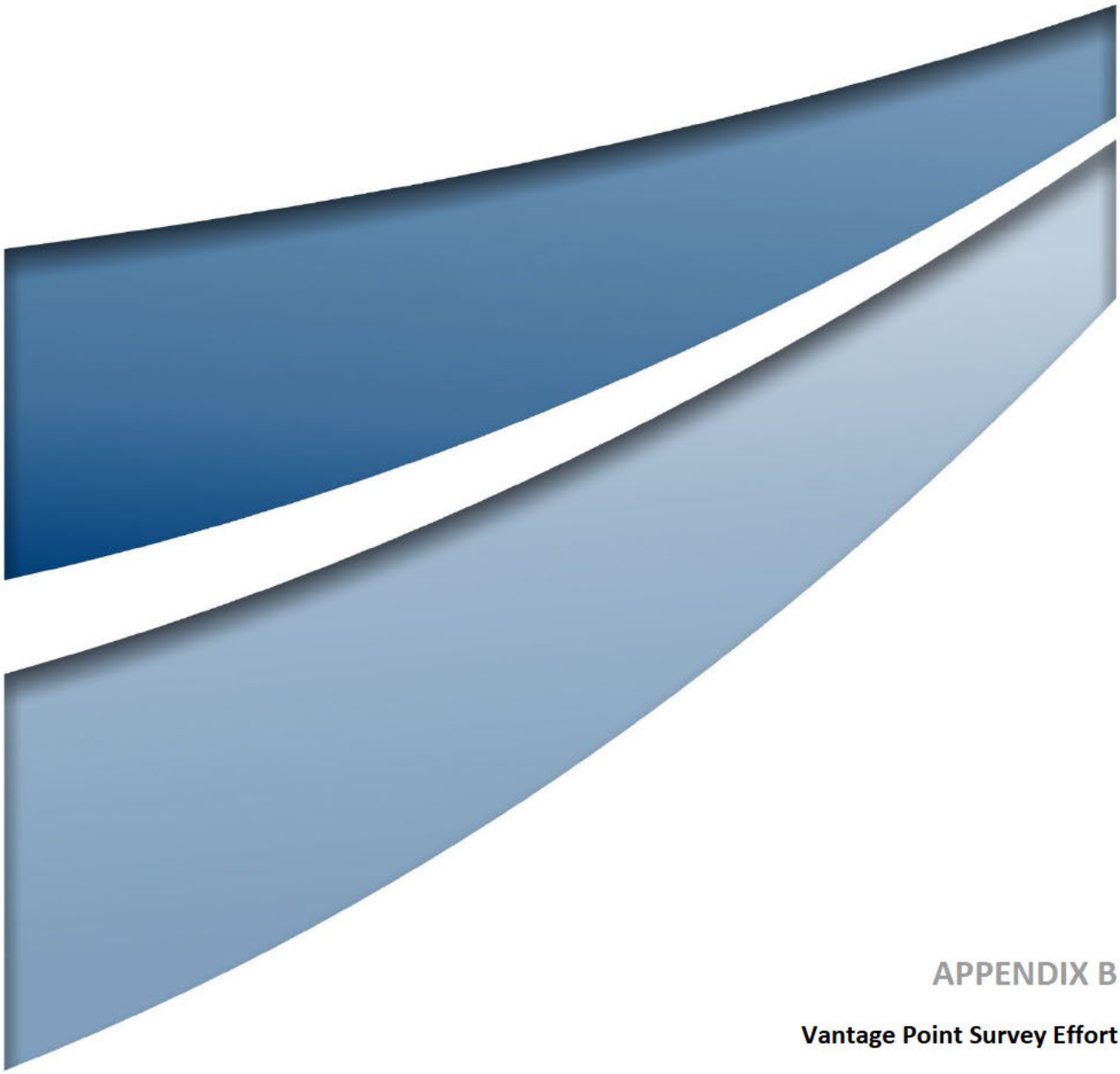


APPENDIX B

Vantage Point Survey Effort

Table B.1 Vantage Point Surveys Completed during each Time Period at each Vantage Point Location

Site Name	Early Morning (6am – 10am)	Late Morning (10am – 12:30)	Early Afternoon (12:30 – 3:00)	Late Afternoon (3:00 – 5:00)	Grand Total
VP1	4	4	4	4	16
VP2	4	4	4	4	16
VP3	4	4	4	4	16
VP4	4	4	4	4	16
VP5	4	4	4	4	16
VP6	4	4	4	4	16
VP7	4	4	4	4	16
VP8	4	4	4	4	16
VP9 (Additional Survey Area)	4	4	4	4	16
VP10 (Additional Survey Area)	4	4	4	4	16
VP11 (Additional Survey Area)	4	4	4	4	16
Grand Total	44	44	44	44	176

APPENDIX C

Vantage Point Photos

Table C.1 Vantage Point Photos

Vantage Point
VP1

VP2

VP3

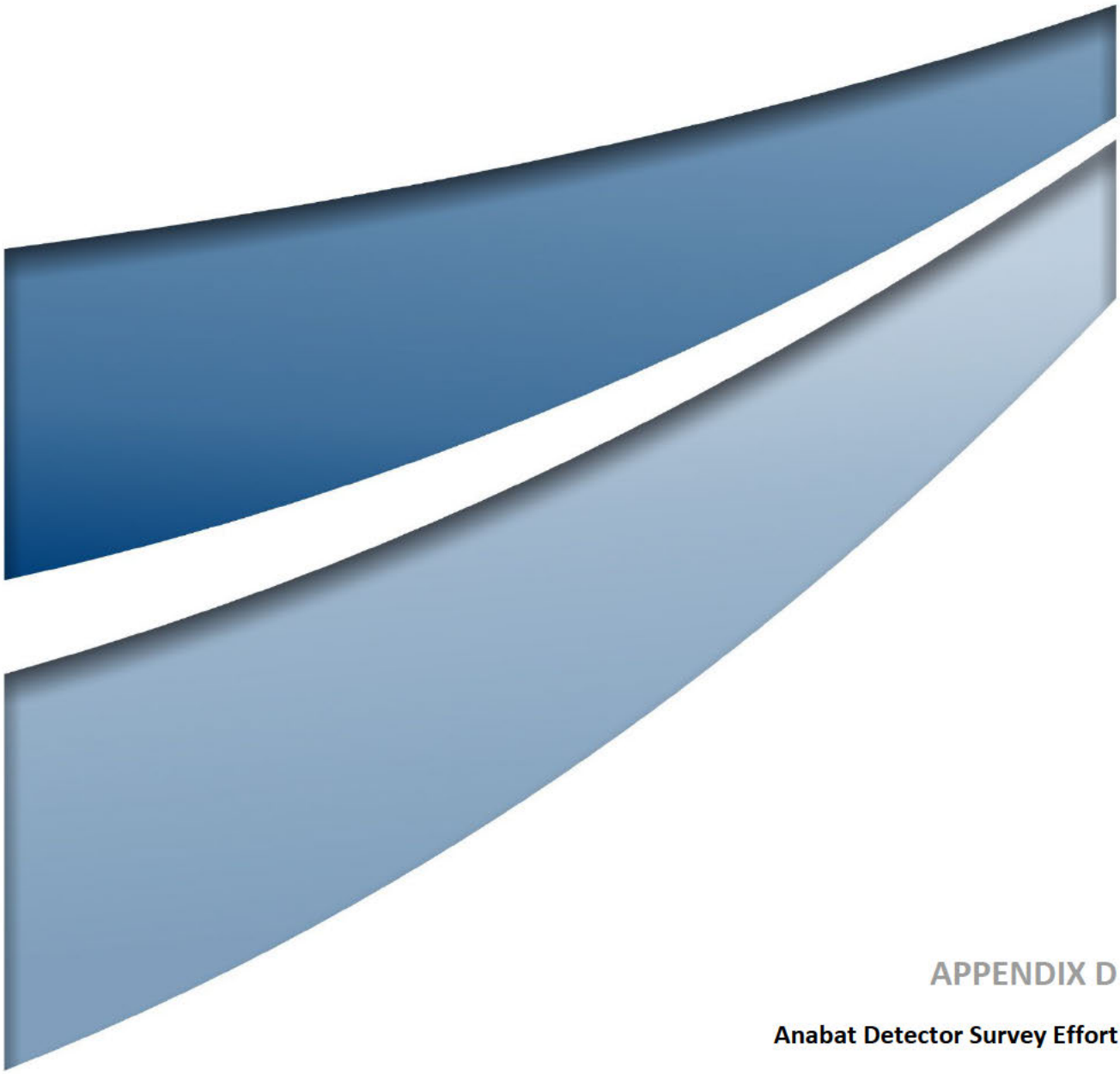
VP4


Vantage Point			
VP5			
			
VP6			
			
VP7			
			
VP8			
			

Vantage Point
VP9 (Additional Survey Area)

VP10 (Additional Survey Area)

VP11 (Additional Survey Area)

APPENDIX D

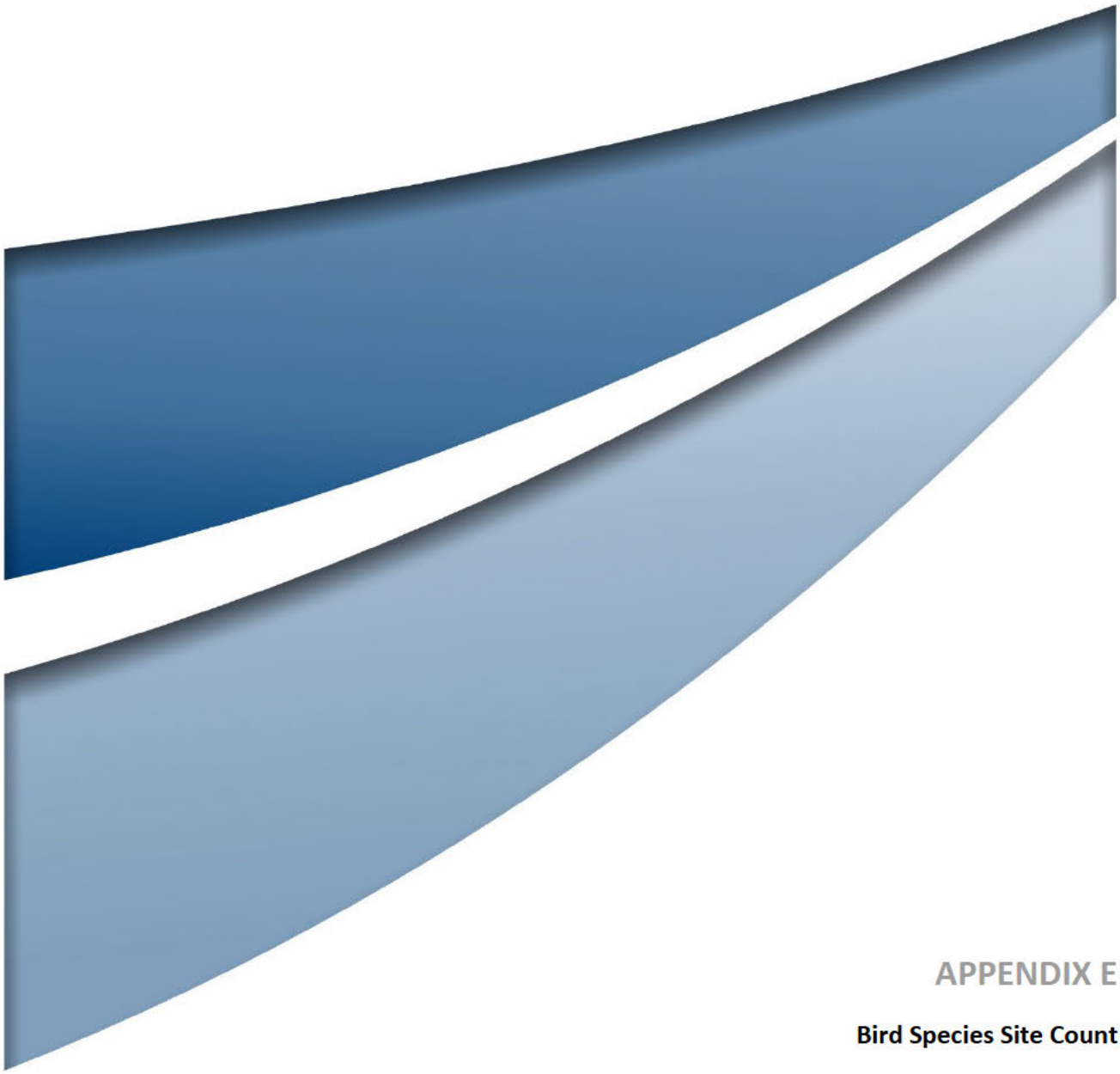
Anabat Detector Survey Effort

Table D.1 Bat Detector Survey Effort at each Vantage Point Location for Summer 2024 survey

Vantage Point Name	Anabat Deployment Date	Anabat Collection Date	Detector Nights
VP1	7 February 2024	9 February 2024	2
VP2	7 February 2024	9 February 2024	2
VP3	5 February 2024	7 February 2024	2
VP4	5 February 2024	7 February 2024	2
VP5	7 February 2024	9 February 2024	2
VP6	5 February 2024	7 February 2024	2
VP7	5 February 2024	7 February 2024	2
VP8	7 February 2024	9 February 2024	2
VP9 (Additional Survey Area)	7 February 2024	9 February 2024	2
VP10 (Additional Survey Area)	5 February 2024	7 February 2024	2
VP11 (Additional Survey Area)	5 February 2024	7 February 2024	2
		Total Detector Nights	22

Table D.2 Bat Detector Survey Effort at each Vantage Point Location for Spring 2023 survey

Vantage Point Name	Anabat Deployment Date	Anabat Collection Date	Detector Nights
VP1	23 October 2023	25 October 2023	2
VP2	25 October 2023	27 October 2023	2
VP3	25 October 2023	27 October 2023	2
VP4	25 October 2023	27 October 2023	2
VP5	25 October 2023	27 October 2023	2
VP6	25 October 2023	28 October 2023	3
VP7	27 October 2023	28 October 2023	1
VP8	23 October 2023	25 October 2023	2
VP9 (Additional Survey Area)	23 October 2023	25 October 2023	2
VP10 (Additional Survey Area)	23 October 2023	25 October 2023	2
VP11 (Additional Survey Area)	23 October 2023	25 October 2023	2
		Total Detector Nights	22



APPENDIX E

Bird Species Site Count

Table E.1 Bird Species Count at each Vantage Point

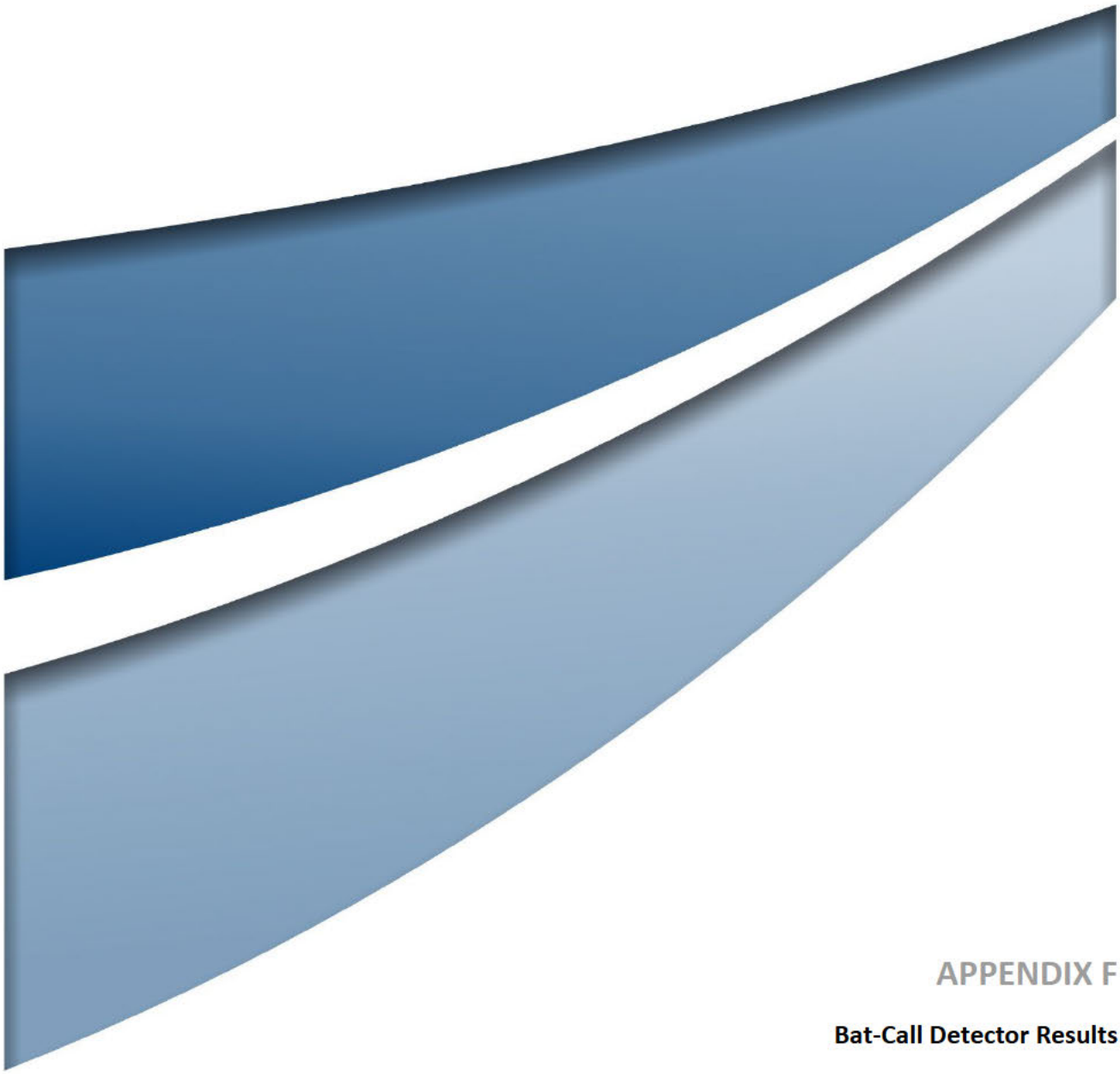
Common Name	Scientific Name	VP1	VP2	VP3	VP4	VP5	VP6	VP7	VP8	VP9[1]	VP10[1]	VP11[1]	Incidental	Grand Total
Australasian Pipit	*Anthus novaeseelandiae*		11	2	2	2			10	14	1	8	2	52
Australian Hobby	*Falco longipennis*									1			0	1
Australian Magpie	*Gymnorhina tibicen*		1	5	11	2	11	7	2	6	6	6	0	57
Australian Raven	*Corvus coronoides*	9	10	2	3	1	5	9	15	20	1	19	16	110
Australian Ringneck	*Barnardius zonarius*		3	42	39	17	21	5	9	22	15	33	16	222
Australian Shelduck	*Tadorna tadornoides*												3	3
Australian Wood Duck	*Chenonetta jubata*						6						1	7
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*			1		8	1	1				1	1	13
Black-faced Woodswallow	*Artamus cinereus*		15		6	8	7	5	8	25		4	12	90
Black-fronted Dotterel	*Elseyornis melanops*							1					0	1
Black-shouldered Kite	*Elanus axillaris*		4		1					2			1	8
Brown Falcon	*Falco berigora*				2						2		2	6
Brown Goshawk	*Accipiter fasciatus*										1		0	1
Brown Honeyeater	*Lichmera indistincta*	1	2	2	4		3				5		1	18
Brown Songlark	*Cincloramphus cruralis*					3		3		3			0	9
Carnaby's Black-Cockatoo	*Zanda latirostris*										3		0	3
Collared Sparrowhawk	*Accipiter cirrocephalus*												1	1
Common Bronzewing	*Phaps chalcoptera*						1						0	1
Crested Pigeon	*Ocyphaps lophotes*				1	2		1		7		1	0	12
Dusky Woodswallow	*Artamus cyanopterus*		2	6			12		7	1	1		1	30

