



Bird and Bat Adaptive Management Plan

Crookwell 3 Wind Farm

Prepared for Global Power Generation Australia Pty Ltd

Prepared by Emily Zouch

30 July 2024



ABOUT THIS DOCUMENT

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DOCUMENT TRACKING

Version	Date	Author	Reviewer	Details
DRAFT v0.1	02/02/2024	Emily Zouch, Shu Lee	Simon Vinson	Draft partial report released for review by GPG
DRAFT v0.2	07/02/2024	Emily Zouch		Draft partial report released for review by DCCEEW(NSW)
DRAFT v0.2	21/03/2024	Emily Zouch	Simon Vinson	Draft report released for review by GPG
DRAFT v0.3	09/04/2024	Emily Zouch	Simon Vinson	Draft report released for external review DCCEEW(NSW)
Provisional v1.0	29/04/2024	Emily Zouch	Simon Vinson	Report for submission DPHI
Provisional v1.1	24/05/2024	Emily Zouch		Incorporation of autumn data. Report for final release.
Provisional v1.2	10/07/2024	Emily Zouch		Incorporation of DCCEEW feedback. Report for final release.
Provisional v1.3	12/07/2024	Emily Zouch		Additional DCCEEW edits
Provisional v1.4	30/07/2024	Emily Zouch		Incorporation of track changes v1.2 and v1.3. Incorporation of DPHI feedback. Report for final release.

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Executive summary

Project background

The proponent has developed Crookwell 3 Wind Farm (the Project), a 16-turbine wind farm 17 km southeast of Crookwell and 25 km northwest of Goulburn NSW. Conditions of Consent for the commissioning of the Project require the updating of the Crookwell 2 Wind Farm Bird and Bat Adaptive Management Plan (BBAMP) to include the development of the Project. This BBAMP has taken the approach of collecting up-to-date, relevant baseline data at Crookwell 3 Wind Farm to accurately assess the risks to bird and bat populations present within the area, while thoroughly taking into consideration all available data from Crookwell 2 Wind Farm to assess the cumulative effects of both wind farms. Implementation of this BBAMP has only been assessed for the application to Crookwell 3 Wind Farm.

Pre-operational bird and bat information

Baseline bird surveys completed for the production of this BBAMP were completed in August 2023, October/November 2023, January/February 2024 and March/April 2024 surveys. Surveys include bird utilisation surveys, raptor vantage point surveys and nocturnal surveys (**Section 2.2**). Bat passive acoustic detection surveys were completed in November 2023 and in March 2024 (**Section 2.3**).

Eight threatened and one migratory bird species were observed within or near Crookwell 3 Wind Farm to warrant inclusion in risk assessments. Three threatened bat species were positively identified through call analysis at ground monitoring sites, no threatened species were positively identified at RSA height monitoring sites. All threatened species observed are listed in **Table E 1**.

TABLE E 1: THREATENED SPECIES FINDINGS DURING BASELINE SURVEYS

Species name	EPBC Act Status	BC Act Status
Birds		
Black Falcon	-	Vulnerable
Dusky Woodswallow	-	Vulnerable
Gang-gang Cockatoo	Endangered	Endangered
Little Eagle	-	Vulnerable
Rufous Fantail	Migratory	-
Scarlet Robin	-	Vulnerable
Superb Parrot	Vulnerable	Vulnerable
Varied Sittella	-	Vulnerable
White-bellied Sea-Eagle	-	Vulnerable
Bats		
Eastern False Pipistrelle	-	Vulnerable
Greater Broad-nosed Bat	-	Vulnerable
Large Bent-winged Bat	-	Vulnerable

Several pre-baseline ecological studies were carried out at Crookwell 3 Wind Farm. This data, as well as data from bird and bat surveys conducted at Crookwell 2 Wind Farm was used to inform risk assessments in this document.

Bird and bat risk assessment

The bird and bat risk assessment identifies species or groups of species considered to be potentially ‘at risk’ from collision with turbines or otherwise impacted by operating turbines at the Crookwell 3 Wind Farm (**Section 3**). An assessment of risk was quantified by estimating the likelihood of impacts ascribed through a two-criteria assessment, and estimation of consequence through the assessment of four

criteria. The resulting ‘low’, ‘moderate’ or ‘high’ rankings were input to a risk matrix to determine the overall risk Crookwell 3 Wind Farm poses to assessed species.

Of the 23 species assessed, one species is considered to be at ‘severe’ risk, six species are considered a ‘high’ risk, and eleven are considered a ‘moderate’ risk of being impacted by the Crookwell 3 Wind Farm. The species most considered to be at risk from direct impacts from the operation of Crookwell 3 Wind Farm are:

- Large Bent-winged Bat (‘severe’ ranking);
- Little Eagle (‘high’ ranking);
- Black Falcon (‘high’ ranking);
- White-throated Needletail (‘high’ ranking);
- Gang-gang Cockatoo (‘high’ ranking);
- Eastern False Pipistrelle (‘high’ ranking); and
- Yellow-bellied Sheathtail-bat (‘high’ ranking).

Turbine risk assessment

A turbine risk assessment has been prepared to assess the specific risk associated with each turbine, determining risk through proximity to landscape and habitat features that are known or likely to increase flight activity of ‘at risk’ species. The turbine risk assessment assesses the risk each turbine poses to the species that have been identified as having a ‘moderate’ or higher risk rating from the Bird and Bat Risk Assessment. **Table E 2** summarises the final risk rating for each turbine. Full risk assessment detailed in **Section 4**.

TABLE E 2: TURBINE RISK RATINGS

Turbine	A3	A4	A5	A8	A9	A10	A12	A13	A15	A16	A17	A20	A21	A22	A24	A25
Risk	High	Med.	High	High	High	High	Very High	Very High	Very High	High	Very High	Very High	Very High	Very High	Very High	Very High

Due to the findings of this risk assessment, this BBAMP has a particular emphasis on the monitoring programs employed and that well defined impact trigger mechanisms are in place to ensure additional appropriate mitigation measures are enacted in the case significant impacts are a result of operations.

Bird and bat monitoring program

Operational phase monitoring of the Project is to be conducted to meet the requirements of the consent conditions and ensure that any potential impacts reasonably attributed to the operation of the Project are detected.

BIRD AND BAT SURVEYS

Bird and bat surveys will be continued post-construction in alignment with baseline surveys for the first two years of operation, and again in the fifth year post-construction. The methods utilised for the surveys will replicate the methods of the baseline surveys. Surveys will include, bird utilisation surveys, raptor vantage point surveys and bat surveys (refer to **Section 5.2** and **Section 5.3**).

CARCASS MONITORING

Carcass monitoring will be conducted in two phases:

- **Phase 1: Pre-commissioning carcass search program.**
 - Carcass monitoring will be conducted during all hold point testing operations of active turbines.
 - During hold point testing stage one (HP0), one turbine will be active. It is recommended that A4 is utilised for this test period (refer to risk assessment **Section 4.3**) Each day this turbine is active, daily carcass searches will be employed.
 - During hold point testing stage two (HP1), eight turbines will be active. It is recommended that turbines A3, A4, A5, A8, A9, A10, A13 and A16 are utilised for this test period (refer to risk assessment **Section 4.3**). Carcass monitoring will occur weekly at all active turbines for the duration of this testing period.
 - Carcass monitoring within the pre-commissioning period will be subject to the BBAMP impact triggers response framework. All data collected, and subsequent revised risk assessment, will be included within three-month review of the Provisional BBAMP (refer to **Section 8.2**).
- **Phase 2: Commissioned carcass search program.**
 - The full carcass search program (refer to **Section 5.4.2.2** for frequency) will begin in the first month of commissioning (all 16 turbines active) for a period of five years at all Project turbines. A review of the program will be completed after two years in agreement with BCS (refer to **Section 8.2**).

Carcass monitoring program includes carcass detectability trials and carcass persistence trials. All surveys to be implemented are summarized in **Table E 3**.

TABLE E 3: SURVEYS TO BE IMPLEMENTED AT CROOKWELL 3 WIND FARM

Survey	Timing	Initiation Duration
Pre-commissioning carcass searches	Carcass searches will be conducted on all active turbines, daily during the hold point testing period HP0 and weekly during HP1 testing period.	Until the implementation of the full Carcass Search Program.
Bird Utilisation Surveys	Ongoing with alignment to baseline surveys, four seasons surveyed in August, November-October, January-February and March/April.	First two years following commissioning and fifth year after commissioning. Subject to review, as seen in Section 8.2 . Addition surveys as triggered.
Raptor Vantage Point Surveys	Ongoing with alignment to baseline surveys, four seasons surveyed in August, November-October, January-February and March/April.	First two years following commissioning and fifth year after commissioning. Subject to review, as seen in Section 8.2 . Addition surveys as triggered.
Bat Surveys	Ongoing with alignment to baseline surveys, two seasons surveyed, consistent with the migratory period of Large Bent-winged Bat	First two years following commissioning and fifth year after commissioning. Subject to review, as seen in Section 8.2 . Addition surveys as triggered.
Carcass Search Program	Once per month, commencing within one month of all turbines becoming active at the wind farm.	Five years, subject to review, see Section 8.2 .
Carcass Persistence Trials	Winter and spring following the commencement of the operation	Two years.
Carcass Detectability Trials	Winter and spring following the commencement of the operation	One year.
Incidental bird and bat finds	To be conducted opportunistically throughout the operational life of the Project.	The operational life of the Project.
Targeted Searches	Subject to recommendations by species experts, BCS and through changing risk assessments, may include targeted surveys for threatened or migratory species	As determined and subject to triggers.

Impact triggers and response procedure

Impact trigger thresholds for threatened and non-threatened bird and bat species will be implemented with specific response processes to be followed in the case where a trigger threshold has been met. These triggers and responses aim to prevent the operational phase of this Project from causing significant impacts on local and/or total populations of birds and bat species.

For threatened bird and bat species that have been identified as a 'high' or 'severe' risk species (**Section 3.3**), a significant impact is defined as one impacted individual. This has been determined appropriate as these species have been assessed as having a likely presence within the Project area and therefore one impact indicates a likelihood for multiple impacts to the species and therefore likely to be a regular occurrence and a significant impact.

The determination of a significant impact on a local and/or total population of all other bird or bat species has not been prescribed by this BBAMP as each species' case has distinct variables that will be examined during each relevant assessment. The impact assessment process ascribed will be used to inform the NSW and/or Commonwealth DCCEEW whether a significant impact has or is likely to occur on a species, further triggering additional monitoring or mitigation in consultation with the relevant department. Refer to **Section 6.1** for the threatened species impact trigger, and **Section 6.2** for non-threatened species impact triggers.

Mitigation measures

Mitigation measures will be utilised to manage the risk of the Project leading to significant impacts on bird and bat species. The Conditions of Consent addresses multiple areas of mitigation measures that the BBAMP should engage with including lighting on turbines, reducing raptor perches, pest control measures, land-use and stock control measures, **Section 7.1** details the current actions towards each of these mitigation measures.

In the event that impact trigger thresholds have been met and where significant impacts have occurred and/or the impacts are likely a regular occurrence additional mitigation measures will be implemented. These mitigation measures will be targeted to reduce the risk to impacted species identified through carcass detection and the decision-making framework. A series of additional mitigation measures have been agreed to for consideration including, acoustic deterrents, ultrasonic deterrents, camera detection systems, radar detection systems, GPS monitoring of threatened species, altering turbine visuals, enhancing impacted species and their local population through funding contributions, offsetting and altering wind turbine cut-in speeds (**Section 7.2**).

Mitigation measures to be considered will evaluate new technology and novel approaches, with a review of new research and strategies used, which will inform potentially suited measures for Crookwell 3 Wind Farm.

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Shortened forms

BAM	Biodiversity Assessment Method
BBAMP	Bird and Bat Adaptive Management Plan
BC Act	Biodiversity Conservation Act 2016 (NSW)
BCS	Biodiversity, Conservation and Science
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
BUS	bird utilisation survey
C2WF	Crookwell 2 Wind Farm
Cth	Commonwealth
DCCEEW	Department of Climate Change, Energy, Environment and Water NSW)
DPHI	Department of Planning, Housing and Infrastructure
EIS	Environmental Impact State
EPBC	Environment Protection and Biodiversity Conservation
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cth)
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
ha	hectares
IPC	Independent Planning Commission
km	kilometres
kV	kilovolt
LEC	Land and Environmental Court
LGA	Local Government Area
m	metres
NSW	New South Wales
PCT	plant community type
RSA	rotor swept area
RVPS	raptor vantage point survey
SPRAT	Species Profile and Threats Database
TBDC	Threatened Biodiversity Data Collection

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iii. Threatened species referenced in this document

Scientific name	Common name	EPBC Act Status	BC Act Status	Utilised in risk assessment	Risk rating
<i>Aphelocephala leucopsis</i>	Southern Whiteface	Vulnerable	Vulnerable	Y	Negligible
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	—	Vulnerable	Y	Moderate
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	Endangered	Endangered	Y	High
<i>Daphoenositta chrysoptera</i>	Varied Sittella	—	Vulnerable	Y	Moderate
<i>Epthianura albifrons</i>	White-fronted Chat	—	Vulnerable	Y	Moderate
<i>Falco subniger</i>	Black Falcon	—	Vulnerable	Y	High
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	—	Vulnerable	Y	High
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	—	Vulnerable	Y	Moderate
<i>Hieraetus morphnoides</i>	Little Eagle	—	Vulnerable	Y	High
<i>Hirundapus caudacutus</i>	White-throated Needletail	Vulnerable & Migratory	Vulnerable	Y	High
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	—	Vulnerable	Y	Severe
<i>Ninox connivens</i>	Barking Owl	—	Vulnerable	Y	Moderate
<i>Ninox strenua</i>	Powerful Owl	—	Vulnerable	Y	Moderate
<i>Petroica boodang</i>	Scarlet Robin	—	Vulnerable	Y	Low
<i>Petroica phoenicea</i>	Flame Robin	—	Vulnerable	Y	Low
<i>Polytelis swainsonii</i>	Superb Parrot	Vulnerable	Vulnerable	Y	Moderate
<i>Rhipidura rufifrons</i>	Rufous Fantail	Migratory	—	Y	Moderate
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	—	Vulnerable	Y	High
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	—	Vulnerable	Y	Low
<i>Stagonopleura guttata</i>	Diamond Firetail	Vulnerable	Vulnerable	Y	Low
Mentioned in this document					
<i>Anthochaera phrygia</i>	Regent Honeyeater	Critically endangered	Critically endangered	N	—
<i>Calyptorhynchus lathami lathami</i>	South-eastern Glossy Black-Cockatoo	Vulnerable	Vulnerable	N	—
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (south-eastern)	Vulnerable	Vulnerable	N	—
<i>Lathamus discolor</i>	Swift Parrot	Critically Endangered	Endangered	N	—
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern)	Endangered	Endangered	N	—
<i>Pyrrholaemus sagittatus</i>	Speckled Warbler	—	Vulnerable	N	—

1 Introduction

1.1 Background

This Bird and Bat Adaptive Management Plan (BBAMP) has been prepared by Ecology Consulting Pty Ltd on behalf of Global Power Generation Pty Ltd (the proponent) for Crookwell 3 Wind Farm (the Project). The Project is located approximately 17 km southeast of Crookwell and 25 km northwest of Goulburn NSW and is adjacent to the existing Crookwell 2 Wind Farm (C2WF).

The development application was initially refused by the Independent Planning Commission (IPC). In the IPC's Statement of Facts and Contentions, ecological issues relating to insufficient information available to assess the Project's impacts on biodiversity were cited. On 24 April 2020, the developer filed a Class 1 appeal (2020/123021) in the LEC against the IPC's refusal of the development application and subsequently addressed the IPC's Statement of Facts and Contentions list, resulting in the final approval of the development application based on the amended Project layout. Development Consent (SSD 6695) was granted by the Land and Environmental Court (LEC) of NSW under the *Environmental Planning & Assessment Act 1979* (EP&A Act) on 14 October 2020.

In accordance with Section 24 Schedule 3 of the Development Consent, the C2WF BBAMP must be updated to include the Project in consultation with the Biodiversity Conservation Division, South East (BCS), of the NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) and approved to the satisfaction of the Secretary of Department of Planning, Housing and Infrastructure (DPHI). This BBAMP has been prepared to satisfy the conditions of this Development Consent, with all commitments listed within this BBAMP being implemented and adhered to for the lifetime of the Project.

Construction of the Project commenced in November 2022, with commissioning projected to commence in June 2024, and full operation of the Project is expected by August 2024.

1.2 Requirements of BBAMP

Conditions of Consent for the commissioning of the Project require the updating of C2WF BBAMP to include the development of the Project. This BBAMP has taken the approach of collecting up-to-date, relevant baseline data for the Project to accurately assess the risks to bird and bat populations present within the Project area, while thoroughly taking into consideration all available data from C2WF to assess the cumulative effects of both wind farms. Implementation of this BBAMP has only been assessed for the application to the Project.

1.2.1 DEVELOPMENT CONSENT

Conditions of Consent issued under section 4.38 of the EP&A Act approved by the LEC are the specific commitments to be met by this document. Details of these commitments and where they have been addressed within the document are summarised in **Table 1**.

TABLE 1: DEVELOPMENT CONSENT CONDITIONS RELEVANT TO THE BBAMP

SSD6695 conditions	BBAMP section
24. Prior to the commissioning of any wind turbines, the Applicant must update the Crookwell 2 Wind Farm Bird and Bat Adaptive Management Plan to include the development in consultation with BCS, and to the satisfaction of the Secretary. This plan must include:	
a) at least 12 months' worth of baseline data on threatened and 'at risk' bird and bat species and populations in the locality that could be affected by Crookwell 2 Wind Farm and the development;	Section 2 and Attachment 1
b) a detailed description of the measures that would be implemented on site for minimising bird and bat strike during operation of the development, including: - minimising the availability of raptor perches on wind turbines; - bird and bat mortality monitoring including surveys, estimates of annual strikes prompt carcass removal; - measures to control feral pests and stock that might attract foraging raptors; and - using best practice methods for bat deterrence, including managing potential lighting impacts;	Carcass monitoring: Section 5.4 Mitigation: Section 7
c) trigger levels for further investigation of the potential impacts of the Development on particular bird or bat species or populations;	Section 6
d) an adaptive management program that would be implemented if the development is having an adverse impact on a particular threatened or 'at risk' bird and/or bat species or populations; including the implementation of measures to: - reduce the mortality of those species or populations such as land management and reducing - threatened and 'at risk' bird and bat species activity around turbines; or - enhance and propagate those species or populations in the locality; and	Section 7
e) a detailed program to monitor and report on: - the effectiveness of these measures; and - any bird and bat strikes on site; - incidences of reaching trigger levels;	Monitoring program: Section 5 Reporting: Section 8.1
f) provisions for a copy of all raw data collected as part of the monitoring program to be submitted to BCS and the Secretary.	Section 8
Following the Secretary's approval, the Applicant must implement the updated Crookwell 2 Wind Farm Bird and Bat Adaptive Management Plan	

1.2.2 LEGISLATION AND OTHER ENVIRONMENTAL MANAGEMENT REQUIREMENTS

Legislation and guidelines relevant to this BBAMP include:

- *Biodiversity Conservation Act 2016* (BC Act),
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act),
- Environmental Management Plan Guidelines (Department of the Environment, 2014),
- Draft Wind Energy Guideline: Guidance for state significant wind energy development (DPE, 2023),
- Biodiversity Assessment Method 2020 (DPIE, 2020), and
- Onshore Wind Farms – interim guidance on bird and bat management (provided by Department of Agriculture, Water and the Environment (Cth)).

1.3 Objectives of BBAMP

The objective of this BBAMP is to set management measures, robust monitoring methods and impact triggers that respond adaptively to mitigate impacts attributed to the operation of the Project. This BBAMP aims to implement strategies that safeguard bird and bat species to prevent significant impacts on total or local populations. A summary of how this BBAMP will action this goal is presented in **Table 2**.

Baseline surveys were completed to inform bird and bat diversity and flight activity over four seasons of survey. The Pre-operational Bird and Bat Report (**Attachment 1**) details methods and findings that inform this document.

To achieve the objectives of this BBAMP, two risk assessments have been completed; assessing the overall risk the Project poses to identified 'at risk' bird and bat species, and assessing the risk of each individual turbine. The Bird and Bat Species Risk Assessment (**Attachment 2**) details a thorough species risk assessment that refines which 'at risk' species are likely to be impacted by the Project. Twenty-two species and one species group were assessed in the bird and bat risk assessment. The 'at risk' species that scored a 'moderate' risk rating or higher were then used in the turbine risk assessment. The outcomes of these risk assessments inform what species are most at risk of impacts from the Project and where these impacts will likely occur.

The information analysed in risk assessments better informs monitoring and mitigation objectives presented in this BBAMP. Continued monitoring will inform future risk assessments and allow for the indication of the need to change management or monitoring strategies.

The implementation of this BBAMP will take an adaptive approach, therefore if more effective management measures and mitigation strategies are determined in the future, the approach should be amended to best include these strategies. This BBAMP is to be implemented, reviewed and refined through ongoing consultation with regulators and through maintaining up-to-date information on emerging research and mitigation technologies.

TABLE 2: A SUMMARY OF THE OBJECTIVES OF THIS BBAMP

BBAMP Objectives	BBAMP section
Determine 'at risk' bird and bat species within the Project area.	Section 2
Assess the risk to bird and bat species.	Section 3
Assess turbine risk.	Section 4
Set a robust monitoring program for ongoing bird and bat surveys for the detection of changes to local populations of birds and bats that can be reasonably attributed to the Project entering the operational phase.	Section 5
Set a robust monitoring program for carcass surveys to record the direct impact.	Section 5.4
To detail the agreed decision-making framework that defines the actions taken upon impacts to bird and bat populations identified from an impact trigger threshold being met, as a result of monitoring or detection of other unacceptable impacts.	Section 6
To detail implemented and potential mitigation measures and how the implementation of these strategies would occur to reduce impacts on bird and bat species.	Section 7
To address report review and ongoing outcomes of monitoring, the decision framework and implementation of mitigation strategies.	Section 8

1.3 Roles and responsibilities

It is the responsibility of the proponent to meet the objectives of this BBAMP and ensure the roles and responsibilities of the BBAMP are in alignment with the obligations of other environmental management plans. The proponent will be responsible for ensuring that implementation of monitoring (**Section 5**), mitigation and management (**Section 7**) and reporting requirements (**Section 8**) are adhered to. This must include administering effective practices including but not limited to, timely communication and negotiation with landholders, suitable site-staff training, and the ongoing application of mitigation measures for sound ecological outcomes.

1.4 Site description

1.4.1 PROJECT AREA

The Project is located approximately 17 km southeast of Crookwell and 25 km northwest of Goulburn NSW within the Upper Lachlan Shire Local Government Area (LGA). The Project area is approximately 1,080 ha, and is defined as the parcel of land known as the 'project site' assigned by the Crookwell 3 Wind Farm Biodiversity Development Assessment Report (BDAR) (Cumberland Ecology, 2022).

The Project is situated on the higher ridgelines of the generally undulating hills of multiple agricultural properties. Historic land use has led to widespread land clearing throughout the area, particularly in the north-western section of the Project area. However, large and small patches of native forest are fragmented throughout the central, southern and eastern areas of the Project area. Despite land clearing, derived native grasslands are present in large areas.

1.4.2 NATIVE VEGETATION

On the upper slopes, large patches of native vegetation dominated by Silvertop Ash (*Eucalyptus sieberi*) and Broad-leaved Peppermint (*E. dives*) can be found in the south and east of the Project area. Generally, open forest can be found throughout the mid-slope areas, dominated by Red Stringybark (*E. macrorhyncha*), Brittle Gum (*E. mannifera*) and Scribbly Gum (*E. rossii*). Only scattered paddock trees remain on lower slopes, where historic clearing for agriculture has disturbed much of the landscape, including small stands of Yellow Box (*E. melliodora*) woodland with Red Stringybark co-dominant.

1.4.3 FAUNA HABITAT

Despite disturbance, the localised areas of forest provide various breeding and sheltering habitat features including many hollow bearing trees, evidence of small to medium sized stick nests, and fallen timber and debris. Foraging habitat for a range of bird and bat species is present within the Project area, including:

- flowering eucalyptus sp. for foraging honeyeaters, parrots and cockatoos;
- mistletoe for foraging honeyeater species;
- complex midstory structure in some areas for foraging small birds;
- rocky outcrops that likely habit reptiles for hunting birds;
- multiple small water bodies such as a creek and agricultural dams for foraging waterbirds, raptors and bats; and
- areas of intact canopy that support arboreal mammals, birds and insects for predatory birds and bats.

No major waterbird habitat such as wetlands, swamps or shallow lakes occur within the Project area. Pejar Dam (local water storage) is located approximately 5 km from Project turbine locations. Being an artificial water storage area, Pejar Dam contains generally steep slopes, limited fringing aquatic vegetation and mudflats, providing limited habitat typically suited to support a diverse range of waterbird species. However, it is important to note, that a diverse range of waterbird species and multiple threatened species have been sighted at Pejar Dam in previous studies, databases and incidental observations for this BBAMP.

Habitat quality throughout the site is varied, with the northwestern section, where historic clearing has removed the majority of native vegetation, habitat quality would be considered low. However, in areas where native canopy exists, habitat quality can range from moderate to high. Important habitat features include hollow bearing trees, mistletoe, and large areas of intact canopy for foraging and breeding are likely to support a diversity of species.

1.5 Overview of the Project

The development of the Project involves the construction, operation, maintenance and decommissioning of:

- 16 wind turbines situated on a crane hard stand area allowing for turbine material to be stored during the construction process. Each turbine consists of a three-blade rotor mounted on a tower, with the following specifications:
 - maximum hub height of 94 m;
 - maximum rotor diameter of 126 m; and
 - maximum tip height of 157 m.
- underground electrical and communication cable network that links internal turbines within the site and connected to the C2WF substation;
- one temporary batch plant for use during the construction phase, to supply concrete, store materials, equipment (now demobilised) and one section for the Project site office;
- internal site unsealed roads suitable for turbine construction;
- upgrade to local road infrastructure to allow access to the site (primarily Graywood Siding Road); and
- up to three wind monitoring masts.

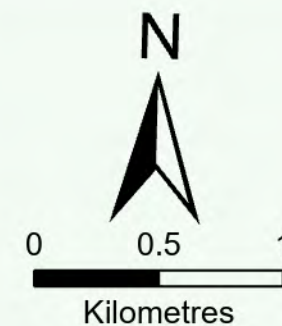
The final layout of the Project is presented in **Figure 1**. A detailed overview of the Project can be found in the Environmental Impact Statement (EIC (Tract Consultants, 2012) and Addendum EIS (Mecone, 2018) previously submitted to the Planning Portal and the Project's website (<https://crookwellthreewindfarm.globalpower-generation.com.au/the-Development/relevant-documentation/>).

1.6 Consultation

This BBAMP has been prepared in consultation with the Biodiversity Conservation Division (BCS) of the NSW DCCEEW (formerly Department of Planning and Environment (DPE)) since July 2023. Draft sections of the BBAMP were submitted to BCS for consultation and review on 9 February 2024. A second full draft was submitted to BSC for review on 9 April 2024. Consultation on the 18 April 2024 resulted in amendments to the BBAMP, including addressing impact triggers and mitigation measures implementation.

A consultation meeting again occurred on the 9 July 2024 to confirm adjustments and final edits recommended on the 11 July 2024. Adjustments included commitments to carcass monitoring program for five years and reviewing monitoring programs in agreement with BCS.

EPBC Act referral to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) (formerly Department of Agriculture, Water and the Environment (DAWE)) occurred in 2021 by Cumberland Ecology. The referral decision found proposed action is not a controlled action.



Legend

- Project footprint
- Hydro area
- Project area
- Named watercourse
- Contour



FIGURE 1: Project layout

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:21/05/2024

1.7 Information sources

Desktop research was undertaken to identify site characteristics, landscape context and threatened species and ecological communities known or likely to occur in or within 10 km of the study area. The databases, resources and search tools included the:

- Atlas of Living Australia;
- Biodiversity Assessment Method Calculator;
- Biodiversity Assessment Method Operational Manual Stage 1;
- Biodiversity Assessment Method Operational Manual Stage 2;
- BioNet Atlas of NSW Wildlife;
- BioNet Threatened Biodiversity Data Collection (TBDC);
- BioNet Vegetation Classification;
- Commonwealth EPBC Act Protected Matters Search Tool;
- National Species Profiles and Threats (SPRAT) database;
- NSW and Commonwealth guidelines for targeted threatened species surveys; and
- NSW Threatened Biodiversity Profile tool.

Full citations for these sources can be found in **References**. Importantly, several key documents produced by other consultancies were used to inform the presence of species within the Project area and at C2WF. These documents include:

- Anderson Environmental Consultants Pty Ltd. (2010). Ecological Assessment for Crookwell 3 Wind Farm, Version 3.4, for Crookwell Development Pty Ltd, Revised September 2012,
- Brett Lane & Associates Pty Ltd (BL&A). (2017). Crookwell 2 & 3 Wind Farms, Bird and Bat Utilisation Surveys, Report No. 8172(9.1) for Crookwell Development Pty Ltd, May 2017
- Brett Lane & Associates Pty Ltd (BL&A). (2018a). Crookwell 2 & 3 Wind Farms, Bird and Bat Utilisation Surveys, Report No. 8172(10.1) for Crookwell Development Pty Ltd, September 2018
- Brett Lane & Associates Pty Ltd (BL&A). (2018b). Crookwell 2 Wind Farm, Bird and Bat Adaptive Management Plan, Report No. 8172(8.3) for Crookwell Development Pty Ltd, September 2018
- Cumberland Ecology. (2022). Crookwell 3 Wind Farm Biodiversity Development Assessment Report (Revised), Report 19262RP4, for Crookwell 3 Development Pty Ltd, April 2022
- Environmental Resources Management Australia (ERM). (2013). Crookwell 3 Wind Farm Supplementary Ecology Report, Report 0193328, for Crookwell Development Pty Ltd, April 2013
- Environmental Resources Management Australia (ERM). (2016). Crookwell 3 Wind Farm, Addendum Ecology Report -RSA Revision, Report P0326056 Final, for Crookwell Development Pty Ltd, March 2016
- Nature Advisory. (2020). Crookwell 2 Wind Farm, Annual Report on the Implementation of the Bird and Bat Adaptive Management Plan, Report No. 8172(25.0) for Crookwell Development Pty Ltd, February 2020
- Nature Advisory. (2021). Crookwell 2 Wind Farm, Second Annual Report on the Implementation of the Bird and Bat Adaptive Management Plan, Report No. 8172(41.0) for Crookwell Development Pty Ltd, July 2021

2 Pre-operational bird and bat information

2.1 Pre-baseline survey investigations

A number of ecological investigations were conducted prior to when Ecology Consulting were engaged to conduct baseline surveys, these included multiple habitat, bird and bat surveys. Some of these surveys were conducted for the Project EIS, and others are surveys in service of the production of C2WF BBAMP which included two survey sites within the Project area. In addition, the monitoring conducted in accordance with C2WF BBAMP, including bird surveys, 'at-risk' species monitoring, and carcass monitoring was included for consideration for this BBAMP. Surveys conducted within the Project area and relevant surveys at C2WF can be found in **Table 3**.

TABLE 3: OVERVIEW OF SURVEYS CONDUCTED AT C2WF AND THE PROJECT AREA RELEVANT TO THIS BBAMP

Survey time	Consultancy	Survey location	Survey type	Targeted species
January 2010 – February 2010	Anderson Environmental Consultants	Project area	Microchiroptetan bat survey	N/A
			Bird surveys with call playbacks	Regent Honeyeater
			Diurnal surveys and stag watches	Brown Treecreeper, Diamond Firetail, Hooded Robin, Speckled Warbler, Varied Sittella, Scarlet Robin, Gang-gang Cockatoo, Glossy Black-Cockatoo and Superb Parrot
			Owl nest tree searches	Barking Owl and Powerful Owl
March 2013	ERM	Project area	Threatened fauna habitat surveys	N/A
July-August 2013	ERM	Project area	Bat surveys (songmeters)	N/A
			Regent Honeyeater and Swift Parrot surveys	Regent Honeyeater and Swift Parrot
			Raptor nest searches	N/A
			Spotlighting and call playback	Barking Owl and Powerful Owl
February 2017	BL&A	C2WF & Project area	Bird utilisation surveys	N/A
March-April 2017	BL&A	C2WF & Project area	Bird utilisation surveys	N/A
November-December 2017	BL&A	C2WF & Project area	Bird utilisation surveys	N/A
			Bird utilisation surveys	N/A
January-December 2019	Nature Advisory	C2WF	Monthly carcass searches	N/A
			'At risk' monitoring: incidental observation, point-count surveys (Sep-Nov 2019)	N/A
			Bird Utilisation Surveys (Feb 2019)	N/A
March 2020	Cumberland Ecology	Project area	Bird surveys, tree hollow searches	Gang-gang Cockatoo and Glossy Black-Cockatoo
			Raptor nest surveys	White-bellied Sea Eagle and Little Eagle
			Hollow searches, call playback and spotlighting	Powerful Owl
			Microchiropteran bat surveys	N/A
January-December 2020	Nature Advisory	C2WF	Monthly carcass searches	N/A
			'At risk' monitoring: incidental observation, point-count surveys (July 2020-Feb 2021)	N/A
			Bird utilisation surveys (Feb, Nov and Dec 2020)	N/A
July 2021	Cumberland Ecology	Project area	Raptor nest surveys	White-bellied Sea Eagle and Little Eagle
			Hollow searches, call playback and spotlighting	Powerful Owl
November 2021	Cumberland Ecology	Project area	Diurnal bird surveys and nest searches	Superb Parrot

2.1.1 PRE-BASELINE SURVEY RESULTS

Pre-baseline survey results have been collected to indicate threatened species presence within the Project area in the past and inform the species' potential presence during the operation of the Project. **Table 4** details the threatened species' findings from available documents. These historical records were used to inform the bird and bat risk assessment in **Attachment 2**.

TABLE 4: SURVEY RESULTS CONDUCTED AT C2WF AND THE PROJECT RELEVANT TO THIS BBAMP

Note: Data collected the C2WF Second Annual Report on the Implementation of the Bird and Bat Adaptive Management Plan does not release raw data, therefore could not be included in this assessment.

Survey time	Consultancy	Survey location	Species Detected	Additional Information
March 2013	ERM	Project area	Little Eagle	One individual – flyover near A8 (opportunistic observation)
			Scarlet Robin	Two individuals – in largest eastern patch of forest (opportunistic observation)
			Varied Sittella	Three individuals – in forest near A12 (opportunistic observation)
			Dusky Woodswallow	No further information, species was not listed at time of surveys
			White-fronted Chat	Two individuals – in open pasture at Project entrance (opportunistic observation)
			Gang-gang Cockatoo	Six individuals – in flight then perched approx. 250 m east A12 (opportunistic observation)
			White-throated Needletail	Four individuals – flyover near A12 (opportunistic observation)
July-August 2013	ERM	Project area	Powerful Owl	Spotlighting and Call Playback
February 2017	BL&A	C2WF & Project area	Varied Sittella	Recorded in BUS counts flying below RSA height at the Project
March-April 2017	BL&A	C2WF & Project area	Yellow-bellied Sheathtail-bat	One sing call recorded flying below RSA height at C2WF
			Large Bent-winged Bat/Forest Bat complex	Recorded flying below RSA height at C2WF
November 2017	BL&A	C2WF & Project area	Dusky Woodswallow	Recorded in BUS counts flying 90% below RSA height at sites on C2WF and Project area. Incidental records also made
			Diamond Firetail	Incidental records made between C2WF and Project area
			Varied Sittella	Recorded in BUS counts flying below RSA height at sites on Project area
November-December 2017	BL&A	C2WF & Project area	Yellow-bellied Sheathtail-bat	Five possible calls were recorded flying below RSA height at Project area (approx. 500 m west of A3)
			Large Bent-winged Bat/Forest Bat complex	Recorded flying below RSA height at C2WF and Project area (approx. 500 m west of A3 and 300 m NW of A13)
February 2019	Nature Advisory	C2WF	Diamond Firetail	Recorded in BUS counts flying below RSA height at C2WF
			Dusky Woodswallow	Recorded in BUS counts flying below RSA height at C2WF
			Varied Sittella	Recorded in BUS counts flying below RSA height at C2WF reference site
July 2019	Nature Advisory	C2WF	Black Falcon	One carcass found at C2WF
March-November 2019	Nature Advisory	C2WF	Black Falcon	Six incidental observations (flight mapped)
			Little Eagle	One incidental observation (flight mapped)
February 2020	Nature Advisory	C2WF	Black Falcon	One carcass found at C2WF
			Little Eagle	One carcass found at C2WF
March 2020	Cumberland Ecology	Project area	Gang-gang Cockatoo	Recorded during bird surveys
			Scarlet Robin	Recorded during bird surveys

August 2020	Nature Advisory	C2WF	Varied Sittella	Recorded during bird surveys
			Dusky Woodswallow	Recorded during bird surveys
			Yellow-bellied Sheath-tail-bat	Recorded during microchiropteran surveys
			Large Bent-winged Bat	Recorded during microchiropteran surveys
February-November 2020	Nature Advisory	C2WF	Black Falcon	One carcass found at C2WF
February-November 2020	Nature Advisory	C2WF	Black Falcon	Six observations during 'at risk' monitoring (point count surveys) and nine incidental observations (flight mapped).
			Little Eagle	Eight observations during 'at-risk' monitoring (point count surveys).
			White-bellied Sea-Eagle	One incidental raptor observation (flight mapped)
October 2022	Ecology Consulting	Project area	Little Eagle	Incidental observation on Graywood Siding Road

2.2 Bird surveys

Pre-operational baseline bird surveys have been conducted between August 2023 and April 2024 to inform the preparation of this report. The pre-operational bird and bat survey report detailing methods and results can be found in **Attachment 1**. Surveys conducted were completed by either an ornithologist and ecologist or field officer, or an ecologist with a suitably skilled field officer. An overview of surveys and results will be summarised below.

Bird utilisation surveys (BUS) were undertaken as diurnal fixed point count surveys at six impact sites and two reference sites during August 2023, October/November 2023, January/February 2024 and March 2024. A total of 370 BUS surveys were completed across the three survey periods. Each survey takes 20 minutes and is completed by two surveyors, totalling 246.6 person-hours for the seasons surveyed so far. A total of 94 bird species were observed during BUS, including the observation of five threatened species and one listed migratory species.

Raptor vantage point surveys (RVPS) were completed using the circular plot survey method across August 2023, October/November 2023, January/February 2024 and March/April 2024. The 60 minutes surveys were completed a total of 117 times across the four-season period. Surveys were largely completed by two surveyors, totalling 225 person-hours. A total of 215 observations of raptor activity were recorded across three internal impact sites and three off-site control sites during RVPS. A total of 307 raptor flight paths were recorded and mapped, including RVPS, raptor observations during BUS and incidental observations. One observation of a threatened species was confirmed during RVPS within the Project area.

Nocturnal surveys were conducted throughout August 2023, October/November 2023, January/February 2024 and March/April 2024. The surveys at a minimum were conducted over 60 minutes, a total of 19 nights were surveyed across the four-season period. Surveys were conducted by two surveyors with effort at minimum totalling 38 person-hours. No threatened species were observed during nocturnal surveys.

Incidental observations of threatened species were recorded when observed outside of formal survey times or outside of the Project area but within species likely foraging or traversal range from the Project area to warrant note. Seven threatened species were observed through incidental observations from within, close to the Project area and in the local area of the Project area.

A total of 101 bird species have been observed from within the Project area during the four-season survey period. Eight raptor species have been observed from within the Project area. A total of eight threatened and one migratory bird species were observed within or near the Project area to warrant inclusion in risk assessments, a summary of the number of individuals of each species for the number of observations can be seen in **Table 5**.

TABLE 5: THREATENED BIRD SPECIES SUMMARY FINDINGS

Species name	Number of individuals	Number of observations	EPBC Act status	BC Act status
Black Falcon	1	1	-	Vulnerable
Dusky Woodswallow	23	4	-	Vulnerable
Gang-gang Cockatoo	91	25	Endangered	Endangered
Little Eagle	12	10	-	Vulnerable
Rufous Fantail	1	1	Migratory	-
Scarlet Robin	48	36	-	Vulnerable
Superb Parrot	7	2	Vulnerable	Vulnerable
Varied Sittella	41	3	-	Vulnerable
White-bellied Sea-Eagle	1	1	-	Vulnerable

2.3 Bat surveys

Pre-operational bat surveys were conducted in November 2023 and March 2024. The Pre-operational Bird and Bat Survey Report detailing methods and results for bat surveys can be found in **Attachment 1**. The timing for both season's survey was coordinated to coincide with the migration of Large Bent-winged Bat. Eight bat detection devices were deployed across six ground monitoring locations and two monitoring sites at RSA height.

Bat detectors collected data over 144 detector nights during November 2023 surveys and 134 detector night during March 2024 surveys. A total of 8,254 calls could be positively attributed to 11 species, plus an undifferentiated genus, and included three threatened species during November 2023 surveys. A total of 12,736 calls could be positively attributed to 11 species, plus the same undifferentiated genus, and included two previously identified threatened species during March 2024 surveys. **Table 6** presents a summary of threatened bat species positively identified during the two seasons surveyed. No threatened species calls were positively identified from RSA height monitoring sites.