Common Name	Scientific Name	VP1	VP2	VP3	VP4	VP5	VP6	VP7	VP8	VP9[1]	VP10[1]	VP11[1]	Incidental	Grand Total
Elegant Parrot	*Neophema elegans*				5		2	8		60			17	92
Eurasian Coot	*Fulica atra*												5	5
Galah	*Eolophus roseicapilla*		2	3	3			4		11			4	27
Grey Fantail	*Rhipidura albiscapa*												0	
Grey Shrike-thrush	*Colluricincla harmonica*		5	2	3		3	2	5	1	6	1	1	29
Grey Teal	*Anas gracilis*												46	46
Hoary-headed Grebe	*Poliocephalus poliocephalus*												4	4
Horsfield's Bronze-Cuckoo	*Chalcites basalis*							1					0	1
Laughing Kookaburra	*Dacelo novaeguineae*			7									0	7
Little Crow	*Corvus bennetti*	11	4	3	6	16	49	7	6	17		1	0	120
Little Raven	*Corvus mellori*					5							0	5
Magpie-lark	*Grallina cyanoleuca*			3	2	3	1		1	4			1	15
Masked Woodswallow	*Artamus personatus*				14					5			0	19
Nankeen Kestrel	*Falco cenchroides*		1			4	8	4	5	4			4	30
Other	Other		1			5			5	12	2	6	6	37
Pacific Black Duck	*Anas superciliosa*												7	7
Pallid Cuckoo	*Heteroscenes pallidus*							2					0	2
Peregrine Falcon	*Falco peregrinus*	1			1								2	4
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	9	3	11	5	2	10	4		2	8		1	55
Rainbow Bee-eater	*Merops ornatus*				5		14	1			5		0	25

Common Name	Scientific Name	VP1	VP2	VP3	VP4	VP5	VP6	VP7	VP8	VP9[1]	VP10[1]	VP11[1]	Incidental	Grand Total
Red Wattlebird	*Anthochaera carunculata*			2	2	5	3	4			2		0	18
Red-capped Parrot	*Purpureicephalus spurius*		1	5	5	7	1	1			2		1	23
Red-capped Robin	*Petroica goodenovii*				5		3	1			9		0	18
Regent Parrot	*Polytelis anthopeplus*							23		1	1	6	4	35
Restless Flycatcher	*Myiagra inquieta*						4	1					0	5
Rufous Songlark	*Cincloramphus mathewsi*		2					3	6	1		1	2	15
Rufous Treecreeper	*Climacteris rufus*						3	1			5		3	12
Rufous Whistler	*Pachycephala rufiventris*		1		1	1	1		3		1	1	2	11
Sacred Kingfisher	*Todiramphus sanctus*							1					0	1
Scarlet Robin	*Petroica boodang*	4			3			1			6		1	15
Silvereye	*Zosterops lateralis*				3								0	3
Singing Honeyeater	*Gavicalis virescens*		2		1	1	2	1	2				0	9
Spotted Dove	*Spilopelia chinensis*											1	0	1
Spotted Harrier	*Circus assimilis*	1											0	1
Spotted Pardalote	*Pardalotus punctatus*							1					0	1
Striated Pardalote	*Pardalotus striatus*	3	20	3	4	1	2	2	7		9		2	53
Stubble Quail	*Coturnix pectoralis*	1											0	1
Tree Martin	*Petrochelidon nigricans*	9	23	4	57	16	43	43	12	42	33	25	8	315
Varied Sittella	*Daphoenositta chrysoptera*			4			8						1	13
Wedge-tailed Eagle	*Aquila audax*	1	3	5	7	11	8	8	1	1	3	2	5	55

Common Name	Scientific Name	VP1	VP2	VP3	VP4	VP5	VP6	VP7	VP8	VP9[1]	VP10[1]	VP11[1]	Incidental	Grand Total
Weebill	*Smicrornis brevirostris*	6	1	2	2		2		1		8		1	23
Welcome Swallow	*Hirundo neoxena*	1		3	40	1	8			1			0	54
Western Gerygone	*Gerygone fusca*	1		3	4		5	2			8		3	26
Western Rosella	*Platycercus icterotis*								1		1		1	3
Western Thornbill	*Acanthiza inornata*	3									3		0	6
Western Yellow Robin	*Eopsaltria griseogularis*												1	1
Whistling Kite	*Haliastur sphenurus*			1						1			0	2
White-browed Babbler	*Pomatostomus superciliosus*												6	6
White-faced Heron	*Egretta novaehollandiae*							1					1	2
White-fronted Chat	*Epthianura albifrons*		2										0	2
White-naped Honeyeater	*Melithreptus lunatus*						1						0	1
White-winged Triller	*Lalage tricolor*	1			11		4	1	1				5	23
Willie Wagtail	*Rhipidura leucophrys*		4	1	7	6	6	1	5	4		1	2	37
Yellow-plumed Honeyeater	*Ptilotula ornata*			1									0	1
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*		3		9	6	5		9		2		1	35

Note. [1]Vantage point located within the Additional Survey Area.



APPENDIX F

Bat-Call Detector Results

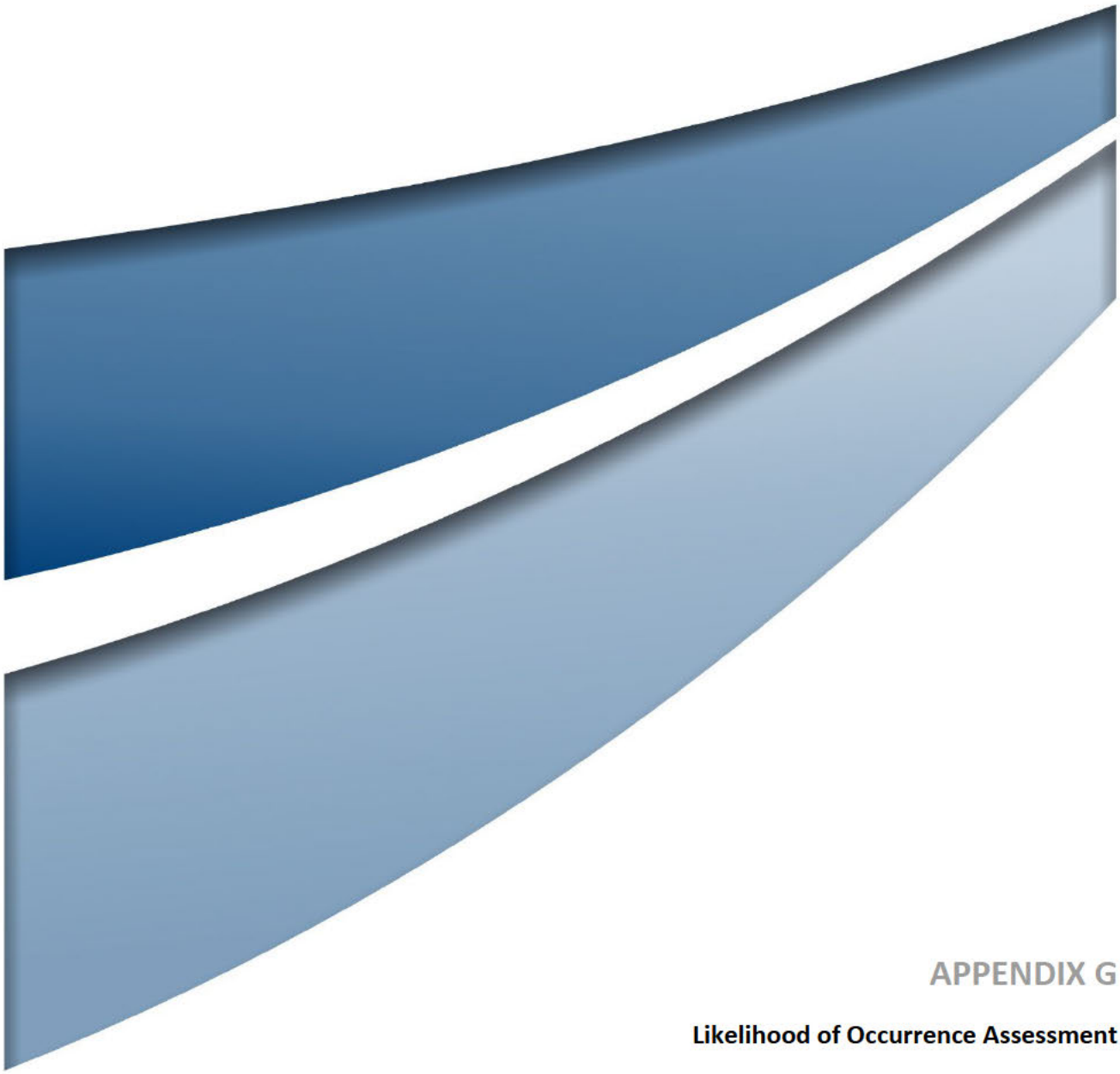
Table F.1 Bat Call Detector Results from the Summer 2024 BBUS

Vantage Point		VP1	VP2	VP3	VP4	VP5	VP6	VP7	VP8	VP9[1]	VP10[1]	VP11[1]
Positively identified calls												
White-striped Free-tailed Bat	*Austronomus australis*		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gould's Wattled Bat	*Chalinolobus gouldii*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chocolate Wattled Bat	*Chalinolobus morio*									Yes	Yes	
Western False Pipistrelle	*Falsistrellus mackenziei*	Yes			Yes	Yes	Yes	Yes		Yes	Yes	
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes		
Western Greater Long-eared bat	*Nyctophilus major major*		Yes				Yes		Yes			
South-western Free-tailed Bat	*Ozimops kitcheneri*	Yes		Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Southern Forest Bat	*Vespadelus regulus*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Site Total	**5**	**5**	**5**	**6**	**6**	**5**	**6**	**6**	**7**	**6**	**4**

Note. [1]Vantage point located within the Additional Survey Area.

Table F.2 Bat Call Detector Results from the Spring 2023 BBUS

Detector		S4U19200				S4U19203				S4U19296			Umbat_12			
Night		23/10/2023	24/10/2023	25/10/2023	26/10/2023	23/10/2023	24/10/2023	25/10/2023	26/10/2023	23/10/2023	24/10/2023	25/10/2023	23/10/2023	24/10/2023	25/10/2023	26/10/2023
Positively identified calls																
White-striped free-tailed bat	*Austronomus australis*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	Yes	-	Yes	Yes	Yes
Gould's wattled bat	*Chalinolobus gouldii*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chocolate wattled bat	*Chalinolobus morio*	Yes	-	Yes	-	Yes	Yes	Yes	Yes	-	-	-	-	-	-	Yes
N/A	*Nyctophilus* sp.	-	-	Yes	-	-	-	Yes	Yes	-	-	-	-	-	Yes	Yes
South-western Free-tailed bat	*Ozimops kitcheneri*	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	Yes
Southern Forest Bat	Vespadelus regulus	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes	-	Yes	Yes	Yes
Unresolved calls																
N/A	*C. gouldii* or *O. kitcheneri*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N/A	*V. regulus* or *Falsistrellus mackenziei*	-	-	Yes	-	-	-	-	-	-	-	-	-	-	Yes	Yes
Site Total		**5**	**5**	**8**	**5**	**6**	**6**	**7**	**7**	**3**	**4**	**5**	**3**	**5**	**7**	**8**



APPENDIX G

Likelihood of Occurrence Assessment

Tabe G.1 Likelihood of Occurrence Assessment

Common Name	Scientific Name	EPBC Act Status	WA Status	Habitat	Likelihood of Occurrence
Conservation Significant Birds					
Australian Painted Snipe	*Rostratula australis*	Endangered	Endangered	The species occurs in shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. The breeding habitat requirements are quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. Nest records are all, or nearby all, from or near small islands in freshwater wetlands.	**Low** - There is a single record located 72 km away south-west from the Study Area and several records 140 km north-west near Perth recorded recently. The Study Area does not support suitable habitat.
Barking Owl (Southwest Subpop.)	*Ninox connivens connivens (southwest subpop.)*	Not listed	Priority 3	The species occurs in woodland and open forest, including fragmented remnants and partly cleared farmland. It roosts in shaded portion of tree canopies, including tall midstorey trees with dense foliage such as *Acacia* and *Casuarina* species.	**Moderate** - There are two records of the species located 14 km north of the Study Area in Lol Gray State Forest, dated recently. There is limited suitable habitat for roosting present in the Study Area in terms of *Acacia* and *Casuarina* tree species.
Baudin's Black-Cockatoo	*Zanda baudinii*	Endangered	Endangered	The species is endemic to the higher rainfall parts of the south-west of WA, generally found within the 500-750mm average annual rainfall isohyet. It prefers the dense Jarrah, Marri and Karri forests of the south-west. A significant proportion of the population relies on the Jarrah forests that are within the Warren, Northern and Southern Jarrah Forest IBRA sub-regions.	**Moderate** - There is one record of the species within the study area and two records within 5 km south-west of the Study Area near Williams, with at least one record being contemporary (within the last 20 years). Suitable habitat is present in the Study Area such as Jarrah, Marri and Karri forests. This species has a moderate likelihood of occurring within the Study Area and may occasionally utilise the Study Area

Common Name	Scientific Name	EPBC Act Status	WA Status	Habitat	Likelihood of Occurrence
Carnaby's Black-Cockatoo	*Zanda latirostris*	Endangered	Endangered	The species is endemic to the southwest of WA, ranging from the Kalbarri in the north to Esperance in the southeast, and inland to Coorow, Kellerberrin and Lake Cronin. They occur in uncleared and remnant areas of woodland, shrubland and kwongan heath dominated by proteaceous species. They breed in the semiarid and subhumid interior eucalypt woodlands, principally dominated by Salmon Gum Eucalyptus *salmonophloia* or Wandoo *Eucalyptus wandoo*.	**Known** - There is one record of the species within the Study Area found recently and several records south-west within 5 km of the Study Area near Williams recorded recently. Suitable habitat is present in the Study Area such as Salmon Gum Eucalyptus and Wandoo. This species was recorded via secondary evidence in the Study Area and aurally in the Additional Survey Area during field surveys and therefore has been upgraded to a Known ranking.
Common Sandpiper	*Actitis hypoleucos*	Migratory	Migratory	The species utilises a wide range of coastal wetlands and some inland wetlands with varying levels of salinity. The species is mostly found around muddy margins or rocky shores and rarely on mudflats. It has been recorded in estuaries and deltas of streams, as well as on banks further upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties.	**Low** - The nearest record is located 38 km south-west of the Study Area and not dated recently (Atlas of Living Australia). There is limited suitable habitat present in the Study Area in terms of coastal features but occasionally the species occurs along the edges of inland waterbodies. The Study Area supports agricultural dams which may provide marginal habitat.
Curlew Sandpiper	*Calidris ferruginea*	Critically Endangered, Migratory	Critically Endangered	The species mainly occurs on intertidal mudflats in sheltered coastal areas such as estuaries, bays, inlets and lagoons, and around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded less often inland, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand, occurring in both fresh and brackish waters.	**Low** –there are three records located south-west near Wagin 40 km away from the Study Area, one is dated recently. Farm dams exist within the Study Area and may provide habitat for the species however the area is mainly used as agricultural land reducing the likelihood the species will utilise farm dams within the Study Area.

Common Name	Scientific Name	EPBC Act Status	WA Status	Habitat	Likelihood of Occurrence
Eastern Curlew, Far Eastern Curlew	*Numenius madagascariensis*	Critically Endangered, Migratory	Critically endangered	The species occurs in sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. The species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. They are often recorded among saltmarsh and on mudflats fringed by mangroves, sometimes within the mangroves. They are also found in coastal saltworks and sewage farms.	**Low** – the nearest records are located 100 km away to the east of the Study Area on the coast, with no record date. The Study Area does not support the required coastal habitat suitable for this species.
Forest Red-tailed Black-Cockatoo	*Calyptorhynchus banksii naso*	Vulnerable	Vulnerable	The species inhabits the dense *Eucalyptus marginata* (Jarrah), *E. diversicolor* (Karri) and *Corymbia calophylla* (Marri) forests, using hollows of mature trees as nesting sites.	**High** – The nearest record located 2.4 km south-west of Study Area dated recently, two other records located north-east of Study Area located within 4 km dated recently. There is suitable habitat present in the Study Area such as Jarrah, Karri and Marri forests known to occur in the region. This species was recorded in the Additional Survey Area during field surveys by Western Wildlife (2024) and therefore it has been assigned a High ranking.
Fork-Tailed Swift	*Apus pacificus*	Migratory	Migratory	The species mostly occur over inland plains, but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches, over dry or open habitats including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. The species is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground.	**Moderate** - The nearest record is located 40 km south of the Study Area and is dated recently. This species is known to occur within the region and may use the aerial space above patches of vegetation within the Study Area to forage on invertebrates. Although this species generally transits south along the coast, individuals have been recorded inland.
Grey Falcon	*Falco hypoleucos*	Vulnerable	Vulnerable	The species frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses. It has been observed hunting in treeless areas and frequents tussock grassland and open woodland, especially in winter.	**Low** - The nearest record is located 84 km south-east of the Study Area, not dated recently. Suitable habitat is not present in the Study Area such as preferred lowland plains and *Acacia* shrubland.

Common Name	Scientific Name	EPBC Act Status	WA Status	Habitat	Likelihood of Occurrence
Grey Wagtail	*Motacilla cinerea*	Migratory	Migratory	This species is a is a scarce but regular visitor to northern Australia. In their normal breeding range, they are found across a variety of wetlands, especially water courses, but also on the banks of lakes and marshes, as well as artificial wetlands such as sewage farms, reservoirs and fishponds. This association with water extends into non-breeding habitats with all confirmed Australian records being associated with water; especially creeks, rivers and waterfalls. On migration they may forage on rocky tidal flats.	**Unlikely** - The nearest record is located 185 km away south-west of the Study Area and is dated recently. There is limited suitable habitat present within the Study Area in land in terms of coastal features.
Malleefowl	*Leipoa ocellata*	Vulnerable	Vulnerable	The species occurs in central and southern WA, as well as parts of SA, NSW, the Northern Territory and Victoria. They are found principally in the semi-arid to arid zone in shrublands and low woodlands dominated by mallee and associated habitats such as Broombush *Melaleuca uncinata* and Scrub Pine *Callitris verrucosa*. In WA, they are also found in some shrublands dominated by acacia, and occasionally in woodlands dominated by eucalypts such as Wandoo *E. wandoo*, Marri *Corymbia calophylla* and Mallet *E. astringens.*	**Low** - Two records 3.1 km north-west of the Study Area were recorded historically. There are also several records located within 15 km north of the Study Area in Lol Gray State Forest, some dated recently. There is some suitable habitat present such as eucalypt woodlands with Wandoo, Marri and Mallet which the species may forage or use as corridors for movement but disturbance to the understorey means the species is unlikely to breed in the Study Area.
Masked Owl (Southern subspecies)	*Tyto novaehollandiae novaehollandiae*	Not listed	Priority 3	The species is found in dry eucalypt forests and woodlands, with preference for mature trees with hollows for nesting.	**Moderate** - There are two records located 13 km north of Study Area in Lol Gray State Forest, one dated recently. There is some suitable habitat for foraging or breeding present within the Study Area such as eucalypt forests.
Pectoral Sandpiper	*Calidris melanotos*	Migratory	Migratory	The species prefers shallow fresh to saline wetlands. It is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	**Unlikely** - The nearest record is located 44 km away south-east of the Study Area and is dated recently. The Study Area does not support suitable habitat for this species as it is not coastal.

Common Name	Scientific Name	EPBC Act Status	WA Status	Habitat	Likelihood of Occurrence
Peregrine Falcon	*Falco peregrinus*	Other specially protected	Not listed	The species occurs in a variety of habitats, from rainforests to the arid zone, and at most altitudes, from the coast to alpine areas. It requires abundant prey and secure nest sites, and prefers coastal and inland cliffs or open woodlands near water.	**Known** - There are several records within 10 km all around the Study Area, dated recently. The Study Area contains large areas of suitable foraging habitat, however nesting habitat is limited. This species was visually recorded during field surveys and therefore has been upgraded to a Known ranking.
Red-Necked Stint	*Calidris ruficollis*	Migratory	Migratory	The species is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. They also occur in saltworks and sewage farms; saltmarsh; ephemeral or permanent shallow wetlands near the coast or inland, including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats.	**Low** - The nearest record is located 200 m away from Study Area but not dated recently. There is also another record located 2.8 km south-east of the Study Area, not dated recently. The Study Area does not support suitable habitat for this species as it is not coastal.
Sharp-Tailed Sandpiper	*Calidris acuminata*	Migratory	Migratory	The species prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland. They also occur in salt works and sewage farms.	**Low -** The nearest record is located 39 km south-west of the Study Area and not dated recently. There is limited suitable habitat present in the Study Area, only supporting artificial waterbodies and small farm dams lacking the required bank habitat that this species uses for cover.
Southern Whiteface	*Aphelocephala leucopsis*	Vulnerable	Not listed	The species live in a wide range of open woodlands and shrublands where there is an understorey of grasses or shrubs, or both. These areas are usually in habitats dominated by *Acacia* or *Eucalyptus* species on ranges, foothills and lowlands, and plains. The species forage almost exclusively on the ground, favouring habitat with low tree densities and an herbaceous understorey litter cover.	**Low** – the nearest record is located 150 km north-east of the Study Area dated recently. There is some suitable habitat present in the Study Area such as *Eucalyptus* woodlands.

Common Name	Scientific Name	EPBC Act Status	WA Status	Habitat	Likelihood of Occurrence
Western Rosella (Inland)	*Platycercus icterotis xanthogenys*	Not listed	Priority 4	The species occurs only in the wheat belt region of south-west WA. They largely occur in open eucalypt forest and timbered areas, including cultivated land and orchards. The inland subspecies however is reported to prefer drier woodland with a heath understorey.	**Known** - The nearest record is located 3.7 km west from the Study Area but not dated recently, two records east within 15 km of the Study Area also not dated recently. There is suitable habitat present in the Study Area, consisting of eucalypt forest. This species was visually recorded during field surveys and therefore has been upgraded to a Known ranking.
Conservation Significant Bats					
Central Long-Eared Bat	*Nyctophilus major tor*	Not listed	Priority 3	The species occurs in the arid and semiarid areas of temperate Western Australia. It occurs in patchy mixed eucalypt woodlands with dense shrublands, and around sheoak and wattle thickets that are on the edges of granite outcrops and old dams.	**High** - The nearest record is 5.5 km north-west of the Study Area and is dated recently. There are also two records 13 km north of the Study Area in Lol Gray State Forest dated recently. There is suitable habitat present within the Study Area such as preferred eucalypt woodlands.
Western False Pipistrelle, Western Falsistrelle	*Falsistrellus mackenziei*	Not listed	Priority 4	The species is found exclusively in south-west WA, and live mainly in wet sclerophyll forests of Karri, Jarrah and Tuart eucalypts. They roost in hollows in old trees, branches and stumps, in colonies of 5 to 30 bats.	**Known** - The nearest records are located 4.8 km north of the Study Area but not dated recently. There is suitable habitat present in the Study Area such as Karri, Jarrah and Tuart eucalypts. This species was recorded via passive acoustic monitoring during field surveys and has therefore been upgraded to a Known ranking.

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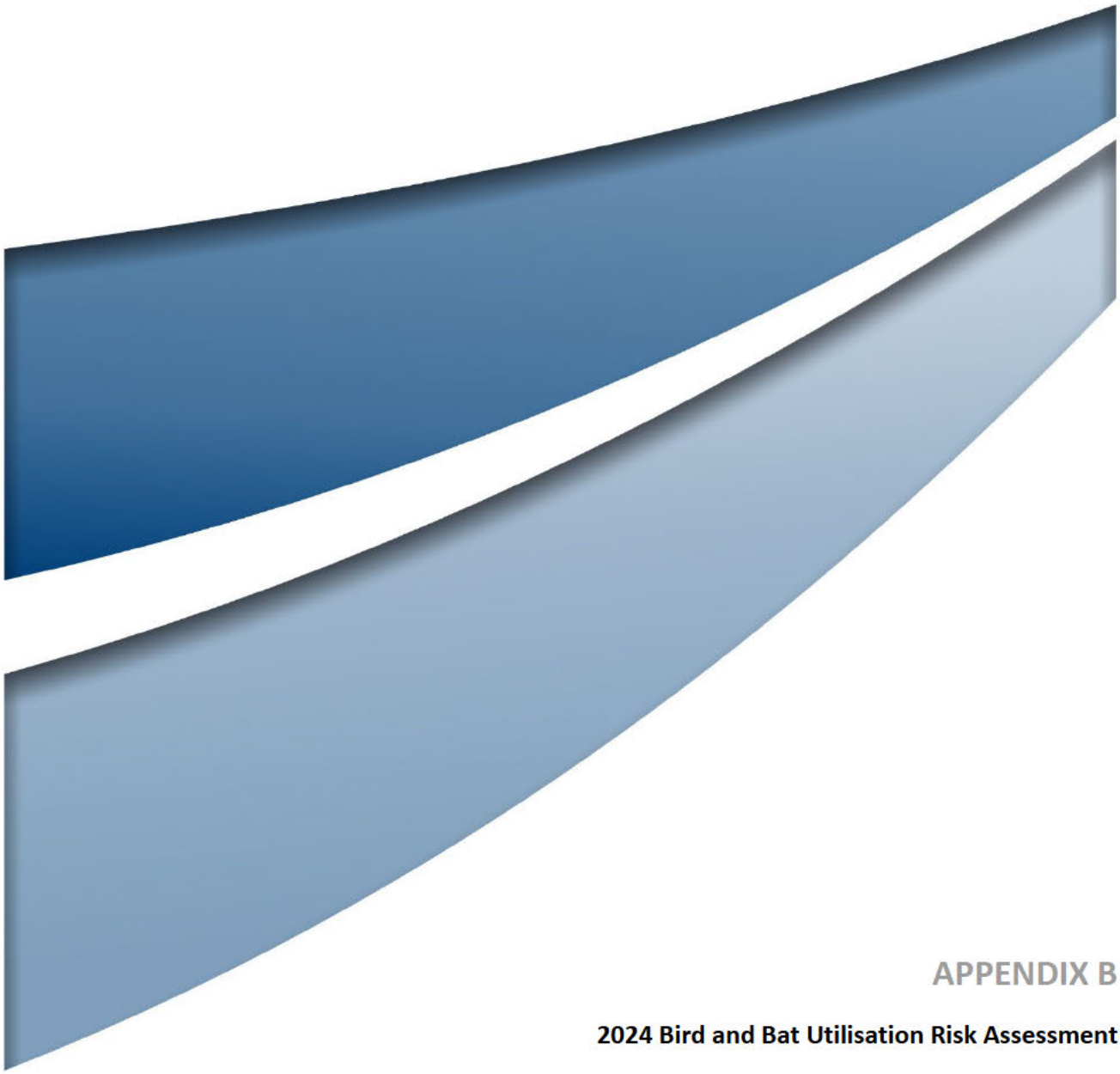

APPENDIX B

2024 Bird and Bat Utilisation Risk Assessment

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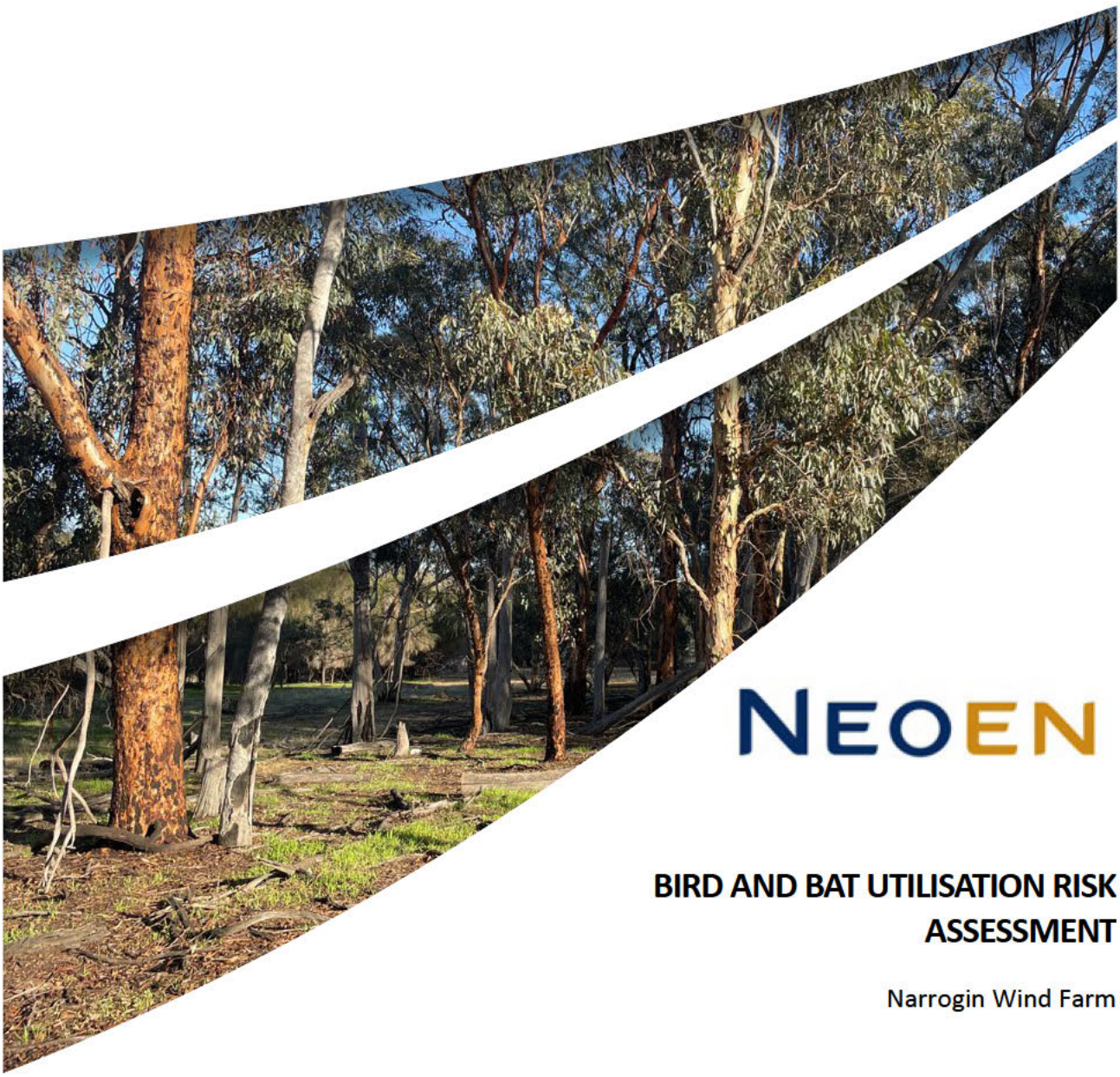

NEOEN

BIRD AND BAT UTILISATION RISK ASSESSMENT

Narrogin Wind Farm

FINAL

September 2024

BIRD AND BAT UTILISATION RISK ASSESSMENT

Narrogin Wind Farm

FINAL

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This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V1	[redacted]	08/05/2024	[redacted]	14/05/2024
V2		22/07/2024		22/07/2024
V3		15/08/2024		15/08/2024
V4		15/09/2024		17/09/2024
V5		20/09/2024		20/09/2024

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1.0 Introduction

1.1 Purpose

Umwelt was engaged by Neoen Australia Pty Ltd (Neoen) to undertake Bird and Bat Utilisation Surveys (BBUS) within the proposed Narrogin Wind Farm (the Project) site to support primary approvals under the *Environmental Protection Act 1986* (WA) (EP Act) and *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

Specifically, the aims of this assessment are to document the bird and bat species that are present or considered likely to occur in the vicinity of the Project location and to assess which species, based on information gathered from desktop assessments, the previous Bird and Bat Utilisation Surveys (BBUS), and Basic Fauna Survey undertaken from 2023 to 2024, may be at risk of turbine collision.

Specific objectives of the assessment include:

- Determining the occurrence and flight characteristics of bird and bat species through a review of existing data and field survey data relevant to the Project site.
- Identifying which bird and bat species may be susceptible to blade strike from wind turbines through an analysis of flight behaviour recorded on site and assessment of publicly available data and published literature.
- Assessing potential impacts of the Project on bird and bat species and estimating the relative level of risk associated with potential impacts on species that are considered most at risk.
- Outlining measures that have been employed at other wind farms to avoid or mitigate impacts of blade strike on birds and bats.

1.2 Project Description

The Project is located approximately 160 km south-east of Perth, Western Australia, in the Wheatbelt South region spanning across Shires of Williams and Narrogin. The Project is expected to comprise a battery energy storage system and up to 25 wind turbines with associated ancillary infrastructure. A 220kV line intersects the southern boundary of the proposed area that the project will connect to.

1.3 Ecological Study Boundaries

There are two distinct boundaries that are relevant to this assessment, including:

Study Area: refers to the boundaries of all involved land parcels where consent has been granted for development of the Project.

Additional Survey Area: refers to the land parcels west of the current Study Area that were surveyed as part of the early conceptual layout of the Project. This area no longer forms part of the Project Area or current Study Area. This boundary is discussed where appropriate in context of the survey effort applied and species utilisation of the Study Area environs.

1.3.1 Study Area

The Study Area (**Figure 1.1**) covers approximately 6,344 ha at elevations between 250 m and 350 m Australian Height Datum (AHD). The Study Area is located across numerous freehold properties approximately 5 km northeast of the township of Williams and 7 km west of the township of Narrogin.

The Study Area is primarily cleared for agriculture and sheep grazing with interspersed patches of remnant and regrowth woodland, generally associated with hills and associated slopes, and watercourses. Dryandra National Park and Lol Gray State Forest are located to the north of the Study Area.

1.3.2 Additional Survey Area

The early conceptual layout of the Project was originally developed in 2023 and included an Additional Survey Area of approximately 3,023 ha which primarily extended further into the Shire of Williams ().

Following phase 1 surveys and preliminary assessments of ecological values and sensitive receptors, Neoen determined that avoidance of impacts to areas of high ecological value could be achieved by reducing the Study Area to the current boundary and reducing the total number of wind turbines from 44 down to 25. This amounted to a total reduction of 32% in the Project area. Data gathered from surveys undertaken within the Additional Survey Area have been utilised where possible to inform the potential occurrence of conservation significant species, characterise the utilisation of the Study Area by bird and bat species, and to understand fauna assemblages in the wider region.

1.4 Wind Turbine Specifications

The wind turbine specifications used for this assessment are based on those presented in (Umwelt, 2024a) as provided by Neoen and reproduced here for reference. They are indicative and conservative at this stage for the purpose of assessing collision risk as the turbine model and blade length has not been finalised.

There are currently three potential turbine models being considered for the Project, each with separate specifications (summarised in **Table 1.1**). Accounting for all models, there is a maximum overall height tip height of 291 m above ground level (AGL) and a lowest blade tip option of 49 m AGL. The turbines will have a horizontal axis, with a rotor consisting of three blades with a maximum blade length of up to 91 m and a maximum hub height of 200 m AGL.