TABLE 6: THREATENED BAT SPECIES SUMMARY FINDINGS

Species name	Number of positively attributed calls	Number of sites observed	EPBC Act Status	BC Act Status
Eastern False Pipistrelle	20	4	-	Vulnerable
Greater Broad-nosed Bat	2	1	-	Vulnerable
Large Bent-winged Bat	248	5	-	Vulnerable

3 Bird and bat risk assessment

3.1 Introduction to the risk assessment

The bird and bat risk assessment found within **Attachment 2** aims to identify species or groups of species considered to be potentially 'at risk' from collision with turbines, or otherwise impacted by operating turbines at the Project.

Species and groups included for assessment have been determined through the following pathway/s:

- species of concern assessed as having a 'likely' or higher likelihood of occurrence within the Project area (refer to **Appendix A** within **Attachment 2**), and/or
- species that have been observed within the Project area or C2WF.

A group of 16 threatened bird species and four threatened bat species met the criteria for risk assessment. Additionally, species and groups of concern that are likely to be proportionally highly impacted by blade strike were assessed. These included Wedge-tailed Eagle, White-striped Freetail Bat and a group representing 'other non-threatened raptor species' observed within the Project area. A total of 22 species and one group of species were considered within the bird and bat risk assessment for the Project.

3.2 Overview of risk assessment approach

This bird and bat risk assessment utilised a qualitative approach that estimates the relative risk of blade strike or barotrauma through a consideration of the likelihood of impacts and the consequences of impacts. Assessment of the likelihood of impacts is ascribed to a two-criteria assessment (criteria A and B), and estimation of consequence is through the assessment of four criteria (criteria C to F) (**Table 7**). Each species or group is ranked within the criteria as 'low', 'moderate' or high' relative to the particulars of that criterion and the specifics of the species' ecology, observed or predicted utilisation of the Project area, and a literature review.

TABLE 7: CRITERIA FROM LUMSDEN ET AL. (2019) AND USED IN RISK ASSESSMENT

	Criteria	Description
Criteria used to ascribe likelihood of risk	Criterion A	Known or likely frequency of flight within rotor swept area (RSA) height.
	Criterion B	Habitat preference and status of frequency of occurrence within the Project area.
Criteria used to ascribe consequence of risk	Criterion C	Highly localised or concentrated population (for whole or part of lifecycle), such that siting of wind farm could have significant consequence to regional, national or international populations.
	Criterion 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).
	Criterion E	Known or estimated size of national or global population.
	Criterion F	Listed conservation status under the Biodiversity Conservation Act 2016 (BC Act) and/or the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act).

To determine the overall risk rating for the likelihood and consequence of collision for the assessed species within the Project area, the results are placed into a risk matrix to determine the level of risk. Five categories of overall risk were used based on the combination of the scores for likelihood and consequence, they include 'negligible', 'low', 'moderate', 'high' and 'severe', as seen in **Table 8**.

TABLE 8: RISK MATRIX FOR 'AT RISK' SPECIES

		Consequence of collisions		
		Low	Moderate	High
Likelihood of collision	Low	Negligible	Low	Moderate
	Moderate	Low	Moderate	High
	High	Moderate	High	Severe

3.3 Risk assessment results

Of the 23 species assessed, one species is considered to be at 'severe' risk, six species are considered a 'high' risk, and 11 are considered a 'moderate' risk of being impacted by the Project (**Table 9**). The resultant risk rating is primarily due to their confirmed or likely presence and their predicted or observed flight behaviour within the Project area, as well as their known susceptibility to blade strike at wind farms in southeast Australia in the context of the potential consequence of risk for each species (estimated through the ascribed ratings for the relevant criteria).

The one 'severe' rating can be attributed to a 'high' risk rating for Criterion C and the consequence of potential impacts on population concentration. In this case, for Large Bent-winged Bat the life-cycle aggregations of bats seasonally to maternity caves create considerable risk with high proportions of the population likely utilising migratory pathways in short periods of time to very restricted locations (i.e. caves). This is precautionary, until greater information is gathered to determine whether the species is regularly recorded utilising the Project area.

All species rated as 'high' overall risk were considered to have a 'high' likelihood and a 'moderate' consequence of collisions. Species rated as 'high' risk include two raptor, one migratory, one parrot and two bat species. The 'high' risk rating for Little Eagle, Black Falcon and Gang-gang Cockatoo aptly reflects the potential impacts of the Project, as these species have been recorded within or near the Project area or have been previously impacted at C2WF.

The 'high' risk rating assigned to White-throated Needletail reflects the 'high' likelihood of collision of the species given their known susceptibility to blade strike due to their flight activity at other wind farms and their historic detection within the Project area. The risk rating for Eastern False Pipistrelle and Yellow-bellied Sheath-tail-bat reflects the 'high' likelihood of collision given their flight activity and detection within the Project area.

Despite a ranked consequence of collision as 'low', all assessed non-threatened species or groups produced an overall risk rating of 'moderate' due to a 'high' likelihood of collision. This is considered an appropriate reflection of the risk of potential impacts attributed to the Project as these species and groups, although they do not hold conservation listings, are likely to comprise a large proportion of blade strike mortalities.

TABLE 9: SPECIES RISK RATING SUMMARY

Common name	Scientific name	Likelihood	Consequence	Overall risk rating
Little Eagle	<i>Hieraaetus morphnoides</i>	High	Moderate	High
Black Falcon	<i>Falco subniger</i>	High	Moderate	High
White-bellied Sea-eagle	<i>Haliaeetus leucogaster</i>	Moderate	Moderate	Moderate
White-throated Needletail	<i>Hirundapus caudacutus</i>	High	Moderate	High
Powerful Owl	<i>Ninox strenua</i>	Moderate	Moderate	Moderate
Barking Owl	<i>Ninox connivens</i>	Moderate	Moderate	Moderate
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	High	Moderate	High
Superb Parrot	<i>Polytelis swainsonii</i>	Moderate	Moderate	Moderate
Scarlet Robin	<i>Petroica boodang</i>	Low	Moderate	Low
Flame Robin	<i>Petroica phoenicea</i>	Moderate	Low	Low
Rufous Fantail	<i>Rhipidura rufifrons</i>	Moderate	Moderate	Moderate
Varied Sittella	<i>Daphoenositta chrysoptera</i>	Moderate	Moderate	Moderate
Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>	High	Low	Moderate
Diamond Firetail	<i>Stagonopleura guttata</i>	Moderate	Low	Low
Southern Whiteface	<i>Aphelocephala leucopsis</i>	Low	Low	Negligible
White-fronted Chat	<i>Epthianura albifrons</i>	Moderate	Moderate	Moderate
Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	High	High	Severe
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	High	Moderate	High
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	High	Moderate	High
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	Low	Moderate	Low
Wedge-tailed Eagle	<i>Aquila audax</i>	High	Low	Moderate
Other non-threatened raptors	n/a	High	Low	Moderate
White-striped Freetail Bat	<i>Austronomus australis</i>	High	Low	Moderate

4 Turbine risk assessment

4.1 Introduction to the risk assessment

This turbine risk assessment has been prepared through consultation with the BCS, to assess the specific risk associated with each turbine within the context of their position in the landscape, surrounding habitat, and known observations of 'at risk' species. The turbine risk assessment aims to provide a metric to identify the blade strike risk of each turbine, to inform areas of risk within the Project area that will likely require focused monitoring and management measures.

The turbine risk assessment assesses the risk each turbine poses to the species that have been identified as having a 'moderate' or higher risk rating of turbine strike risk from the Project, as described in **Section 3.3**. Bird and bat risk assessment results include 17 species and a species group to be at 'moderate' or higher risk of blade strike from the Project, they include;

- Little Eagle,
- Black Falcon,
- White-bellied Sea-Eagle,
- White-throated Needletail,
- Powerful Owl,
- Barking Owl,
- Gang-gang Cockatoo,
- Superb Parrot,
- Rufous Fantail,
- Varied Sittella,
- Dusky Woodswallow,
- White-fronted Chat,
- Large Bent-winged Bat,
- Eastern False Pipistrelle,
- Yellow-bellied Sheath-tail-bat,
- Wedge-tailed Eagle,
- Other non-threatened raptors, and
- White-striped Freetail Bat.

The turbine risk assessment provides an overall risk assessment outcome for each turbine and a further discussion on how each risk rating was determined.

4.1.1 SUMMARY OF THREATENED SPECIES OBSERVATIONS

Importantly, this the turbine risk assessment utilises data collected from baseline surveys, mapped threatened species observations and considers information previously provided in **Section 2.1.1**, taking the precautionary principle to inform locations of known ‘at risk’ species. **Table 10** provides a summary of threatened species findings that informed this turbine risk assessment. For mapped locations of threatened species observations, refer to **Attachment 1**.

TABLE 10: SUMMARY OF THREATENED SPECIES FINDINGS UTILISED FOR TURBINE RISK ASSESSMENT

Species	Observation type	Date	Location (turbine)	Additional Information
Black Falcon	Most recent observation was taken from C2WF reports.	27/09/2020	Project cable corridor connecting to substation.	Included within this assessment to ensure precautionary approach is taken.
Little Eagle	Opportunistic	11/08/2023	Near Project entrance at Graywood Siding Road	One individual observed.
Gang-gang Cockatoo	BUS	24/08/2023	FP8 (A25)	Calls heard from two individuals.
Gang-gang Cockatoo	BUS	25/08/2023	FP5 (A15)	Male and female observed.
Gang-gang Cockatoo	Incidental	17/10/2023	From FP5 area (A15)	Calls heard.
Gang-gang Cockatoo	BUS	8/11/2023	FP4 (A24)	Male and female observed.
Little Eagle	BUS	10/11/2023	Approx 500 m from BUS FP6 location	One individual observed.
Large Bent-winged Bat	Bat surveys	9 - 28/11/2023	Site 1 (A8), Site 2 (A12), Site 3 (A24) and Site 6 (A22).	157 total positively attributed calls.
Eastern False Pipistrelle	Bat surveys	9 - 28/11/2023	Site 1 (A8), Site 2 (A12) and Site 3 (A24).	17 total positively attributed calls.
White-bellied Sea-Eagle	Incidental	17/12/2023	Pejar Dam	One individual observed.
Gang-gang Cockatoo	BUS	16/01/2024	FP4 (A24)	Call heard.
Gang-gang Cockatoo	BUS	17/01/2024	FP4 (A24)	Call heard.
Gang-gang Cockatoo	BUS	18/01/2024	FP3 (A12)	Call heard.
Gang-gang Cockatoo	BUS	23/01/2024	FP2 (reference site)	Group heard calling.
Gang-gang Cockatoo	BUS	24/01/2024	FP2 (reference site)	Group of 10 - 14 seen both in morning and afternoon surveys.
			FP5 (A15)	Call heard.
Gang-gang Cockatoo	BUS	25/01/2024	FP3 (A12)	Two individuals observed.
Dusky Woodswallow	Incidental	25/01/2024	Small forest patch north of FP7	10 individuals perched and flying just above the canopy.
Superb Parrot	Incidental	31/01/2024	Graywood Siding Road and Woodhouselee Road intersection (3 km southwest from turbine A24)	Four individuals observed.
Rufous Fantail	BUS	1/02/2024	FP3 (A12)	One individual observed.
Little Eagle	RVPS	1/02/2024	Observed from RVP2 (A12)	One individual observed.
Superb Parrot	Incidental	2/02/2024	12 km north turbine A5	Three individuals observed.
Large Bent-winged Bat	Bat surveys	4 – 21/03/2024	Site 1 (A8), Site 2 (A12), Site 3 (A24), Site 5 (A17) and Site 6 (A22).	91 total positively attributed calls.
Eastern False Pipistrelle	Bat surveys	4 – 21/03/2024	Site 6 (A22)	Three total positively attributed calls.

Black Falcon	Incidental (during other contracted works)	8/03/2024	Near substation at C2WF	One individual observed.
Dusky Woodswallow	BUS	19/03/2024	FP7 (A17)	10 individuals flying around paddock tree.
Dusky Woodswallow	BUS	20/03/2024	FP7 (A17)	2 individuals flying around paddock tree.
Gang-gang Cockatoo	BUS	20/03/2024	FP5 (A15)	Six individuals observed.
Gang-gang Cockatoo	BUS	26/03/2024	FP5 (A15)	Five individuals observed.
Varied Sittella	BUS	26/03/2024	FP7 (A17)	16 individuals observed.
Varied Sittella	BUS	27/03/2024	FP6 (reference site)	10 individuals observed.

4.2 Method

This risk assessment follows the approach for estimating risk to birds and bats at wind turbines through analysis of likelihood and consequence. It analyses the risk that each specific turbine poses, rather than the overall risk to an individual species present, or potentially present, within the Project area.

The relative risk of impacts caused by turbines is estimated through the following two criteria;

- likelihood of risk described as the distance a turbine is to a resident fauna, habitat, known migratory path or landscape features that is predicted to increase bird and/or bat activity; and
- consequence of risk is the conservation status of the species.

Table 11 describes the criteria for ascertaining turbine strike risk for each turbine. The criteria results determine the turbines overall risk through the matrix presented in **Table 12**.

TABLE 11: CRITERIA FOR IDENTIFYING TURBINE STRIKE RISK FOR BIRDS AND BATS, PROVIDED BY THE BCS

Species	Observation type
Severe	Critically endangered species and/or a species listed at risk of a serious and irreversible impact
Major	Endangered species (BC Act or EPBC Act)
Moderate	Vulnerable species (BC Act or EPBC Act)
Minor	Protected (non-threatened) species (or no species detected)
Turbine Strike Likelihood	Description
Very likely	Very high likelihood of turbine strike based on any of the following being located within 200 m of the proposed turbine location: • resident threatened species habitat or non-threatened raptor species habitat, • migratory or nomadic species habitual flight path, and/or • landscape feature/s likely to increase bird and/or bat activity (including waterbodies, riparian corridors, updraft locations, caves etc.).
Likely	High likelihood of turbine strike based on any of the following being located within 500 m of the proposed turbine location: • resident threatened species habitat or non-threatened raptor species habitat, • migratory or nomadic species habitual flight path, and/or • Landscape feature/s likely to increase bird and/or bat activity (including waterbodies, riparian corridors, updraft locations, caves etc.).
Moderately Likely	Moderate likelihood of turbine strike based on any of the following being located within 1000 m of the proposed turbine location: • resident threatened species habitat or non-threatened raptor species habitat, • migratory or nomadic species habitual flight path, and/or • landscape feature/s known or predicted to increase bird and/or bat activity (including waterbodies, riparian corridors, updraft locations, caves etc.).
Less Likely	Low likelihood of turbine strike based on any of the following being located greater than 1000 m away (or not detected): • resident threatened species habitat or non-threatened raptor habitat, • migratory or nomadic species habitual flight path, and/or • landscape feature/s known or predicted increase bird and/or bat activity (including waterbodies, riparian corridors, updraft locations, caves etc.).

TABLE 12: CATEGORISING TURBINE STRIKE RISK OF TURBINES IN RESPECT TO THEIR LOCATION, PROVIDED BY THE BCS

		Consequence Criteria			
		Severe	Major	Moderate	Minor
Likelihood Criteria	Very likely	Very High	Very High	Very High	High
	Likely	Very High	High	High	Medium
	Moderately likely	Very High	High	Medium	Low
	Less likely	High	Medium	Low	Low

Overall risk has been determined through allocating each risk category with a numerical value, as presented in **Table 13**. For each turbine, an average risk of turbine strike was determined by combining the risk of turbine strike for all assessed species. The risk rating thresholds were determined by calculating the highest potential rating for a turbine, i.e. total species/groups assessed (18) multiplied by the 'very high' numerical value (four) to produce a total highest risk number (72). This was divided into four equal groupings to represent the four overall risk categories.

TABLE 13: RISK RATING ALLOCATED NUMERICAL VALUES AND RISK RATING THRESHOLDS

Collision risk rating	Allocated numerical value	Overall risk rating threshold
Very High	4	55-72
High	3	37-54
Medium	2	19-36
Low	1	0-18

4.3 Risk assessment results

Table 14 summarises the general location of landscape and habitat features and their distance to each turbine. For the purpose of this risk assessment, the proxy of gully lines in hilly areas has been used to determine likely updraft locations, as the steep change in elevation up along the gully line or up the hillside would facilitate an updraft. For this risk assessment forest habitat is defined as a relatively large patch of forest vegetation that contains hollow bearing trees. Additionally, riparian corridors are defined as areas along which a named watercourse flows.

Table 15 details the landscape and/or habitat features that were used as the determining factors on the likelihood of each species' presence near each turbine. If a species is associated with two features, the feature closest to the turbine was utilised. Each species determining factor was attributed through species preferred habitat from desktop research for likelihood of occurrence found in **Attachment 2** and confirmed with site observations (where applicable).

Table 16 presents the results of risk assessment for each turbine, which has taken a conservative approach using the precautionary principle.

TABLE 14: SUMMARY OF LANDSCAPE AND HABITAT FEATURES AND THEIR DISTANCE TO EACH TURBINE

Turbine	Distance from nearby features		
	Gully lines	Forest habitat	Riparian corridors
A3	< 200 m	> 1000 m	> 1000 m
A4	< 500 m	> 1000 m	> 1000 m
A5	< 200 m	> 1000 m	< 1000 m
A8	< 200 m	> 1000 m	> 1000 m
A9	< 200 m	< 1000 m	< 1000 m
A10	< 200 m	< 1000 m	< 1000 m
A12	< 200 m	< 200 m	< 200 m
A13	< 200 m	< 500 m	< 500 m
A15	< 200 m	< 200 m	< 1000 m
A16	< 500 m	< 500 m	< 500 m
A17	< 500 m	< 200 m	< 1000 m
A20	< 200 m	< 200 m	< 1000 m
A21	< 200 m	< 200 m	> 1000 m
A22	< 200 m	< 200 m	> 1000 m
A24	< 200 m	< 200 m	> 1000 m
A25	< 200 m	< 200 m	> 1000 m

TABLE 15: THE DETERMINING FEATURE FOR THE LIKELIHOOD OF TURBINE STRIKE ON SPECIES

Species/species group	Determinate features	
	Feature one	Feature two
Little Eagle	Gully lines	Forest habitat
Black Falcon	Riparian corridors	Gully lines
White-bellied Sea-Eagle	Large waterbodies (Pejar Dam = 6 km)	Gully lines
White-throated Needletail	Forest habitat	-
Powerful Owl	Forest habitat	-
Barking Owl	Forest habitat	-
Gang-gang Cockatoo	Forest habitat	-
Superb Parrot	Forest habitat	-
Rufous Fantail	Forest habitat	-
Varied Sittella	Forest habitat	-
Dusky Woodswallow	Forest habitat	-
White-fronted Chat	Riparian corridors	-
Large Bent-winged Bat	Gully lines	Forest habitat
Eastern False Pipistrelle	Gully lines	Forest habitat
Yellow-bellied Sheathtail-bat	Gully lines	Forest habitat
Wedge-tailed Eagle	Gully lines	Forest habitat
Other non-threatened raptors	Gully lines	Forest habitat
White-striped Freetail Bat	Riparian corridors	Gully lines

TABLE 16: TURBINE STRIKE RISK RATING FOR EACH PROJECT TURBINE

Turbine	Species risk ratings																		Overall
	Little Eagle	Black Falcon	White-bellied Sea-Eagle	White-throated Needletail	Powerful Owl	Barking Owl	Gang-gang Cockatoo	Superb Parrot	Rufous Fantail	Varied Sittella	Dusky Woodswallow	White-fronted Chat	Large Bent-winged Bat	Eastern False Pipistrelle	Yellow-bellied Sheath-tail-bat	Wedge-tailed Eagle	Other non-threatened raptors	White-striped Freetail Bat	
A3	Very High (4)	Very High (4)	Very High (4)	Low (1)	Low (1)	Low (1)	Medium (2)	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	High (3)	High (43)
A4	High (3)	High (3)	High (3)	Low (1)	Low (1)	Low (1)	Medium (2)	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	High (3)	High (3)	High (3)	Medium (2)	Medium (2)	Medium (2)	Medium (36)
A5	Very High (4)	Very High (4)	Very High (4)	Low (1)	Low (1)	Low (1)	Medium (2)	Low (1)	Low (1)	Low (1)	Low (1)	Medium (2)	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	High (3)	High (44)
A8	Very High (4)	Very High (4)	Very High (4)	Low (1)	Low (1)	Low (1)	Medium (2)	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	High (3)	High (43)
A9	Very High (4)	Very High (4)	Very High (4)	Medium (2)	Medium (2)	Medium (2)	High (3)	Medium (2)	Medium (2)	Medium (2)	Medium (2)	Medium (2)	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	High (3)	High (52)
A10	Very High (4)	Very High (4)	Very High (4)	Medium (2)	Medium (2)	Medium (2)	High (3)	Medium (2)	Medium (2)	Medium (2)	Medium (2)	Medium (2)	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	High (3)	High (52)
A12	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	High (3)	Very High (69)
A13	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	High (3)	Very High (60)
A15	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Medium (2)	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	High (3)	Very High (67)
A16	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	Medium (2)	High (53)
A17	Very High (4)	High (3)	High (3)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Medium (2)	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	Medium (2)	Very High (64)
A20	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Medium (2)	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	High (3)	Very High (67)
A21	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Low (1)	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	High (3)	Very High (66)
A22	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Low (1)	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	High (3)	Very High (66)
A24	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Low (1)	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	High (3)	Very High (66)
A25	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Very High (4)	Low (1)	Very High (4)	Very High (4)	Very High (4)	High (3)	High (3)	High (3)	Very High (66)

4.4 Risk assessment discussion

When ascribing to the criteria provided by BCS, Project turbines largely have a risk rating of ‘high’ or ‘very high’. A combination of three factors are attributed to increased risk ratings:

- proximity to landscape features,
- proximity to habitat, and
- the known and/or likely presence of species with a conservation listing of Vulnerable, Endangered and/or Critically Endangered under the BC Act and/or the EPBC Act.

4.4.1 PROXIMITY TO LANDSCAPE FEATURES

The proximity of a turbine to a landscape feature has largely played an influencing factor for the turbines in the north-western section of the wind farm, including A3, A5, A8, A9 and A10. This factor was considered significant when determining risk for the raptor and bat species which can hunt/forage in more open areas, are traveling between foraging areas, or are potentially migrating long distances. Raptors have been observed utilising most areas within the Project area, including soaring up hillsides and ridgelines. Additionally, the detection of bat calls for the Large Bent-winged Bat was highest in the survey site within this area, likely attributed to the long gully lines making suitable flyways.

4.4.2 PROXIMITY TO HABITAT

Comparatively, the close proximity to habitat greatly increased the risk rating for turbines A12, A15, A17, A20, A21, A22, A24 and A25 in the southern section of the wind farm. The layout of many of the turbines has positioned them to be within less than 100 m of forest canopy with the blades positioned even closer to the canopy. In some areas the adjacent canopy (approximately 20 m in height) is situated higher in elevation than the base of the turbine pad, further contributing to the proximity of blades to the canopy. This proximity of turbines to habitat is justifiably ‘very high’ risk, with the air space around habitat being a focus of flight activity for all assessed species.

4.4.3 KNOWN AND/OR LIKELY PRESENCE OF LISTED SPECIES

The known and/or likely presence of species with conservation listing within the Project area further increased the risk rating of all turbines. As discussed in the species risk assessment (refer to **Attachment 2**), these species have a ‘moderate’ or higher likelihood of flying at RSA height, therefore making them more probable victims of blade strike.

Importantly the consistent presence, across multiple seasons, of Gang-gang Cockatoo (listed as Vulnerable under the BC Act and Endangered under the EPBC Act) throughout forest areas of the Project area, creates considerable risk of turbine strike to this species. The species has been observed flying just below RSA height within the Project area. Additionally, Gang-gang Cockatoos have been reported to fly at RSA height at other wind farm locations, and a Gang-gang Cockatoo impact trigger has been enacted at nearby Taralga Wind Farm (BL&A, 2018).

4.4.4 AREAS OF REDUCED RISK

A lower rating of risk has been assessed for non-raptor and owl species for turbines A3, A4, A5, A8, A9 and A10. Risk for these species was determined to be more heavily placed on their proximity to habitat, where they are more likely to be foraging and breeding. Therefore, risk of turbine strike for these species was determined through the distance from forest habitat.

4.5 Risk assessment conclusion

Under the guidelines provided by BCS, 15 of 16 turbines from the Project area fall into a 'high' or 'very high' risk category for turbine strike for the assessed at risk species that are known or likely to be present, and at a 'moderate' or higher risk of becoming victim to blade strike. One turbine, turbine A4 ranked a 'medium' risk category due to greater distance from landscape features and habitat.

Due to the findings of this risk assessment, this BBAMP has a particular emphasis on the monitoring programs employed and that well defined impact trigger mechanisms are in place to ensure additional appropriate mitigation measures are enacted in the case significant impacts are a result of operations.

5 Bird and bat monitoring program

5.1 Monitoring roles and responsibilities

The proponent will engage a suitably qualified ecologist who will be responsible for ensuring many of the BBAMP duties are carried out. The engaged ecologist will:

- ensure that bird and bat monitoring programs are completed in line with the requirements of the BBAMP,
- ensure that the carcass search program, carcass find protocol and injured bird and bat find protocol are adhered to, and
- manage and analyse the data collected during surveys for use in the preparation of reporting (**Section 8.1**) and review (**Section 8.2**).

The proponent or engaged ecologist may decide to sub-contract specialised expertise for parts of the BBAMP works. This may include statistical analysis, modelling, or carcass searches utilising conservation dogs.

The proponent's reporting requirements are detailed in **Section 8.1** and reviewing requirements detailed in **Section 8.2**. Additionally, the proponent has a number of time sensitive communication requirements in the event an impact trigger threshold is met (refer to **Section 6**).

Oversight to the implementation of measures outlined within this BBAMP will require the further liaison between the proponent, engaged ecologist and relevant authority bodies to ensure ecological commitments are met.

5.2 Bird surveys

Operational phase monitoring of the Project is to be conducted to meet the requirements of the consent conditions and to ensure that any potential impacts reasonably attributed to the operation of the Project are detected. The principles for implementing bird surveys post-construction are as follows:

- post-construction bird surveys will use the same survey points and effort as the pre-construction surveys to allow for comparative analysis to identify any difference in bird activity on the site;
- methods employed will replicate the methods utilised for baseline surveys;
- post-construction bird surveys will be undertaken in four seasons, in alignment with previous studies (i.e., August, November-October, January-February and March-April);
- additional surveys will be employed, when necessary, i.e. in the event an impact trigger threshold has been met, or when recommendations are made for threatened species identified in risk assessments; and
- a review of survey methods and schedule will be undertaken upon completion of second year surveys, documented within the second-year survey report. Further information on review requirements is presented in **Section 8.2**.

5.2.1 BIRD UTILISATION SURVEYS

BUS will be continued post-construction every season for the first two years of operation, and again in the fifth year post-construction. The methods utilised for the surveys will replicate the methods of the baseline survey detailed in **Attachment 1**, and summarised as follows:

- surveys conducted as diurnal fixed point count surveys, at eight sites across the Project area, including six impact points and two reference points;

- each survey point is surveyed for a period of 20 minutes. During this time all bird observations are recorded including species, abundance, if species are observed by call, and flight height recorded where there is visual confirmation of the bird. For species of concern (threatened species and raptors) additional information is also collected including the location in relation to the observer, time observed, flight direction and flight path; and
- BUS fixed points are to be surveyed 12 times per season (at each survey point twice per day, over six survey days). Fixed point locations are scheduled to be surveyed at different across morning and afternoon to ensure all sites are visited across different times of the survey period.

The objective of continued BUS is to collect information that will detect changes to the abundance and/or diversity of bird species in proximity to turbine locations. It also allows for continued onsite monitoring for threatened species that may migrate into the area, therefore allowing for additional risk assessments to be carried out where appropriate.

5.2.2 RAPTOR VANTAGE POINT SURVEYS

RVPS will be continued post-construction every season for the first two years of operation, and again in the fifth year post-construction. The methods utilised for the surveys will replicate the methods of the baseline survey detailed in **Attachment 1**, and summarised as follows:

- surveys are conducted using the circular plot survey method with no cut-off distance.
- three impact survey sites located at least 1.5 km apart are located within the Project area, with three control sites selected in an analogous landscape > 10 km away.
- surveys are carried out between the hours of 10:00 and 16:00 for a period of 60 minutes.
- each survey site is to be surveyed a minimum of five hours per season, with each site being surveyed at a different time of day to capture raptor activity throughout the day.
- data collected from these surveys include:
 - species name,
 - number of birds,
 - first time observed,
 - time the bird/s flew out of sight or landed,
 - height when first observed,
 - height range of flight observed,
 - distance from observer,
 - flight direction (45 degrees or can be circling),
 - flight path,
 - behaviour (soaring, gliding, hovering, flapping, display, resting, mobbing or foraging),
 - activity (traveling, hunting, courtship, being attacked),
 - sex,
 - age, and
 - additional notes (e.g. a pair, a pair and juvenile); and
- sites are surveyed only once per day, with survey sites directly adjacent to other sites not surveyed on the same day to reduce risk of double counting of raptor activity.

The purpose of continued RVPS is to monitor changes in flight activity, behaviour, diversity, and abundance of raptor species which are shown to regularly fly at RSA height and be impacted by turbine strike. Continued onsite monitoring allows for pre-construction baseline data to be analysed against any

future changes ensuring adaptive management measures can be adjusted if necessary to support better outcomes for viable local raptor populations.

5.2.3 TARGETED SURVEYS

Additional targeted surveys may be employed at the advice of BCS. In the event of an impact trigger occurring, or a risk assessment for a threatened or 'at-risk' species recommends further investigation.

5.2.4 INCIDENTAL BIRD OBSERVATIONS

All incidental observations of threatened and 'at risk' species within or near to the Project area will be recorded by ecologists while conducting any ecological works within the Project area. This includes any observations made outside of formal bird survey times, deployment of bat detection equipment, during transit and during other ecological works (i.e. work outside of BBAMP scope of works). Information collected includes the location of the bird, time of observation, flight height, flight map (if applicable), behaviour and standard weather conditions.

5.3 Bat surveys

Operational phase monitoring of the Project is to be conducted to meet the requirements of the consent conditions and to ensure that any potential impacts reasonably attributed to the operation of the Project are detected. The principles for implementing bat surveys post construction will be:

- post-construction bat surveys will use the same survey points and effort as the pre-construction surveys to allow for comparative analysis to identify any difference in bat activity on the site;
- methods employed will replicate the methods utilised for baseline surveys;
- post-construction bat surveys will be undertaken in two seasons, in alignment with when previous studies were conducted (i.e., November, March) with consideration to adjust survey period depending on seasonal variations to Large Bent-winged Bat migratory behaviour;
- additional surveys will be employed, when necessary, i.e. in the event an impact trigger threshold has been met or when recommendations are made for threatened species identified in risk assessments; and
- review of survey methods and schedule will be completed upon completion of second year surveys, within the second-year survey report. Further information on review requirements is presented in Section 8.2.

5.3.1 PASSIVE ACOUSTIC DETECTION SURVEYS

Bat surveys will be continued post-construction during Large Bent-winged Bat migration season for the first two years of operation and again in the fifth year after post-construction. The methods utilised for the surveys will replicate the methods of the baseline survey, detailed in **Attachment 1**, and summarised as follows:

- during each deployment, bat detectors will be set for 14 nights. Eight detection devices will be deployed to monitor six ground sites and two sites at RSA height;
- a minimum of 112 detector nights will be collected per season;
- bat detection devices are to be set to begin recording 30 minutes before dusk and stop recording 30 minutes after sunrise; and
- bat detection devices utilise ultrasonic microphones.

The objective of continued bat surveys is to collect information that will detect changes to the diversity of bat species in proximity to turbine locations and detect species flying within RSA impact area. It also

allows for continued onsite monitoring for threatened species that may migrate into the area, therefore allowing for additional risk assessments to be carried out where appropriate.

5.3.1.1 GROUND LEVEL MONITORING

Monitoring sites at ground level have been selected as impact areas close to, or in proximity to wind turbines. Bat detection devices are to be deployed approximately 1.5 – 3 m off the ground with the microphone angled vertically. The six ground level sites will be surveyed in accordance with the methodology of baseline surveys. Descriptions and map of survey locations are presented in **Attachment 1**.

5.3.1.2 MONITORING WITHIN THE RSA

Monitoring within RSA height is to be undertaken through two methods; one at turbine hub-height (approximately 95 m), and one at a meteorological mast height (approximately 50 m). Bat detection device deployment for both monitoring sites at RSA height require detection devices that have microphone cable attachments. Baseline surveys used the Anabat Swift passive detector.

Bat detector deployment at hub-height on turbine A22 is to be deployed through the following methods:

- bat detector device is to be installed at hub height on the wind turbine by an appropriately qualified person with the guidance of an ecologist;
- bat detection microphone is to be mounted on an antenna on top of the hub at the rear of the turbine; and
- the microphone extension cable connects the microphone to the bat detection device which is to be kept inside the nacelle of the turbine.

The bat detector deployed at the meteorological mast was installed to allow ecologists to be able to capture data at RSA height without need for a suitably qualified person to enter the turbine. This ensured that if no personnel were available to access a turbine, data from RSA height could still be collected. Meteorological mast data is to be collected by:

- initial installation by an appropriately qualified person with the guidance of an ecologist;
- attachment of bat detector microphone to 50 m microphone extension cable, extension cable it so be secured to its extent up the meteorological mast; and
- connection of bat detector to microphone extension cable at ground level when deployed. When not in use microphone extension cable is to be covered and protected from weather.

5.3.1.3 CALL ANALYSIS

Upon collection of bat detectors, SD cards holding recorded data are to be safely removed and immediately backed up and transferred to storage devices to be sent to an expert for analysis. Call analysis will be completed by a suitably qualified bat call analyst with specialised expertise in species identification.

5.4 Carcass search program

Carcass searches are performed to determine the actual impact of an existing wind farm on birds and bats by estimating the annual number of birds and bats that are impacted through blade strike or barotrauma with wind turbines. Mortality rates are estimated through appropriate surveys and trials for all bird species combined and all bat species combined.

Mortality is defined as any dead bird or bat detected under a wind turbine and/or within distance of the turbine in which carcasses could potentially fall if impacted. This area is outlined in **Section 5.4.1** with carcass detection occurring either during formal surveys (refer to **Section 5.4.2**) or incidentally during normal operation of the wind farm (refer to **Section 5.4.4**). Carcasses include whole or partial carcasses,

including feather spots that are defined as a clump of five feathers or more and the discovery of an injured bird or bat. All carcasses detected will trigger the *Data collection and carcass find protocol* (refer to **Section 5.4.3**) facilitating consistent data collection on the fatality event for accurate estimation of mortality rates for the Project.

All carcass search programs will be carried out with the use of trained conservation dogs for their increased detectability of carcasses (refer to **Section 5.4.2.1**).

The carcass search program will be implemented in two phases:

- **Phase 1: Pre-commissioning carcass search program.**
 - Carcass monitoring will be conducted during all hold point testing operations of active turbines. The proponent will be responsible for notifying the contracted ecologist when turbine/s are active for carcass survey.
 - During hold point testing stage one (HP0), one turbine will be active. It is recommended that A4 is utilised for this test period (refer to risk assessment **Section 4.3**). Each day this turbine is active, daily carcass searches will be employed.
 - During hold point testing stage two (HP1), eight turbines will be active. It is recommended that turbines A3, A4, A5, A8, A9, A10, A13 and A16 are utilised for this test period (refer to risk assessment **Section 4.3**). Carcass monitoring will occur weekly at all active turbines for the duration of this testing period.
 - Carcass monitoring within the pre-commissioning period will be subject to the BBAMP impact triggers response framework. All data collected, and subsequent revised risk assessment, will be included within three-month review of the Provisional BBAMP (refer to **Section 8.2**).
- **Phase 2: Commissioned carcass search program.**
 - The full carcass search program (refer to **Section 5.4.2.2** for frequency) will begin in the first month of commissioning (all 16 turbines active) for a period of five years at all Project turbines. A review of the program will be completed after two years in agreement with BCS (refer to **Section 8.2**).
 - Preliminary turbine risk assessments (refer to **Section 4.3**) indicate that most turbines fall within the 'high' to 'very high' turbine strike risk category. Evaluation of turbine strike risk and findings from the first two years of the carcass search program will inform the review.

5.4.1 CARCASS SEARCH AREA

The size of the search area has been calculated using the model presented in Hull and Muir (2010) which has been used as the industry standard. Project turbines have a maximum hub height of 94 m, a maximum rotor diameter of 126 m, and a maximum tip height of 157 m. Given the size of turbines present, carcass search areas for each turbine are divided into two zones:

- inner search zone with a radius of 90 m – search transects will be 6 m apart, and
- outer search zone with a radius of 160 m – search transects will be 12 m apart.

The model used to ascertain these results is $Y_{\max} = aH_{\text{Tower}} + bR_{\text{Max}} + c$. Values utilised in, and the results of the calculation are presented in **Table 17**.

TABLE 17: PARAMETERS OF THE MODEL AND ZONE SIZE RESULTS

Search zones	a	b	c	Zone sizes
Bats	0.672	0.046	15.9	81.966
Small birds	0.637	0.097	31.6	86.960
Large birds	0.581	0.176	70.6	161.817

The search areas for each turbine are illustrated in **Figure 2**.

5.4.1.1 UNSEARCHABLE AREA

Dense shrubland or forest remains within the carcass search area following vegetation clearance for the development of the hardstand, roads and other infrastructure for turbines A3, A12, A15, A17, A20, A21, A22, A24 and A25 (**Figure 2**). Such vegetation may impede carcass searching and is likely to negatively impact searcher efficacy or carcass detectability, these areas have been defined as unsearchable areas.

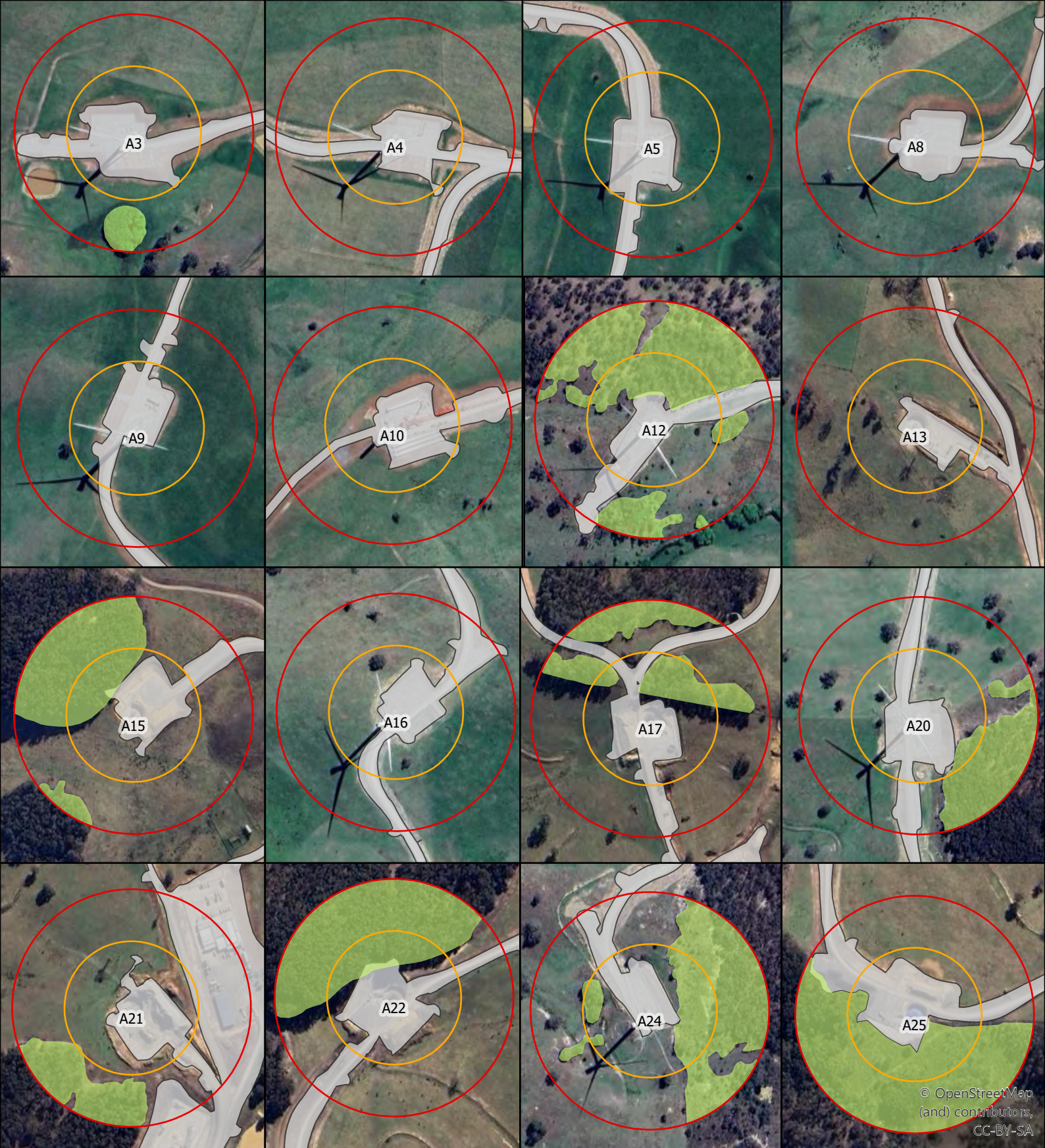
Unsearchable areas will only impact search methods that utilise ecologists alone and not impede searches that use trained conservation dogs. The employment of trained conservation dogs will not require further investigation into unsearchable area search efficiencies.

Unsearchable areas will be included within detectability trials to determine the potential negative impact on searcher efficiency compared to turbines with no unsearchable areas. If a comparative difference is ascertained, a corrective function will be calculated and applied to unsearchable areas to produce a more accurate estimate of total carcass numbers likely to be present within the unsearchable areas.

The contracting of additional statistical analysis services is recommended to complete these works. Further consultation with BCS and consideration of current peer-review methods will also apply.

Given the extent of unsearchable areas as shown in **Figure 2**, the Project turbines have been divided into three categories:

- No unsearchable areas – turbines A4, A5, A8, A9, A10, A13 and A16.
- < 15% unsearchable area – turbines A3, A17, A20 and A21.
- > 15% unsearchable area – turbines A12, A15, A22, A24 and A25.



Legend

- Unsearchable area
- Supporting infrastructure

Carcass search area

- Inner search zone (90m radius) - 6m transect
- Outer search zone (160m radius) - 12m transect



0 100 200 Metres



Ecology
CONSULTING

FIGURE 2: Carcass search area

Imagery: Google Satellite
(5/2024 & 9/2024)
Date: 15/5/2024

5.4.2 FORMAL CARCASS SURVEY

The inner search zone targets the detection of smaller carcasses belonging to bats, and small to medium birds. Search transects are thus arranged at 6 m apart. The outer search zone targets the detection of medium to large sized birds, which can be thrown further from the turbines. Given the larger size of carcasses, transects are arranged at 12 m apart. Given that the defined transect spacing and total search area are based on experience and evidence from previous studies and BBAMPs, they are considered to be suitable for detecting species of concern.

Two formal carcass survey methods are detailed in the sections below, being the use of the following as carcass searchers for the surveys:

- trained conservation dogs; or
- qualified ecologists.

The detectability of carcasses using both methods will be assessed as specified in **Section 5.4.6**.

5.4.2.1 METHOD

Trained conservation dogs. Given the extent of unsearchable areas, trained conservation dogs will be used to detect bird and bat carcasses. During each turbine search, a dog and handler will traverse the search area along paths approximately 20 – 30 m apart depending on wind speed as determined by the handler. The dog would be fitted with a GPS unit to track survey effort. Dog handlers will be trained and experienced in the identification of all bird and bat species that may occur within the Project area and follow data collection and carcass find protocols outlined in **Section 5.4.3**.

5.4.2.2 FREQUENCY

The inner and outer search zones will be surveyed once per month throughout the year, for the first two years. After the first two years of operation, the BBAMP monitoring programs will be reviewed in accordance with **Section 8.2** and the frequency of surveys may be adjusted in agreement with BCS based on impact trigger thresholds being met and/or further risk assessments.

If a migratory species or threatened species that exhibits migratory life cycles is found to be impacted by the Project, additional surveys will be incorporated into the carcass survey program during migration periods of the targeted species. These threatened species including but are not limited to:

- Large Bent-winged Bat:
 - Spring migration - October to December
 - Autumn migration – end of February to early April
- White-throated Needletail:
 - Arrival in Australia– September to November
 - Departure from Australia– May to August

5.4.3 DATA COLLECTION AND CARCASS FIND PROTOCOL

Carcasses and featherspots detected within the search area as defined above in **Section 5.4.1** will be handled according to the following described standard procedures for data collection and carcass handling.

5.4.3.1 CARCASS FIND PROTOCOL

Data collected for the carcass or featherspot will be recorded in the *Deceased or Injured Bird/Bat Data Sheet (Appendix A)* or suitable data collection programs such as ESRI's ArcGIS Survey123 using all fields present in the survey data sheets.

All data and photographs taken of the carcass or featherspot will be entered into a database and stored securely by the ecologist(s) conducting formal carcass surveys.

Carcasses or featherspots are to be removed from the site to prevent re-counting and stored for further identification and/or carcass persistence trials (**Section 5.4.5**). Handling and collection of the carcass will be undertaken as follows:

- rubber gloves will be worn while handling the carcass;
- photographs will be taken to facilitate further identification, i.e. on a white background with an item or measure for scale and adequate lighting;
- plastics bags should be used to double bag the carcass;
- a label with the date, turbine number and species name (if known) must be placed in the second bag to allow cross-reference to the corresponding completed Deceased or Injured Bird/Bat Data Sheet; and
- the carcass will be transported to a freezer (located at the Operations and Maintenance Facility) where it will be retained for further identification and/or use in carcass persistence or detectability trials.

At the conclusion of the carcass search program, any carcasses of interest may be made available to the Australian Museum or disposed of if deemed appropriate in consultation with BCS.

It may be necessary for the wind farm operator to obtain a permit from NSW DCCEEW under the *Biodiversity Conservation Act 2016* to handle and keep native wildlife (including deceased wildlife) as part of the monitoring program. The personnel undertaking carcass monitoring activities consistent with this BBAMP will have correct licencing to handle and keep wildlife carcasses.

5.4.4 INCIDENTAL BIRD AND BAT CARCASS FIND PROTOCOL

If a carcass is discovered by personnel at the Project during normal day-to-day activities outside of a formal carcass search, the carcass will be handled according to the data collection and carcass find protocol outlined in **Section 5.4.3**. All wind farm personnel will be made aware of the carcass search area and carcass handling protocol as part of their HS&E training and induction.

Data and photographs of incidental finds should be provided to the ecologist(s) by the Environmental Representative within 2 business days of the find for the possible reporting of an impact on a threatened species. Incidental finds of threatened species carcasses must adhere to the reporting requirements and timeframes described below in **Section 6.1**.

In addition to opportunistic incidental finds, the proponent of the Project commits to trained environmental representatives undertaking targeted incidental searches for White-throated Needletail following the occurrence of large storm fronts. These storm fronts are associated with changes to barometric pressures, including thunderstorms and lightning storms, passing over the Project between November and April when the White-throated Needletail is likely to utilise airspace within the Project. These checks will be conducted on foot within the inner search zones (excluding unsearchable areas) outlined in **Section 5.4.1**, with any finds recorded as per the data collection and carcass find protocol in **Section 5.4.3**. Any suspected White-throated Needletail finds should be immediately sent to the contracted ecologist for identification to quickly enact a **Section 6.1.1** response.

5.4.5 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 Project turbines (to aid estimation of mortality rates of birds and bats impacted by turbines) a carcass persistence trial will be undertaken.

Carcasses collected under the carcass find protocol (**Section 5.4.3.1**) will be used for the carcass persistence trials, with additional carcasses to be sourced from roadkill or other suitable legal sources if needed. If there are still insufficient carcasses, surrogate carcasses (e.g. domestic chickens) may be used. Carcasses for the detectability trial (**Section 5.4.6**) may be re-used for the persistence trial, however the detectability trial should occur before the persistence trial. All carcasses used in the trial will be marked to prevent confusion with carcasses that are not part of the trial, and marks should be subtle or hidden to avoid interfering with scavenger activity. Latex gloves will be worn at all times while handling carcasses to minimise contact with human scent, which may alter predator responses around carcasses. The following numbers of carcasses will be used:

- ten bat carcasses;
- ten small bird carcasses;
- five medium/parrot carcasses; and
- five large bird/raptor carcasses.

The 30 carcasses as listed above will be distributed amongst all 16 Project turbines, with at least one carcass at each turbine. Scavenger trials will be undertaken twice for each of the first two years of Project operation, one each in Spring and Winter to account for different vegetation conditions.

Previous scavenger trials show that almost all small bird and bat carcasses have been scavenged within five to ten days and medium bird carcasses within 15 days. Large birds may be scavenged within 30 days, however they have been found to persist for months (Nature Advisory, 2021). Carcasses will thus be checked at days 5, 15 and 30, with remote sensing cameras deployed to record scavenger activity to determine the exact time of carcass removal and scavenger species that occur within the Project area. The use of remote sensing cameras may be replaced with another suitably efficient and accurate method if one should become available, with the change in methodology to be undertaken in consultation with BCS.

If the carcass has been moved from its initial position but remains within the search zones, it is not deemed to be removed.

5.4.6 CARCASS DETECTABILITY TRIAL

The detectability of carcasses under turbines can vary depending on factors such as searcher efficacy, size of carcass and vegetation present. Carcass detectability trials are necessary to assess the probability that a searcher following the methodology outlined in **Section 5.4.2** will detect an existing carcass under Project turbines. To account for searcher variability in detecting carcasses, all searchers participating in the formal carcass surveys will participate in the carcass detectability trial. Detection efficacy will be incorporated into later analyses that derive mortality estimates for the Project.

Detectability trials will be conducted once in Spring and once in Winter. They can be undertaken concurrently with carcass persistence trials and/or formal carcass surveys to maximise survey efficiency. The following numbers of carcasses will be used for the detectability trial:

- ten bat carcasses;
- ten small bird carcasses;
- five medium/parrot carcasses; and
- five large bird/raptor carcasses.

Carcasses for this trial will be collected as per **Section 5.4.5** and can be shared with the carcass persistence trial, provided that the persistence trial be conducted after the detectability trial. To avoid confusion and re-counting during formal carcass surveys, carcasses should be marked in a way to not interfere with detectability.

The 30 total carcasses will be distributed randomly across all 16 Project turbines, with at least one carcass at each wind turbine. Six carcasses will be placed within unsearchable areas as defined in **Section 5.4.1.1** to allow for an assessment of potential negative impacts on search efficiency from additional vegetation strata. A person not involved in the formal carcass surveys (the carcass controller) will toss each carcass into the air and allow it to fall, simulating some of the positioning and ruffling of feathers after a fall. The controller will note the GPS co-ordinates of each placed carcass and is free to decide how many are deployed under each turbine. Searchers will then follow the same methodology used for formal carcass surveys (**Section 5.4.2**) to search for placed carcasses.

5.4.7 INJURED BIRD AND BAT FIND PROTOCOL

All on-site staff and monitoring personnel will be advised of the correct procedure for assisting wildlife as outlined below.

If an injured bird or bat is discovered, the Environmental Representative must be notified within 2 hours of the finding. The Environmental Representative will be responsible for organising the recovery and/or treatment or euthanasia of the animal. Where possible, all injured birds should be placed into a ventilated box or cloth bag by a person wearing rubber gloves to minimise stress and assist transportation. If required, local veterinarians, wildlife carers or the contracted ecologist should be contacted by the Environmental Representative to discuss whether release, rehabilitation or euthanasia is the most appropriate action.

Contact details are provided below, however other appropriately qualified veterinarians and wildlife carers may be used:

- Clinton Street Veterinary – (02) 4821 1881
- WIRES, Southern Tablelands – (02) 4822 3888
- Wildcare Queanbeyan – (02) 6299 1966

Site staff are prohibited from touching or handling any bats (injured or otherwise). A qualified and appropriately vaccinated ecologist or wildlife carer must be called upon to handle any bats. Only persons vaccinated against Australian Bat Lyssavirus may handle injured bats.

5.4.8 MORTALITY ESTIMATION

All data collected in this program will be analysed to estimate mortality rates and the annual number of collisions for bird and bats. The results will be detailed in the annual report and will provide a basis for identifying if further detailed investigations or mitigation measures are required. Data to be collected and analysed include but are not limited to:

- species, number, age, and sex (if possible) of birds and bat being struck by turbines;
- variations in number of bird and bat strikes between turbines; and
- any other variations in number of bird and bat strikes.

Statistically robust projections of bird and bat mortality for the entire wind farm site will be presented, based on the data collected from mortality searches. It is acknowledged that this is a current and dynamic aspect of research and that the outcomes from such programs may be equally dynamic. The current program is designed to provide an acceptably accurate and precise estimate of wind farm related bird and bat mortality within two years, so a full analysis and estimate will be provided in the second annual report, together with recommendations on the scope of future monitoring, if required.

The estimated mortality rate will be generated by modelling scavenger losses from the carcass persistence trials (**Section 5.4.5**) and detectability of searchers from the carcass detectability trial (**Section 5.4.6**). Data from the relevant trials will be analysed as per standard statistical analysis using relevant techniques such as those outlined by Korner-Nievergelt *et al.* (2015). In addition to providing

mortality estimates, this analysis will determine significant factors of turbines that may impact mortality rates.

A data science and analytics consultant may be contracted to undertake analysis of data collected.

5.5 Project survey schedule

Table 18 provides an overview of the BBAMP required monitoring programs that are to be completed.

TABLE 18: SURVEYS TO BE IMPLEMENTED

Survey	Timing	Initiation Duration
Pre-commissioning carcass searches	Carcass searches will be conducted on all active turbines, daily during the hold point testing period HP0 and weekly during HP1 testing period.	Until the implementation of the full Carcass Search Program.
Bird Utilisation Surveys	Ongoing with alignment to baseline surveys, four seasons surveyed in August, November-October, January-February and March/April.	First two years following commissioning and fifth year after commissioning. Subject to review, as seen in Section 8.2 . Addition surveys as triggered.
Raptor Vantage Point Surveys	Ongoing with alignment to baseline surveys, four seasons surveyed in August, November-October, January-February and March/April.	First two years following commissioning and fifth year after commissioning. Subject to review, as seen in Section 8.2 . Addition surveys as triggered.
Bat Surveys	Ongoing with alignment to baseline surveys, two seasons surveyed, consistent with the migratory period of Large Bent-winged Bat	First two years following commissioning and fifth year after commissioning. Subject to review, as seen in Section 8.2 . Addition surveys as triggered.
Carcass Search Program	Once per month, commencing within one month of all turbines becoming active at the wind farm.	Five years, subject to review, see Section 8.2 .
Carcass Persistence Trials	Winter and spring following the commencement of the operation	Two years.
Carcass Detectability Trials	Winter and spring following the commencement of the operation	One year.
Incidental bird and bat finds	To be conducted opportunistically throughout the operational life of the Project.	The operational life of the Project.
Targeted Searches	Subject to recommendations by species experts, BCS and through changing risk assessments, may include targeted surveys for threatened or migratory species	As determined and subject to triggers.

6 Impact triggers and response procedure

6.1 Introduction

This section establishes the decision-making framework in which impacts to bird and bat species will be responded to, investigated and managed. Impact trigger thresholds for threatened and non-threatened bird and bat species will be implemented with specific response processes to be followed in the case where a trigger threshold has been met. These triggers and responses aim to prevent the operational phase of this Project from causing significant impacts on local and total populations of bird and bat species.

An impact trigger assessment will be completed in accordance with the guidelines outlined within this document for all impact triggers that occur at the Project. All impact trigger assessments will be conducted by a suitably qualified ecologist. **Table 19** provides definitions to the terms used when completing an impact assessment for the Project.

TABLE 19: IMPACT TRIGGER AND ASSESSMENT DEFINITIONS

Term	Definition
Impact trigger	A direct impact on an individual or group of a species, such as blade strike or barotrauma, that causes injury or death.
Total population	The estimated population of an Australian species, or the estimated population of the relevant subspecies of a migratory species.
Local population	The population that occurs in the study area. Where multiple populations occur in the study area or a population occupies part of the study area, impacts on each subpopulation must be assessed separately.
Significant impact	An impact that affects the local and/or total population of assessed bird or bat species.
Regular occurrence	Likely to occur multiple times over the lifetime of the Project due to a species known or likely presence, presence of habitat or known migratory paths.

The approach for impact trigger assessments will be to assess the impacts of threatened and/or migratory species with reference to both their local and total populations. Non-threatened species impacts will be assessed in reference to only their local populations.

For the purpose of this BBAMP, and for application in impact trigger assessments, the definition of a local population is taken from the Biodiversity Assessment Method (2020):

“the population that occurs in the study area. Where multiple populations occur in the study area or a population occupies part of the study area, impacts on each subpopulation must be assessed separately.”

Local populations will be estimated by examining literature, using pre-existing vegetation mapping, and using baseline survey data to determine likely population densities. Seasonal events, migratory fluctuations, extreme weather events and other unexpected events will be considered in population assessments.

For threatened bird and bat species that have been identified as a ‘high’ or ‘severe’ risk species (**Section 3.3**), a significant impact is defined as one impacted individual. This has been determined appropriate as these species have been assessed as having a likely presence within the Project area and therefore one impact indicates a likelihood for multiple impacts to the species and therefore likely to be a regular occurrence and a significant impact.

Significant impacts on a local and/or total population of bird or bat species for all other species have not been prescribed by this BBAMP as other species’ case has distinct variables that will be examined during each relevant assessment. The impact assessment process will be used to inform the NSW and/or Commonwealth DCCEE whether a significant impact has or is likely to occur on a species, further

triggering additional monitoring and mitigation in consultation with the relevant department. The impact assessment must include in its investigation:

- details of the impact trigger, including the species and number of individuals impacted;
- details of the carcass/featherspot collected, including the date/s, the turbine/s ID, the location/s of the carcass/featherspot in relation to the turbine/s;
- information about environmental factors that may have had an effect on the impact trigger, including recent weather conditions, extreme weather event, climate, flowering/foraging or seasonal opportunities that may have influenced the impacted species migration into the area;
- assessment of the impact in relation to previously collected species data, including but not limited to, baseline survey data, post-construction survey data and previous impact trigger events;
- assess the cumulative impacts on the species from regional wind farms (30 km radius) including Crookwell 2 Wind Farm, Crookwell 1 Wind Farm, Gullen Range Wind Farm, Gunning Wind Farm, Biala Wind Farm, Taralga Wind Farm, and any future wind farm developments in the region. This must include all available information on the number and frequency of impacts on species being investigated;
- estimation on whether the event is likely to be a rare or a regular occurrence; and
- if the impacts are determined to be a regular occurrence or a significant impact, monitoring and mitigation strategies must be recommended for the employment at the Project to address the identified impact and prevent further impacts from occurring.

Consultation with BCS will occur to review impact triggers and the assessment process on year one, year two and year five during production of BBAMP annual reports to ensure that impact triggers are appropriately responding and assessing any impacts occurring at the Project.

The BBAMP impact assessment procedure must be implemented for lifetime of the Project. The proponent of the Project has a responsibility to see that the decision-making framework is adhered to for the lifetime of the Project, including all reporting and record keeping requirements.

6.1 Threatened species

6.1.1 THREATENED SPECIES IMPACT TRIGGER

The impact trigger threshold for species listed as threatened under the EPBC Act and/or the BC Act is the detection of one carcass, injured individual or featherspot ([Australian Centre for Wildlife Genomics](#)) under a wind turbine or in proximity to a turbine, including findings during any surveys or incidental finds made by site staff.

6.1.2 THREATENED SPECIES RESPONSE AND REPORTING REQUIREMENTS

In the event that a threatened species impact trigger threshold has been met, it is the responsibility of the person who discovers the threatened species to notify the Environmental Representative of the discovery immediately. If the carcass, photograph, featherspot or sample needs to be sent to the engaged ecologist for identification it is the responsibility of the ecologist to notify the Environmental Representative of the discovery as soon as confirmation of the threatened species is made. Within two working days of the Environmental Representative being notified, the proponent must then inform the relevant regulatory authority, the NSW and/or the Commonwealth DCCEEW of the impact trigger being met.

If the discovery of the impact trigger was made through an incidental find, the proponent will enact an immediate investigative carcass search of all turbines through a suitably qualified ecologist (**Section 5.4**) in response to the find.

The engaged ecologist will be notified at a minimum the same day as the regulatory body (if they did not make the discovery). The engaged ecologist will immediately work on threatened species impact trigger assessment to determine the cause of death or injury, can it be reasonably attributed to direct impacts from the Project and whether the impact trigger is likely a regular occurrence and/or a significant impact. The assessment will be completed in 10 working days with production of a report to be submitted to the relevant regulatory body giving information and assessment previously stated in **Section 6**. Investigation process will include at a minimum:

- an initial online or in-person meeting with the relevant regulatory authority within five working days of the impact trigger being notified to the relevant regulatory authority; and
- additional meetings as required depending on the consultation needs and nature of ongoing advice.

The investigation will aim to rapidly inform and accurately implement additional monitoring and mitigation measures that will most effectively prevent additional impacts occurring at the Project. The impact trigger response process is shown in **Figure 3**, it is to be implemented completely throughout the lifetime of the Project.

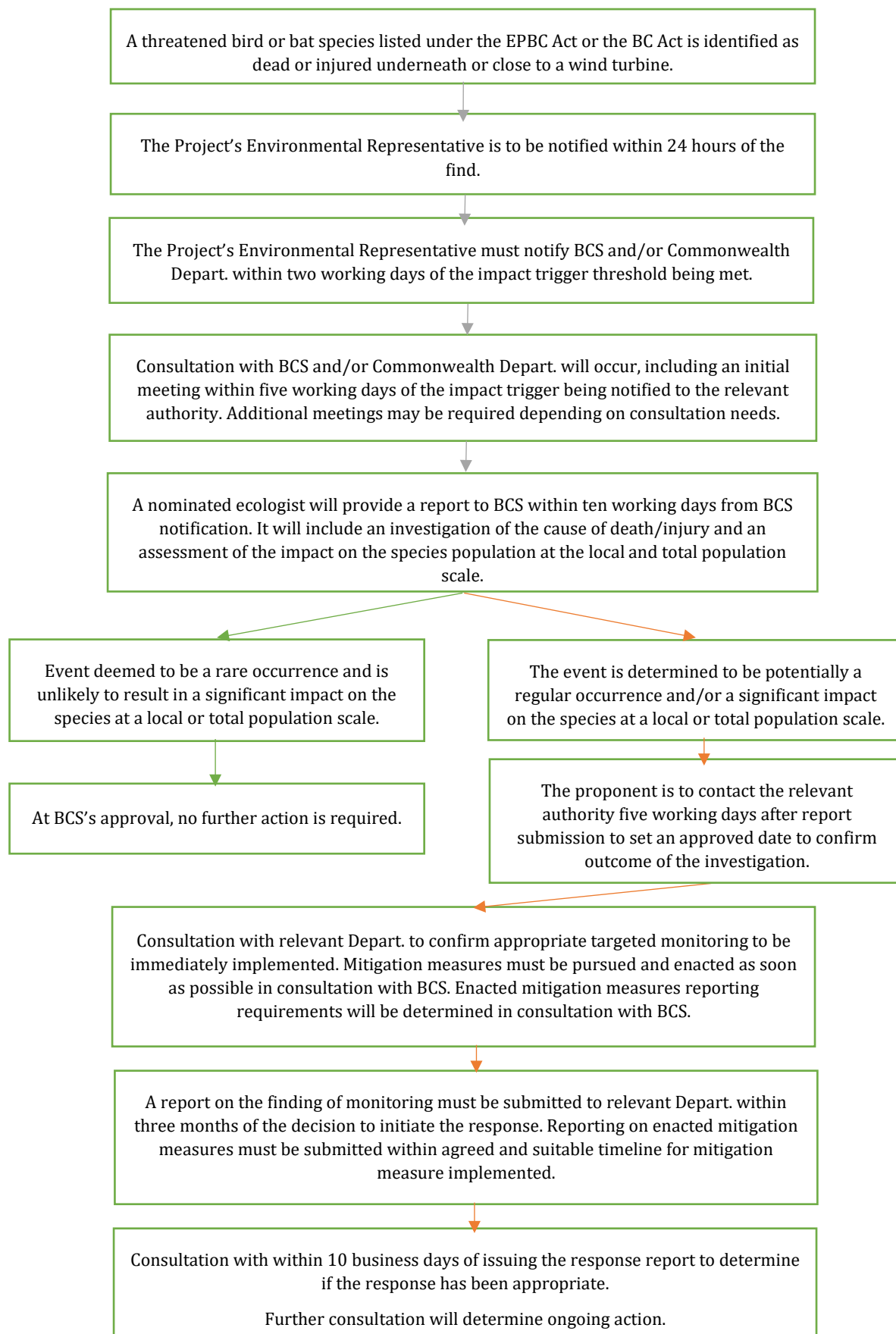
A decision will be made on the pathway forward with the relevant regulatory authority after the submission and review of impact trigger assessment report, utilising the principles of the precautionary approach. Five working days after the impact trigger report submission, the proponent will contact the regulatory body to set an approved meeting date to determine the outcome of the report.

If results from the investigation determine that the impact is a rare occurrence and not likely to cause a significant impact on the local or total population scale, no further action is considered necessary. Noting that this outcome must be approved by the relevant authority.

If the impact trigger assessment find that the event is either regular occurrence or likely to cause significant impact to local or total populations additional species-specific monitoring will be implemented as soon as possible. Monitoring and the need for targeted mitigation measures will be assessed in consultation with the relevant authorities during post-report submission meetings. All additional monitoring and investigations will be reported within annual reports.

If the impact trigger investigations find it likely that impacts are a significant impact or likely to be regular occurrence, additional targeted mitigation measures must be pursued and applied appropriately, these measures can be found in **Table 22**. All implementation of additional mitigation measures will be done in consultation with BCS. Additional mitigation measures determined through impact trigger assessment, consultation and any additional research will be agreed to within three months of the submission of the impact trigger assessment to the relevant regulatory body. Upon agreement, the implementation of a given mitigation measure has a timeframe described in **Table 22**.

FIGURE 3: THREATENED SPECIES IMPACT TRIGGER RESPONSE PROCEDURE



6.2 Non-threatened species

6.2.1 NON-THREATENED SPECIES IMPACT TRIGGER

The impact trigger threshold for non-threatened species is split into two major pathways: Wedge-tailed Eagle and 'other non-threatened species'. Noting that 'other non-threatened species' does not apply to introduced species or the following list of common native species (determined through local assessment and with reference to other BBAMP's):

- Sulphur-crested Cockatoo (*Cacatua galerita*);
- Galah (*Eolophus roseicapilla*);
- Australian Raven (*Corvus coronoides*);
- Australian Magpie (*Cracticus tibicen*); and/or
- Little Raven (*Corvus mellori*).

No impact trigger response or management action is required to be undertaken on discovering carcass or injured individual of an introduced species or the five mentioned native species.

The impact trigger threshold for Wedge-tailed Eagle is the detection of two or more carcasses, an injured individual or featherspot over the wind farm within a three-month period. This includes findings during any survey or incidental finds made by site staff. Furthermore, any Wedge-tailed Eagle carcass observed at the wind farm will be notified to BCS in a strike notification report to inform the species mortality attributed to the Project.

The impact trigger for 'other non-threatened species' is the detection of three or more carcasses, injured individuals or featherspots of the same species close to or under the same or adjacent wind turbine during carcass searches over two consecutive months.

6.2.2 NON-THREATENED SPECIES RESPONSE AND REPORTING REQUIREMENTS

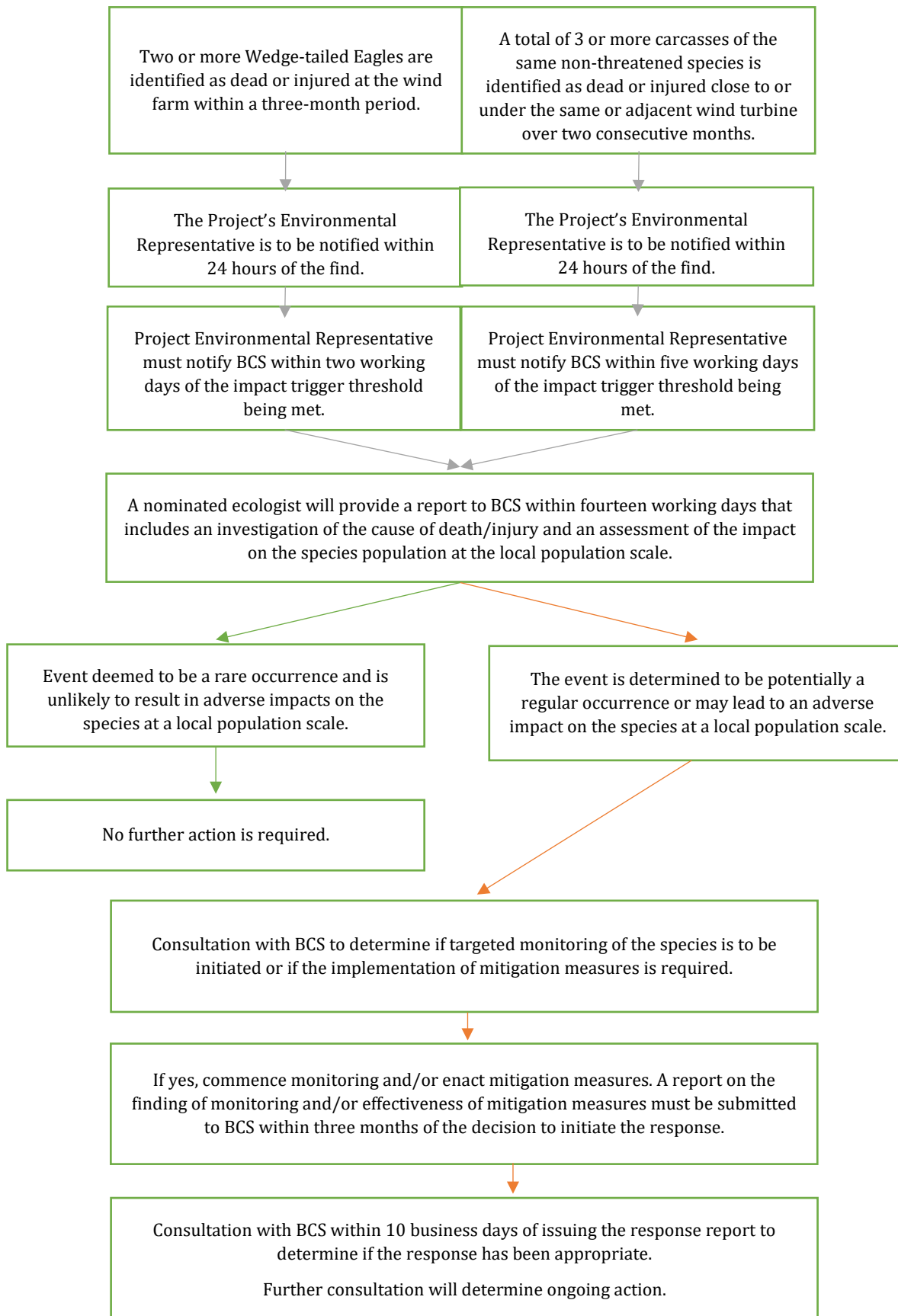
In the event that a non-threatened species impact trigger threshold has been met, it is the responsibility of the person who discovers the carcass/s to notify the Environmental Representative of the discovery immediately. If the carcass, photograph, featherspot or sample needs to be sent to the engaged ecologist for identification it is the responsibility of the ecologist to notify the Environmental Representative of the discovery as soon as species identification is made. At this point the proponent must inform the BCS as follows:

- for Wedge-tailed Eagle impact trigger, BCS must be notified within two days of the Environmental representative being informed of the trigger being met, and
- for all 'other non-threatened species' impact trigger responses BCS must be notified within five working days of the Environmental representative being informed of the trigger being met.

The engaged ecologist will be notified at a minimum the same day as BCS (if they did not make the discovery). The engaged ecologist will start an immediate non-threatened species impact trigger investigation to determine the cause of death or injury, and can it be reasonably attributed to direct impacts from the Project. The investigation will be completed in 14 working days with production of a report to be submitted to BCS giving information and assessment previously stated in **Section 6**.

The investigation will aim to inform and determine if it is necessary for additional monitoring and mitigation measures to be implemented at the Project to prevent further impacts occurring. The impact trigger response process is shown in **Figure 4**, and is to be implemented completely throughout the lifetime of the Project.

FIGURE 4: NON-THREATENED SPECIES IMPACT TRIGGER RESPONSE PROCEDURE



7 Mitigation measures

Mitigation measures will be employed to manage the risk of the Project leading to significant impacts on bird and bat species. The Conditions of Consent addresses multiple areas of mitigation measures that the BBAMP should engage with (refer to **Table 20** for a summary of these strategies). Mitigation measures presented in this BBAMP will be continually developed and approved in consultation with all relevant parties, including the proponent, ecologist(s) landholders, species experts, and BCS to ensure mitigation measures implemented are appropriate and achievable.

TABLE 20: DEVELOPMENT CONDITIONS THAT MAKE MENTION OF MITIGATION MEASURES

SSD6695 conditions that relate to mitigation	Commitment
b) a detailed description of the measures that would be implemented on site for minimising bird and bat strike during operation of the development, including:	minimising the availability of raptor perches on wind turbines;
	measures to control feral pests and stock that might attract foraging raptors; and
	using best practice methods for bat deterrence, including managing potential lighting impacts.
d) an adaptive management program that would be implemented if the development is having an adverse impact on a particular threatened or 'at risk' bird and/or bat species or populations; including the implementation of measures to:	reduce the mortality of those species or populations such as land management and reducing threatened and 'at risk' bird and bat species activity around turbines; and
	enhance and propagate those species or populations in the locality.

Mitigation measures are susceptible to change during the life of the BBAMP and operation of the Project as monitoring results inform the extent of potential impacts. Technological advancements and innovative strategies for mitigation should be introduced when made available and on review of the BBAMP.

7.1 Mitigations to be implemented

The preventative and ongoing mitigation measures to be implemented as a part of this BBAMP are detailed in the sections below and summarised in **Table 21**, including the timing and species targeted by preventative mitigation measures.

7.1.1 MINIMISING AVAILABILITY OF RAPTOR PERCHES

Raptors make use of a range of structures in both the natural and man-made environment to perch from which they often are found to hunt, or simple rest on. The Project infrastructure is designed to not create spaces that allow for the perching of raptors. Large modern turbines, like those installed at the Project have enclosed nacelles, no lattice support structures and are made of smooth aerodynamic materials that make perching behaviour on turbines unlikely.

No removal of natural habitat in the form of additional tree clearing is recommended by this BBAMP to reduce raptor perches near to turbine locations. Turbine location for much of the Project can be found to be in proximity to large areas of canopy, it is not feasible nor ecologically sound to increase the impact of the Project by further removing habitat within the surrounding environment.

If additional removal of perch habitat is determined to be an ecologically sound strategy in the future, additional biological assessments will need to be completed.

7.1.2 PEST CONTROL MEASURES

Pest control measures will be carried out as part of the environmental management of the Project in accordance with Section 4.14 of the Crookwell 3 Wind Farm Biodiversity Management Plan (Cumberland Ecology, 2022). This management includes:

“The management of feral fauna is intended to be adaptive and will be informed/reviews based on the key findings and recommendations of the feral monitoring. Initially the goal will be to reduce the existing populations substantially, with subsequent efforts concentrating on maintaining consistently low levels of feral animals to minimise impacts on native vegetation and fauna.

Ongoing management of feral pests should also have consideration to appropriate waste management measures as well as prompt removal of any animal carcasses.”

Implementation of pest control will have a focus on European Rabbit (*Oryctolagus cuniculus*), European Fox (*Vulpes vulpes*) and European Hare (*Lepus europaeus*) which have all known to be found within the study area. The reduction of prey species may reduce foraging opportunities for raptor species. Reducing fox numbers may also reduce impacts scavenging has on turbine carcass searches and improving the opportunity for searches to detect birds and bats impacted by turbine strike.

Measures implemented will be done in cooperation with landholders and may include poison baiting, shooting or burrow destruction. The Environmental Representative will be responsible for feral pest monitoring and will identify targeted feral species and areas. Removal of carrion from any pest control measure will be carried out immediately to prevent the attraction of raptor scavengers, see *Carrion removal program* in the following section, and in the case of poison baiting, will be disposed of to prevent scavengers being poisoned.

7.1.3 LAND-USE AND STOCK CONTROL MEASURES

Stock management practices can influence the resources available for foraging for multiple ‘at risk’ species. The implementation of multiple management practices, that reduce the available food resources available within the area, has the aim of discouraging the frequent foraging near turbines, avoiding collisions wherever possible.

Implementation of land-use and stock management measures is to be conducted in cooperation with landholders and are subject to landholder agreements. Landholders will form an important part of these mitigation measures. Ongoing consultation and updates to agreements will ensure that all parties are aware of ecological reasons and responsibilities behind the implementation of mitigation measures. The Environmental Representative or another suitable person will be appointed responsible for ensuring that cooperation and coordination of these measures are adopted appropriately.

Measures that should be implemented through landholder agreements include:

- **Carrion removal program.** Scavenging birds, including Wedge-tailed Eagles, may be attracted to areas where carrion is present, regular and quick removal of carrion may reduce risk of turbine strike to these species, using the following methods:
 - monthly inspections by Environmental Representative or suitable person to search a 200 m radius around each turbine for any carrion (including livestock, native animals, pest animals);
 - all wind farm site staff will be trained in carrion removal procedure;
 - inspections will be conducted by vehicle and/or on foot for all turbines and areas;
 - any located carrion must be disposed at least 200 m away from the nearest turbine as soon as possible, this area will be a preapproved location determined through consultation with the landholder;
 - a carrion removal database will keep records of the date, location and type of all carrion removed to preapprove location at least 200 m from nearest turbine;

- any carrion detected outside of the 200 m radius of a turbine's location will be removed in a timely manner;
- implementation of any pest control measure that results in carrion (i.e. poisoning, shooting) must be implemented in conjunction with carrion removal programs, with the use of poisons requiring disposal of carrion to prevent secondary poisoning to scavengers; and
- any bird or bat carcasses found will trigger **Section 5.4.4** Incidental findings protocol.
- **Stock birthing areas.** Lambing and calving season creates foraging opportunities for scavenging birds, including birth material and young stock being susceptible to death. Measures to be implemented include:
 - lambing/calving should be kept to paddocks that are at least 200 m from the nearest turbine to reduce risk to scavenging birds.
- **Stock feed.** Storing or spreading grain, pellets or dry feed can attract various cockatoo, parrot and other bird species. Measures to be implemented include:
 - storing and spreading of stock feed should be restricted to areas at least 200 m from the nearest turbine to reduce the risk of attracting susceptible species close to turbine collision area.

7.1.4 LIGHTING ON TURBINES

It has long been understood that artificial light on tall structures impact the flight path of migratory birds and bats and can lead to increased collision risk. Steady-burning lights have found to attract nocturnal migrating birds to communication towers (Longcore *et al.* 2008). A recent study found that no light variant is likely to be consistently avoided by nocturnally migrating birds across seas, therefore lights should be kept to a minimum. If lights are necessary, blinking lights are preferred, and if continuous lights are required, they should be red (Rebke *et al.* 2019). However, other research may indicate that red light on wind turbines may attract bats and lead to increased collision risk for bat species (Voigt *et al.* 2018).

The lighting of turbines at the Project is currently required under Civil Aviation Safety Authority this includes having lighting installed on nine turbines, A3, A5, A10, A12, A15, A16, A21, A24 and A25. The obstacle lighting installed is steady, red, low-intensity lights utilised only during nighttime hours. Lighting has been installed in accordance with Schedule 3 Condition 6 of the Conditions of Consent and found to be acceptable by the Civil Aviation Safety Authority. Potential future changes to lighting could be pursued through applications to change current Development Application requirements.

7.1.5 GANG-GANG COCKATOO MANAGEMENT PLAN

Pre-operational monitoring of the Project has confirmed that Gang-gang Cockatoos are frequent inhabitant of the woodland and forest within the Project area. Risk assessment have determined that there is a high risk of blade strike to the species on the species due to the proximity of turbines to observed Gang-gang Cockatoo habitat (**Section 4.3**). To further understand the risk and implementation of effective mitigation measures to prevent blade strikes on the species a Gang-gang Cockatoo Management Plan will be implemented at the Project.

The Gang-gang Cockatoo Management Plan will include the following commitments to be completed within the first twelve months after commencement of operations, to be produced with the first annual report:

- Breeding season targeted hollow surveys – investigations of entire Project area to determine if there are breeding pairs utilising hollows within the Project area.
- Flight path mapping of the species during all bird investigations carried out within the Project area.
- Additional monitoring of the species as necessary, in consultation with BCS.

Investigations will be used to inform suitable mitigation strategies implementation which will be completed in consultation with BCS.

7.1.6 SUMMARY

Table 21 summarises mitigation measures employed at the Project for the lifetime of the wind farm.

TABLE 21: SUMMARY OF ONGOING PREVENTATIVE MITIGATION MEASURES

Mitigation measure	Description	Timing	Relevant Species
Pest control measures	Pest control measures will be carried out as part of the environmental management of the Project in accordance with section 4.14 of the Crookwell 3 Wind Farm Biodiversity Management Plan (Cumberland Ecology, 2022). Vertebrate pest control will include monitoring of pest species and implementation of methods such as poisoning, shooting or burrow destruction where required in cooperation with landholders.	Operational life of the wind farm	Wedge-tailed Eagle, Little Eagle, Black Falcon
Land-use and stock control measures	Conducted in cooperation with landholders pending on ongoing landholder agreement negotiations: • carrion removal program to remove any carrion that is found to be within 200 m of a turbine. • controlling stock birthing areas to areas > 200 m from turbines. • controlling stock feed storage and distribution to areas > 200 m from turbines.	Operational life of the wind farm	Wedge-tailed Eagle, Little Eagle, Black Falcon, Superb Parrot, cockatoo and other parrot species
Lighting on turbine	If lighting of turbines is required, the implementation of lighting that minimises increasing collision risk will be adopted by the proponent. Any lighting that is installed, will be done in accordance with Schedule 3 Condition 6 of the Conditions of Consent and found to be acceptable by relevant aviation authorities (i.e. Civil Aviation Safety Authority).	Operational life of the wind farm	All bird and bat species
Gang-gang Cockatoo Management Plan	Development of a management plan through the completion of species-specific investigations to inform risk to the species. Surveys will have a focus on breeding habitat and whether breeding pairs utilise hollows within the Project area. Additionally, investigations to be employed as necessary.	Implementation as soon as practical, no later than twelve months from beginning operations.	Gang-gang Cockatoo

7.2 Mitigations measures for consideration

In the event that impact trigger thresholds have been met and where significant impacts have occurred additional mitigation measures will be implemented. These mitigation measures will be targeted to reduce the risk to impacted species identified through carcass detection and the decision-making framework. Mitigation measures to be considered should include technology and novel approaches that undergo continued review to ensure new research and strategies that might be suited to the Project can be assessed.