Table 1.1 Turbine Specifications

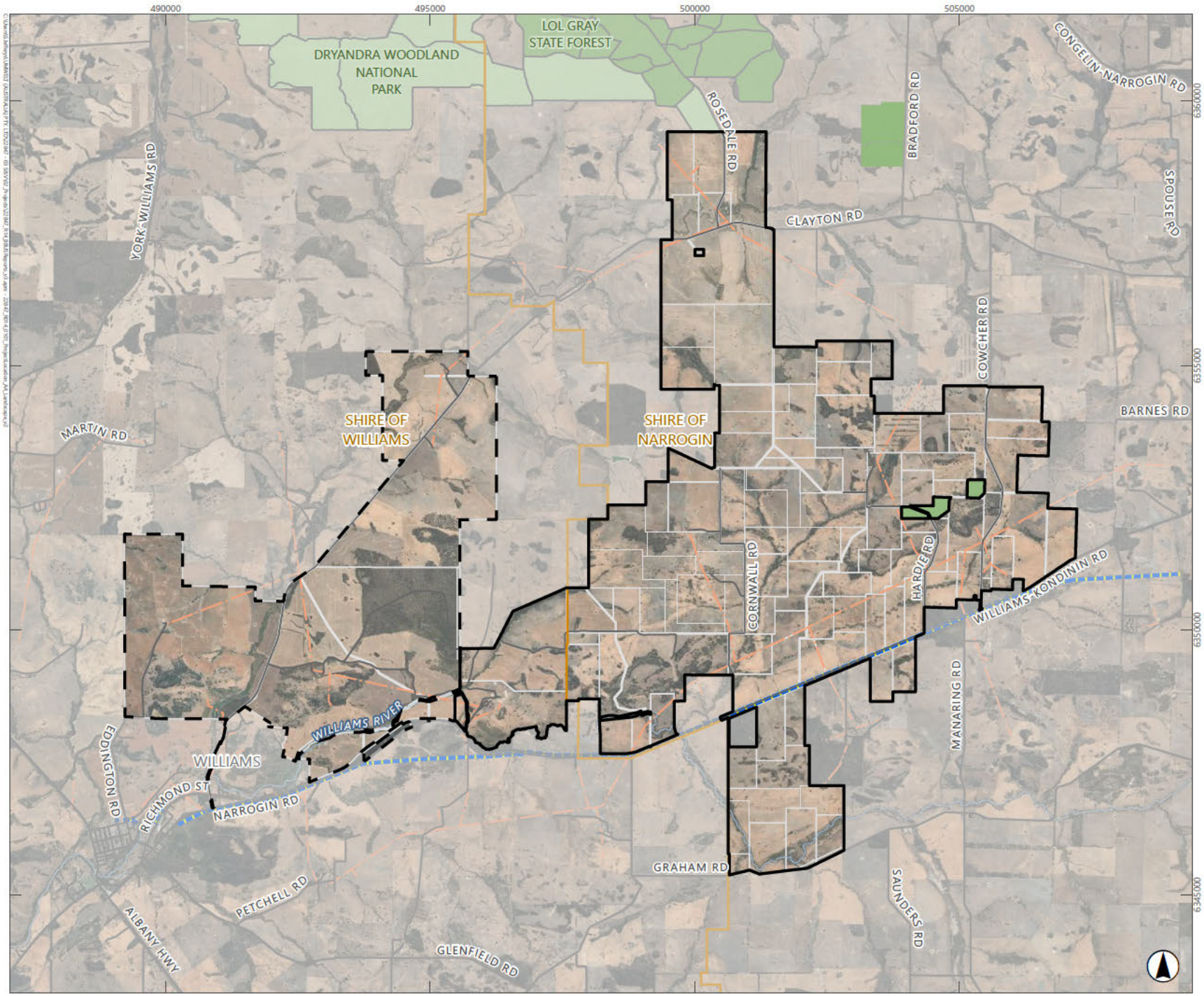
Feature	Maximum Specification
Turbine electrical output	7,200 kilowatts (kW)
Number of turbines	Up to 25
Maximum tip height	Up to 291 m AGL
Maximum hub height	Up to 200 m AGL
Minimum lower blade height (clearance between ground and lowest blade tip option)	49 m
Blade length	Up to 91 m
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s

1.4.1 Rotor Swept Area

The rotor swept area (RSA) refers to the physical area swept by the rotating blades during operation. Based on the specifications provided by Neoen for three different turbine models, the RSA will be located between 49 m AGL to 291 m AGL and is between 23,235 m^2 to 26,015 m^2 in area. A visual representation of these specifications according to model is illustrated on **Figure 1.2**, **Figure 1.3**, and **Figure 1.4**. The maximum hub height for each model has been used in these illustrations where relevant.

The minimum (49 m AGL) and maximum (291 m AGL) turbine blade heights have been used to represent the potential 'RSA height range' in this assessment to identify bird or bat species which may be at risk of turbine strike across a range of potential hub height and blade length combinations.

FIGURE 1.1
Study Area



Legend

- Study Area
- Additional Survey Area
- Local Government Area Boundary
- Road
- Water Pipeline
- NCMT HV Distribution Line
- Major Watercourse
- Property Boundary
- Nature Reserve
- National Park
- State Forest

0 2 4

Kilometres

Scale 1:100,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023), WP (2023), WCORP (2023)

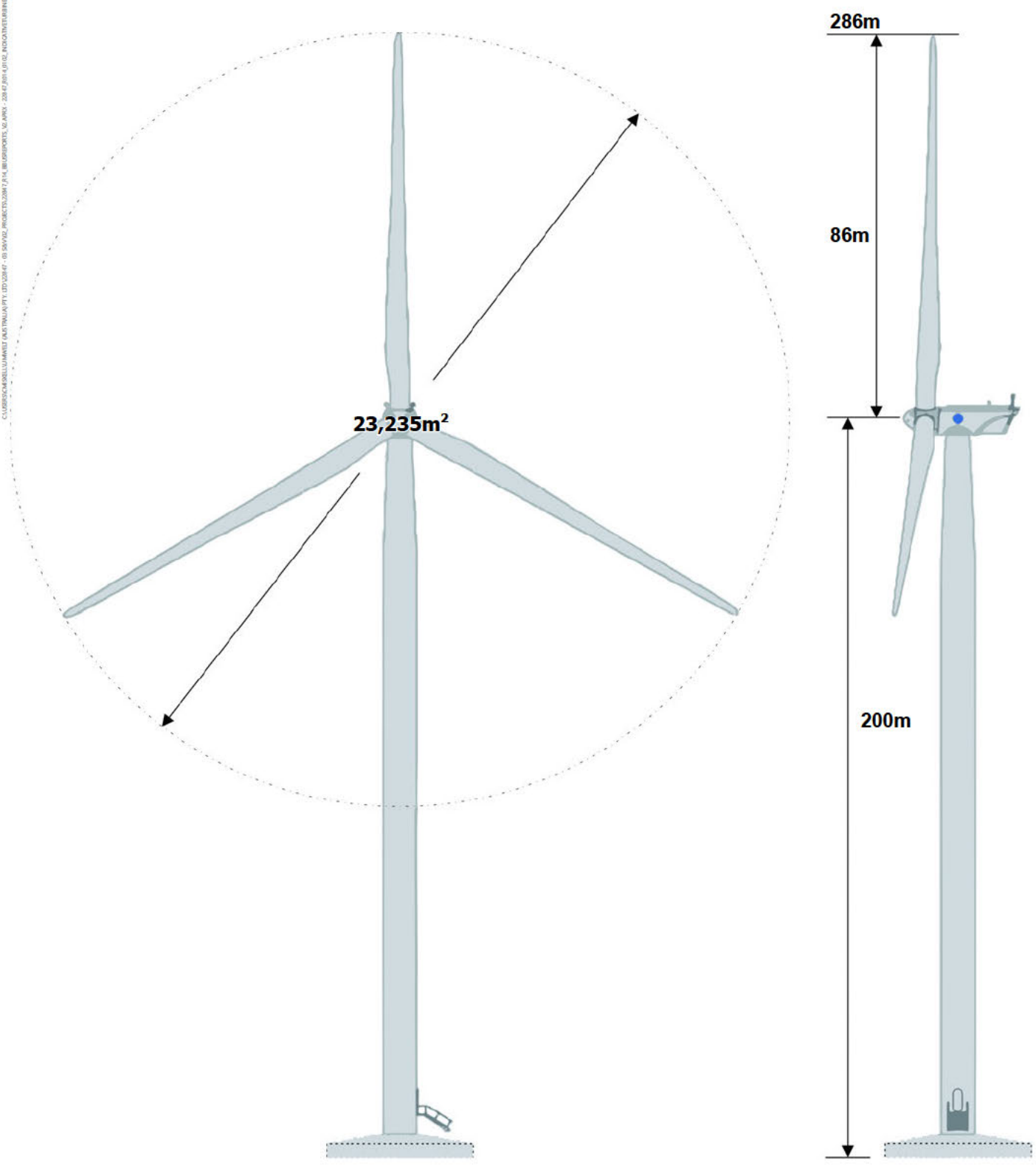


FIGURE 1.2

Indicative Turbine Rotor Swept Area
(V172-7.2 MW Model)

Data source: Turbine design company (2024)

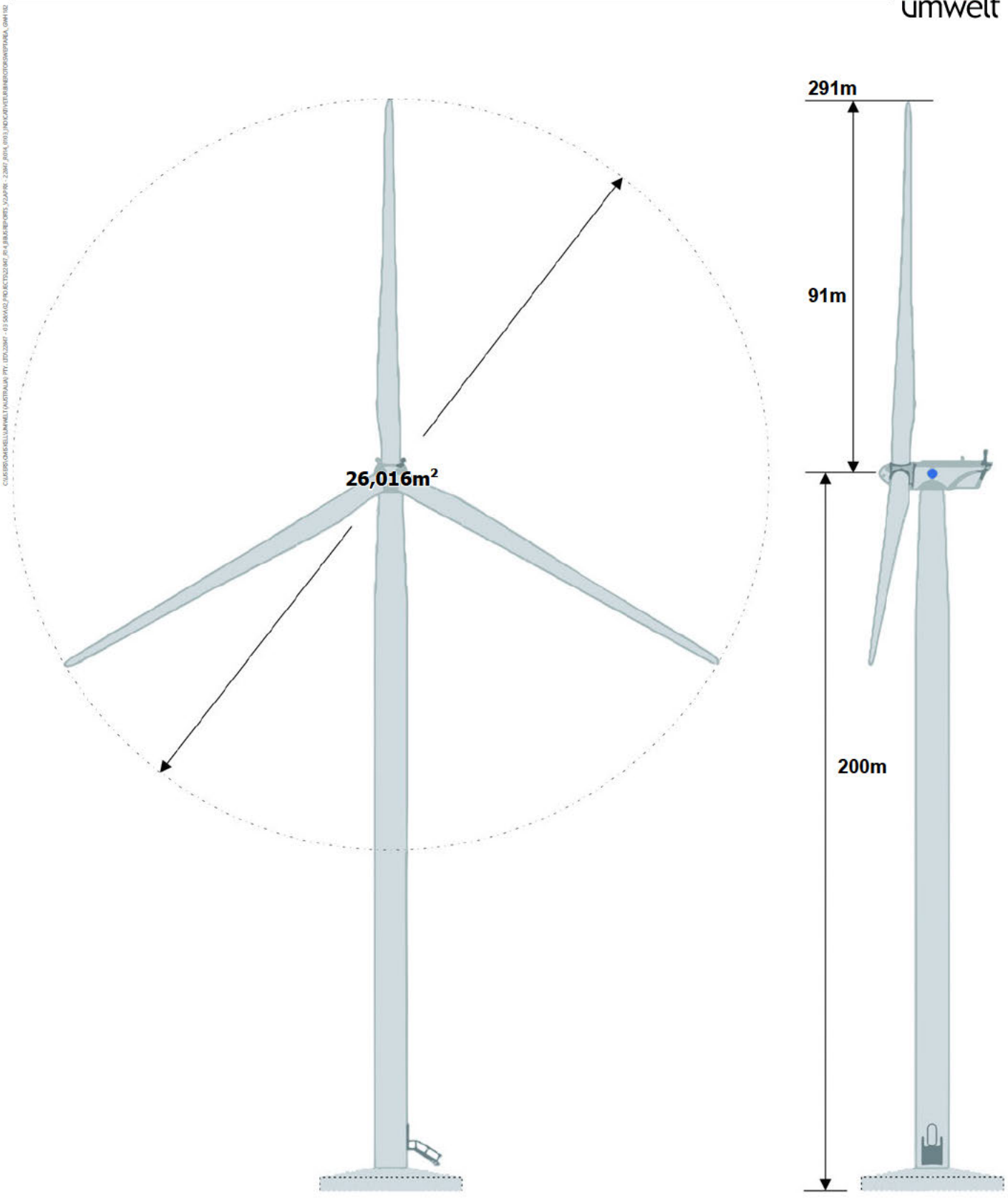


FIGURE 1.3

Indicative Turbine Rotor Swept Area
(GWH182/7.2 MW Model)

Data source: Turbine design company (2024)

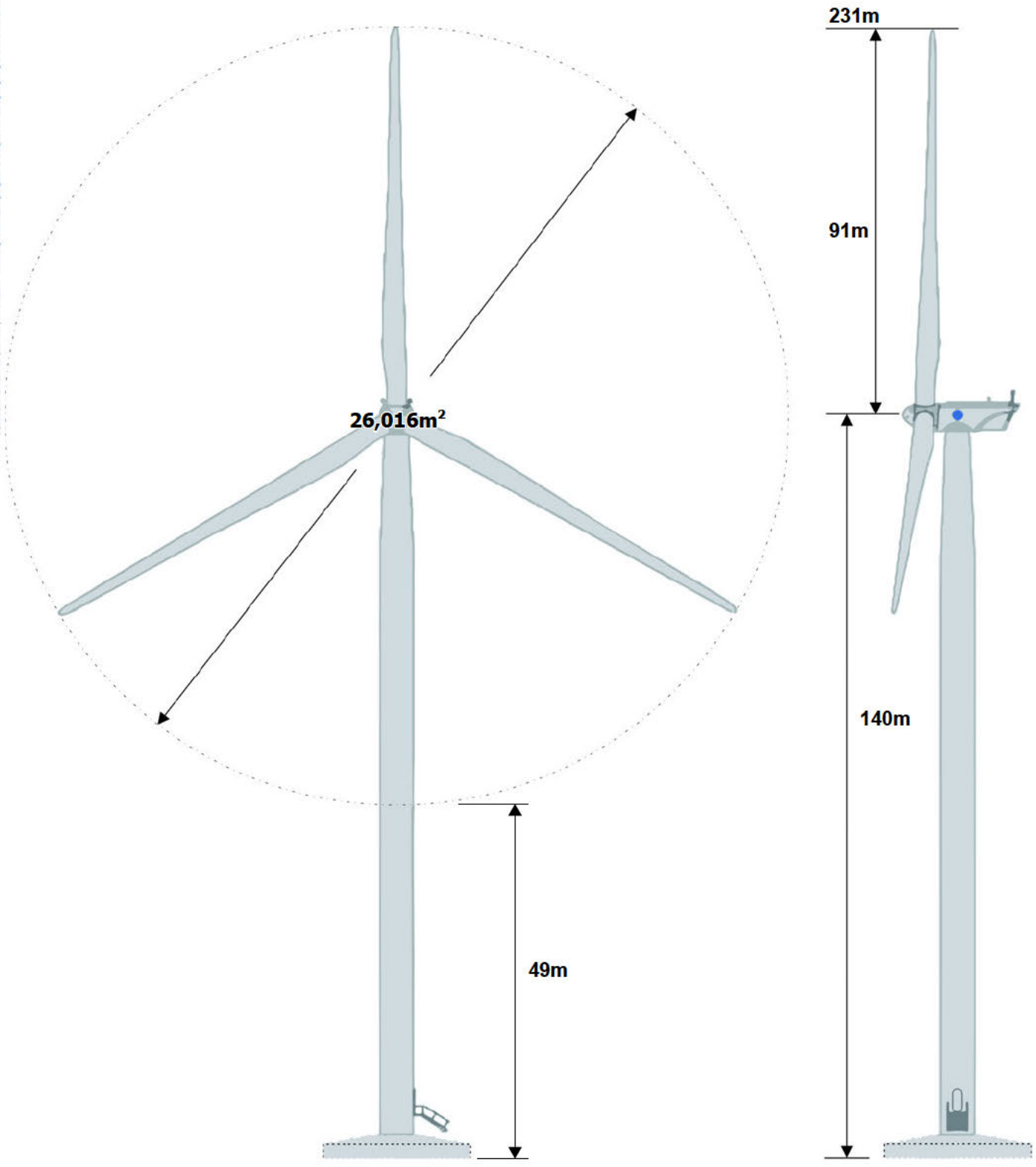


FIGURE 1.4

Indicative Turbine Rotor Swept Area
(GWH182/7.2 MW Low Hub Height Model)

Data source: Turbine design company (2024)

2.0 Previous Ecological Assessments

Previous bird and bat utilisation surveys have been undertaken within the Study Area from 2023-2024. A full summary of the methods and results of these surveys is presented in Umwelt (2024a) and briefly outlined here for reference. The outcomes of these surveys have been used to inform the risk assessment on bird and bat species provided in **Section 4.0.** This information has been supplemented by the results gathered from the Phase 1 Fauna Habitat Assessment undertaken for the Project (Umwelt, 2023) and Phase 2 Basic Fauna Survey (Western Wildlife, 2024) which are briefly outlined below.

A desktop assessment and literature review was also undertaken prior to the BBUS. The objective of the desktop search was to identify which bird and bat species listed under the EPBC Act and/or the *Biodiversity Conservation Act 2016* (WA) (BC Act) may occur in the Study Area. The results of the desktop assessment were also utilised to select the most appropriate timing for surveys based on seasonal movements and behaviours of species of interest (i.e. listed species expected to occur within the Study Area)

2.1 Bird and Bat Utilisation Surveys

Two pre-construction Bird and Bat Utilisation Surveys were undertaken by experienced fauna ecologists during the Spring 2023 and Summer 2024 seasons to coincide with the seasonal migration of EPBC Act listed bird species, including fork-tailed swift (*Apus pacificus*) and optimal timing to observe all three species of black cockatoo (Forest Red-tailed Black-Cockatoo, Baudin's Black-Cockatoo, Carnaby's Black-Cockatoo) breeding and foraging in the Wheatbelt bioregion. Survey timing also aimed to coincide with peak seasonal activity for targeted bat species such as the Western False Pipistrelle (*Falsistrellus mackenziei*). Timing of each survey is detailed below:

- Spring 2023 season: 23rd October to 28th October 2023.
- Summer 2024 season: 5th February to 9th February 2024.

A total of eleven vantage points were established on high points and clearings across the Study Area with best attempts made to position vantage points near proposed wind turbine locations.

A total of 70 bird species were recorded within the Study Area during the BBUS by direct observation or secondary evidence; three of which are listed as conservation significant under the BC Act and/or the EPBC Act:

- Carnaby's Black-Cockatoo (*Zanda latirostris*) – Endangered under the BC Act and EPBC Act (recorded through secondary evidence in the Study Area and observed in the Additional Survey Area).
- Peregrine Falcon (*Falco pregrinus*) – Other Specially Protected under the BC Act.
- Western Rosella (Inland) (*Platycercus icterotis xanthogenys*) – Priority 4 under the BC Act.

Of the 70 species recording during the BBUS, 20 species were not recorded during Phase 2 Fauna Survey (see **Section 2.2**), none of which are listed as conservation significant.

The Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) was not recorded in either the Study Area or Additional Survey Area during the BBUS but was recorded in the Additional Survey Area during the Phase 2 Fauna Survey (discussed further below in **Section 2.2**). Although not recorded in the Study Area, anecdotally the Forest Red-tailed Black Cockatoo occasionally forages on planted vegetation near Rosedale House in the northern extent of the Study Area. It arrives from the north to forage during the day and departs in the evening and flies north towards Dryandra National Park and Lol Gray State Forest. As a result of this and records in the Additional Survey Area it is considered to have a High likelihood of occurring within the Study Area.