Mitigation measures that apply new technologies or innovative approaches will undergo initial testing and incorporate robust monitoring programs in their implementation. This may include the application of a mitigation measure to a single turbine initially, with increased monitoring of the site and a control to determine the effectiveness of the mitigation measure. Additional reporting requirements and review requirements for new mitigation measures will be implemented. The planning and implementation of novel mitigation measures will be carried out in agreement with BCS. Potential mitigation measures identified in **Table 22** have been agreed to as considered mitigation measures.

TABLE 22: MITIGATION MEASURES TO BE CONSIDERED WHEN IMPACTS ARE LIKELY A REGULAR OCCURRENCE OR SIGNIFICANT IMPACTS HAVE OCCURRED

Impact Trigger	Pathway	Mitigation measure	Description	Timing Implementation	Relevant Species
Threatened Species Impact Trigger (Section 6.1) and Non-Threatened Species Impact Trigger (Section 6.2).	Trigger impact assessment determines impacts likely a regular occurrence or significant impact (Section 6.1.2 or Section 6.2.2)	Acoustic Deterrents	Research indicates that high sound frequencies and ultrasonic sounds are either ineffective or potentially dangerous to birds, with lower frequencies more effectively deterring birds (Bishop <i>et al.</i> 2003). However, birds exhibit habituation to repetitive unnatural sounds, and this leads to the reduced efficacy of the stimuli (Roel <i>et al.</i> 2015). Implementation of acoustic deterrent technologies where turbines risk has been deemed unacceptable due to high risk of collisions or an impact trigger being met. Consultation with BCS and thorough technology review of current device options before implementation. Example of technology: Scarecrow – Robin Radar Systems: Humane bird control by utilising bird distress calls to signal threats to other birds, causing them to avoid the area. Largely used in airports and agriculture. Can be paired with a camera or radar system. Supporting research on the efficacy of bioacoustics at wind farms produces mixed results (Dorey <i>et al.</i> 2019).	As soon as practical, no later than six months of the agreed mitigation approach.	Threatened bird species: - Little Eagle, - Black Falcon, - Gang-gang Cockatoo Non-threatened bird species: - Wedge-tailed Eagle
		Ultrasonic Deterrents	Ultrasonic deterrent devices are deployed to create a field of disturbance that interferes with a bat's ability to use its echolocation for foraging and accurately surveying its surroundings. Implementation of ultrasonic deterrent technologies where turbines risk has been deemed unacceptable due to high risk of collisions or an impact trigger being met. Consultation with BCS and thorough technology review of current device options before implementation. Example of technology: NRG Bat Deterrent Systems: Ultrasonic noise generated between frequencies of 20 kHz and 50 kHz, disrupts the bat's own ability to interpret its ultrasonic calls, discouraging it from entering a given area. Used for wind turbines. Due to specific frequency emitted from deterrent device research results show deterrents for species can range from no significant reduction, to 54% - 78% (Weaver <i>et al.</i> 2020) and 17.4% - 66.7% (Good <i>et al.</i> 2022).	As soon as practical, no later than six months of the agreed mitigation approach.	Threatened bat species: - Large Bent-winged Bat, - Eastern False Pipistrelle - Yellow-bellied Sheath-tail-bat Non-threatened bat species: - White-stiped Freetail Bat
		Camera Detection Systems	Camera detection systems can use a combination of 2D, 3D or thermal camera imaging technology to image, track and identify flying animals. Largely used for birds, however, thermal imaging may be utilised for monitoring bats. Integrating AI with visual monitoring can target threatened and 'at risk' species and initiate curtailment of one or more turbines to reduce the risk of collision. Implementation of camera detection systems where turbines risk has been deemed unacceptable due to high risk of collisions or an impact trigger being met. Consultation with BCS. and thorough technology review of current device options before implementation. Example of technology: IdentiFlight: Automatic detection, identification and tracking of target birds: <i>Aquila</i> sp. Possibility of automatic curtailment based on distance and flight path.	As soon as practical, no later than 12 months of the agreed mitigation approach.	Threatened bird species: - Little Eagle, - Black Falcon, - White-bellied Sea-Eagle - Gang-gang Cockatoo Non-threatened bird species: - Wedge-tailed Eagle

Impact Trigger	Pathway	Mitigation measure	Description	Timing Implementation	Relevant Species
			An assessment of the effectiveness of IdentiFlight at Wild Cattle Hill Wind Farm (Tasmania, Aus) found that “performance is in line with published research and does significantly reduce eagle (Wedge-tailed Eagle) collisions.” (Rogers 2022).		
		Radar Detection Systems	Radar detection systems allow for the detection of both birds and bats regardless of the time of day, however, they do not allow for direct identification of species. Therefore, targeting species must be based on known identifying factors that radar can be used to determine, such as species size or migration patterns (Gradolewski <i>et al.</i> 2021). Implementation of camera detection systems where turbines risk has been deemed unacceptable due to high risk of collisions or an impact trigger being met. Consultation with BCS and thorough technology review of current device options before implementation. Example of technology: MAX Avian Radar: Detects and tracks flying objects, birds or bats providing full 3D coverage. Object movements are provided in real-time on a computer or mobile device. Can be used to apply turbine shutdown at defined distances for objects of a certain size class. Deterrents are available.	As soon as practical, no later than 12 months of the agreed mitigation approach.	Threatened bird and bat species: • Little Eagle, • Black Falcon • Gang-gang Cockatoo • Large Bent-winged Bat • Eastern False Pipistrelle • Yellow-bellied Sheathtail-bat Non-threatened bird species: • Wedge-tailed Eagle
		Turbine visuals	The painting of a single turbine blade black can enhance the visibility of rotor blades enabling birds to take evasive action and reducing bird collisions (May <i>et al.</i> 2020). Implementation of this mitigation measure is to be considered when turbines risk has been deemed unacceptable due to high risk of collisions or an impact trigger being met. Consultation with BCS and thorough review of scientific research will be completed before a small trial set will be implemented to assess the effectiveness of the mitigation strategy. This mitigation measure is also reliant on the proponent confirming it is possible to procure a modification to the Development Consent to allow for the implementation of the measure. Which may have implications for the following: • Visual impacts • Turbine specifics • Energy generation efficiency	As soon as practical, no later than 12 months of modification to Development Consent to allow for the mitigation measure to proceed.	Threatened bird species: • Little Eagle • Black Falcon • White-bellied Sea-Eagle • Gang-gang Cockatoo • White-throated Needletail • Superb Parrot • Dusky Woodswallow Non-threatened bird species: • Wedge-tailed Eagle • Non-threatened raptors
		GPS monitoring of threatened species	Monitoring programs of ‘at risk’ species to determine the extent to which a targeted species is affected by the Project. Timing of migration will be used to inform necessary curtailment if impact triggers have been met. • Prepare and test a monitoring program in consultation with species experts and BCS. The program is to be conducted by a suitably qualified consultant with experience in GPS monitoring of bird and/or bat species.	As soon as practical, no later than six months of the agreed mitigation approach, OR during the next migration event after the agreed	Threatened bird and bat species: • Large Bent-winged Bat • Eastern False Pipistrelle • Yellow-bellied Sheathtail-bat

Impact Trigger	Pathway	Mitigation measure	Description	Timing Implementation	Relevant Species
				upon mitigation approach.	• Little Eagle • Black Falcon • Gang-gang Cockatoo • Dusky Woodswallow Non-threatened bird species: • Wedge-tailed Eagle
		Enhancement of impacted species and their local population	• Facilitating and funding revegetation programs in suitable local areas targeting impacted species and restoring habitat. • Remediation efforts in the form of additional installation of artificial nest boxes for targeted species, with post-installation monitoring undertaken to monitor use. • Funding contribution to published recovery programs for species impacted by the Project. • Funding contribution to monitoring programs for species impacted by the Project. • Funding contribution to breeding programs for species impacted by the Project. • Funding and facilitating research programs for impacted bird and bat species.	As soon as practical, no later than six months of the agreed mitigation approach.	Threatened bird and bat species, including but not limited to: • Little Eagle • Black Falcon • Gang-gang Cockatoo • Large Bent-winged Bat, • Yellow-bellied Sheath-tail-bat • Eastern False Pipistrelle Non-threatened bird species: • Wedge-tailed Eagle
		Altering wind turbine cut-in speeds	The curtailing of wind turbines when turbine operation is restricted at low speeds has been shown to reduce bat strike mortality (Bennett <i>et al.</i> 2022). This mitigation measure will be implemented immediately in the event an impact trigger has been enacted for a 'severe' or 'high' risk species (Section 3.3). In the case of species assessed to be at 'moderate' or less risk, or those which have not yet been assessed in risk assessments, this mitigation measure will be implemented as soon as an impact trigger has been enacted twice. • Consultation with BCS, review of scientific research and analysis of impact data will inform the implementation of this mitigation measure. A program will be designed to occur at distinct times of the year when impact triggers have been determined most likely, e.g., migration events. Implementation initially restricted to higher-risk turbines where impacts have occurred for assessment of efficacy.	As soon as practical, no later than one month of the agreed mitigation approach for additionally assessed species.	'Severe' and 'high' risk species: Threatened bat species: • Large Bent-winged Bat (during migratory period) • Yellow-bellied Sheath-tailed Bat • Eastern False Pipistrelle Threatened bird species: • Gang-gang Cockatoo • Little Eagle • Black Falcon • White-throated Needletail (during migratory period) Additional lower risk species include but not limited to:

Impact Trigger	Pathway	Mitigation measure	Description	Timing Implementation	Relevant Species
					- Wedge-tailed Eagle - Dusky Woodswallow
Threatened Species Impact Trigger (Section 6.1).	Trigger impact assessment determines impacts likely a regular occurrence or significant impact (Section 6.1.2)	Offsetting	The offsetting of impacts of turbine strikes will be considered in consultation with regulatory bodies. if other mitigation measures are found to not adequately minimise or stop impact triggers from occurring. Funding and facilitating a conservation measure, research, breeding habitat or other offset in consultation and agreement with NSW or Commonwealth DCCEEW.	As soon as practical, no later than 12 months of the agreed mitigation approach.	Any targeted threatened bird or bat species
		Turbine shutdown	Wind turbine shutdowns will only be considered and implemented as a last resort option should the application of above mentioned and other mitigation measures fail to reduce or prevent the occurrence of impact triggers. Turbines identified for shutdowns will be restricted to those which have been assessed to pose a ‘very high’ risk of blade strike to the species being targeted for protection and only be considered for specific times of day and year. Wind turbine shut down will be coordinated with species specific behaviour that increases the likelihood of blade strike, they will include, but are not limited to: - White-throated Needletail: turbine shutdown will be coordinated during the species known migratory presence in NSW and oncoming stormfronts. Specification to stormfront parameters (i.e. monitoring, distance etc.) will be subject to further research and consultation with BCS. - Gang-gang Cockatoo: turbine shutdown maybe recommended during the species fledging season and observation of species sightings near turbines. Additional information collected from Gang-gang Cockatoo management plan will be used to inform this mitigation measure (Section 7.1.5).	As soon as practical, no later than six months of the agreed mitigation approach.	Threatened bird and bat species include (but not limited to): - White-throated Needletail (migratory period, with curtailment triggered by oncoming storm fronts) - Gang-gang Cockatoo (fledging)

8 Reporting and review

8.1 Reporting

Reporting requirements for this BBAMP are detailed in **Table 23**. Additional monitoring or investigative surveys will be subject to best practice reporting requirements, including the inclusion of detailed methods, data and analysis as a minimum. The reporting outlined in this BBAMP is compliant with relevant reporting requirements referred to in the Conditions of Consent.

8.2 Review

Revision of this BBAMP and its implementation is to occur in two parts:

1. A minor review at the completion of three months after the beginning of the commissioning of the Project to quickly enact changes to the BBAMP. The outcome of this review will move this BBAMP from 'provisional' to 'final'.
2. Major BBAMP reviews, which will occur following the completion of year one, year two and year five of commissioning, and then every five years after for the life of the Project.

The reviews will include the following in their assessments:

- the proponent, on-site staff and relevant agency comments;
- incident reports;
- adherence to procedures set in BBAMP;
- changes to legislation and species nominations on both BC Act and EPBC Act lists;
- efficacy of management and mitigation;
- changes to technologies and novel mitigation measures; and
- recommendations for improved ecological outcomes if applicable.

Details for the objectives of the review process can be found in **Table 24**.

TABLE 23: REPORTING REQUIREMENTS

Report	Description	Timing	Performance Criteria	Person/s Responsible
Impact Trigger Reporting	Report issued to the relevant NSW and/or Commonwealth DCCEEW notifying them of an impact trigger threshold being met. Impact trigger response framework is detailed in Section 6. This report is to be submitted to the relevant department by a suitably qualified ecologist within ten working days for threatened species impact triggers, or fourteen working days for a non-threatened species impact trigger. This impact trigger report must include: • details of the impact trigger, including the species and number of individuals impacted, • details of the carcass/featherspot collected, including the date/s, turbine/s ID, and location/s of the carcass/featherspot in relation to the turbine/s, • information about environmental factors that may have had an effect on the impact trigger, including recent weather conditions, extreme weather event, climate, flowering/foraging or seasonal opportunities that may have influenced the impacted species migration into the area, • assessment of the impact in relation to previously collected species data, including but not limited to, baseline survey data, post-construction survey data and previous impact trigger events, • assessment of the cumulative impacts on the species from regional wind farms (30 km radius) including Crookwell 2 Wind Farm, Crookwell 1 Wind Farm, Gullen Range Wind Farm, Gunning Wind Farm, Biala Wind Farm, Taralga Wind Farm, and any future wind farm developments in the region. This must include all available information of number and frequency of impacts on species being investigated, • estimation on if the event is likely to be a rare or a regular occurrence, using the definition outlined in this BBAMP, and • recommended monitoring and mitigation strategies to be employed as a result of the impact trigger being met, if the impacts are considered to be a regular occurrence and/or a significant impact. The report should include if any additional monitoring or mitigation measure have been enacted pre-empting department recommendations.	In the event an impact trigger has been met, in accordance with thresholds outlined in Section 6 .	Report has been completed accurately and submitted to the relevant department in accordance with outlined timing and content criteria.	Personnel who discovers impact trigger: • Notify Project Environmental Representative. Project Environmental Representative: • Notifying relevant Department of impact trigger being met. Engaged Ecologist • Preparing impact trigger report.

Annual Reporting	Annual reports will be produced at the completion of nominated years of operation to document and analyse findings. Year one annual report will include: • detailed and clear summary of any results that were recorded during the commissioning process and the Provisional BBAMP, • provide results, summaries and commentary on data collected throughout the first year of operation of the wind farm including an analysis of the bird and bat monitoring programs and the carcass monitoring program, • provide an interpretation and discussion on these findings in relation to baseline surveys and the regional context (including but not limited to addressing cumulative impacts from other wind farms and developments), • provide all results and commentary on any additional threatened species that have been found within monitoring programs, including information to be used in reviewed risk assessments to be carried out in Section 8.2, • provide results, commentary on data collected and recommended mitigation measures to be implemented within the Gang-gang Cockatoo Management Plan that will be applied from the production of the first annual report, • if impact triggers have been engaged, summarise and analyse the data collected in relation to collision rate and any relevant monitoring data, • summarise mitigation measures being implemented and discuss the potential effectiveness of the mitigation measures, support with monitoring evidence if applicable, and • report on any outstanding environmental factors that may have impacted the ecology or data collected of the wind farm in the annual period, including but not limited to extreme weather conditions, climate, migration of species, bushfires etc. Each following annual report will include: • provide results, summaries and commentary on data collected throughout the year of operation of the wind farm including an analysis of the bird and bat monitoring programs and the carcass monitoring program, • provide an interpretation and discussion on these findings in relation to baseline surveys, previously collected data and the regional context (including but not limited to addressing impacts from other wind farms and developments), • provide all results and commentary on any additional threatened species that have been found within monitoring programs, including information to be used in reviewed risk assessments to be carried out in Section 8.2, • if impact triggers have been engaged, summarise and analyse the data collected in relation to collision rate and any relevant monitoring data, • summarise mitigation measures being implemented and discuss the potential effectiveness of the mitigation measures, support with monitoring evidence if applicable, and • report on any outstanding environmental factors that may have impacted the ecology or data collected of the wind farm in the annual period, including but not limited to extreme weather conditions, climate, migration of species, bushfires etc.	Annually for the first five years.	Report to be completed in accordance with the criteria outlined in the description column. Report to include all raw data collected from monitoring programs as per the Conditions of Consent. Report to be submitted to BCS and the Planning Secretary as per Conditions of Consent within three months of completing annual monitoring.	Engaged Ecologist: • Collect raw data, and • Prepare annual report. Project Environmental Representative: • Submit the annual report.
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TABLE 24: BIRD AND BAT ADAPTIVE MANAGEMENT PLAN REVIEW REQUIREMENTS

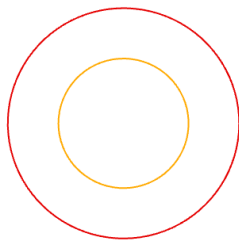
Report	Description	Timing	Performance Criteria
BBAMP Minor Review	Initial minor review will be completed within three months after the beginning of the commissioning of the Project to quickly enact changes to the BBAMP. The purpose is to transition from a Provisional BBAMP to a Final BBAMP. This review will include a complete update to the Final BBAMP with all raw data collected after submission of the Provisional BBAMP. An update to all aspects of the Final BBAMP will be calculated and assessed in relation to the additional data. Review and refinement will include: • an updated complete data set and analysis, • include data and analysis on pre-commissioning carcass searches, • an update to risk assessments based on additional data sets, • refine monitoring programs as necessary, • refine impact triggers to reflect any additional risks, and • review and recommend mitigation measures that reflect any additional risks. This review will be carried out in consultation with BCS and the approval of the Planning Secretary	Three months after commissioning final turbine of the Project.	Transition <i>Provisional BBAMP</i> to <i>Final BBAMP</i> .
BBAMP Major Review	Major BBAMP reviews will be completed year one, year two and year five of commencement of operation. Reviews are to continue every five years after that for the life of the Project for the opportunity for continued risk assessments and implementation of mitigation measures. The major review will include: • confirmation of roles, responsibilities and acknowledgement of any organisation structural changes, • summary of findings from monitoring and any impact trigger breaches, • recalculate risk assessments (Section 3 and Section 4) for observed and impacted species, include addition of newly conservation listed species, • provide a review of new technologies and novel strategies for mitigations that may be applicable for use at the Project, and • introduce new mitigation measures and monitoring programs that will be implemented at Project (if applicable). This review will be carried out in consultation with BCS and the approval of the Planning Secretary.	Year one, year two and year five of operation, and every five years from thereafter for the life of the Project. To be produced within three months of the completion of the annual report.	Review and adapt the implementation of this BBAMP to ensure that the ecological objectives are being met throughout the lifetime of the Project.
Monitoring Program Review	An initial review of all monitoring programs being conducted for the Project during year two after commissioning of the Project. The review will be completed in agreement with BCS and will include a review of each program, the programs reviewed will be: • bird utilisation surveys, • raptor vantage point surveys, • bat surveys, and • carcass search program. The reviews will include an analysis of the programs: • the methods and reliability, • the value of data collected, and • environmental, regional or legislative changes that might alter monitoring needs. The outcome of the review will be used to determine the value of continuing the monitoring program or if the program needs to be adapted. The decision to change will be made in agreement with the BCS and the approval of the Planning Secretary.	Year two and year five of operation. Year five review can enact future reviews as required under agreement with BCS.	Decide in agreement with BCS and Planning Secretary whether to change the following monitoring programs: • bird utilisation surveys, • raptor vantage point surveys, • bat surveys, and • carcass search program.

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Appendix A: Carcass monitoring data sheets

Formal Carcass Survey Data Sheet				
Survey details				
Date:		Observers:		
Start time:	End time			
Turbine number:				
Weather details				
Temperature:				
Precipitation (please circle): Fine Showers Rain				
Wind strength (please circle): Calm Breeze Moderate Strong				
Wind direction:			Cloud cover (%)	
Survey methodology				
Survey method (please circle): Ecologist searcher Conservation dog (ID: _____)				
Ground visibility (please circle): High Moderate Poor				
Was entire search area covered (please circle): Yes No				
If No , estimate percentage of search area covered: _____				
Sketch in area covered in the diagram to the right. (red for outer search zone, orange for inner search zone)				
Survey limitations: <i>e.g. inaccessible areas or tall vegetation</i>				
Bird and Bat find record				
Dead/injured bird or bat record? (please circle) Yes No		Continue filling this section if Yes		
Total number of finds: _____ carcasses and/or _____ injured but alive				
Dead or Injured Bird/Bat Data Sheet complete? (please circle) Yes No				
Photographs taken? (please circle) Yes No				
Dead Bird/Bat			Injured Bird/Bat	
Carcass appropriately packaged and brought to freezer in site office? Yes No			Actions taken: <i>e.g. taken to vet</i>	
NOTE: Carcasses are to be double bagged and brought to freezer in site office			NOTE: Only suitably vaccinated staff are to handle bats.	
Additional Notes				
Data sheet based on Biosis 2018				

Deceased or Injured Bird/Bat Data Sheet

Date and location

Date:	Observers/Personnel:
Time animal was found:	
Turbine number:	
GPS co-ordinates of carcass: Easting _____, Northing: _____	

Weather details at time of detection

Temperature:	
Precipitation (please circle): Fine Showers Rain	
Wind strength (please circle): Calm Breeze Moderate Strong	
Wind direction:	Cloud cover (%)

Detection

Survey method (please circle): Dog search Ecologist search Incidental	
Approximate distance of carcass/injured animal from wind turbine (m):	Approximate orientation of carcass/injured animal from wind turbine (x°):
Describe ground visibility within 1 m radius of where carcass/injured animal was found: <i>e.g. vegetation/structure surrounding</i>	

Carcass/injured animal photographed (please circle): **Yes** **No**
NOTE: if incidental finding, photograph must be sent to Environmental representative for forwarding to ecologist

Carcass/injured animal information and condition

Species (if unknown, closest taxonomic group e.g. raptor, bat):	
Age (please circle): Unknown Adult Juvenile	
Sex (please circle): Unknown Male Female	
Condition (please circle): Dead (carcass) Injured but alive Feather spot (> 5 feathers)	
Degree of decay; Fresh More than 1 week Very old/highly decayed	
Describe conditions and type of any injuries if evident:	Describe evidence of scavenging if any:
If injured, please detail actions taken (e.g. euthanised, taken to vet/wildlife carer):	

Carcasses should be sealed in double plastic bags with a copy of this data sheet and taken to freezer at site office

Data sheet based on Biosis 2018

Attachment 1: Pre-Operational Bird and Bat Survey Report

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Attachment 2: Bird and Bat Risk Assessment Report

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Pre-Operational Bird and Bat Survey Report

Crookwell 3 Wind Farm

Prepared for Global Power Generation Australia Pty Ltd

Prepared by Emily Zouch

30 July 2024



ABOUT THIS DOCUMENT

This document has been prepared by Project Ecologist Emily Zouch and Senior Ecologist Simon Vision, Accredited Biodiversity Assessor NSW licence BAAS23004.

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DOCUMENT TRACKING

Version	Date	Author	Reviewer	Details
DRAFT v0.1	21/03/2024	Emily Zouch	Simon Vinson	Draft for client review
DRAFT v0.2	09/04/2024	Emily Zouch	Simon Vinson	Draft report released for external review DCCEEW(NSW)
Provisional v1.0	29/04/2024	Emily Zouch		Report for release
Provisional v1.1	24/05/2024	Emily Zouch		Incorporation of Autumn data Provisional for submission
Provisional v.1.2	30/07/2024	Emily Zouch		Provisional for submission

ABOUT ECOLOGY CONSULTING



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Shortened forms

BAM	Biodiversity Assessment Method
BBAMP	Bird and Bat Adaptive Management Plan
BC Act	Biodiversity Conservation Act 2016 (NSW)
BCS	Biodiversity and Conservation Science
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
BUS	bird utilisation survey
C2WF	Crookwell 2 Wind Farm
Cth	Commonwealth
DCCEEW	Department of Climate Change, Energy, Environment and Water (NSW)
DPHI	Department of Planning, Housing and Infrastructure
EPBC	Environment Protection and Biodiversity Conservation
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cth)
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
ha	hectares
km	kilometres
LEC	Land and Environmental Court
LEP	Local Environmental Plan
LGA	Local Government Area
m	metres
NSW	New South Wales
PCT	plant community type
RSA	rotor swept area
RVPS	raptor vantage point survey
SPRAT	Species Profile and Threats Database
TBDC	Threatened Biodiversity Data Collection

1 Introduction

Global Power Generation Pty Ltd has engaged Ecology Consulting Pty Ltd to undertake pre-operational bird and bat surveys for the production of the Crookwell 3 Wind Farm Bird (the Project) and Bat Adaptive Management Plan in accordance with the Project's Conditions of Consent issued under section 4.38 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) approved by the Land and Environment Court.

This report details the survey approach and methods applied to pre-operational bird and bat surveys. The methods are consistent with the method requirements for a 'Level One' bird risk assessment as outlined in *Wind Farms and Birds – Interim Standards for Risk Assessment* (AusWEA, 2005). They are in alignment with guidelines outlined in "Best Practice Guidelines for Implementation of Wind Energy Projects in Australia" (Clean Energy Council, 2018) and the "Draft Wind Energy Guideline: Guidance for State significant wind energy development" (NSW DCCEEW, 2023). Furthermore, methods were additionally guided by the Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) and consultation with species experts.

Methods detailed in this document are to be applied during the operational phase of bird and bat surveys to be conducted the Project.

1.1 Background

Global Power Generation Pty Ltd (GPG) is the proponent of the Project and began development in November 2022.

Of relevance to this report is Condition 23 of Schedule 2 of the Development Consent issued under section 4.38 of the EP&A Act approved by the Land and Environment Court, as follows:

- "Prior to the commissioning of any wind turbines, the Applicant must update the Crookwell 2 Wind Farm Bird and Bat Adaptive Management Plan to include the development in consultation with BCS, and to the satisfaction of the Secretary. This plan must include:
 - a) *at least 12 months' worth of baseline data on threatened and 'at risk' bird and bat species and populations in the locality that could be affected by Crookwell 2 Wind Farm and the development;*"

Surveys conducted through four seasons (1: August 2023, 2: October and November 2023, 3: January and February 2024, and 4: March to April 2024) will meet the 12 months of baseline data requirements. Data collected during baseline surveys will provide a suitable measure for potential future impacts and will enable appropriate impact thresholds for adaptive management to be set.

1.2 Rotor swept area height

For the purposes of this report, flight height has been included relative to rotor swept area (RSA) height. The following intervals are based on the height and RSA of the turbines constructed at the Project:

- A = Outside RSA (< 30 metres and > 160 above ground level)
- B = Within RSA (30 -160 metres above ground)

RSA height has been assigned the category of 30 m due to the specifications of the Project turbines being a maximum hub height of 94 m, maximum rotor diameter of 126 m, and maximum tip height of 157 m. Therefore, having a minimum RSA height of 31 m.

2 Bird surveys

2.1 Bird Utilisation Surveys

The main purpose of pre-construction bird utilisation surveys (BUS) at wind farms is to collect suitable baseline data that ensures a comprehensive understanding of the bird species found at the wind farm, allow for future comparative analysis and determine appropriate impact thresholds.

2.1.1 METHOD

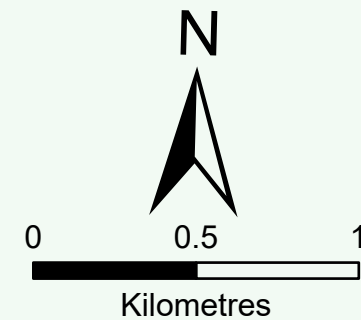
Surveys were conducted as diurnal fixed point count surveys at eight sites across the Project area in 2023 and 2024 (**Figure 1**). Six impact points and two reference sites were selected (**Table 1**). Impact point survey locations were selected close to turbines and nearby habitats with largely unobstructed views of the surroundings. Reference sites were located at least 500 m away from turbines and in analogous habitat to that of impact points. Fixed point surveys were conducted in each season during August 2023, October/November 2023 and January/February 2024 and March 2024 (**Table 2**).

Each survey point was monitored by a lead ornithologist and suitably qualified ecologist for a period of 20 minutes at least 100 m apart and separated by vegetation and/or landscape features. During this time all bird observations were recorded, including the following details:

- species;
- abundance;
- observation type (visual or call heard); and
- flight height (if visual confirmation of the bird was made).

For species of concern (threatened species and raptors), additional information was collected on the location in relation to observer, time observed, flight direction and flight path.

BUS fixed points were surveyed 12 times per season, with each survey point twice per day, over six survey days. Fixed point locations were scheduled to be surveyed at different times of day to ensure all sites were visited across different times of the survey period. Surveys for each season were completed by two three-day field inspections rather than six consecutive days of field surveys. Suitability to survey is subject to weather conditions, ensuring surveys are conducted in calm, appropriate weather, i.e. no high winds, heavy rain or storms.



- Legend**
- Project area
 - Project footprint
 - BUS fixed point locations



FIGURE 1: Bird utilisation survey locations

Imagery: Google Satellite
(5/2024 & 9/2024)
27/02/2024

TABLE 1: BUS FIXED POINT LOCATION DESCRIPTIONS

Fixed point Location	PCT in BDAR	Elevation (m)	Description	Photo
FP1	Exotic	924	IMPACT POINT Cleared grazing land on undulating land with few scattered paddock trees in gully lines. Canopy species present in the gully lines are Red Stringybark (<i>Eucalyptus macrorhyncha</i>) and Inland Scribbly Gum (<i>E. rossii</i>). Understory is largely comprised of exotic pasture grasses. Midstory was found to be absent. Very limited fallen timber present, with only some around scattered canopy trees.	
FP2	PCT1330: Yellow Box – Blakely’s Red Gum grassy woodland on the tablelands	892	REFERENCE POINT Small patch surrounded by cleared grazing land on generally undulating land. Patch of woodland separated by road and powerlines with an agricultural dam located nearby. Dominant canopy species are Yellow Box (<i>E. melliodora</i>) and Apple Box (<i>E. bridgesiana</i>) with scattered Red Stringybark. The understory largely dominated by pasture grasses and exotic forbs with low diversity of native grasses and forbs. Midstory largely absent. Some fallen timber present. Dead stags present. Mistletoe species present throughout much of the canopy.	

FP3	PCT1093: Red Stringybark – Brittle Gum – Inland Scribble Gum dry open forest of the tablelands	876	IMPACT POINT Open cleared grazing land on generally undulating land with scattered paddock trees adjacent to a patch of native forest. Gully lines lead into a creek that has additional patches of native forest lined along them. Dominant canopy species are Red Stringybark and Inland Scribbly Gum and Broad-leaved Peppermint (<i>E. dives</i>) co-dominant. Understory is derived native grassland and is largely native grasses, forbs and rushes. Sparse midstory present in cleared area, with midstory growth more dominant in forest areas. Some fallen timber present. Dead stags present. Mistletoe species highly abundant throughout the canopy.	
FP4	PCT1155: Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tablelands	889	IMPACT POINT Edge of regrowth area of large patch native forest. Open cleared grazing land on generally undulating land to the west with scattered paddock trees. Dominant canopy species Silvertop Ash (<i>E. sieberi</i>) with Red Stringybark and Inland Scribbly Gum co-dominant. Understory is derived native grassland and is largely native grasses and forbs. Some midstory present in cleared area, with midstory very abundant and diverse in forest regrowth area. Few areas of fallen timber present. Dead stags present. Mistletoe species found sparsely throughout the canopy.	

FP5	PCT1155: Silvertop Ash – Narrow- leaved Peppermint open forest on ridges of the eastern tablelands	906	IMPACT POINT Open cleared grazing land on undulating land with patches of native forest in surrounding landscape. A few small agricultural dams in the area. Dominant canopy species are Silvertop Ash with Red Stringybark and Inland Scribbly Gum co-dominant. Understory is a mix of native grasses, forbs and rushes and exotic pasture grasses. Midstory very sparse. Some fallen timber is present in forest areas, absent in cleared grazing land. Mistletoe species present in the forest canopy.	
FP6	PCT1093: Red Stringybark – Brittle Gum – Inland Scribble Gum dry open forest of the tablelands	864	REFERENCE POINT Edge of large patch native forest to the south. Open cleared grazing land on generally undulating land to scattered paddock trees to north. Agricultural dams present along long gully line. Dominant canopy species Red Stringybark and Inland Scribbly Gum and Brittle Gum (<i>E. mannifera</i>) with Broad-leaved Peppermint co-dominant. Understory is derived native grassland and is largely native grasses, forbs and rushes. Sparse midstory present in cleared area, with midstory growth more dominant in forest areas. Fallen timber abundant throughout forest. Dead stags present. Mistletoe is highly abundant throughout the canopy.	

FP7	PCT1093: Red Stringybark – Brittle Gum – Inland Scribble Gum dry open forest of the tablelands	894	IMPACT POINT Open cleared grazing land on generally undulating land with scattered paddock trees adjacent to very small patch of native forest. Agricultural dams nearby. Dominant canopy species Red Stringybark and Inland Scribbly Gum and Brittle Gum. Understory is largely exotic pasture grasses with few native grasses and forbs. Midstory absent. Some fallen timber present in forest but absent in cleared area. Dead stags present. Some mistletoe species present in forest canopy.	
FP8	PCT1155: Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tablelands	936	IMPACT POINT Open cleared grazing land in the shape of a small valley and ridgeline line surrounded by large patches of native forest to the west, south and east. Forest canopy dominated by Silvertop Ash with few Red Stringybark and Broad-leaved Peppermint present. Understory predominantly exotic pasture grasses in open areas and native understory in the forest. Midstory is absent in cleared areas, with some midstory present within forest areas. No fallen timber is present in the cleared area, fallen timber present in forest area. Limited mistletoe is seen throughout the canopy of forest.	

2.1.2 SURVEY TIMING AND WEATHER CONDITIONS

BUS surveys were initially conducted to include survey times across the entire day in alignment with recommendations in “Wind Farms and Birds – Interim Standards for Risk Assessment” (AusWEA 2005), from morning through midday to afternoon. However, through consultation with ornithologist Neil Hermes, following the Biodiversity Assessment Method (BAM) best practices, and recommendations from “Survey guidelines for Australia’s threatened birds: Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999” (DEWHA, 2010a) the methodology was adjusted to focus survey time on early morning and late afternoon when most birds are likely to be active and calling.

Focusing survey effort on the morning, (approximately 6:30 – 10:00) and afternoon (approximately 15:00 – 18:30), with adjustments made for seasonal changes to sunset and sunrise times, allowed differing diurnal activity of bird activity to be assessed while also ensuring times of high behavioural activity to more likely to be detected.

Surveys times and dates can be found in **Table 2**. Prevailing weather conditions and conditions on the day of surveys can be found in **Table 5**.

2.1.3 LIMITATIONS

The application of the BUS was to determine the abundance and diversity of species within the Project area. Constraints within various aspects of the production of the bird and bat adaptive management plan (BBAMP) can lead to limitations within an investigation. Limitations can include:

- **Project impacts limitations** – BUS were conducted after construction activities at the wind farm were already underway, therefore impacts from the development on bird populations likely were already occurring. No true baseline surveys could be produced to show bird species diversity, abundance and density before Project impacts.
- **Temporal limitations** – best practices require at least 24 months of survey for pre-operational baseline data BUS data. This ensures sufficient data about relevant species potential used in the Project area is recorded. Additionally, 24 months is needed to account for climate and migratory variations when capturing particularly cryptic species.
- **Seasonal limitations** – limiting BUS to six days per season over two weeks may not allow for an appropriate length of time to detect seasonal long-distance or altitudinal migrants.
- **Weather limitations** - Conditions at the time of fieldwork were suitable for the completion of each survey, however, if weather conditions were inappropriate for the collection of data, surveys were deferred. This strategy was utilised on several occasions when the weather for the day turned, half of the surveys would be deferred to another day.
- **Project Access limitations** – during the construction of Project some areas were inaccessible due to construction activities. Because of this, some surveys were unable to be completed during certain survey periods, which at the time was found to be unavoidable.

TABLE 2: BIRD UTILISATION SURVEY DATES AND TIMES

Winter	15/08/2023		16/08/2023		17/08/2023		24/08/2023		25/08/2023		28/08/2023	29/08/2023
Site	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
FP1	12:00	17:00	7:30	17:00	10:00	15:30	9:23	16:42	8:52	15:25	8:30	15:20
FP2	Too wet		10:40	Too wet	10:30	16:00	9:55	17:11	9:22	15:54	9:02	15:50
FP3	8:20	12:50	8:00	12:50	6:47	11:00	No access		9:47	16:22	9:32	16:16
FP4	No access	14:00	No access		7:15	12:00	6:52	14:02	10:20	16:50	10:03	16:43
FP5	8:40	14:40	8:30	14:40	7:50	13:30	7:23	14:34	6:51	13:22	10:35	17:13
FP6	9:15	15:30	9:00	15:30	8:20	14:00	7:52	15:05	7:21	13:56	7:00	13:50
FP7	9:45	14:00	9:30	14:00	8:50	14:30	8:20	15:35	7:51	14:23	7:28	14:18
FP8	10:40	14:30	10:00	14:30	9:20	15:00	8:48	16:00	8:20	12:50	7:55	14:45
Spring	17/10/2023		18/10/2023		19/10/2023		8/11/2023		9/11/2023		10/11/2023	
Site	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
FP1	7:50	16:26	7:20	15:35	6:50	15:00	7:26	15:45	6:46	15:05	10:20	18:20
FP2	8:20	16:52	7:52	16:03	7:19	15:33	7:55	16:13	7:14	15:32	6:44	15:09
FP3	8:49	17:18	8:20	16:53	7:47	16:00	8:22	16:46	7:42	16:00	7:11	15:37
FP4	9:18	17:46	8:49	17:22	8:17	16:40	8:55	17:15	8:12	16:28	7:40	16:04
FP5	No access	18:18	No access	17:50	8:51	17:10	9:26	17:50	8:43	17:04	8:11	16:34
FP6	9:56	18:42	9:26	18:21	9:19	17:35	10:01	18:18	9:11	17:31	8:40	17:00
FP7	6:47	15:29	No access				10:30	18:46	9:47	17:39	9:09	17:28
FP8	7:17	15:54	6:50	15:00	9:55	18:07	6:54	15:10	10:15	18:24	9:41	17:54
Summer	16/01/2024	17/01/2024	18/01/2024		19/01/2024	23/01/2024	24/01/2024		25/01/2024		1/02/2024	
Site	Morning	Morning	Morning	Afternoon	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Afternoon
FP1	7:18	7:15	11:11	17:58	16:20	10:22	17:35	9:30	17:10	8:59	16:15	17:22
FP2	7:47	7:41	7:29	18:25	16:46	10:49	18:05	10:00	17:35	9:22	16:39	17:45
FP3	8:16	8:09	7:59	15:16	17:13	7:17	14:40	10:26	18:04	9:49	17:02	18:10
FP4	9:17	8:37	8:43	15:44	17:42	7:46	15:10	7:08	18:36	10:29	17:29	15:15
FP5	8:45	9:06	9:15	16:14	18:19	8:21	15:45	7:39	15:10	10:58	18:01	15:42
FP6	9:48	9:33	9:48	16:42	18:44	8:49	16:10	8:06	15:44	7:40	15:01	16:06
FP7	10:23	10:03	10:09	17:10	19:15	9:23	16:39	8:35	16:15	8:05	15:26	16:30
FP8	6:46	10:33	10:39	17:32	15:50	9:47	17:02	8:59	16:40	8:31	15:48	16:54

Autumn	18/03/2024		19/03/2024		20/03/2024		26/03/2024		27/03/2024		28/03/2024	
Site	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
FP1	10:28	18:00	10:20	17:39	11:05	16:39	10:17	17:48	9:40	16:59	8:40	15:22
FP2	7:04	14:53	10:48	18:03	11:35	17:02	10:48	18:11	10:10	17:25	9:05	15:47
FP3	7:30	15:20	7:19	14:52	12:01	17:27	11:11	18:38	10:44	17:50	9:30	16:15
FP4	7:59	15:49	7:46	15:22	8:45	14:30	7:54	15:27	11:11	18:22	10:03	16:41
FP5	8:30	16:18	8:18	15:53	9:16	14:58	8:25	15:57	7:50	15:10	10:32	17:09
FP6	8:57	16:44	8:45	16:19	9:42	15:23	8:57	16:23	8:20	15:37	11:00	17:32
FP7	9:25	17:10	9:15	16:45	10:09	15:48	9:23	16:49	8:48	16:04	7:45	14:26
FP8	9:51	17:53	9:49	17:09	10:38	16:11	9:48	17:17	9:10	16:29	8:09	14:53

2.2 Raptor Vantage Point Surveys

Raptor vantage point surveys (RVPS) were employed at the Project to collect baseline information on raptor activity within the project area. Surveys conducted aim to capture raptors from within and nearby to the Project area, and from a sample site that has been selected as an analogous region >10 km from the Project area. Information collected will not only build an understanding of the raptor species at the wind farm but also provide a control group to compare potential wind farm impacts.

2.2.1 METHOD

Surveys were conducted from locations that provided largely unobstructed views of the surrounding terrain and sky. Survey sites were at least 1.5 km apart, from areas of elevation and providing a good viewshed. Raptor Vantage Point surveys were conducted in 2023 and 2024 (refer to **Table 3**, the list of exact survey times can be found in **Appendix A1**).

Three survey sites were selected within the Project area as suitable for RVPS, see **Figure 2**. Control sites were selected as an area greater than 10 km away from the Project area or other surrounding wind farms that could potentially impact raptor populations. Three areas of similar undulating terrain and nearby patches of native forest separated by cleared farmland were selected to represent the control group. Control points were selected on safe places to conduct surveys on the side of public roads. See **Table 4** for vantage point location descriptions.

Surveys were conducted using the circular plot survey method with no cut-off distance for a period of 60 minutes. Surveys were conducted between the hours of 10:00 – 16:00. Each survey site was surveyed a minimum of five hours per season, with each site being surveyed at a different time of day to capture raptor activity throughout the day.

Data collected from these surveys included:

- species name,
- number of birds,
- first time observed,
- time the bird/s flew out of sight or landed,
- height when first observed,
- height range of flight observed,
- distance from observer,
- flight direction (45 degrees or can be circling),
- flight path,
- behaviour (soaring, gliding, hovering, flapping, display, resting, mobbing or foraging),
- activity (traveling, hunting, courtship, being attacked), and
- demographic (age, sex and additional notes as applicable (e.g. a pair, a pair and juvenile)).

Sites were surveyed only once per day, with survey sites within 1.5 km of other sites also not surveyed on the same days to reduce the risk of double counting of raptor activity. Survey suitability was also subject to weather conditions, with high winds and heavy rain causing some delays to surveys and reduction of some survey effort.

The following weather-related variables were also recorded during each survey:

- temperature (°C),
- precipitation (none, very light rain, light rain, rain, other),

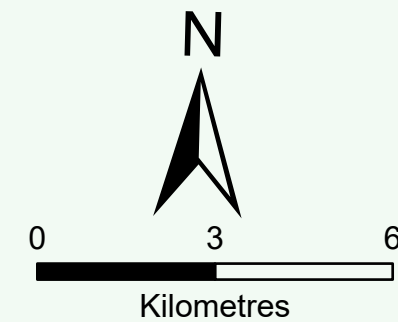
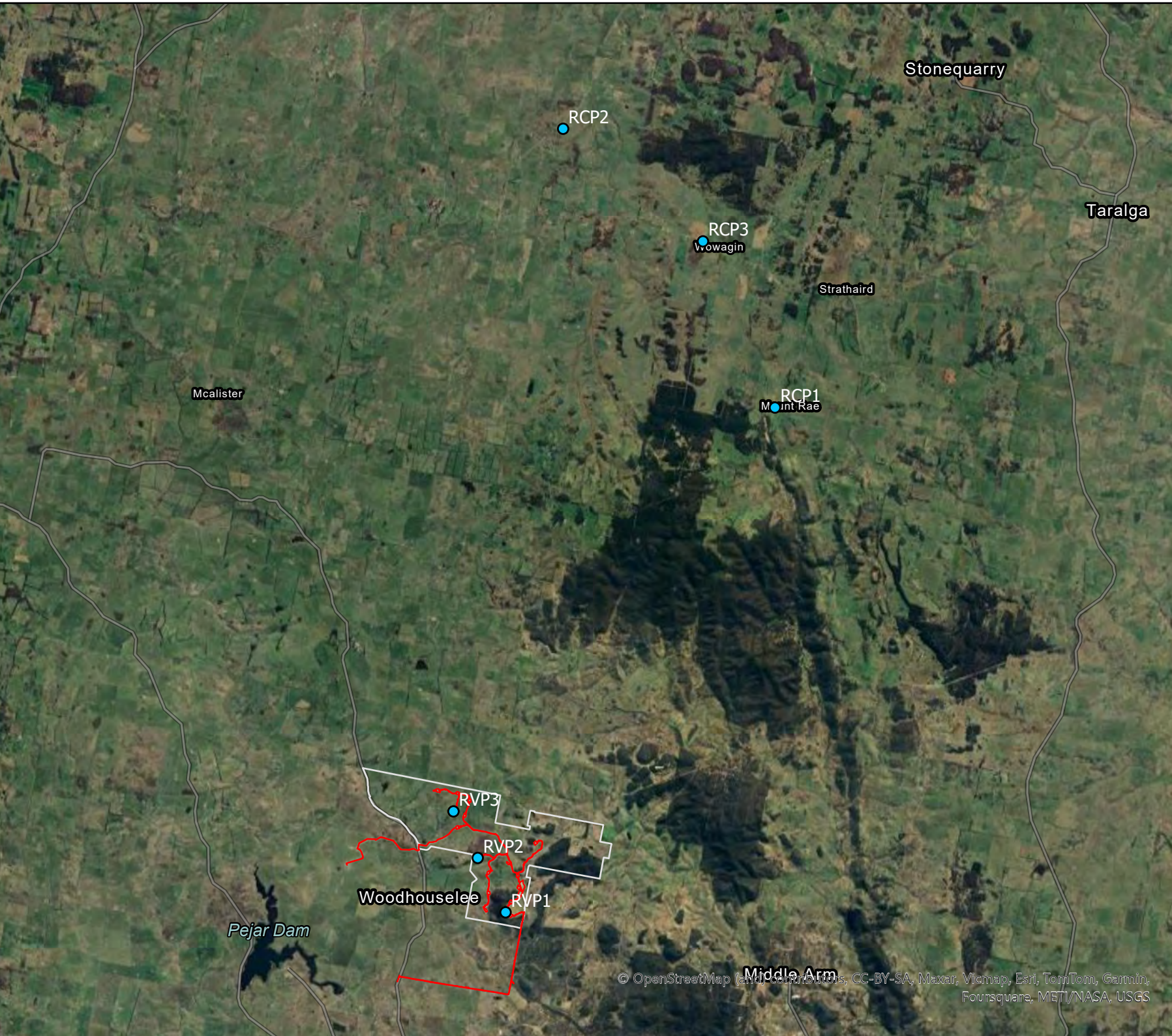
- cloud cover (clear, patchy cloud (<30% cover), partly cloudy (30-90% cover), cloudy (>90% cover)), and
- wind speed.

If threatened or migratory species were observed during these surveys, information was collected in the same manner as the raptor vantage survey.

TABLE 3: RAPTOR VANTAGE POINT SURVEY INDICATIVE SCHEDULE

Winter	10:00	11:00	12:00	13:00	14:00	15:00
10/08/2023	RCP3	RVP1	-	RVP3	-	-
11/08/2023	-	RVP2	-	RCP1	-	RCP3
12/08/2023	-	-	-	RCP2	-	RVP2
15/08/2023	-	RVP1	RVP3	-	RCP1	RCP3
16/08/2023	RVP2	-	RCP1	-	RCP2	-
17/08/2023	RCP2	RCP1	-	-	RVP3	RVP1
23/08/2023	RVP1	RVP3	-	RCP2	-	RCP1
24/08/2023	-	-	RCP3	-	RCP2	RVP3
25/08/2023	-	RCP3	-	-	RVP2	RVP1
28/08/2023	-	-	RVP2	-	-	-
Spring	10:00	11:00	12:00	13:00	14:00	15:00
17/10/2023	-	-	RVP2	-	-	-
18/10/2023	RVP1	-	-	RVP3	-	-
20/11/2023	-	RCP1	RCP2	-	-	RVP2
21/11/2023	-	RVP1	RVP3	-	RCP2	RCP3
22/11/2023	RCP3	-	RCP1	-	RVP2	-
23/11/2023	RCP3	-	RCP1	RCP2	-	RVP1
27/11/2023	-	-	RCP1	-	RCP2	RVP2
28/11/2023	-	RVP3	RVP1	-	RCP3	-
30/11/2023	RVP3	-	RCP1	RCP2	RVP1	-
Summer	10:00	11:00	12:00	13:00	14:00	15:00
16/01/2024	-	RVP3	-	RCP1	RCP2	-
17/01/2024	-	-	RVP3	-	-	-
18/01/2024	-	-	RCP3	-	RVP1	-
19/01/2024	-	-	-	RVP1	-	RVP3
30/01/2024	-	RCP2	RCP1	-	RVP2	-
31/01/2024	RCP3	-	RVP3	RVP1	-	-
1/02/2024	RVP2	-	RCP2	RCP1	-	-
2/02/2024	-	RCP2	RCP1	-	RVP2	-
6/02/2024	RCP3	-	RVP3	-	-	-
7/02/2024	-	-	-	RVP2	-	-
8/02/2024	-	RCP1	RCP2	-	RVP2	-
9/02/2024	RCP3	-	RVP1	-	-	-
15/02/2024	-	-	-	RVP1	RCP3	-

Autumn	10:00	11:00	12:00	13:00	14:00	15:00
12/03/2024	RVP1	-	-	RCP1	RCP2	-
13/03/2024	RVP2	-	RCP3	-	RCP1	-
14/03/2024	RCP3	RCP2	-	RVP3	RVP1	-
15/03/2024	RCP1	-	RCP2	-	RVP2	-
18/03/2024	RVP2	-	-	-	-	-
19/03/2024	-	RVP3	-	RVP1	-	-
20/03/2024	-	-	RVP2	-	-	-
26/03/2024	-	-	-	-	RVP2	-
9/04/2024	-	RCP3	-	RVP3	-	-
10/04/2024	RVP3	RVP1	-	RCP3	RCP1	-
11/04/2024	RCP2	-	RCP1	-	RVP3	RVP1
12/04/2024	RCP2	RCP3	-	-	-	-



Legend

-  Project area
-  Project footprint
-  RVPS locations



FIGURE 2: Overview Raptor Vantage Point Survey locations

Imagery: Google Satellite
(5/2024 & 9/2024)
27/02/2024

TABLE 4: RAPTOR VANTAGE POINT SURVEY LOCATION DESCRIPTIONS

Vantage point Location	PCT	Elevation (m)	Description	Photo
RVP1	PCT1155: Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tablelands	936	IMPACT POINT Open cleared grazing land in the shape of a small valley and ridgeline line surrounded by large patches of native forest to the west, south and east. Forest canopy dominated by Silvertop Ash with few Red Stringybark and Broad-leaved Peppermint present. Understory predominantly exotic pasture grasses in open areas and native understory in the forest. Midstory is absent in cleared areas, with some midstory present within forest areas. No fallen timber is present in the cleared area, fallen timber present in forest area. Limited mistletoe is seen throughout the canopy of forest.	
RVP2	PCT1093: Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands	876	IMPACT POINT Open cleared grazing land on generally undulating land with scattered paddock trees adjacent to a patch of native forest. Gully lines lead into a creek that has additional patches of native forest lined along them. Dominant canopy species are Red Stringybark and Inland Scribbly Gum and Broad-leaved Peppermint (<i>E. dives</i>) co-dominant. Understory is derived native grassland and is largely native grasses, forbs and rushes. Sparse midstory present in cleared area, with midstory growth more dominant in forest areas. Some fallen timber present. Dead stags present. Mistletoe species highly abundant throughout the canopy.	

RVP3	Exotic	924	IMPACT POINT Cleared grazing land on undulating land with few scattered paddock trees in gully lines. Canopy species present in the gully lines are Red Stringybark and Inland Scribbly Gum. Understory is largely comprised of exotic pasture grasses. Midstory was found to be absent. Very limited fallen timber present, with only some around scattered canopy trees.	
RCP1	PCT3348: Southern Tableland Granites Ribbon Gum Grassy Forest	949	CONTROL POINT Open cleared grazing land on rolling hills atop plateau land with scattered paddock trees adjacent to a large patch of old-growth forest. Limited waterbody features nearby. Dominant canopy species for scattered canopy trees Ribbon Gum (<i>E. viminalis</i>), Snow Gum (<i>E. pauciflora</i>) and Narrow-leaved Peppermint (<i>E. radiata</i>), the large old-growth forest is dominated by Ribbon Gum and Narrow-leaved Peppermint. Understory appears to be a mix of pasture grasses, native grasses and rushes. No midstory present in cleared area. Some fallen timber present around patches of paddock trees and intact woodland. Dead stags present. Mistletoe species abundant throughout canopy.	

RCP2	PCT3348: Southern Tableland Granites Ribbon Gum Grassy Forest	1029	CONTROL POINT Open largely cleared valley with some scattered paddock trees with rolling hills and patches of forest and woodland atop the hills. A creek runs north through the centre of the valley. Dominant canopy species for scattered canopy trees Ribbon Gum, Snow Gum and Narrow-leaved Peppermint. Understory appears to be a mix of pasture grasses, native grasses and rushes. Some midstory appears present in cleared area including <i>Acacia</i> spp. Some fallen timber present in areas of intact woodland. Dead stags present. Mistletoe species present throughout canopy.	
RCP3	PCT3370: Central Tableland Red Stringybark Grassy Forest	909	CONTROL POINT Mostly cleared area with some scattered paddock trees and generally undulating hills with patches of forest and woodland atop the hills. A creek lies to the north of the survey point in a low-lying area. Some small dams are scattered throughout the area. Dominant canopy species for scattered canopy trees Ribbon Gum, Red Stringybark, Apple Box and Narrow-leaved Peppermint. The understory is a mix of pasture grasses, native grasses and rushes. Some midstory present in cleared area including <i>Acacia</i> spp.. Some fallen timber present in areas of intact woodland. Dead stags present. Mistletoe species abundant throughout canopy.	

2.2.2 SURVEY TIMING AND WEATHER CONDITIONS

RVPS were conducted to align with the thermal uplift utilised by raptor species for soaring. This usually develops with warming air between the hours of 10:00 and 16:00 depending on the season and weather variations. Surveying during these conditions was considered most likely to capture flight activity that might be impacted by the Project.

Surveys times and dates can be found in **Table 3**. Prevailing weather conditions and conditions on the day of the survey can be found in **Table 5**. Observed weather conditions during each survey can be found in **Appendix A1**.

2.2.3 LIMITATIONS

The purpose of the RVPS was to determine the abundance, diversity and flight activity of the raptor species within the Project area and control sites to allow for the monitoring of impacts at the wind farm. Constraints within various aspects of the production of the RVPS can lead to limitations within an investigation. Limitations can include:

- **Project impact limitations** – RVPS were conducted after construction activities at the wind farm were already underway, therefore impacts from the development of bird populations likely were already occurring. No true baseline surveys could be produced to show raptor species activity before Project impacts. This was mitigated by the use of off-site control sites to use in future analysis.
- **Temporal limitations** – best practices require at least 24 months of survey for pre-operational baseline data. This ensures sufficient data about relevant species potential used in the Project area is recorded. Additionally, 24 months is needed to account for climate and migratory variations when capturing particularly cryptic species.
- **Weather limitations** - Conditions at the time of fieldwork were suitable for the completion of each survey, however, if weather conditions were inappropriate for the collection of data, surveys were deferred. This strategy was utilised on several occasions when the weather for the day turned, half of the surveys would be deferred to another day. However, ongoing poor weather during the spring season caused multiple delays and resulted in surveys for the season falling short by one survey for three sites.
- **Spatial limitations** – Selection of analogous, safe and suitable control sites required the spatial difference between control sites to impact sites being dissimilar. Control sites are spread over a greater area than of impact sites, likely increasing the opportunity for different raptor observations.

2.3 Targeted surveys

2.3.1 GANG-GANG COCKATOO BREEDING HABITAT SEARCHES

The purpose of targeted hollow searches was to inform the risk rating of turbines A3, A4, A5, A8, A9 and A10. Targeted hollow searches were conducted in suitable hollows mapped within the Cumberland Ecology Revised BDAR (2022) for Gang-gang Cockatoo. These hollows occur throughout the Project area, however, hollows targeted were in the northern section of the Project area near to the aforementioned turbines (**Figure 3**).

The Threatened Biodiversity Data Collection (TBDC) and BAM calculator (BAM-C) state that a breeding habitat constraint for Gang-gang Cockatoo is hollow bearing trees (*Eucalyptus* sp.) with hollows at least 3 m above the ground and with a hollow diameter of 7 cm or larger.

Monitoring of Gang-gang Cockatoo habitat occurred in October and November, aligning with the TBDC recommended survey period. These hollows were first surveyed by ecologists to confirm the location and suitability for Gang-gang Cockatoo. A camera mounted on a pole was used to view inside each hollow to confirm if any hollow was in use. **Figure 3** shows the locations of the hollows surveyed.

2.3.2 LIMITATIONS

Surveying for use indicates that these hollows are currently not actively being used by Gang-gang Cockatoos, however, this does not rule out that these hollows cannot be utilised in the future.

2.3.1 WHITE-THROATED NEEDLETAIL SURVEYS

White-throated Needle-tail surveys were conducted in two manners at the Project area:

- informal surveying for the species during all other bird surveys between October 2023 and February 2024 in alignment with the species migration into NSW (TSSC, 2019), and
- a formal targeted survey was employed when a well-defined storm front was approaching the wind farm during this period.

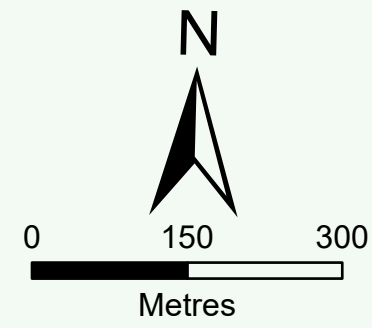
Targeted White-throated Needle-tail survey was conducted from a high point location that gave a good view of the entire sky, including the direction of the oncoming storm front. The survey began approximately one hour ahead of the arrival of the front. A survey period of one hour was completed by viewing directly above the site and ahead of the storm front. This was achieved by ornithologist Neil Hermes lying flat while looking skyward with the aid of binoculars. For the one hour, the surveyor scanned the immediate sky above the site, not the horizons. Any observations were recorded in the same manner that raptor data is collected.

Images of the surveyed storm front were collected from publicly available radar. This methodology was developed by ornithologist Neil Hermes.

2.3.1 LIMITATIONS

The targeted survey provides an indication for White-throated Needle-tail utilisation of the wind farm area association with storm fronts, in which the species is frequently observed flying in the air pressure currents preceding storms. The methodology does not allow for a wide viewpoint of potential White-throated Needle-tails in the areas surrounding the wind farm on the horizon.

Due to the surveying schedule and appropriate weather timing, this methodology was only able to be applied once.



- Legend**
- Project area
 - Project footprint
 - Suitable hollows



FIGURE 3: Gang-gang Cockatoo suited hollows for survey

2.4 Nocturnal surveys

Surveys for nocturnal species were conducted each season alongside RVPS (August 2023, November 2023, January/February 2024 and March/April 2024). Species particularly targeted within these surveys include the Powerful Owl and Barking Owl. The TBDC recommended survey period for Powerful Owl is May - August and for Barking Owl is May - December. Surveys for these species were not always conducted within the recommended guidelines due to time constraints, instead, surveying was completed seasonally in conjunction with other bird surveys.

Meandering spotlighting transects were conducted throughout the Project area where canopy was present and consisted of field traverses at a minimum of 10 m apart. Spotlighting consisted of two people searching separately for at least one hour per night. Nocturnal surveys were completed six nights per season, except for spring, where weather constraints prevented three surveys from taking place.

A thermal camera was utilised for three nights during spring surveys (27, 28 and 30 November 2023), all summer nocturnal surveys (30 and 31 January 2024 and 1, 6, 7 and 8 February 2024) and five surveyed nights in autumn (12 and 13 March 2024 and 8, 9 and 11 April 2024) to aid in the search.

2.5 Incidental observations

All incidental observations of raptors and threatened species within or near the Project area were recorded by the field team while conducting all ecological works. This includes any observations made outside of formal bird survey times, deployment of bat detection equipment, during transit and all other works Ecology Consulting has been contracted to conduct (i.e. work outside of BBAMP scope of works). Information collected includes the location of the bird/s, time of observation, flight height, flight map (if applicable), behaviour and standard weather conditions.

2.6 Weather conditions

Prevailing weather conditions during the surveys (highlighted) and during the lead-up to the surveys are presented in **Table 5**. The data was collated for the nearest reliable Bureau of Meteorology weather station (27.5 km away) at Goulburn Airport (AWS) (station 070330).

TABLE 5: ENVIRONMENTAL CONDITIONS DURING SURVEYS

Survey undertaken	Date	Min. temp. (°C)	Max temp. (°C)	Max wind gust (km/h)	Rainfall (mm)	Field noted conditions
N/A	7 Aug 2023	-2.1	12.4	22	0.2	N/A
N/A	8 Aug 2023	-0.4	15.7	15	0	N/A
N/A	9 Aug 2023	1.7	17.3	44	0	N/A
RVPS – RCP3 RVPS – RVP1	10 Aug 2023	-0.1	15	87	0	Mostly overcast and very windy
RVPS – RVP2 RVPS – RCP1 RVPS – RCP3	11 Aug 2023	-3.1	15.7	35	0.2	Clear skies and light winds, no rain
RVPS – RCP2 RVPS – RVP2	12 Aug 2023	-0.4	12.7	48	0	Overcast with moderate winds
N/A	13 Aug 2023	2.7	10.8	26	0.4	N/A
N/A	14 Aug 2023	6.7	9.9	20	17.2	N/A
BUS – 13 surveys RVPS – RVP1 RVPS – RVP3 RVPS – RCP1	15 Aug 2023	3.4	12.7	22	0.6	Partly cloudy with light winds, no rain

Survey undertaken	Date	Min. temp. (°C)	Max temp. (°C)	Max wind gust (km/h)	Rainfall (mm)	Field noted conditions
RVPS – RCP3 Nocturnal survey						
BUS – 13 surveys RVPS – RVP2 RVPS – RCP1 RVPS – RCP2 Nocturnal survey	16 Aug 2023	-0.9	14.6	17	0	Patchy clouds and light winds
BUS – 16 surveys RVPS – RCP2 RVPS – RCP1 RVPS – RVP3 RVPS – RVP1	17 Aug 2023	-4.4	17	31	0.2	Mostly clear with light to moderate winds
N/A	20 Aug 2023	5.3	16.7	46	0	N/A
N/A	21 Aug 2023	-1.3	16.9	31	0.2	N/A
N/A	22 Aug 2023	-1.4	21.4	65	0	N/A
RVPS – RVP1 RVPS – RVP3 RVPS – RCP2 RVPS – RCP1 Nocturnal survey	23 Aug 2023	3.6	13	37	9	Mostly overcast with very light winds, no rain during surveys.
BUS – 14 surveys RVPS – RCP3 RVPS – RCP2 RVPS – RVP3 Nocturnal survey	24 Aug 2023	0.1	17.4	20	0.2	Clear skies and light winds, no rain.
BUS – 16 surveys RVPS – RCP3 RVPS – RVP2 RVPS – RVP1 Nocturnal survey	25 Aug 2023	-1	19.1	28	0.2	Clear skies and light – moderate winds, no rain.
N/A	26 Aug 2023	-4.3	18	24	0	N/A
N/A	27 Aug 2023	2	18.3	30	0	N/A
BUS – 8 surveys	28 Aug 2023	3	18.7	33	0	Partly cloudy and moderate winds
BUS – 8 surveys RVPS – RVP2 Nocturnal survey	29 Aug 2023	-0.7	20.1	46	0	Patchy clouds and moderate winds.
N/A	14 Oct 2023	7.8	18.2	70	0	N/A
N/A	15 Oct 2023	1.5	19.6	48	0	N/A
N/A	16 Oct 2023	2.9	15.5	74	0	N/A
BUS – 15 surveys RVPS – RVP2 Gang-gang Cockatoo targeted search	17 Oct 2023	-1.8	17.4	43	5.6	Partly cloudy with moderate - high winds
BUS – 13 surveys RVPS – RVP1 RVPS – RVP3	18 Oct 2023	3.9	19.2	39	0	Mostly overcast with moderate winds
BUS – 14 surveys	19 Oct 2023	2	23.5	28	0	Mostly clear with moderate winds
N/A	5 Nov 2023	9.5	15.8	39	0.4	N/A
N/A	6 Nov 2023	10	22.4	33	0	N/A
N/A	7 Nov 2023	3.7	27	37	0	N/A

Survey undertaken	Date	Min. temp. (°C)	Max temp. (°C)	Max wind gust (km/h)	Rainfall (mm)	Field noted conditions
BUS – 16 surveys	8 Nov 2023	7	27.5	46	0	Partly cloudy with moderate winds
BUS – 16 surveys Anabat deployment	9 Nov 2023	6.1	25.4	67	0	Patchy cloud, moderate to high winds
BUS – 16 surveys	10 Nov 2023	6.2	28.3	35	7	Cleary skies moderate winds
N/A	17 Nov 2023	9.4	21.2	33	0	N/A
N/A	18 Nov 2023	4.3	26.9	39	0.2	N/A
N/A	19 Nov 2023	5.3	31.3	41	0	N/A
Gang-gang Cockatoo targeted search RVPS – RCP1 RVPS – RCP2 RVPS – RVP2	20 Nov 2023	13.4	26.5	54	0	Overcast with moderate to high winds
RVPS – RVP1 RVPS – RVP3 RVPS – RCP2 RVPS – RCP3	21 Nov 2023	7.3	26.3	48	1.4	Mostly clear with moderate winds
RVPS – RCP3 RVPS – RCP1 RVPS – RVP2	22 Nov 2023	13.7	25.1	39	1	Partly cloudy with moderate winds
RVPS – RCP3 RVPS – RCP1 RVPS – RCP2 RVPS – RVP1	23 Nov 2023	8.8	22.2	46	0	Overcast with high winds, light rain at the end of two surveys
N/A	24 Nov 2023	13.6	20.3	28	0	N/A
N/A	25 Nov 2023	15.3	25.4	35	4	N/A
N/A	26 Nov 2023	10.2	27.5	61	1.6	N/A
RVPS – RCP1 RVPS – RCP2 RVPS – RVP2 Nocturnal survey	27 Nov 2023	12.4	29	43	0	Partly cloudy with moderate - high winds
Anabat retrieval RVPS – RVP3 RVPS – RVP1 RVPS – RCP3 Nocturnal survey	28 Nov 2023	15.2	21.4	48	0	Mostly overcast with moderate winds, some rain in between surveys
N/A	29 Nov 2023	14.3	22.7	80	98.2	N/A
RVPS – RVP3 RVPS – RCP1 RVPS – RCP2 RVPS – RVP1 Nocturnal survey	30 Nov 2023	11.1	21.3	46	27.4	Overcast with moderate winds and light rain in one survey.
N/A	13 Jan 2024	12.8	30.9	46	0	N/A
N/A	14 Jan 2024	14	21.8	41	0	N/A
N/A	15 Jan 2024	11.2	16.6	43	11.6	N/A
BUS – 8 surveys RVPS – RVP3 RVPS – RCP1 RVPS – RCP2	16 Jan 2024	11.5	23.3	39	14.2	Overcast and moderate winds, light rain at the end of one survey
BUS – 8 surveys	17 Jan 2024	15.7	24.7	41	7.2	Mostly overcast, moderate – high winds, brief

Survey undertaken	Date	Min. temp. (°C)	Max temp. (°C)	Max wind gust (km/h)	Rainfall (mm)	Field noted conditions
White-throated Needletail targeted survey						downpour with storm
RVPS – RVP3						
BUS – 16 surveys RVPS – RCP3 RVPS – RVP1	18 Jan 2024	17.2	23.5	59	10.4	Partly cloudy with moderate - high winds, no rain
BUS – 8 surveys RVPS – RVP1 RVPS – RVP3	19 Jan 2024	10.1	25.6	46	0	Patchy clouds with moderate - high winds
N/A	20 Jan 2024	15.7	28.7	33	0	N/A
N/A	21 Jan 2024	11.1	32.4	54	0	N/A
N/A	22 Jan 2024	12.3	23.3	43	0	N/A
BUS – 16 surveys	23 Jan 2024	13.8	25.1	30	0	Overcast with moderate winds
BUS – 16 surveys	24 Jan 2024	10.1	27.2	46	0.2	Patchy clouds with moderate - high winds
BUS – 16 surveys	25 Jan 2024	20.5	32.4	46	0	Overcast with moderate winds, light rain at the end of surveys
N/A	27 Jan 2024	13.8	26	41	0.2	N/A
N/A	28 Jan 2024	11	26.2	30	0	N/A
N/A	29 Jan 2024	12.9	30.5	31	0	N/A
RVPS – RCP2 RVPS – RCP1 RVPS – RVP2 Nocturnal survey	30 Jan 2024	15.1	26.2	33	0	Overcast with light – moderate winds
RVPS – RCP3 RVPS – RVP3 RVPS – RVP1 Nocturnal survey	31 Jan 2024	17.9	21	30	0	Overcast, light – moderate winds. Heavy fog rolled in the late afternoon
RVPS – RVP2 RVPS – RCP2 RVPS – RCP1 Nocturnal survey	1 Feb 2024	14.8	29.4	41	0	Partly cloudy with moderate winds
RVPS – RCP2 RVPS – RCP1 RVPS – RVP2	2 Feb 2024	11.2	29.7	30	0	Clear skies with moderate winds
N/A	3 Feb 2024	16.1	31.2	24	0	N/A
N/A	4 Feb 2024	11.7	34.1	46	0	N/A
N/A	5 Feb 2024	18.3	23.8	44	27	N/A
RVPS – RCP3 RVPS – RVP3 Nocturnal survey	6 Feb 2024	17.6	20	30	41.8	Overcast and mostly still, light rain in the morning leading to heavy rain in the afternoon
RVPS – RVP2 Nocturnal survey	7 Feb 2024	8.2	20.5	35	0.2	Partly cloudy, moderate winds
RVPS – RCP1 RVPS – RCP2 RVPS – RVP2 Nocturnal survey	8 Feb 2024	12.3	21.8	39	0	Mostly partly cloudy and moderate winds

Survey undertaken	Date	Min. temp. (°C)	Max temp. (°C)	Max wind gust (km/h)	Rainfall (mm)	Field noted conditions
RVPS – RCP3 RVPS – RVP1	9 Feb 2024	7	26.2	35	0	Overcast and moderate winds
N/A	12 Feb 2024	11	30.2	30	0	N/A
N/A	13 Feb 2024	12.6	30.7	61	0	N/A
N/A	14 Feb 2024	17.5	26.7	46	6.8	N/A
RVPS – RVP1 RVPS – RCP3	15 Feb 2024	12.1	18	26	0.2	Overcast, moderate winds
N/A	9 Mar 2024	11.4	28	39	0	N/A
N/A	10 Mar 2024	6.3	27.8	28	0	N/A
N/A	11 Mar 2024	9.7	28.8	24	0	N/A
RVPS – RVP1 RVPS – RCP1 RVPS – RCP2 Nocturnal survey	12 Mar 2024	6.4	32	-	0	Clear and moderate winds
RVPS – RVP2 RVPS – RCP3 RVPS – RCP1 Nocturnal survey	13 Mar 2024	11.6	28.5	24	-	Patchy cloud, light winds
RVPS – RCP3 RVPS – RCP2 RVPS – RVP3 RVPS – RVP1	14 Mar 2024	11.3	30.2	46	0	Overcast to mostly clear with moderate winds, rain in the evening
RVPS – RCP1 RVPS – RCP2 RVPS – RVP2	15 Mar 2024	12.4	21.3	48	22	Misty morning to partly cloudy with moderate winds
N/A	16 Mar 2024	9.4	21.2	35	0.4	N/A
N/A	17 Mar 2024	13.8	18.1	28	0.2	N/A
BUS – 16 surveys RVPS – RVP2	18 Mar 2024	13.7	25	31	2.8	Partly cloudy with some mist, moderate winds
BUS – 16 surveys RVPS – RVP3 RVPS – RVP1	19 Mar 2024	12	27.9	30	0.4	Patchy cloud with light winds
BUS – 16 surveys RVPS – RVP2	20 Mar 2024	15.7	22.3	43	10.8	Overcast with moderate winds and some light rain
N/A	23 Mar 2024	6.9	21.4	28	0	N/A
N/A	24 Mar 2024	11.2	24.4	37	0.2	N/A
N/A	25 Mar 2024	1.9	26.3	37	0	N/A
BUS – 16 surveys RVPS – RVP2	26 Mar 2024	1.6	26.9	35	0	Clear skies with moderate winds
BUS – 16 surveys	27 Mar 2024	9.3	24.2	31	0	Overcast with moderate winds
BUS – 16 surveys	28 Mar 2024	13	24.7	30	0	Overcast with moderate winds
N/A	5 Apr 2024	13	15.9	54	1.4	N/A
N/A	6 Apr 2024	12.2	21.9	63	80.8	N/A
N/A	7 Apr 2024	12.8	21	43	6.2	N/A
Nocturnal survey	8 Apr 2024	10.5	21.3	39	0.2	Patchy cloud with moderate winds

Survey undertaken	Date	Min. temp. (°C)	Max temp. (°C)	Max wind gust (km/h)	Rainfall (mm)	Field noted conditions
RVPS – RCP3 RVPS – RVP3 Nocturnal survey	9 Apr 2024	8.4	15.6	56	0	Overcast with moderate-high winds and rain
RVPS – RVP3 RVPS – RVP1 RVPS – RCP3 RVPS – RCP1 Nocturnal survey	10 Apr 2024	-0.1	16.9	41	8.6	Partly cloudy with moderate winds
RVPS – RCP2 RVPS – RCP1 RVPS – RVP3 RVPS – RVP1 Nocturnal survey	11 Apr 2024	0.2	19.3	20	0	Patchy cloud with light winds
RVPS – RCP2 RVPS – RCP3	12 Apr 2024	6.9	20.5	31	0	Clear to patchy cloud with light winds

3 Bat surveys

3.1 Passive acoustic detection surveys

The aim of bat surveys is to collect sufficient information to understand the bat species found to utilise or transit through the Project area and therefore ensure appropriate impact thresholds are set for adaptive management. Bat surveys conducted were guided by “Survey guidelines for Australia’s threatened bats: Guidelines for detecting bats listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999” (DEWHA, 2010b).

Bat surveys were conducted in November 2023 and March 2024. This timing for both survey periods was to coincide with the migration of Large Bent-winged Bat. Consultation was undertaken with species expert Dr Doug Mills of the NSW DCCEEW and with reference to his published paper, the monitoring was determined to coincide with migration events that are known to occur at Drum Cave and Church Cave in NSW, which are maternity caves found 40 km to the south-east, and 100 km south-west respectively of the Project (Mills, 2021).

Eight bat detection devices (two Anabat Swift passive detectors and six Anabat Chorus) were deployed across six ground monitoring locations and two monitoring sites at RSA height. The recording protocol for the survey is summarised as follows:

- each bat detection device was deployed by a qualified ecologist;
- bat detection devices were set to begin recording 30 minutes before dusk and stop recording 30 minutes after sunrise; and
- upon collection bat detector collection, SD cards holding recorded data were removed and immediately backed up and transferred to storage devices to be sent to an expert for analysis.

3.1.1 DEPLOYMENT SEASON

3.1.1.1 NOVEMBER 2023

During deployment, all but one of the bat detectors were set out on 9 November 2023 and retrieved on 28 November 2023. The installation of one detector in turbine A22 was delayed until 22 November 2023 and thus it was retrieved on 12 December 2023. The detector installed in the turbine filled the SD card memory after four nights due to excessive ambient wind noise and therefore no further data was captured for this survey site. Data was collected over 144 detector nights.

3.1.1.2 MARCH 2024

All bat detection devices were deployed between 4 March 2024 and 22 March 2024, all devices except for the device deployed on turbine A22 and at ABAT4/Site 4 collected data for the entirety of the survey period. Due to detector errors, the detector mounted on turbine A22 recorded only 10 nights of data, and ABAT4 collected two survey nights fewer than the expected survey period. Data over the season was collected for 134 detector nights.

3.1.2 MONITORING AT GROUND LEVEL

Monitoring sites at ground level were selected within impact areas close to or in proximity to wind turbines. Monitoring sites were selected to capture areas of habitat and flyways near turbines. Anabat Chorus devices with ultrasonic sonic microphone attachment were used, the bat detector devices were deployed approximately 2 m off the ground with the microphone angled vertically. **Table 6** describing bat detection site, and **Figure 4** indicating location.

TABLE 6: BAT SURVEY GROUND DETECTION SITES

Bat detector/ Site	PCT in BDAR	Description
ABAT1/ Site 1	Exotic	Attached to a paddock tree on a hilltop aside from a gully line in a stand of a few Inland Scribbly Gum. The surrounding area all largely cleared for grazing with very few scattered paddock trees. Scattered trees and stands of trees further down the gully line. Four small agricultural dams line the length of the gully.
ABAT2/ Site 2	PCT1093: Red Stringybark – Brittle Gum – Inland Scribble Gum dry open forest of the tablelands	Attached to a Red Stringybark at the edge of a patch of forest on the hillside overlooking the turbine A12 stand. The hill has a steep slope to the south where a permanent creek runs. A more gradual cleared slope to the west also leads to a gully line and into the creek in the south. There are scattered paddock trees and additional smaller stands of trees around the gullies in addition to the larger patch of forest to the north. The patch of Red Stringybark has a dense midstory of <i>Cassina aculeata</i> .
ABAT3/ Site 3	PCT1155: Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tablelands	Attached to a standalone Inland Scribbly Gum in a cleared area with some scattered paddock trees in between stand A24 and the large patch of native forest to the east. A patch of regeneration area bordered the uncleared native forest, this area has an abundance and diverse midstory. To the west, a gradual slope leads into a cleared valley with various dams and shallow gully lines.
ABAT4/ Site 4	PCT1155: Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tablelands	Attached to an Inland Scribbly Gum at the edge of the small patch of forest on the hillside overlooking turbine A15 stand. The patch is relatively small, with little midstory and understory present. There is generally undulating topography with a crest to the east of the turbine. To the west of the patch is a well-defined gully line. There are a couple of small agricultural dams over 100 m away.
ABAT5/ Site 5	PCT1093: Red Stringybark – Brittle Gum – Inland Scribble Gum dry open forest of the tablelands	Attached to a Red Stringybark at the edge of a small patch of native forest facing the turbine A17 stand. The surrounding area is largely cleared with a few scattered paddock trees within a generally undulating landscape. A moderately sized dam installed for sedimentary control lies approximately 100 m to the east of the monitoring site.
ABAT6/ Site 6	PCT1155: Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tablelands	Attached to a Silvertop Ash at the edge of a large patch of native forest on the hillside overlooking the turbine A22 stand. The area of native forest has sparse midstory and understory, and is predominantly dry with bare ground and litter. The hillside overlooks a mostly cleared valley with a few scattered paddock trees. The valley is largely surrounded but native forest on the high points within the landscape.

3.1.3 MONITORING WITHIN THE ROTOR SWEEP AREA (RSA)

Monitoring within RSA height was undertaken through two methods, with one at the turbine hub height of approximately 95 m, and one survey site on a meteorological mast at 50 m (refer to **Table 7**). Anabat Swift passive detectors were used with microphone extension cables to extend ultrasonic omnidirectional microphones into detection locations.

Bat detector deployment at hub height was conducted at turbine A22, it was deployed through the following methods:

- bat detector device was installed at hub height on the wind turbine by an appropriately qualified person with the guidance of an ecologist;
- bat detection microphone was mounted on an antenna on top of the hub at the rear of the turbine; and
- the microphone extension cable connects the microphone to the Anabat Swift passive detector which is kept inside the nacelle of the turbine.

The bat detector deployed at the meteorological mast (Metmast) was installed in addition to the one at hub height to allow ecologists to be able to capture data at RSA height without the need for a suitably qualified person to enter the turbine. This ensured that if no personnel were available to access a turbine, data from RSA height could still be collected. Metmast data was collected by:

- initial installation was carried out by an appropriately qualified person with the guidance of an ecologist;
- bat detector microphone was attached to a 50 m microphone extension cable, this was secured to its extent up the meteorological mast; and
- Anabat Swift passive detector was connected to a microphone extension cable at ground level when deployed. When not in use microphone extension cable was covered and protected from weather.

TABLE 7: BAT SURVEY RSA HEIGHT DETECTION SITES

Bat detector at RSA	PCT	Elevation from ground (m)	Description
Metmast	Exotic	50	Metmast situated in an open cleared paddock on one of the higher hilltops. Very sparse paddock trees in the area with the understory being exotic pasture grasses.
A22	PCT1155: Silvertop Ash – Narrow-leaved Peppermint open forest on ridges of the eastern tablelands	95	Turbine location is adjacent to the large patch of native forest on the west and north. The turbine pad is lower in elevation than the native forested hillsides surrounding it. To the east of the turbine is a mostly cleared valley with a few scattered paddock trees. The valley is largely surrounded but native forest on the high points within the landscape.