One Threatened (i.e. conservation significant) bird species, the Baudin's Black-Cockatoo (*Zanda baudinii*), was identified as having a Moderate likelihood of occurring within the Study Area based on numerous historical records within a 20 km radius of the Study Area, with the most recent being in 2018. Four additional conservation significant bird species were also identified with a Moderate likelihood of occurrence in the Study Area, including the Barking Owl (Southwest subpop.) (*Ninox connivens connivens* [southwest subpop.]), Masked Owl (southern subspecies) (*Tyto novaehollandiae novaehollandiae*), and Fork-tailed Swift (*Apus pacificus*).

A total of 22 bird species observed were flying within or higher than the RSA height range (49 m – 291 m AGL), placing them at risk of turbine blade strike. Whilst 22 species were identified as 'at-risk', five were considered to be of interest due to the combination of number of occurrences of observed flights within the RSA height range, total count of individuals observed, and/or their status as a conservation significant species. These included the Wedge-tailed Eagle (*Aquila audax*), Tree Martin (*Petrochelidon nigricans*), Nankeen Kestrel (*Falco cenchroides*), Australian Raven (*Corvus coronoides*), and Peregrine Falcon. The Peregrine Falcon, which was recorded flying within the RSA height range on one occasion, was the only at-risk species listed as conservation significant (Other Specially Protected under the BC Act).

Seven bat species were recorded within the Study Area during the BBUS; two of which were not recorded during the Phase 2 Fauna Survey (see **Section 2.2**). One of the species recorded during the BBUS is listed as conservation significant:

- Western False Pipistrelle (*Falsistrellus mackenziei*) (Priority 4 under the BC Act).

One conservation significant bat species, the Central Long-eared Bat (*Nyctophilus major tor*), was also identified as having a High likelihood of occurring within the Study Area.

Bat species were recorded via passive acoustic monitoring and therefore no flight height data was acquired.

2.2 Phase 1 Fauna Habitat Assessment and Phase 2 Basic Fauna Survey

An initial Phase 1 Fauna Habitat Assessment was undertaken for the Study Area in early 2023 at a desktop level (Umwelt, 2023). The outcomes of this assessment were later updated as part of the Phase 2 Basic Fauna Survey (Western Wildlife, 2024).

The Phase 2 Basic Fauna Survey was undertaken between 23 – 27 October 2023, with some remote sensing equipment (camera traps and passive acoustic recorders) remaining in the field until retrieval on 24 and 25 November 2023.

Habitat assessments were undertaken at 40 points across the Study Area, with the aim of sampling the heterogeneity present in each habitat in both large and small remnant patches. Fauna habitats of the Study Area were then identified and mapped using the habitat assessments and observations made in the field during the fauna survey, interpretation of vegetation mapping (Umwelt, 2024b), aerial photography, and land system mapping.

Five broad fauna habitats were identified in the Study Area which are summarised in **Table 2.1.** The most dominant habitat type occurring is the 'cleared' habitat type, comprising approximately 80% of the Study Area. Habitat types representative of those found across the Study Area were selected for locating vantage points utilised during the BBUS. This was intended to allow for recording of bird assemblage and utilisation variations across those habitat types that may be impacted. Bat detectors were also deployed at each of the vantage points during the BBUS.

Table 2.1 Fauna Habitats of the Study Area (Western Wildlife, 2024)

Habitat Type	Important Habitat Elements	Area (ha)
Eucalypt woodland on laterite rise	• Laterite outcropping and surface rocks provide shelter habitat for reptiles. • Fallen timber, logs, woody debris and leaf litter provides shelter for reptiles and small mammals. • Tree hollows provide habitat for hollow nesting birds, roosting bats and some arboreal reptiles and mammals. • Where present, Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata)* and/or an understory of shrubby *Banksia* (e.g. *B. sessilis*) may provide foraging habitat for Threatened black cockatoos. • Wandoo (*Eucalyptus wandoo*), Jarrah and Marri potentially provide breeding habitat for black-cockatoo species listed under the BC Act and EPBC Act.	407.4
Eucalypt – Sheoak woodland with granites	• Fallen timber, logs, woody debris and leaf litter provides shelter for reptiles and small mammals. • Tree hollows provide habitat for hollow nesting birds, roosting bats and some arboreal reptiles and mammals. • Dense vegetation provides nesting habitat for birds. • Exfoliating rock on granite outcrops and granite boulders provide shelter for reptiles. • Ephemeral rock pools and seasonally wet runoff areas provide breeding habitat for frogs. • York Gum (*Eucalyptus loxophleba*) or Wandoo potentially provide breeding habitat for Threatened black-cockatoos.	181

Habitat Type	Important Habitat Elements	Area (ha)
Creekline	• Tree hollows may support breeding and roosting by birds, bats and arboreal reptiles. • Fallen timber and hollow logs may provide shelter for reptiles and mammals. • Seasonally wet areas may provide frog breeding habitat. • Linear corridors of vegetation may provide 'wildlife corridors' promoting the movement of fauna through the landscape. • Where present, Marri (*Corymbia calophylla*) may provide foraging habitat for Threatened black cockatoos. • Where present, Marri, Flooded Gum (*Eucalyptus rudis*) and York Gum (*Eucalyptus loxophleba*) potentially provide breeding habitat for Threatened black-cockatoos.	563
Planted	• Linear corridors of vegetation may provide 'wildlife corridors' promoting the movement of fauna through the landscape.	93.8
Cleared	• Pasture may provide foraging habitat for macropods and birds that forage in open habitats. • Crops such as Canola may provide foraging habitat for birds, including Carnaby's Black-Cockatoo. • Farm dams may provide frog breeding habitat and breeding and foraging habitat for a small number of waterbirds. • Isolated paddock trees may provide foraging and/or breeding habitat for birds and roosting habitat for bats.	5,098.9

During the Phase 2 Basic Fauna Survey, fauna occurrences (including for birds and bats) were recorded via either incidental observation during field surveys, passive acoustic monitoring devices, or Anabat Swift call detectors.

A total of 69 bird species were recorded in the Phase 2 Basic Fauna Survey within the Study Area during habitat assessments, opportunistically throughout, or via passive acoustic monitoring. This included 19 bird species not recorded during the 2023 Spring or 2024 Summer BBUS.

Of the 69 bird species recorded during the Phase 2 Basic Fauna Survey, three are listed under the BC Act or EPBC Act and therefore are considered conservation significant. All of these conservation significant species were also recorded during the BBUS. Conservation significant bird species recorded during the Phase 2 Basic Fauna Survey included:

- Carnaby's Black Cockatoo (Endangered under the BC Act and EPBC Act).
- Peregrine Falcon (Other Specially Protected under the BC Act).
- Western Rosella (Inland) (Priority 4 under the BC Act).

Additionally, one Threatened bird species, the Forest Red-tailed Black-Cockatoo, was recorded within the Additional Survey Area outside of the Study Area and has been assigned a High likelihood of occurrence.

Of the 6 bat species recorded during the Phase 2 Basic Fauna Survey, none are listed as a conservation significant species. Five of these species were also recorded during the 2023 Spring or 2024 Summer BBUS.

2.3 Summary of Birds and Bats

A review of all bird and bat species recorded during field surveys is provided below:

- 89 bird species, including 4 conservation significant species:
  - Carnaby's Black Cockatoo (Endangered under the BC Act and EPBC Act) (recorded in the Additional Survey Area, secondary evidence in Study Area).
  - Peregrine Falcon (Other Specially Protected under the BC Act).
  - Forest Red-tailed Black Cockatoo (Vulnerable under the BC Act and EPBC Act) (recorded in Additional Survey Area).
  - Western Rosella (Inland) (Priority 4 under the BC Act).
- 8 bat species, including 1 conservation significant species:
  - Western False Pipistrelle (Priority 4 under the BC Act).

Further details on the specifics of the field surveys methods and results are provided in Umwelt (2024a).

2.4 Results of Likelihood of Occurrence

Previous desktop assessment results were combined with field observations (Umwelt, 2024a; Western Wildlife, 2024) to develop the Likelihood of Occurrence originally presented in Umwelt (2024a). Species identified as having a Moderate or greater likelihood of occurrence and subsequently assessed for their collision risk are presented in **Table 2.2.**

Table 2.2 Likelihood of Occurrence Summary (Umwelt, 2024a)

Common Name	Scientific Name	EPBC Act Status	WA Status
Known			
Carnaby's Cockatoo	*Zanda latirostris*	Endangered	Endangered
Peregrine Falcon	*Falco peregrinus*	Not listed	Other specially protected
Western Rosella (inland)	*Platycercus icterotis xanthogenys*	Not listed	Priority 4
Western False Pipistrelle	*Falsistrellus mackenziei*	Not listed	Priority 4
High			
Central Long-eared Bat	*Nyctophilus major tor*	Not listed	Priority 3
Forest Red-Tailed Black Cockatoo	*Calyptorhynchus banksii naso*	Vulnerable	Vulnerable
Moderate			
Barking Owl (Southwest subpop.)	*Ninox connivens connivens* (southwest subpop.)	Not listed	Priority 3
Baudin's Cockatoo	*Zanda baudinii*	Endangered	Endangered
Masked Owl	*Tyto novaehollandiae novaehollandiae*	Not listed	Priority 3
Fork-tailed Swift	*Apus pacificus*	Migratory	Migratory

Additionally, species with high counts of individuals recorded, and species observed as flying within RSA height during BBUS field surveys and considered to have a heightened collision risk due to the number of occurrences of observed flights within the RSA, have been included as part of this risk assessment and are listed in **Table 2.3**.

Table 2.3 At-risk Species Included in the Risk Assessment

Common Name	Scientific Name	Observed Flight Height (m AGL)		Species Count	Count of Flights within RSA
		Minimum	Maximum		
Australian Raven	*Corvus coronoides*	1	85	110	39
Nankeen Kestrel	*Falco cenchroides*	1	120	30	13
Tree Martin	*Petrochelidon nigricans*	1	150	315	128
Wedge-tailed Eagle	*Aquila audax*	2	400	55	44

3.0 Methods

3.1 Literature Review

In addition to the Desktop Assessment component conducted as part of the Bird and Bat Utilisation Summary Report (Umwelt, 2024a), a targeted literature review was undertaken for conservation significant species to further understand flight behaviours and species' potential movements within landscapes similar to the Study Area and expected flight heights or behaviours. Literature included peer-reviewed studies, field guides, textbooks, and online databases. Published literature on previous turbine collisions or "blade strikes" from other wind farm projects in Australia was also reviewed and used to inform the risk assessment. This information is summarised in **Appendix A** where relevant.

3.2 Collision Risk Assessment

The relative risk of turbine collision was estimated for species using the method described below.

3.2.1 Approach

The results of previous ecological assessments (**Section 2.0**) and associated updated desktop assessment provided the foundation of information on birds and bats to inform the collision risk assessment on these fauna groups. The risk assessment considered the likelihood of species presence and conservation status of species observed or indicated to be present in the Study Area, as well as risk to observed species based on flight characteristics. Species that met any of the following criteria were included in the risk assessment:

- Conservation significant bird and bat species (i.e. listed under the EPBC Act or BC Act) either recorded or deemed to have a Moderate or High likelihood of occurrence in the Study Area.
- Bird and bat species recorded flying at RSA height in the Study Area and identified as having a heightened risk due to the number of occurrences of observed flights within the RSA or total count of individuals observed.
- Microbats identified during field surveys, which were assessed as a single group.
- Raptors identified during field surveys, which were assessed as a single group.

3.2.2 Criteria for Estimating the Relative Risk of Blade Strike

The relative risk for assessed species was estimated using two criteria to assign the likelihood of risk (for Criteria A and B, see **Table 3.1**), and four criteria to assign the consequence of risk (for Criteria C, D, E, and F, see **Table 3.2**). This method was adapted from a recent study that aimed to develop a science-based approach to aid decision-making regarding turbine collision risk for birds and bats in Victoria (Lumsden et al., 2019).

Table 3.1 Criteria for Likelihood of Risk

Criterion	Likelihood of Risk
A	Known or likely frequency of flights within RSA height
B	Status or frequency of occurrence in the Study Area

Table 3.2 Criteria for Consequence of Risk

Criterion	Consequence of Risk
C	Highly localised or concentrated population (for whole or part of lifecycle), such that siting of wind farm could have significant consequence to Queensland, national or international population
D	Impact on population relative to demographic capacity to replace fatalities (i.e. generalised combination of dispersal capacity of potential replacements, fecundity, and generation time)
E	Known or estimated size of national or global population
F	Listed conservation status under the EPBC Act and/or the BC Act

Further detail for each criterion used in the assessment are provided below:

- **Criterion A (flight height)** was assessed by identifying the frequency of flights observed between 49 m and 291 m in the Study Area and assessing this with consideration of observed and reported flight behaviour from elsewhere in Australia. Given that flight height data for bird and bat species in Australia is scant and observation data from pre-construction surveys at wind farms largely unavailable, estimates of flight height require an adequate number of survey observations coupled with consideration of expert opinion on known flight behaviour. This Criterion is important as flight height is the primary variable through which a relative estimate of collision risk can be reached.

- **Criterion B (status in Study Area)** was assessed by determining the status or estimating the frequency of occurrence in the Study Area. This Criterion is included as it is an essential component for estimating overall blade strike risk. Data from field surveys conducted by Umwelt and Western Wildlife in 2023 and 2024 were primarily used to establish the ranking for this criterion. In the absence of species observations, likelihood of occurrence was predicted based on historical and local observations, known ranges and/or presence of suitable foraging or nesting habitat and/or expert opinion.

- **Criterion C (geographic population concentration)** was assessed by estimating the degree to which a species' population may be concentrated due to site related factors such as geographic location, habitat type, proximity to important habitat or roost locations (i.e., significant wetlands, roost caves) and how this relates to the specific landscape in which the Study Area is located. Lumsden et al. (2019) noted that this criterion is intended to account for situations where the degree to which a taxon is geographically concentrated may influence the risk posed by the particular location of a wind farm. Where large flocks or aggregations are involved, the concentration of individuals may be for short seasonal periods (i.e. during summer breeding seasons) but may nonetheless substantially heighten risk to a large portion of a species' total population. This is particularly important if a large proportion of a species' population passes through a localised area, such as a migratory corridor, over the course of each seasonal passage.

- **Criterion D (demographic resilience)** was assessed through consideration of known aspects of each assessed species breeding biology and, most specifically, the nature of species' life-history traits. This criterion is included in the risk assessment as it is necessary to estimate the capacity to which a species may replace individuals lost to mortality resulting from blade strike.

- **Criterion E (population size)** is included to account for the variation in the significance of mortality of a given number of individuals between species as a result of the large variation in assessed species' national or global populations. This, when assessed in combination with Criterion D provides a measure through which the relative vulnerability of a species to loss of individuals can be estimated.

- **Criterion F (listed conservation status)** refers to the status of bird and bat species listed under the EPBC Act and/or the BC Act. In instances where a species is dual listed, and the listing differs between Acts, for example one that is listed vulnerable under the BC Act and endangered under the EPBC Act, the EPBC Act listing is considered to take precedence, and this has been used in inform Criterion F. Species listed as migratory and/or marine under the EPBC Act are assigned a low rank for this criterion.

Each species was ranked either low, moderate or high for each of the above criterion depending on which was most appropriate in consideration of the assessed species' ecology and observed or predicted utilisation of the Study Area. Descriptions for each ranking are outlined in **Table 3.3**.

Table 3.3 Descriptions of Each Ranking for Criterion A-F

Rank	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
	Likelihood of Risk		Consequence of Risk			
Low	Species that do not or rarely fly at RSA height.	Species that rarely occur in the Study Area.	Species that are widely distributed within areas of suitable habitat and the habitat itself is relatively widely dispersed.	Species that form breeding territories and that have a reasonable proportion of the population as nonbreeding 'floaters' that can rapidly replace breeding territorial adults if lost; species that may or may not form breeding territories and that are short-lived and have high fecundity; species that have capacity for long range or widespread juvenile or sub-adult dispersal.	Total population (i.e. whether that corresponds to the national population of Australian endemics or a migrant's global population) is estimated to number more than 20,000 individuals.	Species not listed under the EPBC Act or listed as near threatened, least concern or special least concern under the BC Act. Includes species listed as migratory under the EPBC Act.
Moderate	Species which regularly fly below RSA height and occasionally fly at RSA height.	Species that occasionally occur in, or occasionally move through the Study Area.	Species that may be more widespread or have greater flexibility in the range of suitable habitat availability, but where a high proportion of their population is likely to be concentrated at sites where they do occur.	Species with life-history characteristics that sit between the low and high descriptions for Criterion D.	Total population is estimated to number between 5,000 and 20,000 individuals.	Species listed as vulnerable under the EPBC Act or BC Act.
High	Species in which a high proportion of flight activity is at RSA height.	Species that regularly occur in, or regularly move through the Study Area.	Bat species that have major aggregations at a few caves, or bird or bat species that have either very restricted distributions or those where a substantial proportion of a population may move through certain areas (i.e. migratory pathways).	Species that form breeding territories but where there is limited capacity for a lost breeding adult to be readily replaced; species that do not form breeding territories and that are long-lived and/or have low fecundity; species that may have short-distance juvenile or sub-adult dispersal capacity only.	Total population is estimated to number less than 5,000 individuals.	Species listed as endangered or critically endangered under the EPBC Act or the BC Act.

3.2.3 Estimating Overall Risk

Estimates of overall risk for each assessed species were determined by following an approach similar to that employed by Lumsden (2019) with the most notable exception being the difference in spatial scale for which resulting estimates of risk are intended to be relevant to (i.e. state-wide vs site-specific). Elements of the likelihood and consequence of collision were combined to form an overall qualitative risk category (Low/Moderate/High) specific to the Project for the likelihood of collision and the consequence of collision. Likelihood of collision questions (Criterion A and B) and consequence of collision questions (Criterion C to F) were combined in a generally additive process to determine whether the overall likelihood and consequence of collisions was Low, Moderate or High. The following describes how the **likelihood of collision** was determined:

- **High**: Either criteria A or B is High and neither can be Low.
- **Moderate**: All other combinations not described in High or Low.
- **Low**: Both criteria A and B are Low, or
    - In cases where criterion A is Low because the likelihood of flight at RSA is deemed highly unlikely based on knowledge of the species' flight behaviour and/or observations from the Study Area.
    - In cases where criterion B is Low because the likelihood of occurrence is deemed very unlikely based on the distribution of the species, expert advice and / or supported by literature or records.

The following describes how the **consequence of collision** was determined:

- **High**: The majority of criteria C through F are High, or the risk associated with criterion C for localised concentration is High. It was considered that the consequences of high mortality due to wind turbine collisions for species that have a limited distribution and/or have the capacity to be highly concentrated is sufficiently large such that, if a species' risk associated with this element was High, the consequences of collision should also be set to High, irrespective of the risks of the other criteria.
- **Moderate**: The majority of criteria C through F were Moderate.
- **Low:** The majority of criteria C through F were Low.

In cases where risk achieved two of two criteria, the higher risk rating was designated, e.g. two Moderate and two High criteria would result in a High rating. Once the overall risk levels for the likelihood and consequence of collision specific to the Project had been assigned for a species, the results were then placed into a risk matrix to determine the level of concern (**Table 3.4**). Five categories of risk were used, namely Negligible, Minor, Moderate, High, and Very High, based on the combination of the scores for likelihood and consequence. The final risk classification provides a qualitative assessment based on the criteria described to inform management actions. A "high" or above risk rating indicates a level of concern that should be addressed via further survey and/or adaptive management actions.

Table 3.4 Risk Matrix

		Consequence of Collisions		
		Low	Moderate	High
Likelihood of Collisions	Low	Negligible	Minor	Moderate
	Moderate	Minor	Moderate	High
	High	Moderate	High	Very High

4.0 Results

4.1 Collision Risk Assessment

The results of the collision risk assessment for bird and bat species included as part of this risk assessment are summarised in **Table 4.1** according to the criteria met for their inclusion. The full results of the collision risk assessment are provided in **Appendix A.**

Table 4.1 Collision Risk Assessment Summary

Common Name	Scientific Name	Likelihood	Consequence	Overall Risk Rating
Listed Bird Species				
Barking Owl (Southwest subpop.)	*Ninox connivens connivens* (southwest subpop.)	Low	Moderate	Minor
Baudin's Cockatoo	*Zanda baudinii*	Low	High	Moderate
Carnaby's Cockatoo	*Zanda latirostris*	Moderate	Moderate	Moderate
Forest Red-Tailed Black Cockatoo	*Calyptorhynchus banksii naso*	Moderate	Moderate	Moderate
Fork-tailed Swift	*Apus pacificus*	High	Low	Moderate
Masked Owl (Southern subspecies)	*Tyto novaehollandiae novaehollandiae*	Low	Moderate	Minor
Peregrine Falcon	*Falco peregrinus*	High	Low	Moderate
Western Rosella (inland)	*Platycercus icterotis xanthogenys*	Moderate	Moderate	Moderate
Listed Bat Species				
Central Long-eared Bat	*Nyctophilus major tor*	Moderate	Moderate	Moderate
Western False Pipistrelle	*Falsistrellus mackenziei*	Moderate	Moderate	Moderate
At-risk Bird Species				
Australian Raven	*Corvus coronoides*	High	Low	Moderate
Nankeen Kestrel	*Falco cenchroides*	High	Low	Moderate
Tree Martin	*Petrochelidon nigricans*	High	Low	Moderate
Wedge-tailed Eagle	*Aquila audax*	High	Low	Moderate
Grouped Species				
Microbats	*Microchiroptera*	High*	Moderate	High
Raptors	*Strigiformes, Accipitriformes, & Falconiformes*	High	Low	Moderate

Note. *Due to data deficiency on flight heights on microbats in available literature, the precautionary principle has been applied, and it is assumed that all eight species of microbat recorded in the Study Area may fly at RSA at some periods during their lifecycle.

5.0 Potential Impacts

This section provides a high-level overview of common impacts to volant wildlife from wind turbine projects.

Species-specific impact assessments tailored to the species listing status under the BC Act and EPBC Act will need to consider potential impacts on the threatened or migratory species as a result of the Project holistically, inclusive of collision risks outlined in this assessment as well as other factors including predicted habitat loss.

5.1 Collisions

Mortality at wind farms can result from birds or bats colliding with wind turbine blades, towers, nacelles, guy cable, power lines and meteorological masts. There are a range of factors that influence risk of collisions with such infrastructure including:

- Physical attributes of a wind turbine generator (i.e. turbine dimensions, lighting).
- Species-specific variables (i.e. abundance, flight behaviour, turbine avoidance capacity).
- Biophysical attributes (i.e. landscape position, topography, vegetation type).

Factors falling under the latter two points are often interrelated and generally highly spatially and temporally variable by nature. Proximity to roost locations, migratory flight pathways and wetlands appear to be particularly important factors that influence bird and bat utilisation. A range of other factors not necessarily related to a site's biophysical state such as weather conditions (including wind speed, temperature and relative humidity) can also affect utilisation and therefore collision risk.

Data from Australia, Europe and North America indicate that the risk of collision is likely to be highest in any given area or landscape where species most susceptible to collision (i.e. migratory species, raptors, swifts, waterbirds, high flying microbats) most frequently occur and lowest in areas where activity of such species is comparatively low. The consequence of mortality resulting from collision for any given species is largely influenced by the species' population size and life history traits such as longevity and fecundity which combine to determine a species' capacity to replace individuals lost.

5.2 Barotrauma

Barotrauma is a phenomenon in which rapid air pressure changes cause tissue damage to air-containing structures, most notably the lungs (Baerwald et al., 2009). It is thought that barotrauma can also result in non-lethal injuries, such as hearing impairments and other internal injuries that may result in bats succumbing to their injuries away from turbines.

Research conducted in North America on the relative risk of barotrauma compared with direct collisions has resulted in mixed findings regarding the proportion of deaths that have been attributed to each factor (Ellison, 2015), though it appears the majority of fatalities are due to collisions (Grodsky et al., 2011). Rollins et al. (2012) found that only 6% (5/81) of bats collected at a wind farm in Illinois had lesions possibly consistent with barotrauma aetiology leading the authors to conclude that 'traumatic injury is the major cause of bat mortality at wind farms, and, at best, barotrauma is a minor aetiology'. Due to the difficulty in diagnosing barotrauma unless the carcass is examined immediately after death, it is possible that cases attributed to barotrauma have been confused with traumatic injury associated with direct collisions.

There is currently no published information on barotrauma in Australia.

6.0 Management Actions

This section outlines an adaptive management approach to potential turbine strike impacts and presents mitigation measures which should be considered as part of the development of a Project-specific Bird and Bat Adaptive Management Plan (BBAMP). The BBAMP would aim to address potential Project impacts along with site-specific and regional considerations of wind farm-species interactions.

6.1 Adaptive Management Approach

The strategy of the management plan is to monitor and mitigate the potential impacts of turbine strike on birds and bats via trigger based, adaptive management. Pre and post commissioning monitoring of bird and bat activity (including flight behaviours) is a key requirement of the plan. The monitoring will inform a risk profile of each turbine to direct tailored management actions when and where required.

The objectives of the BBAMP are typically to:

- Provide an overview of pre-commissioning survey results for the Project.
- Present the outcomes of the collision risk assessment, focussing on species of conservation significance or otherwise considered to be of high risk for collision impacts.
- Present an overview of post-commissioning survey requirements including further bird and bat utilisation surveys, as well as a carcass detection program.
- Provide proposed impact trigger thresholds for listed threatened and migratory species.
- Present the adaptive management framework to be initiated in the event that a trigger threshold is reached or exceeded.
- Outline ongoing and preventative mitigation and management measures, as well as reporting and BBAMP review requirements.

6.2 Potential Mitigation Measures

There are a range of mitigation measures employed at wind farms globally to reduce the impact of operating turbines on birds and bats. These include measures designed to deter birds and bats from turbines, measures employed to minimise the attractiveness of turbines and measures used to lure birds and bats away from turbines. Other measures include altering the operation of turbines such that birds and/or bats that do fly through a turbine's RSA may be at lower risk of impact. Despite the widespread implementation of several mitigation measures there has been relatively little empirical research conducted on the effectiveness of the majority of those that have been employed (Gartman et al., 2016).

A review undertaken in 2023 of measures employed at select windfarms internationally found variable effectiveness between passive and active measures for bird species. For passive measures, Garcia-Rosa et al. (2023) found approximately 70% effectiveness reported in reducing mortality for raptors after painting one turbine blade and up to 48% for landfowls when painting wind turbine towers. For active measures, approximately 65% effectiveness for soaring birds was reported for turbine shutdown and between 33-53% for raptors when using sound activation. Only a few mitigation measures specifically employed overseas to reduce bird and bat collision risk are regularly implemented in Australia to date but may provide multiple potential avenues to reduce impacts relative to current common practices in Australia.

This section outlines the main mitigation measures that have been employed in Australia and/or overseas with a focus on cases where measures appear to be effective in reducing direct impacts, noting that the approved BBAMP will provide a more detailed plan for adaptive management actions to reduce potential impacts.

6.2.1 Carrion Removal

Removal of carrion from near turbines is undertaken at wind farms (particularly in Australia) to mitigate the risk of carrion feeders such as raptors and other scavengers colliding with turbines. Carrion removal programs typically involve regular searches of target areas for any animal. Regular searches and removal limit the amount of time carcasses are present to attract scavengers and can be complemented by opportunistic identification by personnel undertaking unrelated work at a given wind farm.

Despite carrion removal programs being a key component of most bird and bat adaptive management plans prepared for wind farms in Australia, there is currently no publicly available information based on empirical research on their effectiveness. However, regular carrion removal is an established technique to reduce the presence of aerial scavengers employed in aviation to reduce the risk of aircraft bird strike (Avisure, 2016).

6.2.2 Lighting

There is inconsistency amongst recommended use of (or avoidance of) lighting on wind turbines to specifically reduce impacts on birds and bats. This is likely partly due to variability in the way in which different species appear to respond (or not) to different lighting arrangements or configurations (i.e. according to colour, constant vs flashing etc) and the overall poor understanding of bird and bat interactions with turbines at night.

In instances where lighting is required on wind turbines it appears that the use of synchronised, flashing red lights is the best option for mitigating bird and bat collisions at night. There is evidence that steady-burning lights on communication towers increase the risk of collision for nocturnal migrants (Longcore et al., 2008). Gehring et al. (2009) found that communication towers with red strobe, red flashing, and white strobe lights result in less mortality than towers with steady-burning lights. The use of synchronised, flashing red aviation lights on wind turbines was recommended by Kerlinger et al. (2010) to mitigate risk of blade strike for birds as it was found that their use does not attract birds. A study conducted by Bennett & Hale (2014) found that use of flashing red aviation lights does not appear to be one of the potential causes of bat fatalities at wind farms leading the authors to recommend red aviation lights on turbines over other options to manage impacts on bats.

There is currently no information on the influence of lighting on wind turbines on bird and bat collision risk in Australia.

6.2.3 Painting Turbines

May et al. (2017) demonstrated that painting one wind turbine blade black reduced the annual bird fatalities across a range of bird species by 70%, compared to a non-painted turbine. Painting a turbine blade increased rotor visibility by reducing 'motion smear', the phenomenon where fast-moving objects appear to blend together.

It is noted that painting turbine blades would conflict with standard conditions of wind farm project approval, and this measure would require additional authorisation from regulators and special consideration from all stakeholders.

6.2.4 Temporary Shutdown Periods

Employing temporary shutdown of turbines has been shown to be an effective measure for reducing fatalities of certain birds and bats (de Lucas et al., 2012; Gartman et al., 2016; Smallwood & Bell, 2020). While no species assessed here have been directly researched, findings for other species from international wind farms may provide an indication of the suitability of this mitigation measure. For example, de Lucas et al. (2012) investigated mortality rates for Griffon vulture (*Gyps fulvus*) at 10 out of 13 wind facilities in Spain by conducting turbine shutdown programs from 2008 to 2009 and compared rates from a non-stop program in 2006 to 2007. The researchers found that selectively stopping a few turbines during a few months of the year can significantly reduce mortality rates by more than 50% (de Lucas et al., 2012; Muñoz et al., 2011). This mortality reduction was achieved through short shutdown periods between the first two hours after sunrise until the last two hours before sunset, resulting in only a negligible reduction (0.07%) in energy production at the particular windfarm site (de Lucas et al., 2012). In another study, Smallwood & Bell (2020) found that employing turbine shutdown periods significantly reduced fatalities of bats but not of birds in the United States.

Temporary turbine shutdowns specifically designed to reduce the risk of strike of a threatened bird species (Tasmanian wedge-tailed eagle [*Aquila audax fleayi*]) are employed at the Cattle Hill Wind Farm in Tasmania, however the effectiveness of this measure on reducing collision risk has not been reported.

An alternative method to mitigating risk of turbine collision which may be explored as the Project progresses involves the installation of automatic detection systems (ADS). These systems trigger a shutdown of turbines when a bird considered at risk of collision is identified nearby. There are three primary types of ADS currently in use. The first, two-dimensional (2D) optic systems, generally analyse changes in pixel contrast across successive images to identify a moving object and subsequently uses the size of the object to classify it as a target. The second, three-dimensional (3D) optic systems, is considered more accurate due to a combination of using a stereoscopic camera and 2D optical camera. This allows the ADS to assess the 3D trajectory of the targeted object. Both of these ADS rely primarily on either manually programmed or artificial intelligence algorithms to classify at-risk objects as targets. The third, radar technology, detects objects via the reflection of radio waves which allows a much larger detection range but may only classify targets based on approximate size classes, or sometimes species groupings using their wingbeats. The effectiveness of these technologies in minimising or mitigating the risk of collision is still in question, and requires further investigation (Ballester et al., 2024).

6.2.5 Altering Cut-in Speed of Turbines (Curtailment)

Increasing the cut-in speed of wind turbines (the velocity at which turbines start producing electricity) appears to be the most effective mitigation measure for reducing microbat mortality partly because bat mortality rates are generally higher during nights with low wind speeds (Francisco Amorim et al., 2012; Kerns & Horn, 2005; Rydell et al., 2010). Investigations conducted in North America indicate that bat mortality can be reduced by increasing the cut-in speed with reductions from 30% to 90% being reported (Arnett et al., 2008, 2011; Baerwald et al., 2009). Similarly, Wellig et al. (2018) found that collision risk could be drastically reduced if nocturnal operation of wind turbines would be restricted to wind speeds above 5 ms^{-1} at a site in Switzerland.

A curtailment study was undertaken at the Cape Nelson North wind farm in southwest Victoria which reported similar results to international studies showing a significant decrease in bat mortality of 54% when curtailment measures were applied to the site (Bennett et al., 2022). This mitigation measure appears to be most effective at locations where there is a high frequency of flights undertaken at RSA such as in migratory pathways.

7.0 Conclusion

To date, two BBUS and one Basic Fauna Survey have been undertaken within the Study Area including:

- Spring 2023 BBUS (October 2023).
- Summer 2024 BBUS (February 2024).
- Phase 2 Basic Fauna Survey (October-November 2023).

Birds

A total of 70 bird species were directly recorded within the Study Area during the BBUS field surveys; 2 of which are listed as conservation significant under the BC Act and/or the EPBC Act:

- Peregrine Falcon (Other Specially Protected under the BC Act).
- Western Rosella (Inland) (Priority 4 under the BC Act).

During previous fauna surveys, one conservation significant bird species was recorded via secondary evidence within the Study Area:

- Carnaby's Black-Cockatoo (Endangered under the BC Act and EPBC Act) – secondary evidence in Study Area.

The same fauna surveys also recorded one other bird species visually within the Additional Survey Area and therefore this species has a High likelihood of occurrence within the Study Area (Western Wildlife, 2024):

- Forest Red-tailed Black-Cockatoo (Vulnerable under the BC and EPBC Act) – recorded in Additional Survey Area.

In total, 89 bird species were recorded during both the BBUS and Phase 2 Basic Fauna surveys. Of these 89 recorded bird species, 22 visually observed species were recorded flying within the Project's RSA height range and considered "at-risk" of collision. This included one conservation significant species, the Peregrine Falcon (Other Specially Protected under the BC Act).

The likelihood of occurrence assessment for conservation significant bird species identified three bird species known to occur within the Study Area, one species with a high likelihood of occurrence and four bird species with a moderate likelihood of occurrence in the Study Area.

Table 7.1 Likelihood of Occurrence – Conservation Significant Bird Species

Common Name	Scientific Name	EPBC Act Status (Cth)	BC Act Status (WA)
Known			
Carnaby's Black-Cockatoo	*Zanda latirostris*	Endangered	Endangered
Peregrine Falcon	*Falco peregrinus*	Not listed	Other specially protected
Western Rosella (inland)	*Platycercus icterotis xanthogenys*	Not listed	Priority 4

Common Name	Scientific Name	EPBC Act Status (Cth)	BC Act Status (WA)
High			
Forest Red-Tailed Black-Cockatoo	*Calyptorhynchus banksii naso*	Vulnerable	Vulnerable
Moderate			
Barking Owl (southwest subpop.)	*Ninox connivens connivens* (southwest subpop.)	Not listed	Priority 3
Baudin's Black-Cockatoo	*Zanda baudinii*	Endangered	Endangered
Fork-tailed Swift	*Apus pacificus*	Migratory	Migratory
Masked Owl (southern subspecies)	*Tyto novaehollandiae novaehollandiae*	Not listed	Priority 3

Bats

A total of 8 bat species were recorded during the BBUS surveys, including the Western False Pipistrelle (Priority 4 under the BC Act). Of these 8 bat species, 6 were also recorded during the Phase 2 Basic Fauna Survey (none of which were conservation significant). One additional conservation significant bat species, the Central Long-eared Bat (Priority 3 under the BC Act), was found to have a High likelihood of occurring in the Study Area based on the desktop assessment results.

Table 7.2 Likelihood of Occurrence – Conservation Significant Bat Species

Common Name	Scientific Name	EPBC Act Status (Cth)	BC Act Status (WA)
Known			
Western False Pipistrelle	*Falsistrellus mackenziei*	Not listed	Priority 4
High			
Central Long-eared Bat	*Nyctophilus major tor*	Not listed	Priority 3

Summary

All conservation significant species known or with a likelihood of occurrence of Moderate or greater within the Study Area were incorporated into the risk assessment. Other species incorporated into the risk assessment included four at-risk species considered to be of interest based on the number of occurrences of observed flights within the RSA or total count of individuals observed.

In total, 14 bird and bat species were included in this risk assessment including:

- 8 conservation significant bird species.
- 2 conservation significant bat species.
- 4 at-risk bird species.

Two “groups” of species were also included in this risk assessment based on the potential for these species to occur within the RSA height range due to flight behaviours or presence within the Study Area. These groups were microbats and raptors.

Of all species and groups assessed for their collision risk, only the Microbats group received a High overall risk rating. A total of 12 species received a Moderate overall risk rating as well as the raptors group. The remainder of species (2) received a Minor overall risk rating.

Recommendations

A Project BBAMP should be developed with the aim of mitigating and managing Project risks on both EPBC Act and BC Act listed threatened species and at-risk, non-threatened species. The BBAMP will detail mitigation and management procedures to be undertaken during the operational phase of the Project which may include:

- A carcass detection program as well as a detailed carcass persistence trial.
- A carrion removal program.
- The use of lighting and deterrents.
- Shutdown or curtailment processes.
- Pre-clearance nest surveys for threatened species.
- An adaptive management process based on the identification of unacceptable risks (trigger levels) to all threatened and migratory species.