3.1.4 CALL ANALYSIS

Bat detector data for both November 2023 and March 2024 were analysed by Greg Ford (Principal Ecologist, Balance! Environmental), the reports can be found in **Appendix B**. Analysis was performed in Anabat Insight (Version 2.0.8; Titley Scientific, Brisbane). Methods presented in the report are as follows:

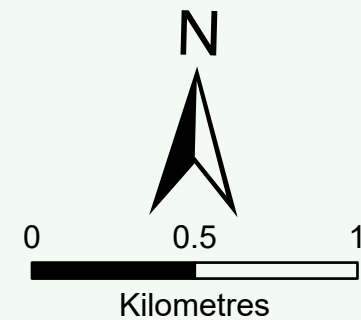
1. *“All files were processed with a filter to remove files that contained only non-bat noise and/or fewer than three recognisable bat call pulses.”*
2. *The Decision Tree Analysis tool was used to scan, group and label the remaining files according to the average zero crossing metrics of calls within each file. Separation was based primarily on the characteristic frequency (Fc) metric, but metrics such as pulse duration (Dur), slope of characteristic section (Sc) and time between pulses (TBC) were included to further refine call recognition by the Decision Tree.*
3. *Species present within each Decision Tree group were then confirmed using a combination of further species-specific metric-based filters and manual review of the call spectrograms. This was achieved by comparing visual properties of call spectrograms and derived metrics of the files with those of regionally relevant reference calls and/or with published call descriptions.”*

3.1.5 LIMITATIONS

The use of bat detection devices was to determine the diversity, likely flight height and areas of concern for bat species present within the Project area. Constraints within various aspects of the production of the bat surveys can lead to limitations within an investigation, limitations can include:

- **Project impact limitations** – bat surveys were conducted after construction activities at the wind farm were already underway, therefore impacts from the development of bat populations likely were already occurring. No true baseline surveys could be produced to show bat species activity before Project impacts.
- **Temporal limitations** – best practices require at least 24 months of survey for pre-operational baseline data. This ensures sufficient data about relevant species potential used in the Project area is recorded. Additionally, 24 months is needed to account for climate and migratory variations when capturing particularly cryptic species.
- **Technical limitations** – the SD card within the bat detector deployed on A22 was filled by ambient noise, likely from the wind on the protection nets covering stationary turbine blades.

- **Detector limitations** – the use of bat detectors for the detection of bat calls has limitations in the distance in which a given detector may record a call depending on various characteristics of any given bat call and many environmental conditions. For the Anabat devices, a study in 2012 indicated that approximately 30 m was the distance in which a sample would be collected in good weather in unobstructed areas (Adams, 2012).
- **Weather limitations** – weather and climatic conditions influence bat activity, variables such as air temperature, humidity, wind speed, direction and moonlight can affect relative bat activity. (Milne *et al.* 2005). Furthermore, wet weather and storms are not suitable weather for bat flight. Weather conditions within the period surveyed can be found in **Table 8**, no severe weather or heavy rain was recorded during this survey period.



Legend

- Project area
- Project footprint
- Bat detector locations



FIGURE 4: Bat detection device locations

Imagery: Google Satellite
(5/2024 & 9/2024)
27/02/2024

3.2 Weather conditions

Prevailing weather conditions during the surveys (highlighted) and during the lead-up to the surveys are presented in **Table 8**. The data was collated for the nearest Bureau of Meteorology weather station (27.5 km away) at Goulburn Airport (AWS) (station 070330).

TABLE 8: ENVIRONMENTAL CONDITIONS DURING BAT SURVEYS

Survey undertaken	Date	Min. temp. (°C)	Max temp. (°C)	Max wind gust (km/h)	Rainfall (mm)
N/A	6 Nov 2023	10	22.4	33	0
N/A	7 Nov 2023	3.7	27	37	0
N/A	8 Nov 2023	7	27.5	46	0
Bat detector installation, six on ground sites and one at RSA height site	9 Nov 2023	6.1	25.4	67	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	10 Nov 2023	6.2	28.3	35	7
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	11 Nov 2023	7.3	32.7	59	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	12 Nov 2023	9.8	30.8	61	4.4
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	13 Nov 2023	8	26.2	39	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	14 Nov 2023	4.8	26.5	33	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	15 Nov 2023	13.2	26.5	37	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	16 Nov 2023	9.1	25.3		0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	17 Nov 2023	9.4	21.2	33	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	18 Nov 2023	4.3	26.9	39	0.2
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	19 Nov 2023	5.3	31.3	41	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	20 Nov 2023	13.4	26.5	54	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	21 Nov 2023	7.3	26.3	48	1.4
Installation of bat detector on turbine A22	22 Nov 2023	13.7	25.1	39	1
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast and turbine A22)	23 Nov 2023	8.8	22.2	46	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast and turbine A22)	24 Nov 2023	13.6	20.3	28	0
SD card of bat detector installed on turbine A22 filled	25 Nov 2023	15.3	25.4	35	4
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	26 Nov 2023	10.2	27.5	61	1.6
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	27 Nov 2023	12.4	29	43	0
Retrieval of bat detectors installed on 9 Nov 2023	28 Nov 2023	15.2	21.4	48	0

Survey undertaken	Date	Min. temp. (°C)	Max temp. (°C)	Max wind gust (km/h)	Rainfall (mm)
Retrieval of bat detector installed on 22 Nov 2023	12 Dec 2023	16.4	27.1	31	0
N/A	1 March 2024	16.9	32.4	44	0.8
N/A	2 March 2024	17.1	25.6	35	0.4
N/A	3 March 2024	10.7	27	54	0
Bat detector installation, six on ground sites and two RSA height sites		8.6	21.6	35	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast & A22)	4 Mar 2024				
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast & A22)	5 Mar 2024	7.1	26.5	39	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast & A22)	6 Mar 2024	7.4	-	-	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast & A22)	7 Mar 2024	8.9	26.4	35	-
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast & A22)	8 Mar 2024	16.2	28.4	30	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast & A22)	9 Mar 2024	11.4	28	39	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast & A22)	10 Mar 2024	6.3	27.8	28	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast & A22)	11 Mar 2024	9.7	28.8	24	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast & A22)	12 Mar 2024	6.4	32	-	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast & A22)	13 Mar 2024	11.6	28.5	24	-
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	14 Mar 2024	11.3	30.2	46	0
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	15 Mar 2024	12.4	21.3	48	22
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	16 Mar 2024	9.4	21.2	35	0.4
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	17 Mar 2024	13.8	18.1	28	0.2
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	18 Mar 2024	13.7	25	31	2.8
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	19 Mar 2024	12	27.9	30	0.4
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	20 Mar 2024	15.7	22.3	43	10.8
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	21 Mar 2024	2	18.5	41	0.2
Ground level bat acoustic recording RSA height bat acoustic recording (Metmast)	22 Mar 2024	5	22.8	33	0
Retrieval of bat detectors	23 Mar 2024	6.9	21.4	28	0

4 Bird survey results

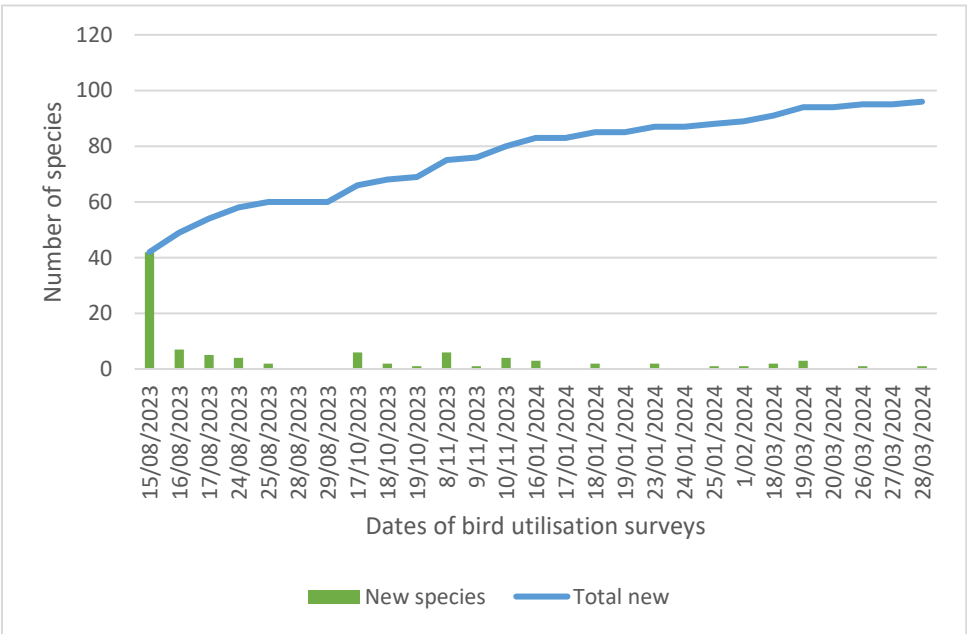
4.1 Bird Utilisation Surveys

4.1.1 SURVEY SUITABILITY

A cumulative species curve has been produced for the winter, spring, summer and autumn surveys completed in alignment with the “Interim Standards for Risk Assessment for Wind Farms and Birds” (AusWEA, 2005). The production of a cumulative species curve has been summarised to dates of surveys rather than individual surveys as each survey day usually consisted of 16 individual surveys. A full breakdown of surveys completed can be found in **Table 2**.

Figure 5 shows the general increase in new species observations across the survey period, with a greater increase in species observed throughout the spring season. This may be expected with additional seasonal migratory species being found within the Project area. The number of new bird species recorded can be seen to level off at the end of the winter, summer, and autumn seasons with either no or only a few additional species observed. These results suggest that the surveys are capturing the bird diversity present within survey locations within the Project area.

FIGURE 5: CUMULATIVE NUMBER OF BIRD SPECIES OBSERVED DURING BIRD SURVEYS AT THE PROJECT



4.1.2 SPECIES AND ABUNDANCE

A total of 94 species have been recorded during the four BUS undertaken in winter (August 2023), spring (October & November 2023), summer (January & February 2024) and autumn (March 2024). When including incidental observations and observations from other surveys, the total number of bird species observed within the Project area for the four-season period was 101.

Species richness was lowest in the August 2023 surveys at 59 species recorded, compared to a higher species richness of 73 species in the October/November 2023 surveys and a species richness of 66 species in January/February 2024 and March 2024 surveys. The most abundant species were predominantly cockatoos, parrots, corvids and songbirds. A breakdown of the most common species observed each season can be found in **Table 9**.

Total abundance was highest in the January/February 2024 surveys (5335 observations) and March (5201 observations), followed by August 2023 (3895 observations) and October/November 2023 (3161 observations). However, the winter observations are likely overrepresented as during initial survey periods ecologists were recording the number of birds calling, e.g. four Laughing Kookaburra calling. In following seasons calls were counted as one species observation. Removing call observations, the highest abundance was in the January/February 2024 surveys with 4395 bird sightings, followed by March 2024 with 4270 observations, October/November 2023 with 2126 bird sightings and finally August 2023 with 1169 bird sightings, illustrated in **Figure 6**.

FIGURE 6: SPECIES RICHNESS AND SPECIES SIGHTED ABUNDANCE FOR AUGUST 2023 – MARCH 2024

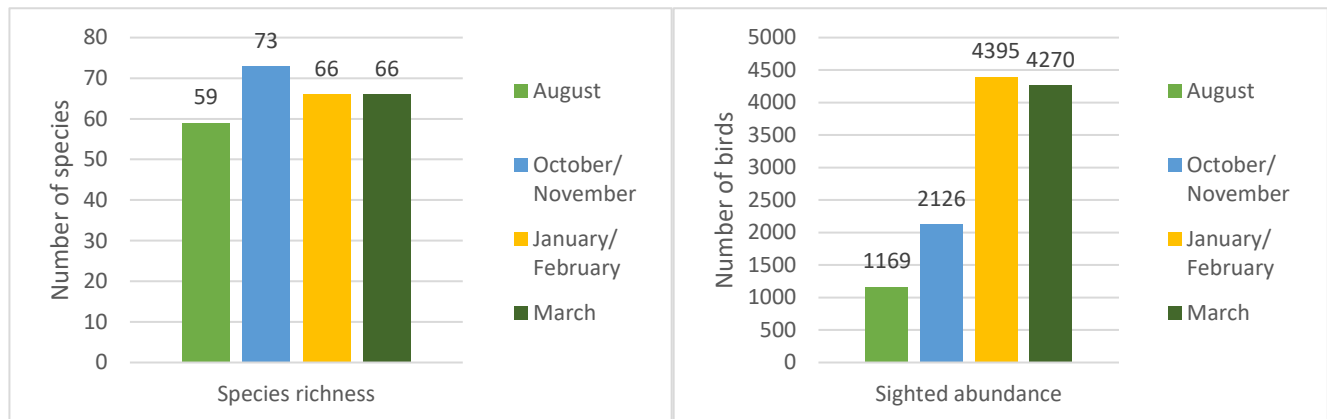


TABLE 9: SUMMARY OF SPECIES AND ABUNDANCE FINDINGS FOR BIRD UTILISATION SURVEYS

Survey period	August 2023	October/November 2023	January/February 2024	March 2024
Total abundance	3893 (call 2724)	3161 (call 1035)	5334 (call 939)	5201 (call 931)
Species richness	59	73	66	66
Number of new species recorded in BUS	59	20	8	7
Most abundant species	• Crimson Rosella (660) • Australian Magpie (361) • Sulphur-crested Cockatoo (249) • Brown Thornbill (226) • Common Starling (226)	• Crimson Rosella (367) • Australian Magpie (238) • Common Starling (233) • Yellow-rumped Thornbill (202) • Little Raven (177)	• Sulphur-crested Cockatoo (1686) • Common Starling (579) • Crimson Rosella (327) • Australian Magpie (318) • Australian Wood Duck (296)	• Sulphur-crested Cockatoo (1314) • Common Starling (916) • Little Raven (395) • Australian Magpie (348) • Crimson Rosella (309)
Observed threatened species	• Gang-gang Cockatoo (4) • Scarlet Robin (20)	• Gang-gang Cockatoo (2) • Little Eagle (1) • Scarlet Robin (1)	• Gang-gang Cockatoo (50) • Rufous Fantail (1)	• Dusky Woodswallow (13) • Gang-gang Cockatoo (20) • Scarlet Robin (25) • Varied Sittella (41)

4.1.2.1 IMPACT SITES

The most commonly observed species at the impact sites in order of abundance include:

- Sulphur-crested Cockatoo (17.5% of all impact site bird observations);
- Common Starling (13.0%);
- Crimson Rosella (10.6%);
- Australian Magpie (7.5%); and
- Little Raven (5.8%).

These species are representative of the generally disturbed agricultural land present in much of the cleared open areas of the wind farm. This group included the introduced species Common Starling, which was largely overrepresented in the mostly cleared area in the northern section of the wind farm at FP1 due to a large flock present in the area in the summer months. Refer to **Table 10** for a further breakdown of species observations at each impact site.

The other four native species are commonly found on farmland and were observed to have periods of high abundance with high foraging opportunities particularly due to increased rain and grass seeds. Large flocks of Sulphur-crested Cockatoos were particularly found to be foraging and moving through the Project area during the summer and autumn.

The general composition of the species found at the impact sites are largely commonly found native species associated with agricultural land, however, there is a considerable number of woodland and forest species. These species are mostly only found within or below the canopy or in shrubland and not found in the open cleared landscape. This is expected due to the large amounts of forest habitat and the location of impact sites near such habitat.

4.1.2.2 REFERENCE SITES

The most common observed species at the reference sites in order of abundance, include:

- Sulphur-crested Cockatoo (21.4% of all reference site bird observations);
- Noisy Miner (9.1%);
- Crimson Rosella (6.1%);
- Common Starling (5.9%); and
- Australian Magpie (5.8%).

Although similar to that of the impact sites, the most abundant species at reference sites reflect the dominant communities at the two sites surveyed. Noisy Miners make up a high abundance of the reference site abundance due to FP2 being situated within a particular area where the species has taken over a patch of woodland. Furthermore, an often-seen flock of Common Starling began frequenting FP2 during the autumn season resulting in an overall high abundance for the species. There is a significant presence of waterbirds often observed at the reference sites as both sites have nearby views of agricultural dams, often skewing a high representation of waterbirds. Refer to **Table 11** for a further breakdown of species observations at each reference site.

The significantly high abundance of Sulphur-crested Cockatoos, like in reference sites, can be attributed to a summer influx of the species foraging in a particular area near to FP2. Like the impact sites, the reference sites have a composition largely of common native species found in agricultural land with a mix of woodland species.

TABLE 10: NUMBER AND FLIGHT HEIGHT DISTRIBUTION BY SPECIES AT THE IMPACT POINTS

Species observed	FP1		FP3		FP4		FP5		FP7		FP8		Total		Total visual observations	Percentage of flight at RSA height at impact points for species (%)
	A	B	A	B	A	B	A	B	A	B	A	B	A	B		
Sulphur-crested Cockatoo	479	45	243	282	75	42	132	62	86	153	314	58	1329	642	1971	32.57
Little Raven	75	36	118	117	-	13	60	26	99	10	-	35	352	237	589	40.24
Silvereye	-	50	182	-	5	-	6	-	20	-	5	-	218	50	268	18.66
Woodswallow sp.	-	-	-	-	-	-	-	-	-	50	-	-	0	50	50	100
Australian Raven	12	4	13	9	4	3	10	10	25	6	6	-	70	32	102	31.37
Galah	50	5	10	-	4	-	14	10	58	9	39	-	175	24	199	12.06
Australian Magpie	70	1	49	3	60	5	161	1	119	6	98	3	557	19	576	3.30
Wedge-tailed Eagle	-	-	1	2	-	7	-	3	-	3	-	-	1	15	16	93.75
Nankeen Kestrel	2	3	-	1	5	3	6	2	8	3	-	-	21	12	33	36.36
Eastern Rosella	34	12	2	-	15	-	6	-	24	-	-	-	81	12	93	12.90
Noisy Friarbird	-	-	8	2	19	-	8	8	5	-	9	2	49	12	61	19.67
Yellow-faced Honeyeater	7	-	26	-	18	10	36	-	12	-	7	-	106	10	116	8.62
Tree Martin	9	-	-	-	-	-	-	2	-	6	-	-	9	8	17	47.06
Black-faced Cuckoo-shrike	-	2	18	-	25	2	5	-	-	-	-	2	48	6	54	11.11
Pied Currawong	3	-	30	-	11	4	4	2	8	-	26	-	82	6	88	6.82
Little Corella	35	4	3	-	25	-	-	-	6	-	-	-	69	4	73	5.48
Little Pied Cormorant	-	1	-	3	3	-	1	-	-	-	-	-	4	4	8	50
Brown Falcon	2	-	1	-	-	1	-	2	-	-	-	-	3	3	6	50
Australian Hobby	-	-	-	2	-	-	-	1	-	-	-	-	0	3	3	100
Welcome Swallow	2	-	1	1	1	-	5	-	13	2	-	-	22	3	25	12
White-faced Heron	1	3	-	-	7	-	-	-	5	-	-	-	13	3	16	18.75
Pacific Black Duck	-	-	-	2	-	-	8	-	98	-	-	-	106	2	108	1.85

Species observed	FP1		FP3		FP4		FP5		FP7		FP8		Total		Total visual observations	Percentage of flight at RSA height at impact points for species (%)
	A	B	A	B	A	B	A	B	A	B	A	B	A	B		
Common Starling	1094	-	21	-	23	-	-	-	366	2	10	-	1514	2	1516	0.1
Eurasian Skylark	12	2	-	-	-	-	-	-	-	-	-	-	12	2	14	14.29
Falcon sp.	-	1	-	-	-	1	-	-	-	-	-	-	0	2	2	100
Black-shouldered Kite	-	2	-	-	-	-	-	-	-	-	-	-	0	2	2	100
Magpie-lark	23	-	2	-	4	-	2	-	4	2	1	-	36	2	38	5.26
Pied Butcherbird	-	-	7	-	2	-	-	-	-	-	-	-	9	2	11	18.18
Peregrine Falcon	-	-	-	-	-	-	-	-	-	1	-	-	0	1	1	100
Cormorant sp.	-	-	-	-	-	1	-	-	-	-	-	-	0	1	1	100
Australasian Darter	-	1	-	-	-	-	-	-	-	-	-	-	0	1	1	100
Great Pied Cormorant	-	1	-	-	-	-	-	-	-	-	-	-	0	1	1	100
Little Black Cormorant	-	-	-	1	-	-	-	-	-	-	-	-	0	1	1	100
Red Wattlebird	2	-	20	-	15	-	9	-	3	1	1	-	50	1	51	1.96
European Goldfinch	-	-	4	-	-	-	-	-	-	-	-	-	4	0	4	0
Yellow-tailed Black-Cockatoo	-	-	2	-	-	-	-	-	-	-	-	-	2	0	2	0
Laughing Kookaburra	4	-	3	-	7	-	44	-	5	-	6	-	69	0	69	0
White-browed Scrubwren	-	-	4	-	-	-	-	-	-	-	1	-	5	0	5	0
Brown-headed Honeyeater	-	-	-	-	16	-	-	-	-	-	20	-	36	0	36	0
Grey Butcherbird	1	-	1	-	6	-	2	-	2	-	-	-	12	0	12	0
Sacred Kingfisher	-	-	-	-	2	-	-	-	-	-	-	-	2	0	2	0
Crested Pigeon	1	-	-	-	-	-	-	-	1	-	-	-	2	0	2	0

Species observed	FP1		FP3		FP4		FP5		FP7		FP8		Total		Total visual observations	Percentage of flight at RSA height at impact points for species [%]
	A	B	A	B	A	B	A	B	A	B	A	B	A	B		
Striated Pardalote	3	-	4	-	1	-	-	-	5	-	-	-	13	0	13	0
Crimson Rosella	68	-	69	-	136	-	218	-	127	-	245	-	863	0	863	0
Superb Fairy-wren	-	-	69	-	2	-	8	-	-	-	-	-	79	0	79	0
Weebill	-	-	2	-	-	-	-	-	-	-	-	-	2	0	2	0
Grey Shrikethrush	-	-	2	-	6	-	1	-	4	-	6	-	19	0	19	0
Long-billed Corella	-	-	-	-	-	-	-	-	4	-	-	-	4	0	4	0
White-winged Chough	-	-	53	-	-	-	-	-	35	-	-	-	88	0	88	0
Australasian Pipit	37	-	-	-	1	-	-	-	-	-	-	-	38	0	38	0
Gang-gang Cockatoo	-	-	2	-	2	-	15	-	-	-	-	-	19	0	19	0
Masked Lapwing	-	-	-	-	-	-	-	-	2	-	-	-	2	0	2	0
Australasian Shoveler	-	-	-	-	-	-	-	-	1	-	-	-	1	0	1	0
Australian Wood Duck	8	-	20	-	16	-	14	-	271	-	1	-	330	0	330	0
Scarlet Robin	-	-	1	-	5	-	-	-	-	-	14	-	20	0	20	0
Australasian Grebe	-	-	-	-	7	-	2	-	13	-	-	-	22	0	22	0
Noisy Miner	2	-	-	-	1	-	-	-	2	-	1	-	6	0	6	0
Striated Thornbill	-	-	-	-	18	-	12	-	-	-	8	-	38	0	38	0
Olive-backed Oriole	-	-	-	-	3	-	5	-	1	-	-	-	9	0	9	0
Fairy Martin	1	-	-	-	-	-	-	-	-	-	-	-	1	0	1	0
Eastern Spinebill	-	-	9	-	-	-	1	-	-	-	1	-	11	0	11	0
Thornbill sp.	-	-	-	-	8	-	-	-	2	-	-	-	10	0	10	0
Brown Thornbill	-	-	14	-	15	-	11	-	4	-	19	-	63	0	63	0
Buff-rumped Thornbill	-	-	2	-	36	-	8	-	-	-	19	-	65	0	65	0

Species observed	FP1		FP3		FP4		FP5		FP7		FP8		Total		Total visual observations	Percentage of flight at RSA height at impact points for species (%)
	A	B	A	B	A	B	A	B	A	B	A	B	A	B		
Common Myna	-	-	-	-	3	-	-	-	-	-	-	-	3	0	3	0
White-plumed Honeyeater	-	-	1	-	-	-	-	-	-	-	-	-	1	0	1	0
Raven sp.	5	-	-	-	-	-	-	-	-	-	-	-	5	0	5	0
White-throated Treecreeper	-	-	4	-	5	-	9	-	2	-	3	-	23	0	23	0
Yellow-rumped Thornbill	-	-	76	-	75	-	30	-	37	-	39	-	257	0	257	0
Willie Wagtail	-	-	1	-	-	-	2	-	4	-	-	-	7	0	7	0
Grey Fantail	-	-	9	-	8	-	1	-	-	-	6	-	24	0	24	0
Yellow Thornbill	-	-	7	-	12	-	4	-	9	-	20	-	52	0	52	0
Grey Teal	-	-	-	-	2	-	2	-	35	-	-	-	39	0	39	0
Red-browed Finch	-	-	12	-	-	-	-	-	-	-	-	-	12	0	12	0
Eurasian Coot	-	-	-	-	-	-	-	-	20	-	-	-	20	0	20	0
Red-rumped Parrot	6	-	-	-	-	-	-	-	-	-	-	-	6	0	6	0
Dusky Woodswallow	-	-	-	-	-	-	-	-	12	-	-	-	12	0	12	0
Varied Sittella	-	-	-	-	-	-	-	-	31	-	-	-	31	0	31	0
Rufous Fantail	-	-	1	-	-	-	-	-	-	-	-	-	1	0	1	0
Great Cormorant	1	-	-	-	-	-	-	-	-	-	-	-	1	0	1	0
Rufous Whistler	-	-	1	-	-	-	-	-	-	-	-	-	1	0	1	0
Grand Total	2049	173	1128	427	714	92	862	129	1588	254	925	100	7266	1175	8441	13.94

*A = flight outside of RSA height (< 30 m and > 160 m), B = flight within RSA height (30 m and 160 m)

TABLE 11: NUMBER AND FLIGHT HEIGHT DISTRIBUTION BY SPECIES AT THE CONTROL POINTS

Species observed	FP2		FP6		Total		Total visual observations	Percentage of flight at RSA height at control points for species (%)
	A	B	A	B	A	B		
Sulphur-crested Cockatoo	758	228	81	43	839	271	1110	24.41
Galah	29	66	61	23	90	89	179	49.72
Little Raven	60	6	68	44	128	50	178	28.09
Little Corella	-	20	-	-	0	20	20	100
Welcome Swallow	1	-	6	16	7	16	23	69.57
Australian Raven	14	5	9	9	23	14	37	37.84
Common Starling	262	11	16	-	278	11	289	3.81
Tree Martin	1	-	8	10	9	10	19	52.63
Australian Magpie	72	1	128	7	200	8	208	3.85
Little Pied Cormorant	2	5	3	-	5	5	10	50
Nankeen Kestrel	-	-	4	5	4	5	9	55.56
Wedge-tailed Eagle	2	2	2	2	4	4	8	50
Great Pied Cormorant	-	3	-	-	0	3	3	100
Magpie-lark	23	2	-	-	23	2	25	8
Red Wattlebird	1	-	2	2	3	2	5	40
Black-faced Cuckoo-shrike	5	-	2	2	7	2	9	22.22
Brown Goshawk	1	-	11	1	12	1	13	7.69
Brown Falcon	1	1	-	-	1	1	2	50
Little Eagle	-	-	-	1	0	1	1	100
Australian Hobby	-	1	-	-	0	1	1	100
Yellow-rumped Thornbill	78	-	56	1	134	1	135	0.74
Striated Thornbill	-	-	12	-	12	0	12	0
Crimson Rosella	82	-	122	-	204	0	204	0

Species observed	FP2		FP6		Total		Total visual observations	Percentage of flight at RSA height at control points for species [%]
	A	B	A	B	A	B		
Grey Butcherbird	10	-	-	-	10	0	10	0
Scarlet Robin	-	-	1	-	1	0	1	0
Grey Fantail	-	-	28	-	28	0	28	0
Gang-gang Cockatoo	30	-	-	-	30	0	30	0
Grey Shrikethrush	1	-	9	-	10	0	10	0
White-winged Chough	17	-	19	-	36	0	36	0
Grey Teal	86	-	19	-	105	0	105	0
Rufous Whistler	-	-	11	-	11	0	11	0
Spotted Pardalote	-	-	5	-	5	0	5	0
Laughing Kookaburra	-	-	18	-	18	0	18	0
Leaden Flycatcher	-	-	1	-	1	0	1	0
Brown Thornbill	-	-	30	-	30	0	30	0
Little Black Cormorant	1	-	-	-	1	0	1	0
White-throated Gerygone	-	-	1	-	1	0	1	0
Australian Wood Duck	57	-	217	-	274	0	274	0
Eastern Rosella	230	-	6	-	236	0	236	0
Restless Flycatcher	1	-	-	-	1	0	1	0
Sacred Kingfisher	-	-	15	-	15	0	15	0
Silvereye	10	-	10	-	20	0	20	0
Striated Pardalote	2	-	23	-	25	0	25	0
Australasian Grebe	-	-	22	-	22	0	22	0
Noisy Friarbird	3	-	2	-	5	0	5	0
Noisy Miner	367	-	2	-	369	0	369	0
Golden Whistler	-	-	3	-	3	0	3	0
White-bellied Cuckoo-shrike	3	-	-	-	3	0	3	0

Species observed	FP2		FP6		Total		Total visual observations	Percentage of flight at RSA height at control points for species (%)
	A	B	A	B	A	B		
Yellow-faced Honeyeater	60	-	22	-	82	0	82	0
White-faced Heron	4	-	9	-	13	0	13	0
Varied Sittella	-	-	10	-	10	0	10	0
White-throated Treecreeper	-	-	6	-	6	0	6	0
Pied Butcherbird	2	-	-	-	2	0	2	0
Willie Wagtail	2	-	2	-	4	0	4	0
Pied Currawong	-	-	3	-	3	0	3	0
Yellow Thornbill	-	-	24	-	24	0	24	0
European Goldfinch	3	-	-	-	3	0	3	0
Red-rumped Parrot	2	-	1	-	3	0	3	0
Pacific Black Duck	3	-	17	-	20	0	20	0
Buff-rumped Thornbill	-	-	58	-	58	0	58	0
Peregrine Falcon	-	-	1	-	1	0	1	0
Grand Total	1747	214	798	156	2545	370	2915	12.69

*A = flight outside of RSA height (< 30 m and > 160 m), B = flight within RSA height (30 m and 160 m)

4.1.3 NUMBER OF BIRD SIGHTINGS AT RSA HEIGHT

The distribution of bird sightings according to impact and reference site can be seen in **Table 12**. The table further describes the percentage of observations that were of birds flying at RSA height. Observations of flight height between total impact and total reference sites suggest that the flight height of birds, although varied by site, is largely comparable. Data present does not yet indicate if impacts from the construction of the Project has impacted flight height behaviour or birds present between impact and reference sites. Rather, the wide variations in flight height percentages present for individual sites is likely due to factors such as different site terrain, habitat and foraging opportunities that more strongly influence the flight behaviours of the birds present in these areas.

TABLE 12: SUMMARY OF FLIGHT HEIGHT OBSERVATIONS FOR IMPACT SITES AND REFERENCE SITES

Impact site	Total outside RSA	Total within RSA	Survey site total	Percentage flight at RSA
FP1	2049	173	2222	7.8%
FP3	1128	427	1555	27.5%
FP4	714	92	806	11.4%
FP5	862	129	991	13.0%
FP7	1588	254	1842	13.8%
FP8	925	100	1025	9.8%
Total	7266	1175	8441	13.9%
Reference site				
FP2	2286	351	2637	13.3%
FP6	1186	166	1352	12.3%
Total	3472	517	3989	13.0%
Seasons				
Winter Impact	753	63	816	7.7%
Winter Reference	307	46	353	13.0%
Spring Impact	1097	127	1224	10.4%
Spring Reference	810	92	902	10.2%
Summer Impact	2323	412	2735	15.1%
Summer Reference	1428	232	1660	14.0%
Autumn Impact	3093	573	3666	15.6%
Autumn Reference	927	147	1074	13.7%

A summary of total bird sightings at RSA height per season surveys is shown in **Table 13**. Seasonal variations in flight height are likely attributed to the large influx of high-flying species foraging in the summer and autumn months, particularly the Sulphur-crested Cockatoo. An increase in observations of birds flying at RSA height can be observed both at impact site and reference sites, as seen in **Table 12**.

TABLE 13: SUMMARY OF FLIGHT HEIGHT OBSERVATIONS PER SURVEY SEASON

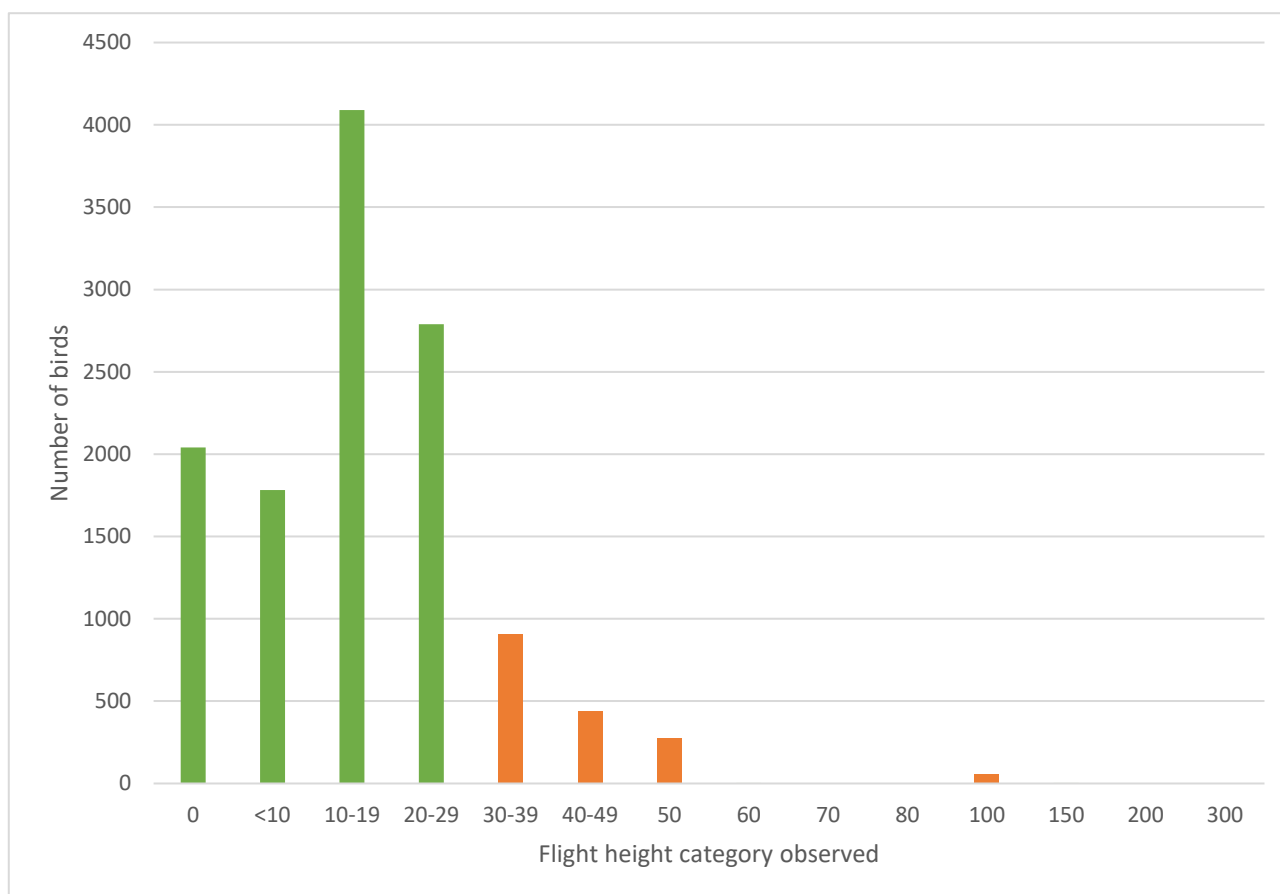
Survey period	August 2023	October/November 2023	January/February 2024	March 2024
Total sighted	1169	2126	4395	4270
Total outside RSA	1060	1907	3751	3652
Total within RSA	109	219	644	618
Percentage total flight within RSA	9.3%	10.3%	14.7%	14.5%

4.1.4 FLIGHT HEIGHTS

Flight height data was collected by ecologists as accurately as possible in the field (e.g. flight height of 2 m high), for the purpose of this report, categories of flight heights have been grouped for analysis and presentation.

The distribution of species flying at RSA height varies per survey site, as seen in **Table 12**. Overall, 86.4% of observations were made of birds not flying at RSA height. The distribution of flight observations is shown in **Figure 7**. This distribution that most birds were recorded to be flying below RSA height.

FIGURE 7: FLIGHT HEIGHT DISTRIBUTION FOR BIRD SIGHTINGS IN BIRD UTILISATION SURVEYS



*Green = flight outside of RSA height (< 30 m and > 160 m), orange = flight within RSA height (30 m and 160 m)

A total of 37 species were observed flying within RSA height across, with the majority of these species consisting of cockatoo, corvid, raptor and waterbird species.

- Sulphur-crested Cockatoo – 913 sightings at RSA height (7.3 % total observations);
- Little Raven – 287 sightings at RSA height (2.3 % total observations);
- Galah – 113 sightings at RSA height (0.9 % total observations);
- Silvereye and a Woodswallow sp. – both with 50 sightings at RSA height (0.4 % total observations); and
- Australian Raven – 46 sightings at RSA height (0.4 % total observations).

Of the observed species flying at RSA height, species that flock at height were observed, including that of the Sulphur-crested Cockatoo, Galah, Silvereye, a Woodswallow sp. and Little Corella.

4.1.4.1 RAPTORS

Eight raptor species were observed during BUS surveys, they included:

- Nankeen Kestrel (47 total observations);
- Wedge-tailed Eagle (24);
- Brown Goshawk (17);
- Brown Falcon (8);
- Australian Hobby (4);
- Black-shouldered Kite (2);
- Peregrine Falcon (2);
- Little Eagle (1); and
- two unidentified Falcon sp. observations.

The location of these species' sightings can be found in **Table 10** and **Table 11**. Nankeen Kestrel was the most abundant raptor species found within the Project area. A breeding pair of Nankeen Kestrels were known and observed mating, roosting in a hollow and hunting from a stag near to FP7. A pair of Brown Goshawks and their nest was also discovered in summer surveys near reference site FP6 which increased observations of the species. Although no nest was observed for Wedge-tailed Eagles, however, a pair of Wedge-tailed Eagles were often seen in flight together indicating that there is likely a nest nearby.

Of all the raptor observations during BUS, 47.2% were of birds flying at RSA. However, if accounting for raptors actually exhibiting flight behaviour and removing observations of perched or birds on the ground, raptors flying at RSA height account for 48.5% of observations. Flight height data is likely lower than actual raptor flight behaviour due to multiple observations of the previously mentioned breeding pairs of raptors and the low flight activities near to breeding sites. It is likely that raptor species present the highest risk group to blade strike at the wind farm due to their flight activity throughout the area, which is explored further in the raptor vantage point surveys **Section 4.2**.

4.1.4.2 WATERBIRDS

Fourteen water bird species were observed during BUS surveys withing the Project area:

- Australian Wood Duck (659 total observations);
- Grey Teal (145);
- Pacific Black Duck (139);
- Australasian Grebe (48);
- White-faced Heron (34);
- Eurasian Coot (20);
- Little Pied Cormorant (18);
- Masked Lapwing (6);
- Great Pied Cormorant (4);
- Australian Shelduck (2);
- Little Black Cormorant (2);
- Great Cormorant (1);
- Australasian Shoveler (1);
- Australasian Darter (1); and

- one unidentified Cormorant sp. observation.

The location of these species' sightings can be found in **Table 10** and **Table 11**. The most abundant species present was the Australian Wood Duck, a common farmland waterbird found around agricultural dams that also forages in open grasslands or flooded pastures. The species has had a significant presence across the various dams throughout the Project area, however in the recent summer surveys uncharacteristically wet conditions have resulted in multiple large flocks gathering across the Project area. These flocks usually have additional species residing with them, including the Grey Teal or Pacific Black Duck. The flight observations of these duck species have been observed to only occasionally fly at RSA height and therefore likely have a relatively low risk of blade strike.

Of all the waterbird observations 1.9% were of birds flying at RSA. However, if accounting for birds exhibiting flight behaviour and removing observations of birds on the water or birds on the ground, birds flying at RSA height account for 32.8% of observations. It is likely that specific waterbird species are at greater risk than others, with these flight observations not fully capturing the flight behaviour of many waterbird species. Cormorant sp. were more consistently observed to be flying within RSA height than other waterbird species and likely are at greater risk of blade strike. Additionally, the Australasian Grebe only flies at nighttime, therefore no flight data could be collected and risk of collision for the species is unknown based on the data collected.

Flight data for each species observed during BUS can be seen in **Table 14**.