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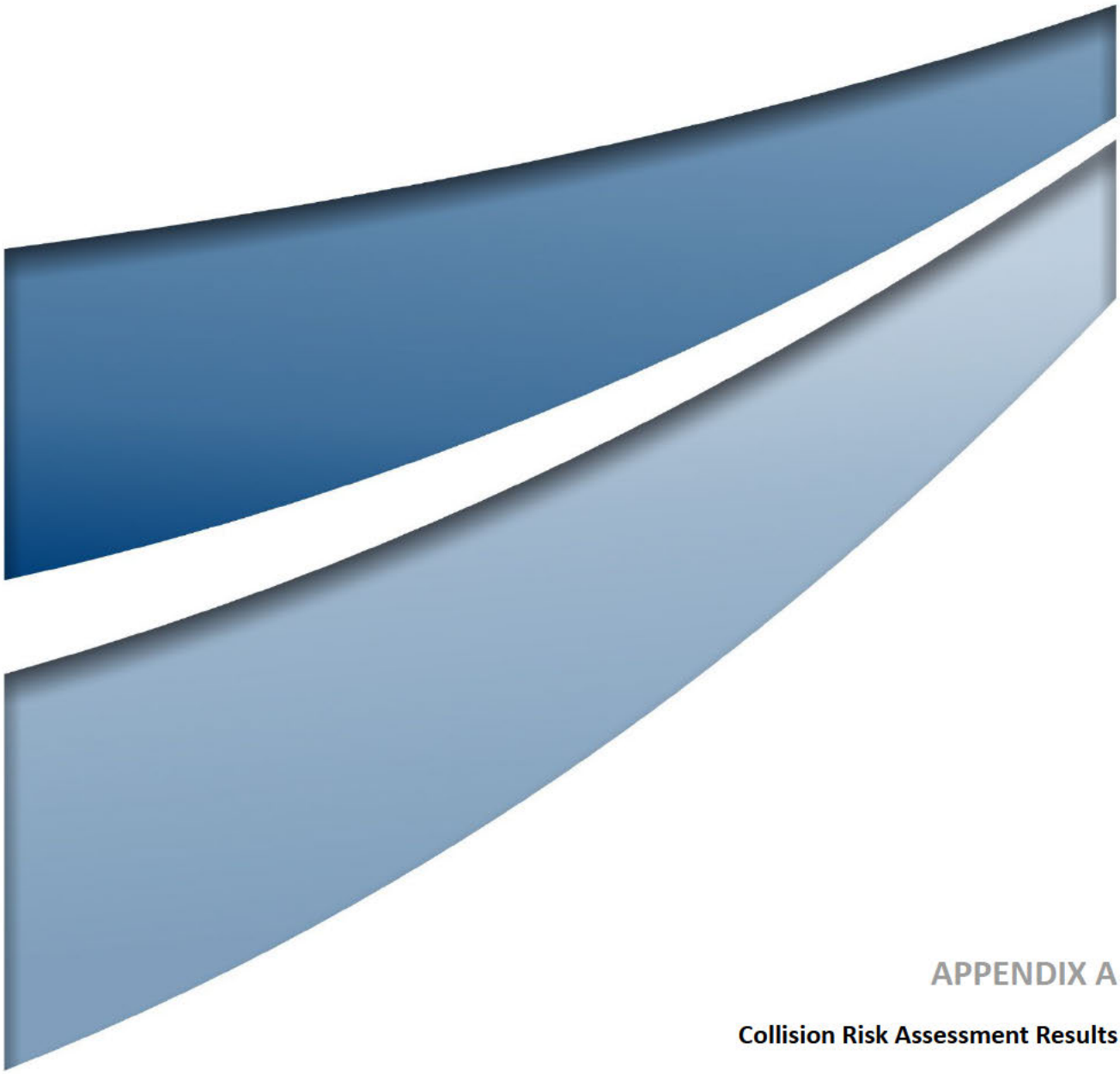

APPENDIX A

Collision Risk Assessment Results

A.1 Conservation Significant Bird Species

1. BARKING OWL (*Ninox connivens connivens* [southwest subpop.])

Information on Barking Owl from Australian wind farms

There is no publicly available literature on blade strike of the Barking Owl at wind farms within this species' distribution.

Likelihood and Consequence of Impacts

The overall risk rating for the Barking Owls is Minor based on a Low likelihood rating and a Moderate consequence rating. Rationale for responses to each Criterion are as follows:

- **Criterion A**: It is likely that Barking Owl (southwest subpop.) rarely fly at RSA height.
- **Criterion B**: The species has been ranked as a Moderate likelihood of occurrence in the Study Area. There are two records of the species located 14 km north of the Study Area in Lol Gray State Forest, dated recently. There is limited suitable habitat for roosting present in the Study Area in terms of Acacia and Casuarina tree species.
- **Criterion C**: Barking Owl (southwest subpop.) are widely distributed within areas of suitable habitat and the habitat itself is relatively widely dispersed. Dryandra National Park and Lol Gray State Forest are located approximately 4.5 km north of the Study Area and provide large patches of continuous woodland which is likely to support breeding and foraging habitat for this species. These areas may concentrate the population to the Project region.
- **Criterion D**: The life-history characteristics of Barking Owl overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D (Garnett, 2020)
- **Criterion E**: Barking Owl's (southwest subpop.) total population is estimated to comprise of 11,000 mature individuals (Garnett, 2020).
- **Criterion F**: Barking Owl (southwest subpop.) is not listed under the EPBC Act and is listed as Priority 3 under the BC Act.

Table A.1 Barking Owl Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X		X			X
Moderate		X		X	X	
High						
Risk Rating						
Likelihood	Low	**Consequence**	Moderate	**Risk Rating**	Minor	

2. BAUDIN'S BLACK-COCKATOO (*Zanda baudinii*)

Information on Baudin's Black-Cockatoo from Australian wind farms

There is no publicly available literature on blade strike of the Baudin's Black-Cockatoo at wind farms within this species' distribution.

Likelihood and Consequence of Impacts

The overall risk rating for the Baudin's Black-Cockatoos is Moderate based on a Low likelihood rating and a High consequence rating. Rationale for responses to each Criterion are as follows:

- **Criterion A**: Black cockatoos regularly fly below the minimum RSA height of 49 m but may occasionally fly at RSA height when evading predatory raptors or congregating in large numbers.
- **Criterion B**: There is one record of the species within the Study Area and two records within 5 km south-west of the Study Area near Williams from the last 20 years. Suitable habitat is present in the Study Area such as Jarrah, Marri and Karri forests. This species has a moderate likelihood of occurring within the Study Area and may occasionally utilise the Study Area.
- **Criterion C**: Baudin's Black-Cockatoo may have greater flexibility in the range of suitable habitat availability but a high proportion of their population is likely to be concentrated at sites where they do occur. Review of DBCA roosting habitat for black cockatoos identifies that a roosting site exists 12.2 km east of the Study Area in Narrogin and another 12.6 km north of the Study Area in Lol Gray State Forest. Habitat comprising of Marri, Flooded gum and York gum woodlands occur within the Study Area, providing areas of breeding, roosting and refuge. Habitats within the broader Project region may be more suitable than habitats within the Study Area. Therefore the population is unlikely to be concentrated in the Study Area.
- **Criterion D**: The life-history characteristics of Baudin's Black-Cockatoo align with aspects of the description for a High rating for Criterion D such that there is limited capacity for a lost breeding adult to be readily replaced.
- **Criterion E**: Baudin's Black-Cockatoo's total population is estimated to comprise of approximately 3,254 mature individuals (Garnett, 2020).
- **Criterion F**: Baudin's Black-Cockatoo is listed as Endangered under both the EPBC Act and BC Act.

Table A.2 Baudin's Black-Cockatoo Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X					
Moderate		X	X			
High				X	X	X
Risk Rating						
Likelihood	Low	**Consequence**	High	**Risk Rating**	Moderate	

3. CARNABY'S BLACK-COCKATOO (*Zanda latirostris*)

Information on Carnaby's Black-Cockatoo from Australian wind farms

There were no records of blade strike for the Carnaby's Black-Cockatoo reported during 2019 post-construction monitoring surveys at the Badgingarra Wind Farm north of Perth (Ecoscape, 2019), and none reported at the Warradarge Wind Farm also north of Perth during post-construction monitoring from 2020 to 2022 (Bright Energy Investments, n.d.).

There is no publicly available literature on blade strike of the Carnaby's Black Cockatoo at the majority of wind farms within this species' distribution.

Likelihood and Consequence of Impacts

The overall risk rating for Carnaby's Black Cockatoos is Moderate based on a Moderate likelihood rating and a Moderate consequence rating. Rationale for responses to each Criterion are as follows:

- **Criterion A**: Black cockatoos regularly fly below the minimum RSA height of 49 m but may occasionally fly at RSA height when evading predatory raptors or congregating in large numbers. Flight height data collected for the Badgingarra wind farm for Carnaby's Black-Cockatoo recorded the species flying between 20-150 m AGL on five occasions, or 20% of records with flight height data (Ecoscape, 2019).

- **Criterion B**: There is one record of the species within the Study Area found recently and several records south-west within 5 km of the Study Area near Williams recorded recently. Suitable habitat is present in the Study Area such as Salmon Gum Eucalyptus and Wandoo. This species was visually and aurally recorded during field surveys within the Additional Survey Area but outside of the Study Area, and again via secondary evidence (foraging evidence) within the Study Area by Western Wildlife (2024). The species is considered to be a seasonal visitor likely to forage and/or roost in the Study Area and may breed in large tree hollows.

- **Criterion C**: A high proportion of the Carnaby's Black Cockatoo population is likely to be concentrated at sites where they do occur. A review of DBCA roosting habitat for black cockatoos identified that a roosting site exists 12.2 km east of the Study Area in Narrogin and another 12.6 km north of the Study Area in Lol Gray State Forest. Habitat comprising of Marri, Flooded gum and York gum woodlands occur within the Study Area, providing areas of breeding, roosting and refuge. Habitats within the broader Project region may be more suitable than habitats within the Study Area. Therefore, the population is unlikely to be concentrated in the Study Area.

- **Criterion D**: The life-history characteristics of Carnaby's Black Cockatoo align with aspects of the description for a High rating for Criterion D such that there is limited capacity for a lost breeding adult to be readily replaced.

- **Criterion E**: Carnaby's Black Cockatoo's total population is estimated to comprise of 34,000 mature individuals (Garnett, 2020).

- **Criterion F**: Carnaby's Black Cockatoo is listed as endangered under both the EPBC and BC Act.

Table A.3 Carnaby's Black Cockatoo Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X				X	
Moderate			X			
High		X		X		X
Risk Rating						
Likelihood	Moderate	**Consequence**	Moderate	**Risk Rating**	Moderate	

4. FOREST RED-TAILED BLACK COCKATOO (*Calyptorhyncus banksii naso*)

Information on Forest Red-tailed Black Cockatoo from Australian wind farms

There is no publicly available literature on blade strike of the Forest Red-tailed Black Cockatoo at wind farms within this species' distribution.

Likelihood and Consequence of Impacts

The overall risk rating for Forest Red-tailed Black Cockatoos is Moderate based on a Moderate likelihood rating and a Moderate consequence rating. Rationale for responses to each Criterion are as follows.

- **Criterion A**: Black cockatoos regularly fly below the minimum RSA height of 49 m but may occasionally fly at RSA height when evading predatory raptors or congregating in large numbers.
- **Criterion B**: The nearest record located 2.4 km south-west of Study Area dated recently, two other records located north-east of Study Area located within 4 km dated recently. There is suitable habitat present in the Study Area such as Jarrah, Karri and Marri forests known to occur in the region. This species was visually recorded during field surveys by Western Wildlife (2024) in the Additional Survey Area outside of the Study Area, with a small flock of probably two birds heard in Eucalypt Sheoak woodland. The species is considered to be a seasonal visitor likely to forage and/or roost in the Study Area and may breed in large tree hollows.
- **Criterion C**: Forest Red-tailed Black Cockatoos may have great flexibility in the range of suitable habitat availability, but a high proportion of their population is likely to be concentrated at sites where they do occur. A review of DBCA roosting habitat for black cockatoos identified that a roosting site exists 12.2 km east of the Study Area in Narrogin and another 12.6 km north of the Study Area in Lol Gray State Forest. Habitat comprising of Marri, Flooded gum and York gum woodlands occur within the Study Area, providing areas of breeding, roosting and refuge. Habitats within the broader Project region may be more suitable than habitats within the Study Area. Therefore, the population is unlikely to be concentrated in the Study Area.
- **Criterion D**: The life-history characteristics of Forest Red-tailed Black Cockatoo overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D.
- **Criterion E**: Forest Red-tailed Black Cockatoo's total population is estimated to comprise of 16,800 mature individuals (Garnett, 2020).
- **Criterion F**: Forest Red-tailed Black Cockatoo is listed as vulnerable under both the EPBC Act and BC Act.

Table A.4 Forest Red-tailed Black Cockatoo Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X					
Moderate			X	X	X	X
High		X				
Risk Rating						
Likelihood	Moderate	**Consequence**	Moderate	**Risk Rating**	Moderate	

5. FORK-TAILED SWIFT (*Apus pacificus*)

Information on Fork-tailed Swift from Australian wind farms

There is one record of blade strike of fork-tailed swift in the available literature from Victoria (Lumsden et al., 2019). There is no publicly available information on blade strike from the majority of wind farms located in this species' Australian range.

Likelihood and Consequence of Impacts

The overall risk rating for Fork-tailed Swifts is Moderate based on a High likelihood rating and a Low consequence rating. It is noted that due to this species' very large population size and the Study Area not being capable of supporting an ecologically significant proportion of a population (Department of the Environment, 2015) , an overall risk rating of Minor rather than Moderate may also be considered appropriate. Rationale for responses to each Criterion are as follows:

- **Criterion A**: It is likely that a high proportion of the Fork-tailed Swift's flight activity is at RSA height.
- **Criterion B**: The species has been ranked as a Moderate likelihood of occurrence in the Study Area. The nearest record is located 40 km south of the Study Area and is dated recently. This species is known to occur within the region and may use the aerial space above patches of vegetation within the Study Area to forage on invertebrates. Although this species generally transits south along the coast, individuals have been recorded inland.
- **Criterion C**: Fork-tailed Swift are widely distributed within areas of suitable habitat across their range and the habitat itself is relatively widely dispersed. Fork-tailed Swift are a wide-ranging aerial species distributed within areas of suitable habitat. Population concentration for the species is largely dependent on the availability of insect prey, which is often associated with vegetated areas.
- **Criterion D**: The life-history characteristics of Fork-tailed Swift overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D(Chantler et al., 2020).
- **Criterion E**: Fork-tailed Swift's total population has not been quantified, however given estimated national population sizes for certain East Asian nations (i.e., an estimated 10,000-100,000 breeding pairs for both Korea and Russia) it is likely to exceed 20,000 individuals (BirdLife International, 2023).
- **Criterion F**: Fork-tailed Swift is listed as Migratory under the EPBC Act and the BC Act.

Table A.5 Fork-tailed Swift Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate		X		X		
High	X					
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	Moderate	

6. MASKED OWL (SOUTHERN SUBSPECIES) (*Tyto novaehollandiae novaehollandiae*)

Information on Masked Owl from Australian wind farms

There is no publicly available literature on blade strike of the Masked Owl at wind farms within this species' distribution.

Likelihood and Consequence of Impacts

The overall risk rating for Masked Owl (Southern subspecies) is Minor based on a Low likelihood rating and a Moderate consequence rating. Rationale for responses to each Criterion are as follows:

- **Criterion A**: It is likely that Masked Owls (Southern subspecies) rarely fly at RSA height.
- **Criterion B**: The species has been ranked as a Moderate likelihood of occurrence in the Study Area. There are two records located 13 km north of Study Area in Lol Gray State Forest, with one dated recently. There is some suitable habitat for foraging or breeding present within the Study Area such as eucalypt forests.
- **Criterion C**: Masked Owl (Southern subspecies) may have great flexibility in the range of suitable habitat availability, but a high proportion of their population is likely to be concentrated at sites where they do occur. Dryandra National Park and Lol Gray State Forest are located approximately 4.5 km north of the Study Area and provide large patches of continuous woodland which is likely to support breeding and foraging habitat for this species. The Study Area also consists of some farmland which may provide prey species such as invasive rodents. These areas may concentrate the population to the Project region.
- **Criterion D**: The life-history characteristics of Masked Owl (Southern subspecies) overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D.
- **Criterion E**: Population size of Masked Owl (Southern subspecies) is not documented. It has conservatively been assessed as Moderate.
- **Criterion** F: The Masked Owl (Southern subspecies) is not listed under the EPBC Act and listed as Priority 3 under the BC Act.

Table A.6 Masked Owl (Southern subspecies) Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X					X
Moderate		X	X	X	X	
High						
Risk Rating						
Likelihood	Low	**Consequence**	Moderate	**Risk Rating**	Minor	

7. PEREGRINE FALCON (*Falco peregrinus*)

Information on Peregrine Falcon from Australian wind farms

There are two records of blade strike of Peregrine Falcons in the available literature from Victoria (Lumsden et al., 2019). There is no publicly available information on blade strike from the majority of wind farms located in this species' Australian range.

Likelihood and Consequence of Impacts

The overall risk rating for the Peregrine Falcon is Moderate based on a High likelihood rating and a Low consequence rating. Rationale for responses to each Criterion are as follows:

- **Criterion A**: A high proportion of Peregrine Falcon's flight activity is likely to be at RSA height.
- **Criterion B**: This species was visually recorded during field surveys and therefore has been assigned a Known likelihood of occurrence ranking. There are several records within 10 km all around the Study Area dated recently. The Study Area contains large areas of suitable foraging habitat, however nesting habitat is limited. This species was visually recorded during field surveys and therefore has been upgraded to a Known ranking.
- **Criterion C**: Peregrine Falcon are widely distributed within areas of suitable habitat across their range and the habitat itself is relatively widely dispersed. Peregrine falcons are a wide-ranging aerial species distributed within areas of suitable habitat, which may include Dryandra National Park and Lol Gray State Forest located approximately 4.5 km north of the Study Area. Habitats within the broader Project region may be more suitable than habitats within the Study Area. Therefore, the population is unlikely to be concentrated in the Study Area.
- **Criterion D**: The life-history characteristics of Peregrine Falcon overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D (Higgins et al., 1993)
- **Criterion E**: Peregrine Falcon's total population is estimated to comprise 100,000 - 499,999 mature individuals (BirdLife International, 2024)
- **Criterion F**: Peregrine Falcon is not listed under the EPBC Act and listed as Other Specially Protected under the BC Act.