TABLE 14: FLIGHT HEIGHT (M) DATA BY SPECIES COLLECTED DURING BIRD UTILISATION SURVEYS

Species observed	Call	Not flying	<10	10	15	20	25	30	35	40	45	50	60	70	80	100	150	200	300	500	Grand Total observations
Australasian Darter	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
Australasian Grebe	4	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48
Australasian Pipit	11	13	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49
Australasian Shoveler	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Australian Hobby	-	-	-	-	-	-	-	2	1	-	-	-	-	-	1	-	-	-	-	-	4
Australian Magpie	487	110	155	296	80	113	3	18	-	9	-	-	-	-	-	-	-	-	-	-	1271
Australian Raven	225	10	9	31	5	29	9	29	3	11	-	3	-	-	-	-	-	-	-	-	364
Australian Shelduck	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Australian Wood Duck	55	542	8	30	16	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	659
Black Honeyeater	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Black-faced Cuckoo-shrike	84	-	7	9	9	28	2	4	-	2	-	2	-	-	-	-	-	-	-	-	147
Black-shouldered Kite	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2
Brown Falcon	-	-	-	2	-	1	1	1	-	-	-	1	1	-	-	1	-	-	-	-	8
Brown Goshawk	4	1	1	4	-	6	-	-	-	1	-	-	-	-	-	-	-	-	-	-	17
Brown Thornbill	238	5	59	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	331
Brown-headed Honeyeater	1	-	-	20	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37
Buff-rumped Thornbill	82	6	50	29	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	205
Common Bronzewing	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Common Myna	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Common Starling	149	59	174	836	141	578	4	13	-	-	-	-	-	-	-	-	-	-	-	-	1954
Cormorant sp.	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
Crested Pigeon	5	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7

Species observed	Call	Not flying	<10	10	15	20	25	30	35	40	45	50	60	70	80	100	150	200	300	500	Grand Total observations
Crimson Rosella	596	32	245	386	249	148	7	-	-	-	-	-	-	-	-	-	-	-	-	-	1663
Dusky Woodswallow	1	-	-	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
Eastern Rosella	83	3	95	150	52	17	-	12	-	-	-	-	-	-	-	-	-	-	-	-	412
Eastern Spinebill	48	-	4	4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	59
Eurasian Coot	-	18	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
Eurasian Skylark	42	-	1	3	2	4	2	2	-	-	-	-	-	-	-	-	-	-	-	-	56
European Goldfinch	1	-	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
Fairy Martin	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Falcon sp.	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	2
Fan-tailed Cuckoo	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Galah	62	25	26	40	71	87	16	34	2	65	-	12	-	-	-	-	-	-	-	-	440
Gang-gang Cockatoo	27	2	6	-	10	21	10	-	-	-	-	-	-	-	-	-	-	-	-	-	79
Golden Whistler	6	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
Great Cormorant	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Great Pied Cormorant	-	-	-	-	-	-	-	-	-	1	-	3	-	-	-	-	-	-	-	-	4
Grey Butcherbird	121	-	9	9	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	143
Grey Currawong	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Grey Fantail	72	1	35	14	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	124
Grey Shrikethrush	107	1	22	4	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	136
Grey Teal	1	138	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	145
Honeyeater sp.	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
Horsfield's Bronze-Cuckoo	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Laughing Kookaburra	279	-	26	24	16	17	4	-	-	-	-	-	-	-	-	-	-	-	-	-	366
Leaden Flycatcher	3	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Little Black Cormorant	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	2

Species observed	Call	Not flying	<10	10	15	20	25	30	35	40	45	50	60	70	80	100	150	200	300	500	Grand Total observations
Little Corella	36	-	-	4	9	47	9	22	-	2	-	-	-	-	-	-	-	-	-	-	129
Little Eagle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
Little Pied Cormorant	-	2	1	3	1	1	1	2	2	2	-	2	1	-	-	-	-	-	-	-	18
Little Raven	201	58	8	137	14	223	40	121	-	32	-	134	-	-	-	-	-	-	-	-	968
Long-billed Corella	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Magpie-lark	173	10	19	20	4	4	2	2	-	2	-	-	-	-	-	-	-	-	-	-	236
Masked Lapwing	4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
Nankeen Kestrel	5	3	1	4	1	8	8	8	-	4	1	4	-	-	-	-	-	-	-	-	47
Noisy Friarbird	46	-	5	11	28	6	4	10	-	2	-	-	-	-	-	-	-	-	-	-	112
Noisy Miner	264	3	102	171	41	54	4	-	-	-	-	-	-	-	-	-	-	-	-	-	639
Olive-backed Oriole	19	-	3	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28
Pacific Black Duck	11	116	2	3	-	5	-	2	-	-	-	-	-	-	-	-	-	-	-	-	139
Pallid Cuckoo	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
Peregrine Falcon	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	2
Pied Butcherbird	57	1	1	9	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	70
Pied Currawong	242	2	15	24	13	27	4	2	1	-	-	3	-	-	-	-	-	-	-	-	333
Raven sp.	-	-	-	1	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Red Wattlebird	136	-	6	19	17	11	-	2	1	-	-	-	-	-	-	-	-	-	-	-	192
Red-browed Finch	15	-	6	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27
Red-rumped Parrot	2	-	2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
Restless Flycatcher	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Rufous Fantail	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Rufous Whistler	51	-	5	4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63
Sacred Kingfisher	15	-	10	3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32
Scarlet Robin	25	-	12	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47
Silvereye	20	5	26	49	6	146	6	-	-	50	-	-	-	-	-	-	-	-	-	-	308
Spotted Pardalote	44	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49

Species observed	Call	Not flying	<10	10	15	20	25	30	35	40	45	50	60	70	80	100	150	200	300	500	Grand Total observations
Striated Pardalote	215	-	14	9	11	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	253
Striated Thornbill	23	1	29	18	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	73
Stubble Quail	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
Sulphur-crested Cockatoo	307	778	23	390	61	822	94	514	49	190	1	107	-	1	1	50	-	-	-	-	3388
Superb Fairy-wren	110	-	57	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	189
Thornbill sp.	13	-	2	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23
Tree Martin	1	-	12	6	-	-	-	-	6	12	-	-	-	-	-	-	-	-	-	-	37
Varied Sittella	-	-	-	-	26	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41
Wedge-tailed Eagle	-	-	1	-	-	-	-	1	2	1	-	5	-	-	-	7	3	1	1	2	24
Weebill	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Welcome Swallow	-	-	14	10	2	-	3	12	6	-	-	-	-	1	-	-	-	-	-	-	48
White-bellied Cuckoo-shrike	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
White-browed Scrubwren	16	-	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
White-eared Honeyeater	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
White-faced Heron	5	7	5	4	4	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	34
White-plumed Honeyeater	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
White-throated Gerygone	34	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35
White-throated Treecreeper	477	-	15	9	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	506
White-winged Chough	73	32	60	27	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	197
Willie Wagtail	26	-	6	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37
Woodswallow sp.	-	-	-	-	-	-	-	-	-	50	-	-	-	-	-	-	-	-	-	-	50
Yellow Robin	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1

Species observed	Call	Not flying	<10	10	15	20	25	30	35	40	45	50	60	70	80	100	150	200	300	500	Grand Total observations
Yellow Thornbill	36	5	47	20	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	112
Yellow-faced Honeyeater	69	5	24	38	30	41	50	10	-	-	-	-	-	-	-	-	-	-	-	-	267
Yellow-rumped Thornbill	85	-	267	121	-	3	-	1	-	-	-	-	-	-	-	-	-	-	-	-	477
Yellow-tailed Black-Cockatoo	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Grand Total	5700	2043	1782	3097	1007	2516	289	832	75	436	2	277	3	2	3	59	3	1	1	2	18130
Percentage total (%)	31.5	11.3	9.8	17.1	5.6	13.9	1.6	4.6	0.4	2.4	<0.1	1.5	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	-
Percentage seen (%)	-	16.4	14.3	24.9	8.1	20.2	2.3	6.7	0.6	3.5	<0.1	2.2	<0.1	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	-

4.1.5 THREATENED AND MIGRATORY SPECIES

The majority of the species observed during BUS surveys are widespread species found throughout Australia. Five threatened and one migratory listed species have been recorded during the BUS. These observations are detailed below, with a threatened species map (**Figure 8**) provided to indicate flight path of species observations where applicable. The threatened species map shows all threatened species data, including RVPS, incidental observations as well as the BUS observations described in this section.

4.1.5.1 DUSKY WOODSWALLOW

The Dusky Woodswallow is listed as Vulnerable under the BC Act in NSW. The species is widespread across eastern, southern and south western Australia, and found throughout most of NSW (OEH, 2017a). Depending on the location and local climate, the species can exhibit migrations north after their breeding season, these include NSW birds migrating to northern NSW and southern QLD, and Tasmanian birds migrating to southeastern NSW (OEH, 2017a).

The species can be observed in a wide variety of habitats and can be found foraging in open areas, however, Dusky Woodswallow are considered to be a woodland dependent bird (OEH, 2017a).

Three observations of the species were made during BUS surveys, all during the autumn season of survey. One observation was that of the species call, which was observed at the same survey site and start time as the species was seen by another surveyor. It is likely that these observations are of the same small flock of Dusky Woodswallow. The next day another couple individuals of the species were observed at the same location, FP7, it is likely that they were from the same flock that was observed the previous day. **Table 15** details the specifics of each observation of the species.

All observations of the species were made of the birds flying below RSA height.

4.1.5.2 GANG-GANG COCKATOO

The Gang-gang Cockatoo is listed as Endangered under the EPBC Act and Vulnerable under the BC Act. It is found throughout south-eastern Australia being more adapted to cooler conditions and found more commonly at higher elevations and southern latitudes, the Southern Tablelands region is well within the species' known distribution (DAWE, 2022).

The species is an altitudinal migrant that moves between higher altitudinal tall wet sclerophyll forests and woodlands during summer months and lower altitude drier open forests and woodland during winter months. However, the overlapping of winter and summer ranges is common and migration for the species is not a necessity (DAWE, 2022).

Multiple sighted and call observations of Gang-gang Cockatoos were made over the BUS period, including at least one observation of the species in each season. **Table 15** details the specifics of each observation of the species. Observations included a pair of male and female of the species and groups of Gang-gang Cockatoos.

Observations of the species were largely constrained to forested patches and observations of Gang-gang Cockatoos travelling between forest and/or woodland patches of habitat. Due to the consistent presence of Gang-gang Cockatoos across August 2023, October/November 2023, January/February 2024 and March 2024 surveys, the species will likely have a continued presence within the Project area.

No observations were made of Gang-gang Cockatoo flying within RSA height during the BUS.

4.1.5.3 LITTLE EAGLE

The Little Eagle is listed as Vulnerable under the BC Act in NSW. The species is distributed throughout the Australian mainland except for the most densely forested areas. The Little Eagle can be found in open

eucalypt forest and woodland rich in prey, utilising remnant patches with a tall living tree for nesting (OEH, 2021).

One sighting of the species was made during the October/November 2023 BUS period at the reference site location FP6. **Table 15** details the specifics of the observation. The Little Eagle observation was made approximately 1 km from the nearest turbine. The Little Eagle was observed to be flying within the range of 80 m to 100 m from the ground during the observation period, therefore flying at RSA height. For the flight mapping of this observation refer to **Figure 8** (Map ID LE2). The Little Eagle's flight path was not observed to be in an area putting it at risk of blade strike.

4.1.5.4 RUFIOUS FANTAIL

The Rufous Fantail is listed as Migratory under the EPBC Act. Rufous Fantail occurs in coast and near-coastal distributions of northern and eastern Australia, with breeding populations occurring east of the Dividing Range in NSW. The species also occurs in Papua New Guinea, the Solomon Islands and Micronesia (DoE, 2024). The species is an altitudinal and north-south migrant for the area, with pronounced migratory periods observed within the Canberra region (COG, 2024). The species mainly inhabits wet sclerophyll forests, gullies or rainforests but will utilise drier woodland and forest while migrating (DoE, 2024).

One sighting of the species was made during January/February 2024 BUS period at the impact site location FP3. **Table 15** details the specifics of the observation of Rufous Fantail, with the observation flight mapped within **Figure 8** (Map ID RF1). The observation was of a single individual flying below RSA height.

4.1.5.5 SCARLET ROBIN

The Scarlet Robin is listed as Vulnerable under the BC Act in NSW. The species is found in south-eastern Australia and south-western Australia, with the Southern Tablelands region well within the species' known distribution (OEH, 2017c). The species breeds in drier eucalypt forests and temperate woodlands, commonly on ridges and slopes, often migrating to more open grassy habitats and woodlands in autumn and winter after breeding (OEH, 2017c).

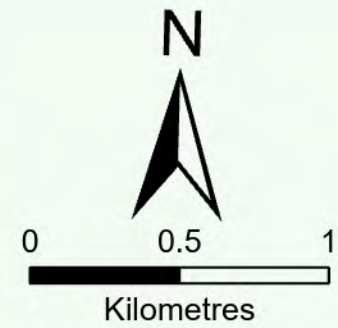
Multiple sightings and call observations of the species were made, predominantly throughout the August 2023 and March 2024 survey period, often from one survey location, FP8. **Table 15** details the specifics of each observation of the species. Observations of the species include an observation of pairs of male and female birds. Likely, the multiple observations of the Scarlet Robins from the FP8 location are of the same breeding pair of the species, as the species is known to display territorial behaviour when breeding (Robinson, 1993).

All observations of the species were constrained to near or within forested patches of habitat. All sighted observations of the species were recorded as flying below RSA height and canopy height.

4.1.5.6 VARIED SITTELLA

The Varied Sittella is listed as Vulnerable under the BC Act in NSW. The species is sedentary that inhabits most of mainland Australia, relying on eucalyptus forests and woodlands, and not found in treeless deserts and open grasslands (OEH, 2017d). The species' distribution in NSW is nearly continuous from the coast to the far west, therefore the Southern Tablelands are within the species distribution (OEH, 2017d). **Table 15** details the specifics of each observation of the species.

Two observations of a flock of the species were made within the March 2024 BUS period over two days at two different sites across the Project area. The observations included up to approximately 15 individuals all flying below RSA height.



Legend

- Project area
- Project footprint

Flight path

- Dusky Woodswallow
- Gang-gang Cockatoo
- Little Eagle
- Rufous Fantail
- Scarlet Robin
- Superb Parrot
- Varied Sitella

Point data

- Gang-gang Cockatoo
- Scarlet Robin



FIGURE 8: Threatened species observations within or close to the Project area (includes all observations across all surveys)

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:6/05/2024

TABLE 15: THREATENED SPECIES OBSERVATIONS DURING BUS SURVEYS

Date	Site	Start	Observer	Common Name	Count	Call	Seen	Flight height (m)	MapID	Notes	Outside RSA	Within RSA
19/03/2024	FP7	9:15	N	Dusky Woodswallow	1	1	-	-	Likely DW2	-	-	-
19/03/2024	FP7	9:15	G	Dusky Woodswallow	10	-	10	20	DW2	2-20 min-max FH	10	-
20/03/2024	FP7	10:09	G	Dusky Woodswallow	2	-	2	20	DW3	10-20 min-max FH	2	-
24/08/2023	FP8	16:00	N	Gang-gang Cockatoo	2	2	-	-	GG1	Later seen and GPSed in nocturnal survey	-	-
25/08/2023	FP5	6:51	N	Gang-gang Cockatoo	2	-	2	20	GG2	Male & Female -flew to FP5	2	-
8/11/2023	FP4	17:15	N	Gang-Gang Cockatoo	2	-	2	0	GG3	-	2	-
16/01/2024	FP4	9:17	N	Gang-Gang Cockatoo	1	1	-	-	GG4 (indicative area)	-	-	-
17/01/2024	FP4	8:37	N	Gang-Gang Cockatoo	1	1	-	-	GG5 (indicative area)	-	-	-
18/01/2024	FP3	7:59	N	Gang-Gang Cockatoo	1	1	-	-	GG6 (indicative area)	-	-	-
23/01/2024	FP2	10:49	D	Gang-Gang Cockatoo	12	12	-	-	GG7 (indicative area)	Heard group	-	-
24/01/2024	FP2	10:00	N	Gang-Gang Cockatoo	1	1	-	-	GG8 (indicative area)	-	-	-
24/01/2024	FP2	10:00	D	Gang-Gang Cockatoo	10	-	10	25	GG9	N-S flight	10	-
24/01/2024	FP2	17:35	N	Gang-Gang Cockatoo	14	-	14	20	GG10	S-N flight	14	-
24/01/2024	FP2	17:35	D	Gang-Gang Cockatoo	1	1	-	-	Likely GG10	Many heard, flock of 20 flying over FP2 into Box Gum Woodland from the North	-	-
24/01/2024	FP5	7:39	N	Gang-Gang Cockatoo	1	1	-	-	GG11 (indicative area)	-	-	-
25/01/2024	FP2	9:22	N	Gang-Gang Cockatoo	6	-	6	8	GG12	-	6	-
25/01/2024	FP3	9:49	N	Gang-Gang Cockatoo	2	-	2	15	GG13	-	2	-
19/03/2024	FP5	8:18	G	Gang-gang Cockatoo	1	1	-	-	-	-	-	-

Date	Site	Start	Observer	Common Name	Count	Call	Seen	Flight height (m)	MapID	Notes	Outside RSA	Within RSA
19/03/2024	FP6	8:45	G	Gang-gang Cockatoo	1	1	-	-	-	-	-	-
19/03/2024	FP7	9:15	G	Gang-gang Cockatoo	1	1	-	-	-	-	-	-
20/03/2024	FP5	14:58	N	Gang-gang Cockatoo	2	-	2	15	GG14	-	2	-
20/03/2024	FP5	14:58	G	Gang-gang Cockatoo	6	-	6	15	GG16	4-15 min-max flight height	6	-
20/03/2024	FP6	9:42	N	Gang-gang Cockatoo	1	1	-	-	-	-	-	-
26/03/2024	FP5	8:25	N	Gang-gang Cockatoo	1	1	-	-	-	-	-	-
26/03/2024	FP5	8:25	D	Gang-gang Cockatoo	5	-	5	20	GG20	10-20 min-max flight height	5	-
28/03/2024	FP5	10:32	N	Gang-gang Cockatoo	1	1	-	-	-	-	-	-
28/03/2024	FP5	10:32	D	Gang-gang Cockatoo	1	1	-	-	-	-	-	-
10/11/2023	FP6	17:00	N	Little Eagle	1	-	1	80	LE2	80-100 (min-max) Observed 30 sec, 500m east of FP6. Flight mapped.	-	1
1/02/2024	FP3	18:10	G	Rufous Fantail	1	-	1	4	RF1	-	1	-
15/08/2023	FP8	16:30	N	Scarlet Robin	2	-	2	2	SR1	Male & female	2	-
15/08/2023	FP8	16:30	D	Scarlet Robin	2	-	2	2	SR2	Male & female	2	-
15/08/2023	FP8	10:38	D	Scarlet Robin	2	2	-	-	-	-	-	-
16/08/2023	FP3	7:50	N	Scarlet Robin	1	-	1	1	SR3	Male	1	-
16/08/2023	FP8	10:00	N	Scarlet Robin	1	-	1	2	SR4	-	1	-
16/08/2023	FP8	10:00	D	Scarlet Robin	2	2	-	-	-	-	-	-
17/08/2023	FP8	9:20	N	Scarlet Robin	1	1	-	-	-	-	-	-
17/08/2023	FP8	9:20	D	Scarlet Robin	2	2	-	-	-	-	-	-
17/08/2023	FP8	14:58	N	Scarlet Robin	1	-	1	3	SR5	-	1	-
24/08/2023	FP8	8:48	D	Scarlet Robin	2	2	-	-	-	-	-	-
25/08/2023	FP3	9:47	N	Scarlet Robin	1	1	-	-	-	-	-	-
25/08/2023	FP3	16:22	N	Scarlet Robin	1	1	-	-	-	-	-	-
25/08/2023	FP8	8:20	N	Scarlet Robin	1	1	-	-	-	-	-	-
28/08/2023	FP5	10:35	N	Scarlet Robin	1	1	-	-	-	-	-	-
17/10/2023	FP8	7:17	N	Scarlet Robin	1	1	-	-	-	-	-	-
18/03/2024	FP5	16:18	N	Scarlet Robin	1	1	-	-	-	-	-	-

Date	Site	Start	Observer	Common Name	Count	Call	Seen	Flight height (m)	MapID	Notes	Outside RSA	Within RSA
18/03/2024	FP8	9:51	N	Scarlet Robin	2	-	2	10	SR6	Adult M&F	2	-
18/03/2024	FP8	9:51	G	Scarlet Robin	2	-	2	5	Likely SR6	0-5 min-max flight height , mixed flocked	2	-
19/03/2024	FP5	8:18	N	Scarlet Robin	1	1	-	-	-	-	-	-
19/03/2024	FP8	9:49	N	Scarlet Robin	1	1	-	-	-	-	-	-
20/03/2024	FP4	9:45	G	Scarlet Robin	2	-	2	2	SR7	1-2 min-max FH mixed flock	2	-
20/03/2024	FP8	10:34	N	Scarlet Robin	2	-	2	10	SR8	Classic Winter Mixed Species Flock, foraging (0-10 min-max flight height)	2	-
26/03/2024	FP4	7:54	N	Scarlet Robin	1	-	1	10	SR9	Mixed sp. flock (0-10 min – max flight height)	1	-
26/03/2024	FP6	16:23	N	Scarlet Robin	1	1	-	-	-	-	-	-
26/03/2024	FP8	9:48	N	Scarlet Robin	1	-	1	5	SR10	-	-	-
26/03/2024	FP8	9:48	D	Scarlet Robin	1	-	1	15	Likely SR10	2-15 min-max flight height	-	-
27/03/2024	FP3	17:50	N	Scarlet Robin	1	1	-	-	-	-	-	-
27/03/2024	FP4	11:11	N	Scarlet Robin	1	1	-	-	-	-	-	-
27/03/2024	FP5	7:50	N	Scarlet Robin	1	1	-	-	-	-	-	-
27/03/2024	FP6	8:20	N	Scarlet Robin	1	-	1	15	SR11	Mixed sp. flock	1	-
27/03/2024	FP6	8:20	D	Scarlet Robin	1	1	-	-	-	-	-	-
27/03/2024	FP6	15:37	D	Scarlet Robin	1	1	-	-	-	-	-	-
28/03/2024	FP3	16:15	N	Scarlet Robin	1	1	-	-	-	-	-	-
28/03/2024	FP4	10:03	N	Scarlet Robin	2	-	2	10	SR12	Mixed sp. flock, foraging (0-10 min-max flight height)	2	-
28/03/2024	FP6	11:00	D	Scarlet Robin	1	1	-	-	-	-	-	-
26/03/2024	FP7	9:23	N	Varied Sittella	16	-	16	15	VS1	15-20	16	-
26/03/2024	FP7	9:23	D	Varied Sittella	15	-	15	20	Likely VS1	-	15	-
27/03/2024	FP6	8:20	N	Varied Sittella	10	-	10	15	VS2	Mixed sp. flock	10	-

4.2 Raptor Vantage Point surveys

4.2.1 SURVEY SUITABILITY

Vantage point surveys with a focus on raptors and other 'at risk' groups are included for specific monitoring of groups at higher risk of collision with turbine due to flight behaviour. However, the monitoring of these groups usually does not include an off-site monitoring of a control site. As construction of the Project was already well underway when bird surveys for the BBAMP were employed, there is no point of reference for a true baseline of what the bird and raptor utilisation was before impacts occurred. Therefore, it was determined that a control or reference site was of particular importance at the Project. The inclusion of these specific survey methodologies would allow for comparison to an area with no impacts from wind farm development. Although not a completely one-for-one representation in size due to constraints with suitable sites for surveying and safety, continued monitoring of the control sites will help illustrate any impacts on raptor populations within the Project area.

4.2.2 NUMBER OF RAPTOR OBSERVATIONS

RVPS made 215 observations of raptors from the fixed-point locations during surveys. These included 66 observations during the winter season, 34 observations during the spring, 73 observations during the summer and 42 observations during the autumn season. A total of 64 observations were recorded at impact sites within the Project area, including 20 observations in winter, 13 observations in spring, 21 observations in summer and 10 observations in autumn. External control sites recorded a total of 151 observations, this included 46 observations occurring in the winter season, 21 in the spring, 52 in the summer and 32 in the autumn season. **Table 16** summarises the number of records for each season and survey sites.

4.2.2.1 SEASONS

The spring (34) season had the least observations, followed by autumn (42), both of which had considerably fewer observations than the winter (66) and summer (73) seasons. The spring season was impacted by access issues and seasonal storms, which resulted in sites RVP2, RVP3 and RCP3 being one survey short for the season. The poor weather conditions likely have also played a role in the fewer raptor observations in general, as more survey days had to be worked around suboptimal survey conditions. Autumn season numbers could be impacted by the migration of breeding pairs and their juveniles outside of the area after fledging as well as fewer repeat observations these breeding pairs around nest sites likely observed in summer.

Summer had the highest records of raptor observations overall, however, the high observation numbers were localised to certain sites, particularly RVP2, RCP2 and RCP3. Likewise, the winter season's higher number of records were localised to specific sites, RCP1, RCP2 and RCP3. Autumn season exhibited a high number observations at RCP2 but an overall low number of observations at all other sites.

Interestingly some sites that yielded high records in some seasons also had very low records in other seasons, particularly the control sites. Low observations associated with spring may be due to weather conditions. But in the case of particularly low observations for summer for the sites RCP1 and RVP1, when raptor observations for the season are overall high and previous observations for the sites are higher, it is unclear what has led to fewer observations for these sites.

4.2.2.2 IMPACT SITE VERSES CONTROL SITE

There is a clear difference in observation records between impact sites and control sites, with impact sites producing consistently lower observations than control sites. Consideration should be taken into

account that the area surveyed for control sites was required to be further spread out and has resulted in a greater area for visual observation compared to greater overlap in impact sites. Control sites are approximately 4.5 km away from each other and impact sites are approximately 1.5 km apart. This is illustrated in **Figure 9**. This greater visual area for observation naturally would increase the opportunity for recording species. The area in the example 2 km viewshed from control sites equals 37.5 km², comparatively the area viewed in impact sites only equates to 23.9 km². Therefore, approximately over a 50% larger area is viewed in control sites than in impact sites.

The considerably lower observation numbers at the impact sites may also be attributed to the construction works already underway at the Project, producing noise and disturbances that potentially deter more sensitive species from the Project area. However, no conclusions can be drawn without any data prior to the commencement of construction works.

4.2.2.3 INCIDENTAL OBSERVATIONS

An additional 92 incidental observations and observations made by BUS surveyors were recorded across the Project area, during winter (26), spring (12), summer (38) and autumn (16). The number of incidental raptor records further reflects the level of raptor activity across the Project area during each season seen throughout the RVPS. The low number of spring incidental observations confirms a lower raptor activity for the development area for the season, likely attributed to the suboptimal wet and storm seasonal weather. Observed low observations during autumn likely is related to fewer observations after fledging of juvenile birds and nesting pairs have moved on from nesting areas.

There were a large number of raptor observations during the BUS surveys for the summer season (34) which indicates that this season was particularly active for raptors within the Project area, likely due to a combination of the repeated observation of breeding pairs and a high abundance of foraging opportunities available for the season.

4.2.3 SPECIES AND ABUNDANCE

A total of nine raptor species were observed while conducting RVPS, they include:

- Wedge-tailed Eagle (102 observations);
- Nankeen Kestrel (40);
- Brown Falcon (35);
- Black-shouldered Kite (14);
- Peregrine Falcon (8);
- Whistling Kite (2);
- Australian Hobby (2);
- Brown Goshawk (1); and
- Little Eagle (1).

The raptor species observed within or near the Project area that include the incidental observations are:

- Wedge-tailed Eagle (56 observations);
- Nankeen Kestrel (50);
- Brown Falcon (17);
- Brown Goshawk (11);
- Peregrine Falcon (8);
- Black-shouldered Kite (5);

- Australian Hobby (3); and
- Little Eagle (3).

The most abundant raptor species during RVPS was the Wedge-tailed Eagle and it was consistently the most abundant species recorded across all survey sites. Raptor species observations per site can be found in **Table 17**. The second most abundant raptor species was the Nankeen Kestrel, followed by the Brown Falcon. These species were consistently observed throughout most survey sites across all seasons.

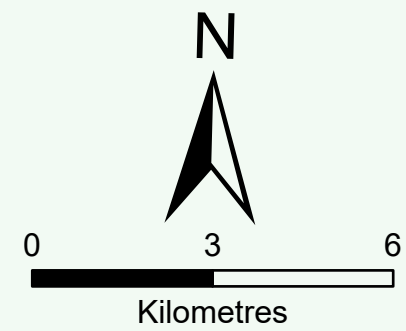
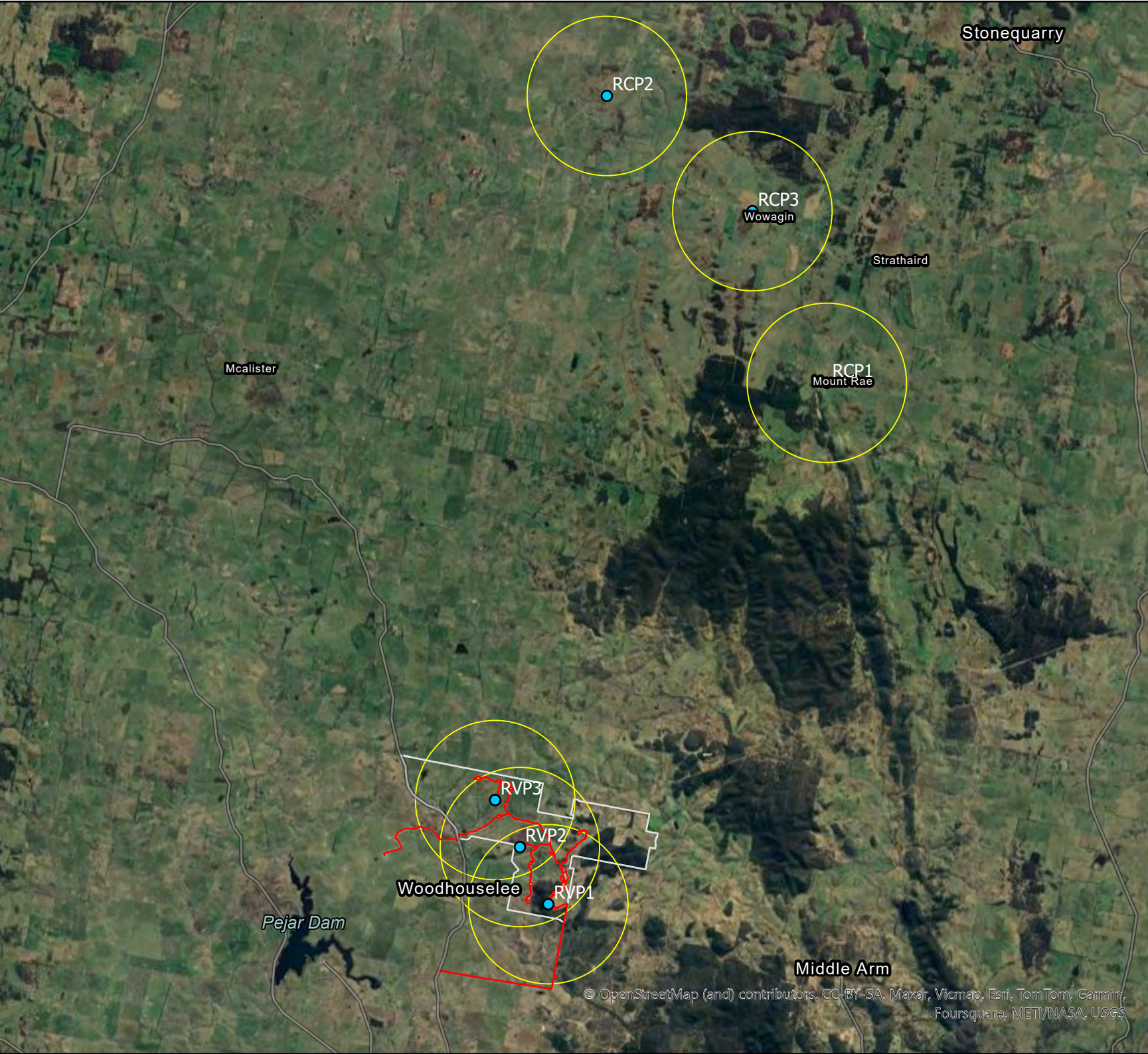
Raptor species richness was highest for impact site RVP2 (six species) and for control site RCP2 (eight species) across all surveyed seasons. The autumn season of surveys produced the highest species richness for the survey period, with eight species recorded.

TABLE 16: SUMMARY OF RAPTOR FLIGHT OBSERVATIONS MADE DURING RVPS AND INCIDENTAL OBSERVATIONS

Seasons	RVP1	RVP2	RVP3	Impact point total	RCP1	RCP2	RCP3	Control point total	Survey total	BUS	Incidental	Incidental total	Grand Total
Winter	6	6	8	20	19	14	13	46	66	10	16	26	92
Spring	5	2	6	13	12	3	6	21	34	11	1	12	46
Summer	5	15	1	21	4	29	19	52	73	34	4	38	111
Autumn	2	3	5	10	5	18	9	32	42	16	0	16	58
Grand Total	18	26	20	64	40	64	47	151	215	71	21	92	307

TABLE 17: RAPTOR SPECIES OBSERVATION ACROSS SURVEY SITES AND SEASONS

Survey Site	Australian Hobby	Black-shouldered Kite	Brown Falcon	Brown Goshawk	Falcon sp.	Little Eagle	Nankeen Kestrel	Peregrine Falcon	Unknown sp.	Wedge-tailed Eagle	Whistling Kite	Grand Total
RVP1	0	0	1	0	0	0	4	2	0	11	0	18
RVP2	0	1	2	0	0	1	4	2	0	16	0	26
RVP3	0	0	5	0	1	0	6	2	0	6	0	20
RCP1	1	0	9	0	2	0	11	0	0	17	0	40
RCP2	0	13	14	1	2	0	7	2	0	24	1	64
RCP3	1	0	4	0	1	0	8	0	4	28	1	47
Survey Total	2	14	35	1	6	1	40	8	4	102	2	215
BUS	2	2	8	11	2	1	26	2	0	17	0	71
Incidental	1	2	1	0	0	1	10	0	0	6	0	23
Grand Total	5	18	44	12	8	3	76	10	4	125	2	307
Season (RVPS)												
Winter	0	2	4	0	1	0	19	0	4	36	0	66
Spring	0	0	10	0	4	0	9	0	0	10	1	34
Summer	0	6	13	0	0	1	8	6	0	38	1	73
Autumn	2	6	8	1	1	0	4	2	0	18	0	42
Survey Total	2	14	35	1	6	1	40	8	4	102	2	215



- Legend**
- Project area
 - Project footprint
 - 2 km radius from survey site
 - RVPS locations



FIGURE 9: Map representation of survey and raptor population overlap

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:25/02/2024

4.2.4 FLIGHT OBSERVATIONS

Flight within RSA height was determined through the flight minimum and maximum of each species record, and whether it entered the RSA height range (i.e. 30 m – 160 m). Of the total 307 raptor observations recorded across RVPS, BUS and incidental observations, 194 (63.2%) of raptors observed flew within RSA height. Flight height observations for RVPS alone yielded a 65.6% rate of raptors flying within RSA height. Species flight height observations are summarised in **Table 18**.

Unlike in BUS flight height calculations where perch data was removed to describe the actual flight behaviour of a large dataset, the few data points collected for some raptor species do not permit this additional analysis.

4.2.4.1 SPECIES FLIGHT HEIGHT

The species with the largest number of flight observations was Wedge-tailed Eagle, with 102 RVPS observations and 125 total observations. The overall percentage of flight observed for the species within RSA height was 76.0%. Due to this being the largest data set for a single species, it is likely the most accurate representation of a species' flight behaviour. Additionally, Wedge-tailed Eagles were rarely observed perched and not exhibiting flight behaviour. Importantly, the majority of Wedge-tailed Eagle flight observations that occur outside of RSA height are at a flight height greater than RSA height (85.7%).

Nankeen Kestrel was the second most recorded species with 40 RVPS observations and 76 total observations. The overall percentage of flight observed for the species within RSA height was 59.2%. Nankeen Kestrels were observed displaying various flight behaviours throughout the survey sites, including courtship and mating, hunting from perches and utilising wind farm roads for hunting.

Brown Falcon was observed 35 times during RVPS and was recorded 44 times across all surveys and incidental observations. The species yielded an overall flight percentage within RSA height of 52.3%, which is likely due to a proportionately high number of only perch observations and multiple observations of hunting from a perched position.

Of the other species observed the Black-shouldered Kite (18 total) and Brown Goshawk (12 total) have low flight height within RSA, 27.8% and 8.3% respectively. Both species had a high proportion of observations of individuals perched and observations of flight behaviours associated with low flight, including, hunting from a perch, flight around a nest site and flight through canopy.

Peregrine Falcon (10 total) yielded 70% of its observed flight within RSA height. Peregrine Falcons were observed actively hunting or attacking other birds in 30.0% of all Peregrine Falcon records, which was likely associated with lower flight height behaviours.

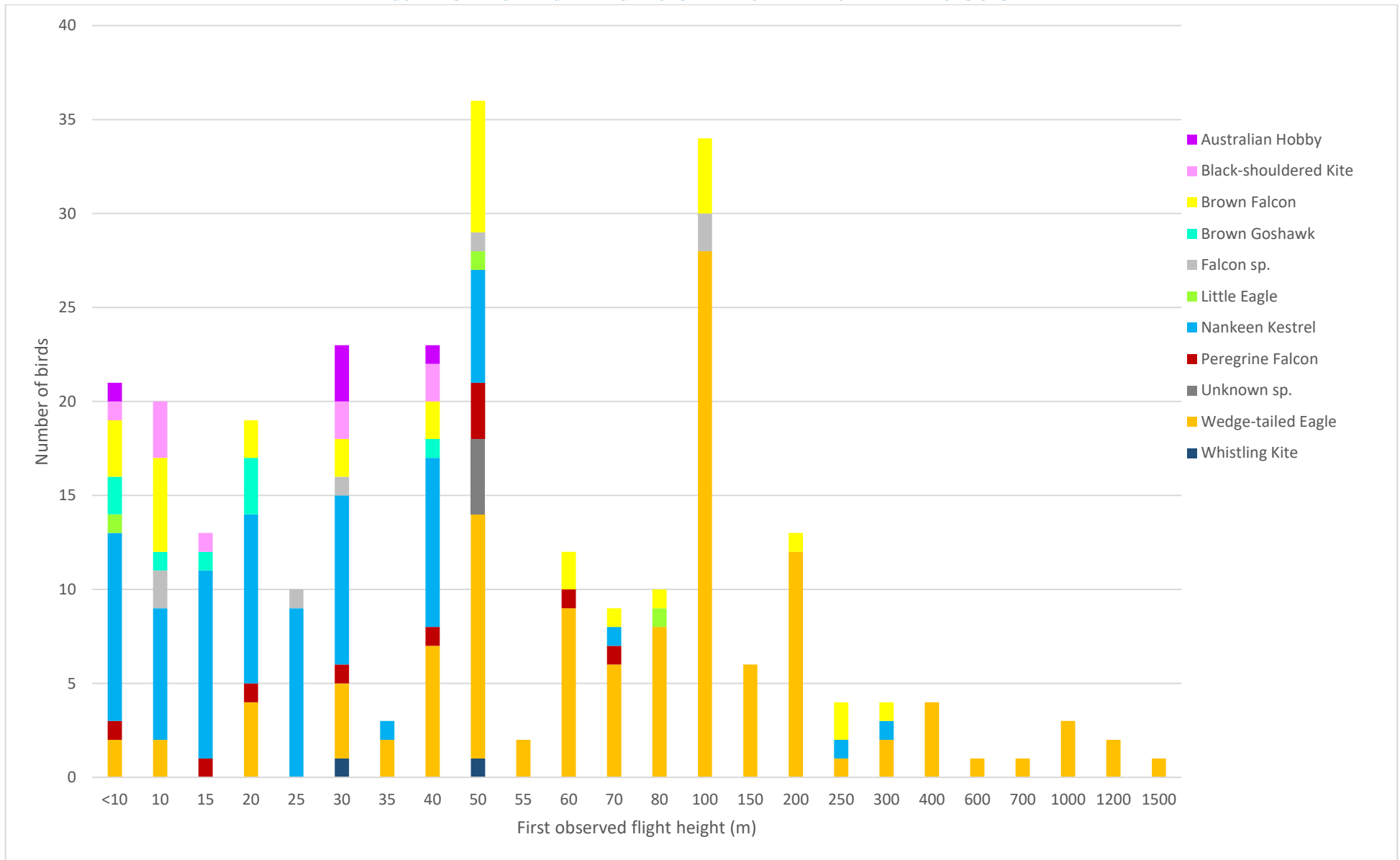
Australian Hobby (5 total), Little Eagle (3 total) and Whistling Kite (2 total) had very few observations, the outcome percentages of their flight at RSA height are less likely to be fully representative of their flight behaviour due to a low amount of data.

A graph showing the first observed flight height for each raptor species has been included in **Figure 10**. This graph illustrates a trend of Wedge-tailed Eagles flying high and well above RSA height while observed, while also showing that Nankeen Kestrels fall into lower flight height categories while still flying within RSA height.