Table A.7 Peregrine Falcon Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate				X		
High	X	X				
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	Moderate	

8. WESTERN ROSELLA (INLAND) (*Platycercus icterotis xanthogenys*)

Information on Western Rosella (inland) from Australian wind farms

There is no publicly available literature on blade strike of the Western Rosella (inland) at wind farms within this species' distribution. However, there have been two occurrences of blade strike recorded for the Crimson Rosella in the available literature from Victoria (Lumsden et al., 2019; Wood, 2020) and one recorded for the Green Rosella in the available literature from Tasmania (Hull et al., 2013).

Likelihood and Consequence of Impacts

The overall risk rating for Western Rosella (inland) is Moderate based on a Moderate likelihood rating and a Moderate consequence rating. Rationale for responses to each Criterion are as follows:

- **Criterion A**: It is likely that Western Rosella (inland) rarely fly at RSA height.
- **Criterion B**: This species was visually recorded during field surveys and therefore has been assigned a Known likelihood of occurrence ranking. The nearest record is located 3.7 km west from the Study Area but not dated recently, two records east within 15 km of the Study Area also not dated recently. There is suitable habitat present in the Study Area, consisting of eucalypt forest.
- **Criterion C**: Western Rosella (inland) may have great flexibility in the range of suitable habitat availability, but where a proportion of their population is likely to be concentrated at sites where they do occur. The Study Area mainly consists of farmland, with limited suitable habitat. Dryandra National Park and Lol Gray State Forest are located approximately 4.5 km north of the Study Area and provide large patches of continuous woodland habitat. These areas are likely to provide more suitable habitat than available in the Study Area.
- **Criterion D**: The life-history characteristics of Western Rosella (inland) overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D.
- **Criterion E**: Population size of Western Rosella (inland) is not documented. It has conservatively been assessed as Moderate.
- **Criterion F**: Western Rosella (inland) is not listed under the EPBC Act and is listed as Priority 4 under the BC Act.

Table A.8 Western Rosella (inland) Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X					X
Moderate			X	X	X	
High		X				
Risk Rating						
Likelihood	Moderate	**Consequence**	Moderate	**Risk Rating**	Moderate	

A.2 Conservation Significant Bat Species

9. CENTRAL LONG-EARED BAT (*Nyctophilus major tor*)

Information on Central Long-eared Bat from Australian wind farms

There is no publicly available literature on blade strike of the Central Long-eared Bat at wind farms within this species' distribution.

Likelihood and Consequence of Impacts

The overall risk rating for Central Long-eared Bat is Moderate based on a Moderate likelihood rating and a Moderate consequence rating. Rationale for responses to each Criterion are as follows.

- **Criterion A**: Although little is known about its flight behaviour, it is assessed that Central Long-eared Bats rarely fly at RSA height, consistent with other long-eared bats.
- **Criterion B**: The nearest record is 5.5 km north-west of the Study Area and is dated recently. There are also two records 13 km north of the Study Area in Lol Gray State Forest dated recently. There is suitable habitat present within the Study Area such as preferred eucalypt woodlands. This species was not recorded during field surveys and therefore a Moderate ranking for this criterion is considered suitable.
- **Criterion C**: The Central Long-eared Bat is widely distributed within areas of suitable habitat across their range and the habitat itself is relatively widely dispersed. Dryandra National Park and Lol Gray State Forest are located approximately 4.5 km north of the Study Area and provide large patches of continuous woodland which is likely to support breeding and foraging habitat for this species. Habitats within the broader Project region may be more suitable than habitats within the Study Area. Therefore, the population is unlikely to be concentrated in the Study Area.
- **Criterion D**: The life-history characteristics of the Central Long-eared Bat overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D.
- **Criterion E**: Population size of the Central Long-eared Bat is not documented. It has conservatively been assessed as Moderate.
- **Criterion F**: The Central Long-eared Bat is not listed under the EPBC Act and is listed as Priority 3 under the BC Act.

Table A.9 Central Long-eared Bat Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X		X			X
Moderate		X		X	X	
High						
Risk Rating						
Likelihood	Moderate	**Consequence**	Moderate	**Risk Rating**	Moderate	

10. WESTERN FALSE PIPISTRELLE (*Falsistrellus mackenziei*)

Information on Western False Pipistrelle from Australian wind farms

There is no publicly available literature on blade strike of the Western False Pipistrelle at wind farms within this species' distribution.

Likelihood and Consequence of Impacts

The overall risk rating for Western False Pipistrelle is Moderate based on a Moderate likelihood rating and a Moderate consequence rating. Rationale for responses to each Criterion are as follows.

Criterion A: It is likely that Western False Pipistrelle rarely fly at RSA height.

Criterion B: The nearest records are located 4.8 km north of the Study Area but not dated recently. There is suitable habitat present in the Study Area such as Karri, Jarrah and Tuart eucalypts. This species was recorded via passive acoustic monitoring in all habitats within the Study Area and the detection rate of this species was unexpected. The results potentially indicate that there is a seasonal presence in the area attracted by flowering vegetation (Bat Call WA, 2024).

Criterion C: Western False Pipistrelle may have great flexibility in the range of suitable habitat availability, but where a proportion of their population is likely to be concentrated at sites where they do occur. Dryandra National Park and Lol Gray State Forest are located approximately 4.5 km north of the Study Area and provide large patches of continuous woodland which is likely to support breeding and foraging habitat for this species. Habitats within the broader Project region may be more suitable than habitats within the Study Area. Therefore the population is unlikely to be concentrated in the Study Area.

Criterion D: The life-history characteristics of Western False Pipistrelle aligns with aspects of the description for a Low rating for Criterion D such that a reasonable proportion of the population exist as nonbreeding 'floaters' that can rapidly replace breeding territorial adults if lost (Animalia, n.d.).

Criterion E: Population size has not been documented; however, it is assumed to be greater than 10,000 mature individuals (Woinarski et al., 2014).

Criterion F: Western False Pipistrelle is not listed under the EPBC Act and listed as Priority 4 under the BC Act.

Table A.10 Western False Pipistrelle Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X			X		X
Moderate			X		X	
High		X				
Risk Rating						
Likelihood	Moderate	**Consequence**	Moderate	**Risk Rating**	Moderate	

A.3 At-risk Bird Species

11. AUSTRALIAN RAVEN (*Corvus coronoides*)

Information on Australian Raven from Australian wind farms

There are five records of blade strike of Australian Ravens in the available literature from Victoria (Lumsden et al., 2019). There is no publicly available information on blade strike from the majority of wind farms located in this species' Australian range.

Likelihood and Consequence of Impacts

The overall risk rating for Australian Ravens is Moderate based on a High likelihood rating and a Low consequence rating. Rationale for responses to each Criterion are as follows:

Criterion A: Of the 110 recorded flight observations of Australian Ravens within the Study Area, 39 flights (35%) were within the RSA. The species may occasionally fly at RSA but is considered to regularly occur below the RSA height range. A Moderate rating has been considered appropriate for Criterion A.

Criterion B: This species has been recorded within the Study Area on 110 occasions during field surveys. This species is considered a resident, and individuals are likely to spend all periods of their lifecycle within the Study Area. Therefore, a High rating has been applied to Criterion B.

Criterion C: Australian Ravens are relatively abundant and widely distributed within areas of suitable habitat and the habitat itself is widely dispersed.

Criterion D: The life-history characteristics of the Australian Raven overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D, placing it in the Moderate category for this criterion (Debus, 2020).

Criterion E: Australian Raven populations have not been readily quantified; however, it is highly likely that is exceeds 20,000 as they are a relatively abundant species with a population considered to be increasing (Debus, 2020). Therefore, a Low rating is considered suitable for Criterion E.

Criterion F: This species has not been assigned a conservation status and is classified as Least Concern under the IUCN Red List Categories; therefore, a ranking of Low is considered suitable for Criterion F

Table A.11 Australian Raven Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate	X			X		
High		X				
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	Moderate	

12. NANKEEN KESTREL (*Falco cenchroides*)

Information on Nankeen Kestrel from Australian wind farms

There are 54 records of blade strike of the Nankeen Kestrel in the available literature from Victoria (Lumsden et al., 2019). There is no publicly available information on blade strike from the majority of wind farms located in this species' Western Australian range.

Likelihood and Consequence of Impacts

The overall risk rating for Nankeen Kestrels is Moderate based on a High likelihood rating and a Low consequence rating. Rationale for responses to each Criterion are as follows:

Criterion A: Of the 30 recorded flight observations of Nankneen Kestrels within the Study Area, 13 flights (43%) were within the Project's RSA height range. A significant proportion of this species flight activity is within this range based on field survey data; therefore a High rating has been ascribed to Criterion A.

Criterion B: The species has been recorded within the Study Area on 30 occasions during field surveys. This species is considered to regularly occur in, or move through, the Study Area. Therefore, a High rating has been applied to Criterion B.

Criterion C: Nankeen Kestrels are widely distributed within areas of suitable habitat and the habitat itself is relatively widely dispersed.

Criterion D: The life-history characteristics of Nankeen Kestrels overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D (Debus & Kirwan, 2021).

Criterion E: Nankeen Kestrel populations have not been readily quantified but are estimated to be between 75,000–750,000 pairs in Australia (Debus & Kirwan, 2021).

Criterion F: This species has not been assigned a conservation status and is classified as Least Concern under the IUCN Red List Categories; therefore, a ranking of Low is considered suitable for Criterion F.

Table A.12 Nankeen Kestrel Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate				X		
High	X	X				
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	Moderate	

13. TREE MARTIN (*Petrochelidon nigricans*)

Information on Tree Martin from Australian wind farms

There is no publicly available literature on blade strike of the Tree Martin at wind farms within this species' distribution.

Likelihood and Consequence of Impacts

The overall risk rating for Tree Martins is Moderate based on a High likelihood rating and a Low consequence rating. Rationale for responses to each Criterion are as follows:

Criterion A: Of the 315 recorded flight observations of Tree Martins within the Study Area, 128 flights (41%) were within the Project's RSA height range. A significant proportion of this species flight activity is within this range based on field survey data; therefore a High rating has been ascribed to Criterion A.

Criterion B: The species has been recorded within the Study Area on 315 occasions during field surveys. This species is considered a resident, and individuals are likely to spend all periods of their lifecycle within the Study Area. Therefore, a High rating has been applied to Criterion B.

Criterion C: Tree Martins are relatively abundant and widely distributed within areas of suitable habitat and the habitat itself is relatively widely dispersed.

Criterion D: The life-history characteristics of Nankeen Kestrels overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D (Turner, 2020).

Criterion E: Tree Martin populations are unknown but the species are relatively abundant and is highly likely to exceed 20,000 individuals.

Criterion F: This species has not been assigned a conservation status and is classified as Least Concern under the IUCN Red List Categories; therefore, a ranking of Low is considered suitable for Criterion F.

Table A.13 Tree Martin Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate				X		
High	X	X				
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	Moderate	

14. WEDGE-TAILED EAGLE (*Aquila audax*)

Information on Wedge-tailed Eagle from Australian wind farms

The wedge-tailed eagle is commonly reported during mortality monitoring events at wind farms in Australia. Lumsden et al. (2019) report wedge-tailed eagle as the second most frequently recorded bird species found dead during monitoring from 2003 to 2018 across 15 wind farms in Victoria, with 58 carcasses detected and equating to 10% of all birds found. Using this data, Lumsden et al. (2019) calculated mortality estimates of 0.06 (95% CI: 0.02–0.41) and 0.1 (95% CI: 0–0.2) individuals per turbine per year at two Victorian wind farms.

At two wind farms in north-western Tasmania, 18 wedge-tailed eagle carcasses were recorded during monitoring conducted for three and six years at Bluff Point Wind Farm and Studland Bay Wind Farm respectively (Hull et al., 2013). This particular monitoring program modelled a mortality estimate of 1.5 and 1.1 collisions per annum at Bluff Point (37 turbines) and Studland Bay (25 turbines). A 95% turbine avoidance rate closely approximated the observed mean annual mortality rate of 1.6 and 1.1 individuals per annum at each wind farm respectively (Lumsden et al., 2019).

Wedge-tailed eagle occur at the majority of wind farms in Australia; however, publicly available information on blade strike is restricted to that collected from select Victoria and Tasmania wind farms discussed above.

Likelihood and Consequence of Impacts

The overall risk rating for Wedge-tailed Eagle is Moderate based on a High likelihood rating and a Low consequence rating. Rationale for responses to each Criterion are as follows:

Criterion A: Of the 55 recorded flight observations of wedge-tailed eagle within the Study Area, 44 flights (80%) were within the Project's RSA height range and 7 (13%) were above. A high proportion of this species flight activity is within this range based on field survey data; therefore a High rating has been ascribed to Criterion A.

Criterion B: The species has been recorded within the Study Area on 55 occasions during field surveys. This species is considered to regularly occur in, or move through, the Study Area. Therefore, a High rating has been applied to Criterion B.

Criterion C: Wedge-tailed Eagles are widely distributed within areas of suitable habitat. Habitat suitable to this species within the Study Area is not considerably different to that in the broader region. Therefore, a Low rating has been applied to Criterion C.

Criterion D: The life-history characteristics of Wedge-tailed Eagles overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D (Debus & Kirwan 2020).

Criterion E: The population of Wedge-tailed Eagles has not been reliably calculated, however, it is considered highly likely that it exceeds 20,000 individuals. Therefore, a 'low' rating has been applied to Criterion E.

Criterion F: This species has not been assigned a conservation status and is classified as Least Concern under the IUCN Red List Categories; therefore, a ranking of Low is considered suitable for Criterion F

Table A.14 Wedge-tailed Eagle Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate				X		
High	X	X				
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	Moderate	

A.4 Grouped Species

15. MICROBATS

Information on Microbats from Australian wind farms

Of the microbats recorded during field surveys, Moloney et al. (2019) reported 5 recorded blade strike mortalities for the Chocolate Wattled Bat, 49 for the Gould's Wattled Bat, 6 for the Lesser-long-eared Bat, 2 for the Southern Forest Bat, and 296 for the White-striped Free-tailed Bat in the available literature from Victoria (Moloney et al., 2019). Symbolix (2020) reported that the two most common species detected in mortality data in Western Victoria include White-striped Free-tailed Bat (229 carcasses at 10 sites) and Gould's Wattled Bat (77 carcasses at eight sites).

In South Australia, Bennett et al. (2022) reported 24 recorded blade strikes of the White-striped Free-tailed Bat, 9 for the Gould's Wattled Bat, 1 for Chocolate Wattled Bat, 2 for Southern Forest Bat, and 2 of the Lesser Long-eared Bat. In the available literature from Tasmania, Hull & Cawthen (2012) reported 38 recorded blade strikes for the Gould's Wattled Bat (with another 14 likely strikes) and two *Vespadelus* species recorded. In New South Wales, Nature Advisory (2021) reported 20 blade strike mortalities of Gould's Wattled Bat, 10 of White-striped Free-tailed Bat, 6 of Southern Forest Bat, and 1 Chocolate Wattled Bat.

There is no publicly available information on blade strike from the majority of wind farms located in these species' Australian range, including Western Australia.

Likelihood and Consequence of Impacts

The overall risk rating for Microbats is High based on a High likelihood rating and a Moderate consequence rating. Rationale for responses to each Criterion are as follows:

Criterion A: Due to data deficiency on flight heights on microbats in available literature, the precautionary principle has been applied, and it is assumed that all eight species of microbat recorded in the Study Area may fly at RSA at some periods during their lifecycle. Therefore, a Moderate rating for Criterion A has been considered suitable.

Criterion B: At least 8 microbats were recorded via passive acoustic monitoring within the Study Area with a total of 3,895 calls recorded over four nights during the Spring 2023 BBUS and all species being recorded again during the Summer 2024 BBUS. Therefore, these species are collectively considered to regularly occur in, or regularly move through the Study Area and a High rating for Criterion B has been considered suitable.

Criterion C: Given the large scale clearing of the Wheatbelt region, habitat of microbats in this region would be largely restricted to remnant vegetation and anthropogenic structures (i.e. sheds, house roofs etc). Some species of microbats in this area may roost in colonies, while some may roost in solitary. A 'Moderate' risk ranking has been selected as a result for this criterion.

Criterion D: The life-history characteristics of most microbats overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D.

Criterion E: Microbats assessed as part of this grouping are considered to have relatively stable population numbers as they have not been assigned a conservation status; however, as population numbers are not well defined for microbats, a Moderate ranking for Criterion E has been considered appropriate.

Criterion F: The microbats assessed as part of this grouping have not been assigned a conservation status and therefore a ranking of Low is considered suitable for Criterion F.

Table A.15 Microbats Group Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low						X
Moderate	X		X	X	X	
High		X				
Risk Rating						
Likelihood	High	**Consequence**	Moderate	**Risk Rating**	High	

16. RAPTORS

Information on Raptors from Australian wind farms

Of the raptors recorded during field surveys for the Project, there has been 1 recorded of blade strike for the Australian Hobby, 3 for the Black-shouldered Kite, 62 for the Brown Falcon, 3 for the Brown Goshawk, 1 for the Collared Sparrowhawk, 1 for the Spotted Harrier, and 5 for the Whistling Kite in the available literature from Victoria and Tasmania (Lumsden et al., 2019; Wood, 2020).

There is no publicly available information on blade strike from the majority of wind farms located in these species' Australian range.

Likelihood and Consequence of Impacts

The overall risk rating for Raptors is Moderate based on a High likelihood rating and a Low consequence rating. Rationale for responses to each Criterion are as follows.

Criterion A: It is likely that a high proportion of Raptor's flight activity is at RSA height. Therefore, a High rating for Criterion B has been considered suitable.

Criterion B: A number of raptor species not assessed elsewhere were recorded visually during field surveys including the Australian Hobby, Black-shouldered Kite, Brown Goshawk, Brown Falcon, Collared Sparrowhawk, Spotted Harrier, and Whistling Kite. The maximum number of observations for these species was 8 (Black-shouldered Kite) with most being recorded only once or twice. However, as the Study Area is within the known range of all species (Menkhorst et al., 2019) and contains suitable habitat (e.g. open areas and farmland, woodlands, and creeklines) a Moderate ranking has been considered appropriate for Criterion B.

Criterion C: Raptors with a potential to occur within the Study Area are widely distributed among areas of suitable habitat which itself is relatively widely dispersed.

Criterion D: The life-history characteristics of most raptors overlap with certain aspects of both the descriptions for a Low and High rating for Criterion D.

Criterion E: Raptors assessed as part of this grouping generally have stable population numbers as they have not been classified as conservation significant species and are therefore assigned a ranking of Low for criterion E.

Criterion F: Raptors assessed as part of this grouping which have the potential to occur in the Study Area have not been assigned a conservation status and therefore are allocated a ranking of Low for criterion F.

Table A.16 Raptors Group Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate		X		X		
High	X					
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	Moderate	

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