TABLE 18: SPECIES FLIGHT OBSERVATIONS

Species observed	Impact					Control					Total RVPS					Incidental			Grand total		
	Within RSA	Outside RSA	Perch	Total	% RSA	Within RSA	Outside RSA	Perch	Total	% RSA	Within RSA	Outside RSA	Perch	RVPS Total	% RSA total	Within RSA	Outside RSA	Perch	Within RSA total	Grand total	% RSA G. total
Wedge-tailed Eagle	21	12	0	33	63.6	54	13	2	69	78.3	75	25	2	102	73.5	20	3	0	95	125	76.0
Nankeen Kestrel	10	4	0	14	71.4	16	8	2	26	61.5	26	12	2	40	65.0	19	16	1	45	76	59.2
Brown Falcon	6	0	2	8	75.0	13	7	7	27	48.1	19	7	9	35	54.3	4	4	1	23	44	52.3
Black-shouldered Kite	1	0	0	1	100.0	2	5	6	13	15.4	3	5	6	14	21.4	2	0	2	5	18	27.8
Brown Goshawk	0	0	0	0	0.0	0	1	0	1	0.0	0	1	0	1	0.0	1	6	4	1	12	8.3
Peregrine Falcon	4	2	0	6	66.7	2	0	0	2	100.0	6	2	0	8	75.0	1	1	0	7	10	70.0
Falcon sp.	1	0	0	1	100.0	2	3	0	5	40.0	3	3	0	6	50.0	2	0	0	5	8	62.5
Australian Hobby	0	0	0	0	0.0	2	0	0	2	100.0	2	0	0	2	100.0	3	0	0	5	5	100.0
Unknown sp.	0	0	0	0	0.0	4	0	0	4	100.0	4	0	0	4	100.0	0	0	0	4	4	100.0
Little Eagle	1	0	0	1	100.0	0	0	0	0	0.0	1	0	0	1	100.0	1	1	0	2	3	66.7
Whistling Kite	0	0	0	0	0.0	2	0	0	2	100.0	2	0	0	2	100.0	0	0	0	2	2	100.0
Total	44	18	2	64	68.8%	97	37	17	151	64.2%	141	55	19	215	65.6%	53	31	8	194	307	63.2%

FIGURE 10: FIRST FLIGHT HEIGHT OBSERVATION DATA FOR ALL RAPTORS OBSERVED



4.2.4.2 IMPACT VERSUS CONTROL SITES

The total calculated flight within RSA height was 68.8% for impact sites and 64.2% for control sites. A higher observed flight at impact sites may be influenced by the fewer observations of raptors (particularly Brown Falcon and Black-shouldered Kite) perched or exhibiting low flight behaviours like hunting from perch within the impact sites during RVPS.

Percentage flight height within RSA height also differed for species between impact sites and control sites. The Wedge-tailed Eagle exhibited a higher rate of flight within RSA height at the control sites (78.3%), however, Nankeen Kestrels yielded a high percentage of flight at RSA height within the impact sites (71.4%).

4.2.4.3 FLIGHT MAP OBSERVATIONS OF THE PROJECT AREA

Flight maps for the RVPS within the Project area and each season have been provided; winter (**Figure 11**), spring (**Figure 14**), summer (**Figure 17**) and autumn (**Figure 20**). Incidental observations and observations mapped during the BUS can be found in **Figure 13**, **Figure 16**, **Figure 19** and **Figure 22**. Control site maps can be referred to in **Figure 12**, **Figure 15**, **Figure 18** and **Figure 21**. Flight data collected for each observation can be found in **Appendix A2**.

Raptors were observed utilising most areas of the wind farm throughout their flight paths. Wedge-tailed Eagles were observed actively flying, gliding and soaring throughout many areas, travelling along ridges and above the larger patches of forest. Although no Wedge-tailed Eagle nests have been found it is likely that there is at least one pair of the species with a nest nearby as often two adult Wedge-tailed Eagles have been observed in flight together.

Nankeen Kestrels likewise have been observed widely utilising the Project area, with repeated hunting areas observed in the open and cleared valleys. A Nankeen Kestrel pair was observed courting and mating next to the compound area, and then entering a hollow in a dead tree next to turbine A21. This pair of Nankeen Kestrels has repeatedly been observed within this area hunting and calling.

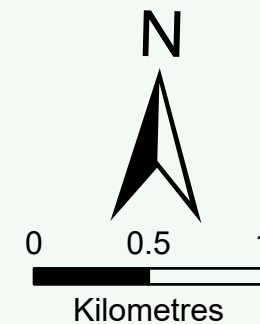
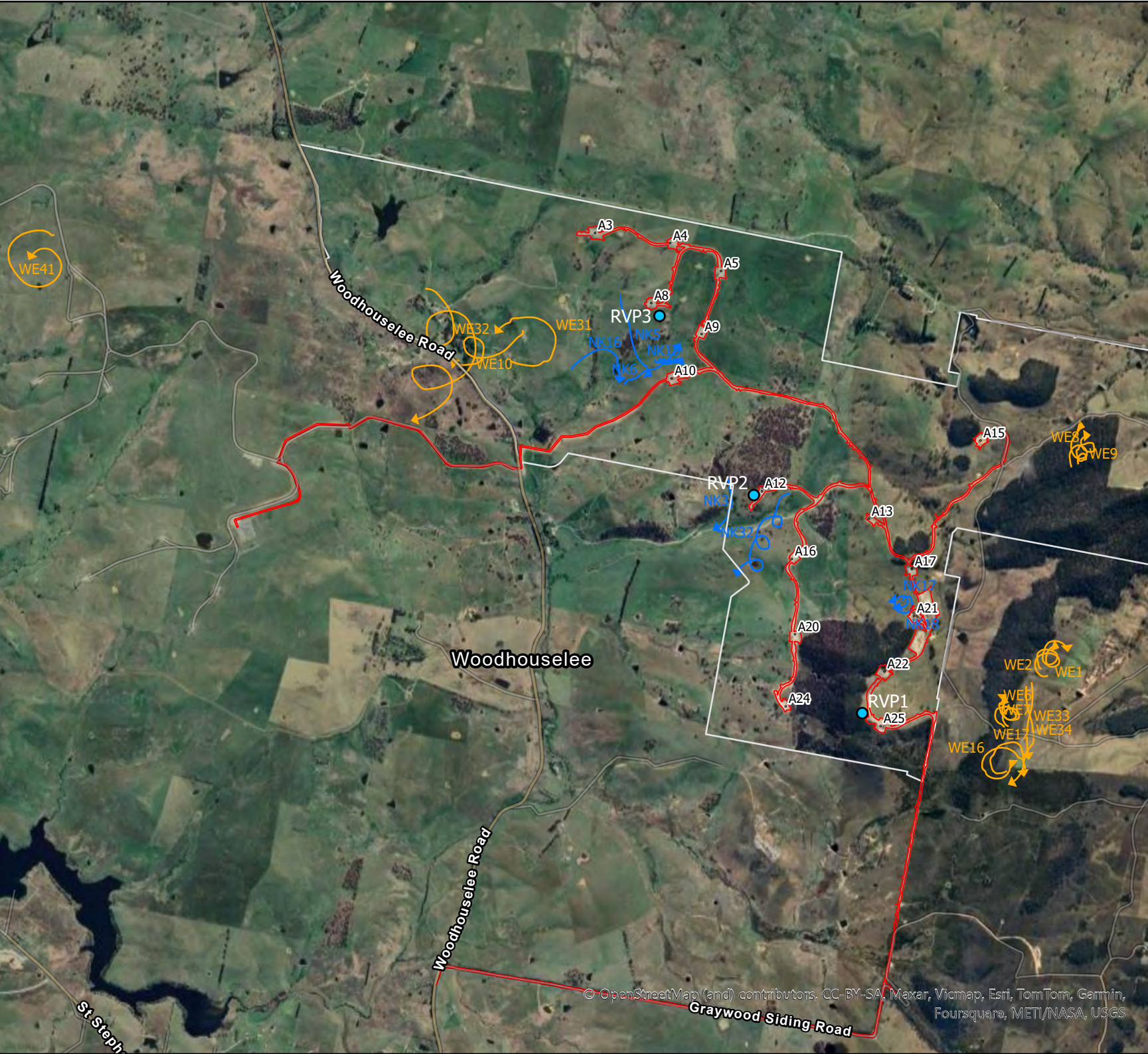
The only area of the wind farm where little raptor flight has been observed is that for the areas close to turbines A3, A4 and A5 in the north-west of the Project. This likely is due to the little habitat and less potential foraging opportunities in this area.

4.2.4.4 FLIGHT MAP OBSERVATIONS IN POTENTIAL IMPACT AREA OF TURBINES

Observations from flight path data indicates that although much of the airspace within the Project area has been utilised by raptors, particular turbine areas likely pose greater risk to blade strike if raptor flight behaviour goes unchanged. The turbines which exhibit the most flight activity near them appear to be, in order of most significant activity:

- Turbine A12 – This turbine is located atop a steep hill above a riparian area and adjacent to a patch of native woodland. This native woodland is situated higher in elevation than the hillside in which the turbine pad is built into. A gully line from the east and a gradual hillslope has additionally been seen to funnel the flight path of raptors into the area of the turbine. The distinct habitat, foraging and flight updraft opportunities of this area likely contributed to the significant amount of raptor flight observations within this area.
- Turbine A21 – This turbine has been observed to have a Nankeen Kestrel nest within a stag at the base of the turbine. Observations of the pair of Nankeen Kestrels are made frequently each season and risk to either or both individuals being impacted by blade strike is likely high.

- Turbine A24 – This turbine is situated on a gradual hillslope that is adjacent to the large patch of native forest found to the east of it. This native forest is situated higher in elevation than the hillside in which the turbine pad is built into. There have been multiple observations of raptors taking flight or returning to the forest in flight paths that take them near to the turbine. Furthermore, multiple Wedge-tailed Eagles are often observed travelling from this area into the more open landscapes to the west and southwest, likely to hunt.
- Turbine A20 – Like turbine A24, this turbine is situated on a gradual hillslope that is adjacent to the large patch of native forest found to the southeast. This native forest is situated higher in elevation than the hillside in which the turbine pad is built into. There have been multiple observations of raptors taking flight or returning to the forest in flight paths that take them near to the turbine.



Legend

- Project area
- Project footprint
- RVPS locations

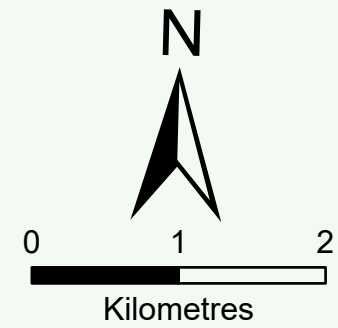
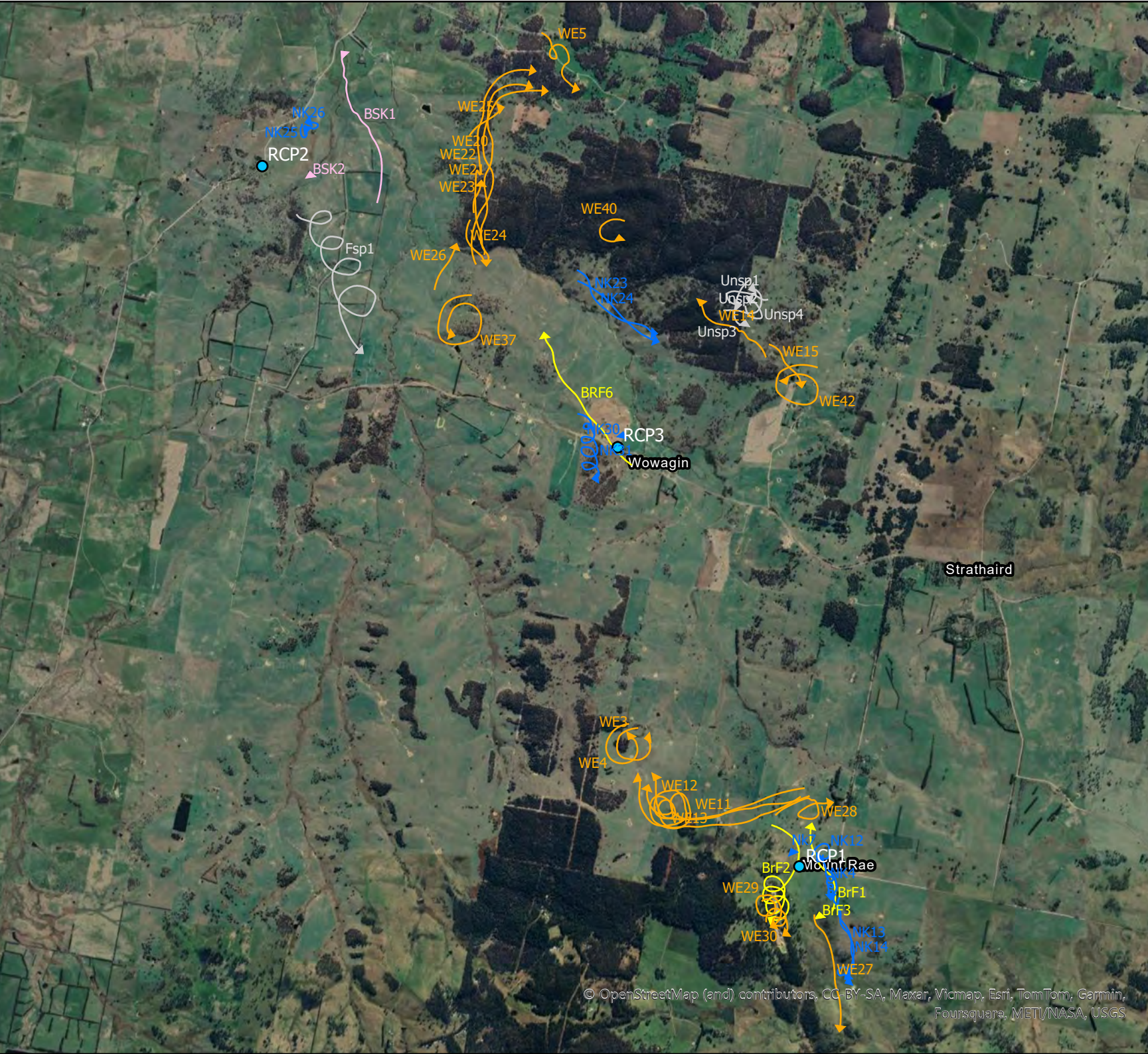
Winter RVPS

- Wedge-tailed Eagle
- Nankeen Kestrel



FIGURE 11: Raptor flight path map for impact points for winter survey season

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:25/02/2024

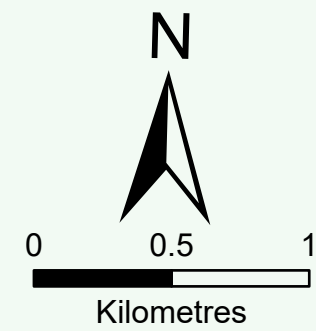


- Legend**
- RVPS locations
- Winter RVPS**
- Wedge-tailed Eagle
 - Nankeen Kestrel
 - Brown Falcon
 - Black-shouldered Kite
 - Unknown sp.



FIGURE 12: Raptor flight path map for control points for winter survey season

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:25/02/2024



Legend

- Project area
- Project footprint
- RVPS locations

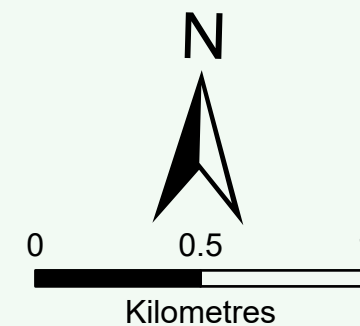
Winter Incidentals

- Wedge-tailed Eagle
- Nankeen Kestrel
- Brown Falcon
- Black-shouldered Kite
- Australian Hobby
- Little Eagle
- Brown Goshawk



FIGURE 13: Raptor flight path map for incidental observations for winter survey season

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:25/02/2024



Legend

- Project area
- Project footprint
- RVPs locations

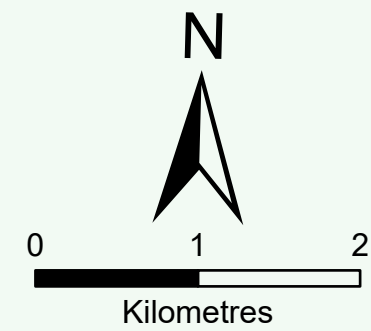
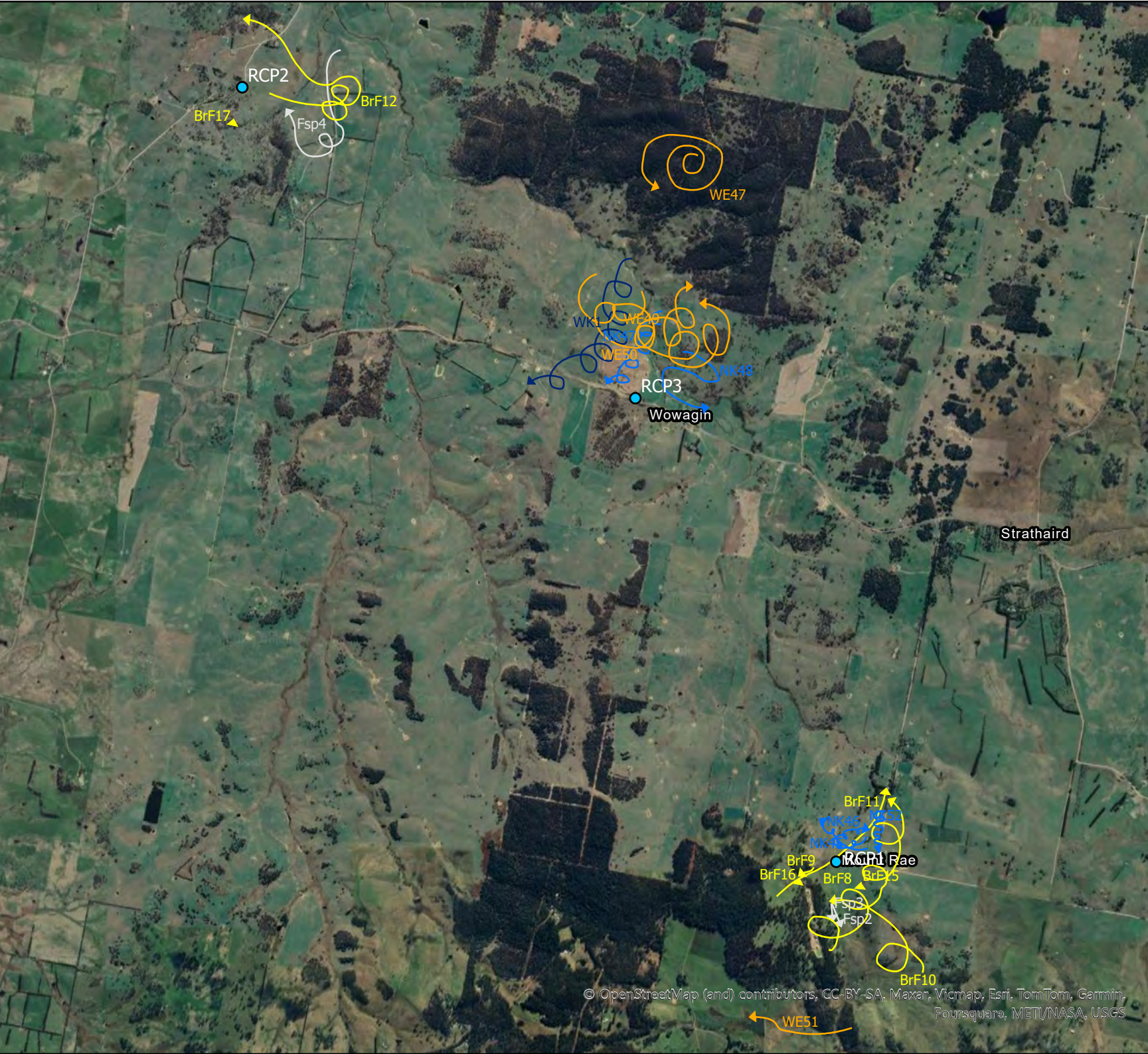
Spring RVPS

- Wedge-tailed Eagle
- Nankeen Kestrel
- Brown Falcon
- Unknown sp



FIGURE 14: Raptor flight path map for impact points for spring survey season

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:25/02/2024

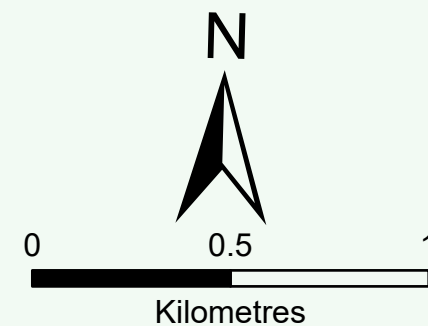


- Legend**
- RVPS locations
 - Spring RVPS**
 - Wedge-tailed Eagle
 - Nankeen Kestrel
 - Brown Falcon
 - Whistling Kite
 - Unknown sp



FIGURE 15: Raptor flight path map for control points for spring survey season

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:25/02/2024



Legend

- Project area
- ▭ Project footprint
- RVPs locations

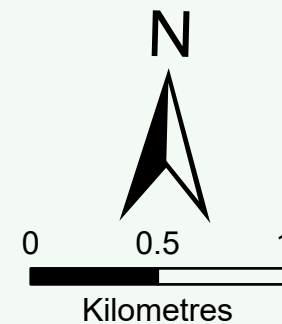
Spring Incidentals

- ➡ Nankeen Kestrel
- ➡ Brown Falcon
- ➡ Little Eagle
- ➡ Brown Goshawk
- ➡ Australian Hobby



FIGURE 16: Raptor flight path map for incidental observations for spring survey season

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:25/02/2024



Legend

- Project area
- Project footprint
- RVPS locations

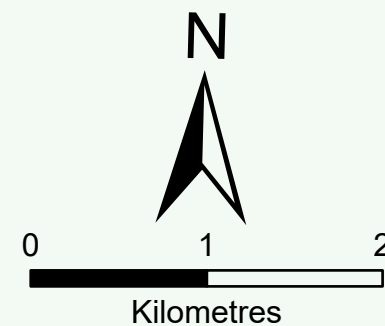
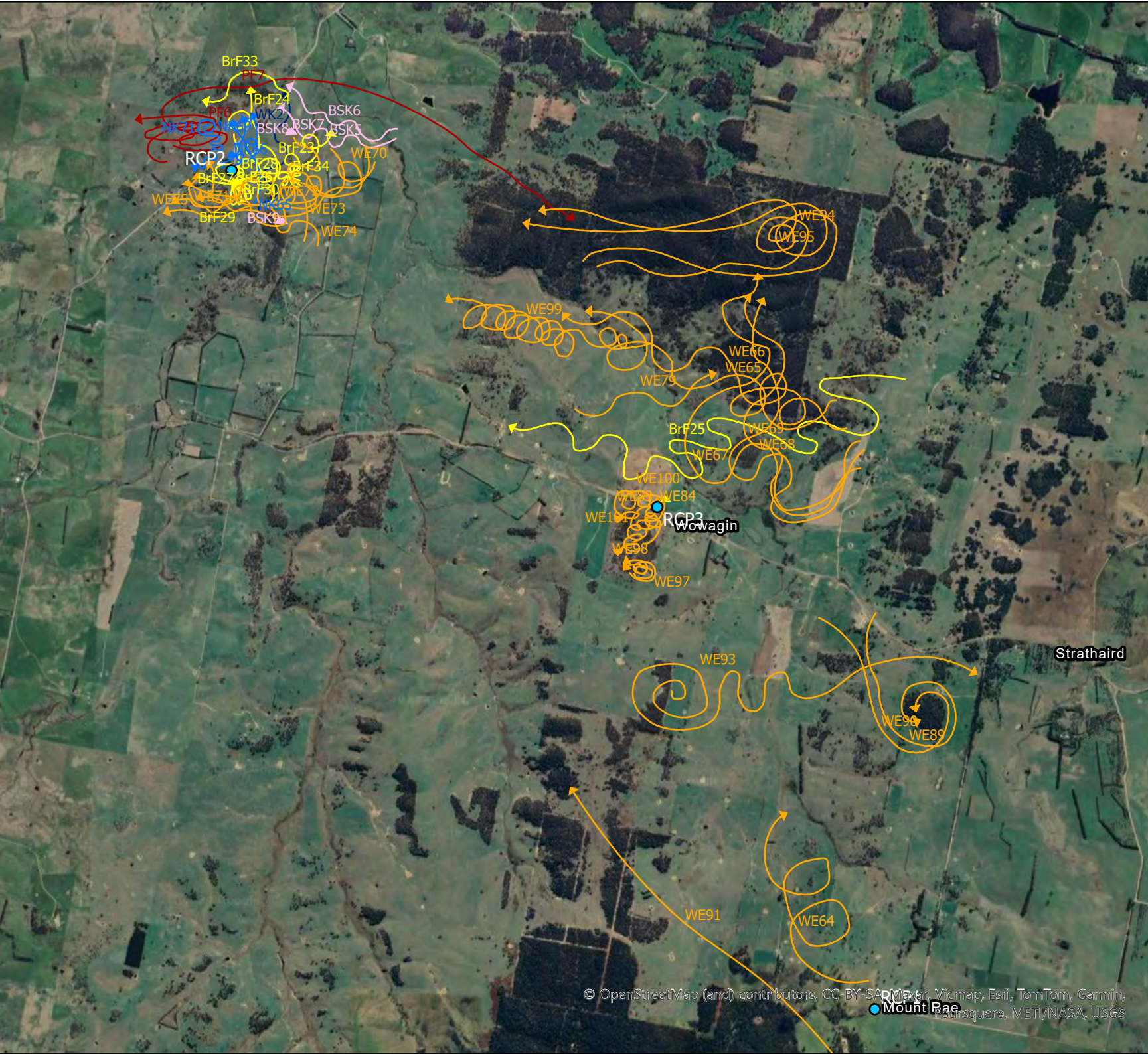
Summer RVPS

- Wedge-tailed Eagle
- Nankeen Kestrel
- Brown Falcon
- Peregrine Falcon
- Little Eagle



FIGURE 17: Raptor flight path map for impact points for summer survey season

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:25/02/2024



Legend

- RVPS locations

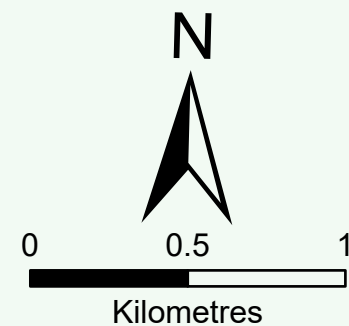
Summer RVPS

- Wedge-tailed Eagle
- Nankeen Kestrel
- Brown Falcon
- Black-shouldered Kite
- Peregrine Falcon
- Whistling Kite



FIGURE 18: Raptor flight path map for control points for summer survey season

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:25/02/2024



Legend

- Project area
- ▭ Project footprint
- RVPS locations

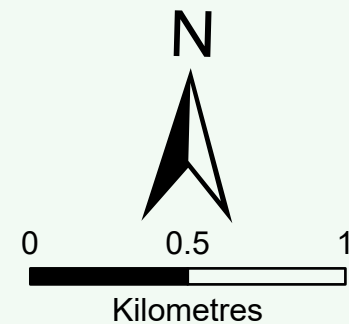
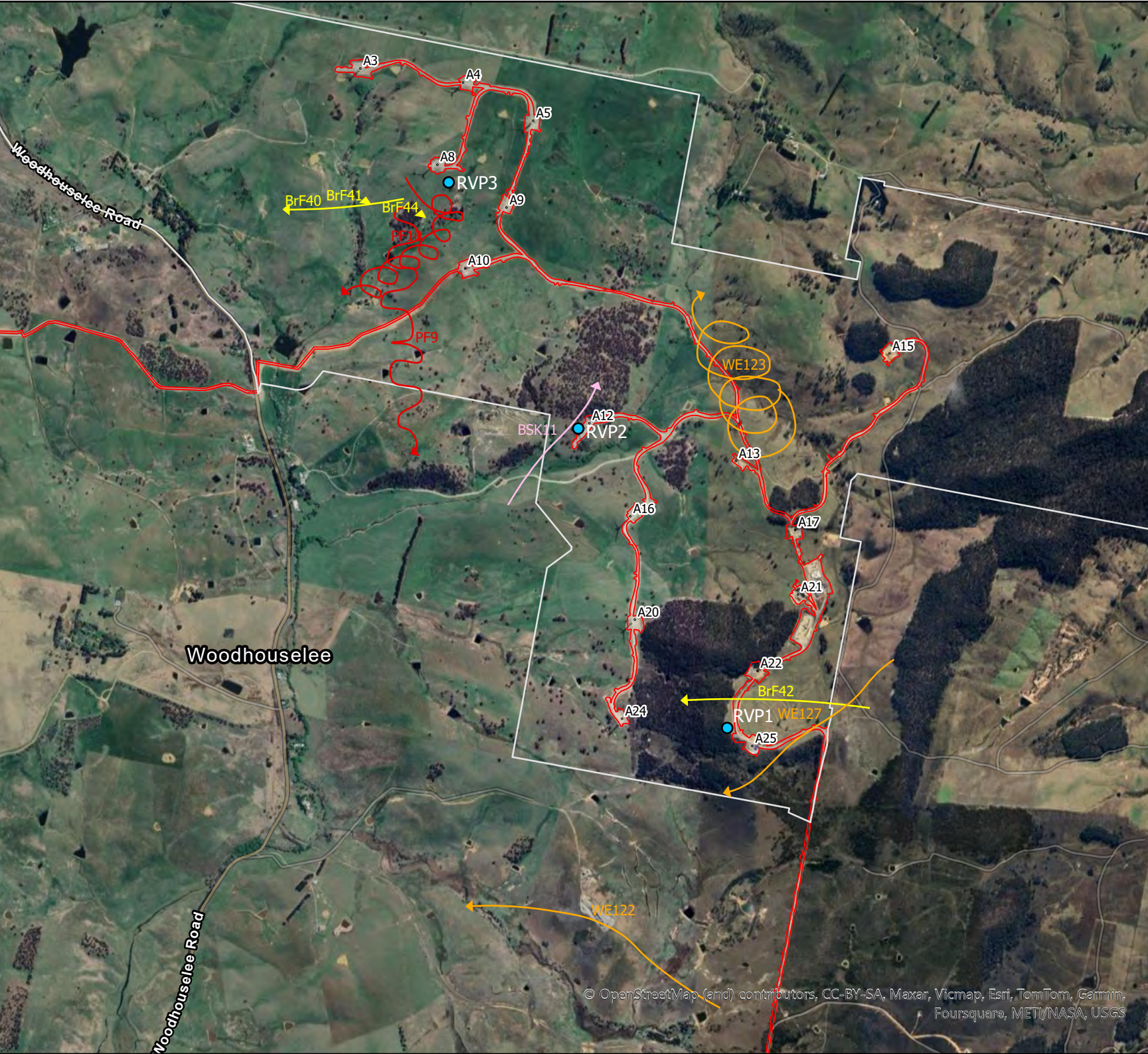
Summer Incidentals

- Wedge-tailed Eagle
- Nankeen Kestrel
- Brown Falcon
- Peregrine Falcon
- Brown Goshawk
- Falcon sp.



FIGURE 19: Raptor flight path map for incidental observations for summer survey season

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:25/02/2024



Legend

- Project area
- ▭ Project footprint
- RVPS locations

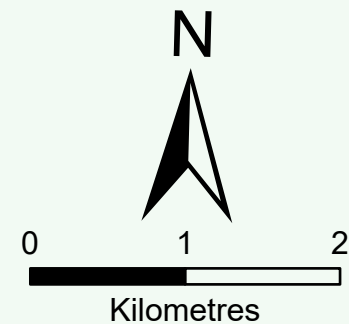
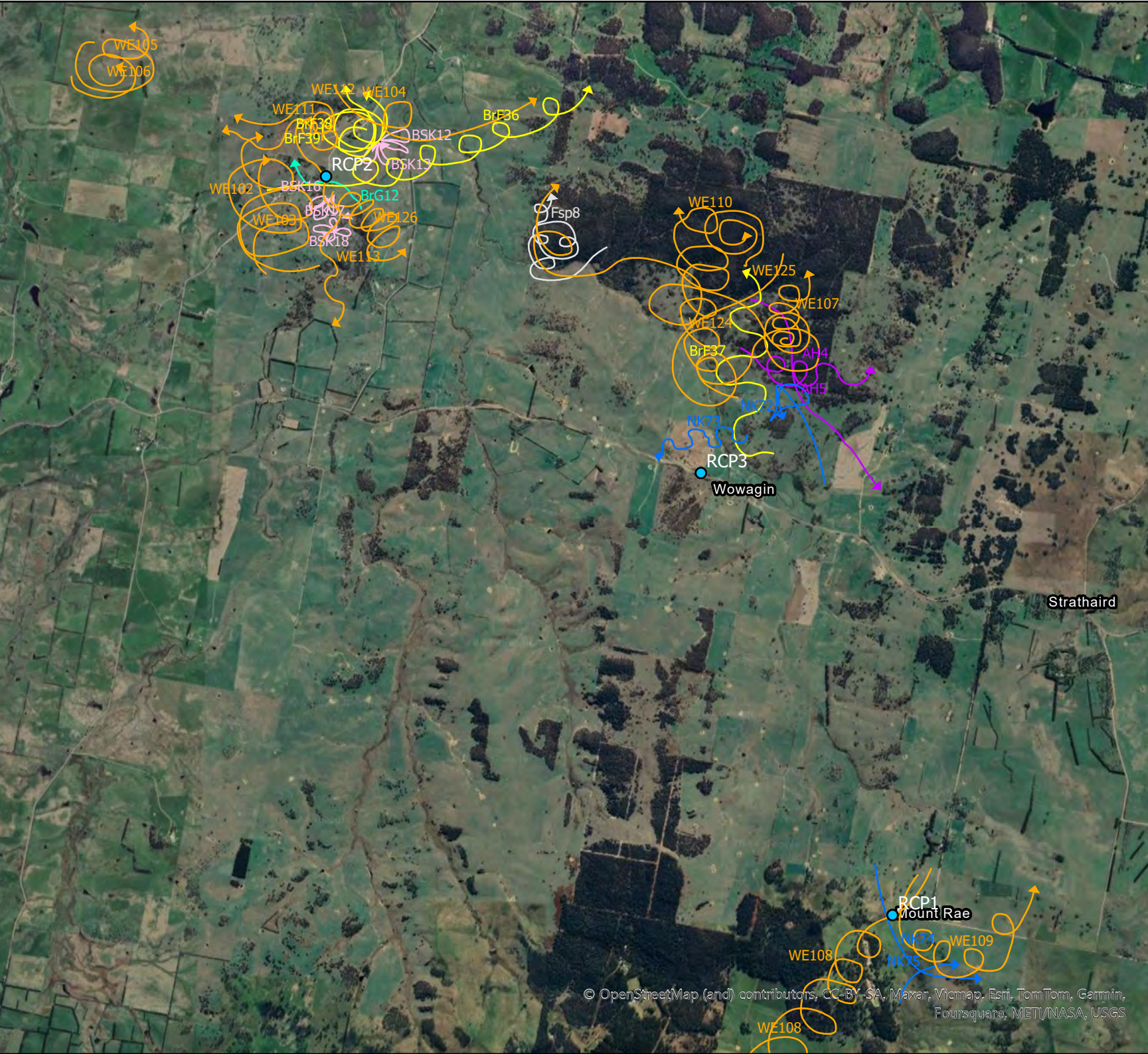
Autumn RVPS

- Wedge-tailed Eagle
- Brown Falcon
- Peregrine Falcon
- Black-shouldered Kite



FIGURE 20: Raptor flight path map for impact points for autumn survey season

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:19/04/2024



Legend

- RVPS locations

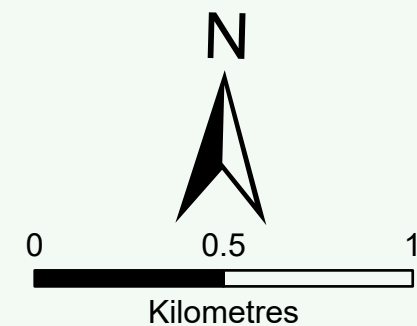
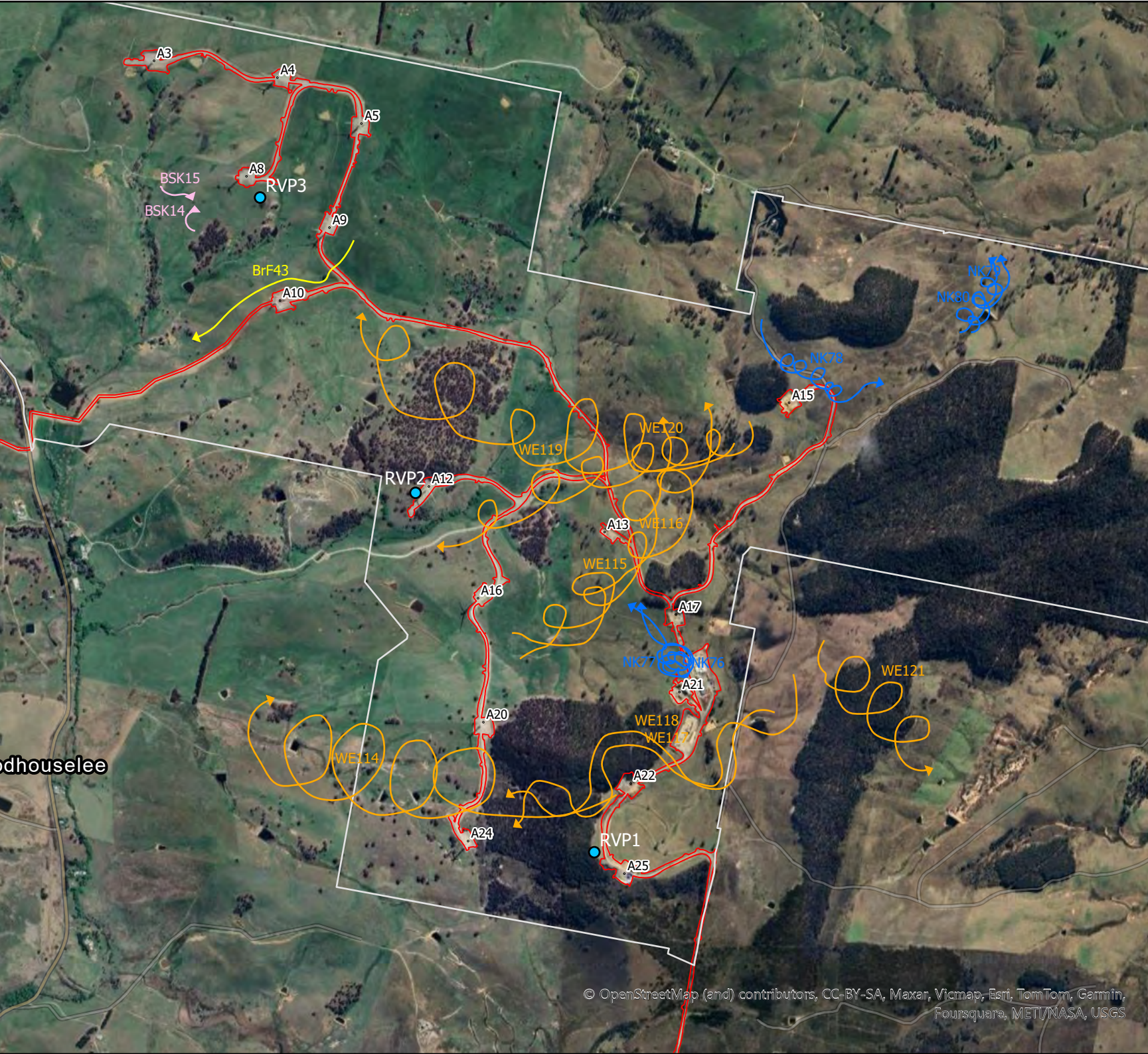
Autumn RVPS

- Wedge-tailed Eagle
- Nankeen Kestrel
- Brown Falcon
- Black-shouldered Kite
- Australian Hobby
- Brown Goshawk
- Falcon sp.



FIGURE 21: Raptor flight path map for control points for autumn survey season

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:19/04/2024



- Legend**
- Project area
 - Project footprint
 - RVPS locations
- Autumn Incidentals**
- Wedge-tailed Eagle
 - Nankeen Kestrel
 - Brown Falcon
 - Black-shouldered Kite



FIGURE 22: Raptor flight path map for incidental observations for autumn survey season

Imagery: Google Satellite
(5/2024 & 9/2024)
Date:19/04/2024

4.2.5 THREATENED AND LISTED MIGRATORY SPECIES

The majority of the species observed during RVPS surveys are widespread species found throughout Australia. Only one threatened species and/or listed migratory was observed while conducting RVPS with observations detailed below.

4.2.5.1 LITTLE EAGLE

The Little Eagle is listed as Vulnerable under the BC Act in NSW. The species is distributed throughout the Australian mainland except for the most densely forested areas. The Little Eagle can be found in open eucalypt forest and woodland rich in prey, utilising remnant patches with a tall living tree for nesting (OEH, 2021).

An observation of Little Eagle was recorded on 1 February 2024 during RVPS. The observation was from site RVP2 with a Little Eagle flying east along a hillside between the heights of 50 – 150 m, exhibiting soaring flight behaviour (refer to **Figure 17**, Map ID LE3).

4.3 Targeted surveys

4.3.1 GANG-GANG BREEDING HABITAT SEARCHES

All four trees were initially surveyed for suitability of hollows on 17 October 2023. Each hollow was confirmed to meet the TBDC and BAM-C criteria of breeding habitat for Gang-gang Cockatoo. On 20 November 2023, a camera mounted to a pole was used to inspect inside each of the hollows for use by the target species. One hollow was being utilised by Eastern Rosellas; however, all other hollows were observed to be unused.

Targeted Gang-gang Cockatoo surveys had the aim of determining if the species were using any of these hollows near northern turbines A3, A4, A5, A8, A9 and A10. No Gang-gang Cockatoo use of these hollows has been observed, it is unlikely that these hollows would be utilised in the future as they are located in very open areas isolated from other habitats. Gang-gang Cockatoo prefer old-growth forest and woodland for nesting and roosting (DAWE, 2022).

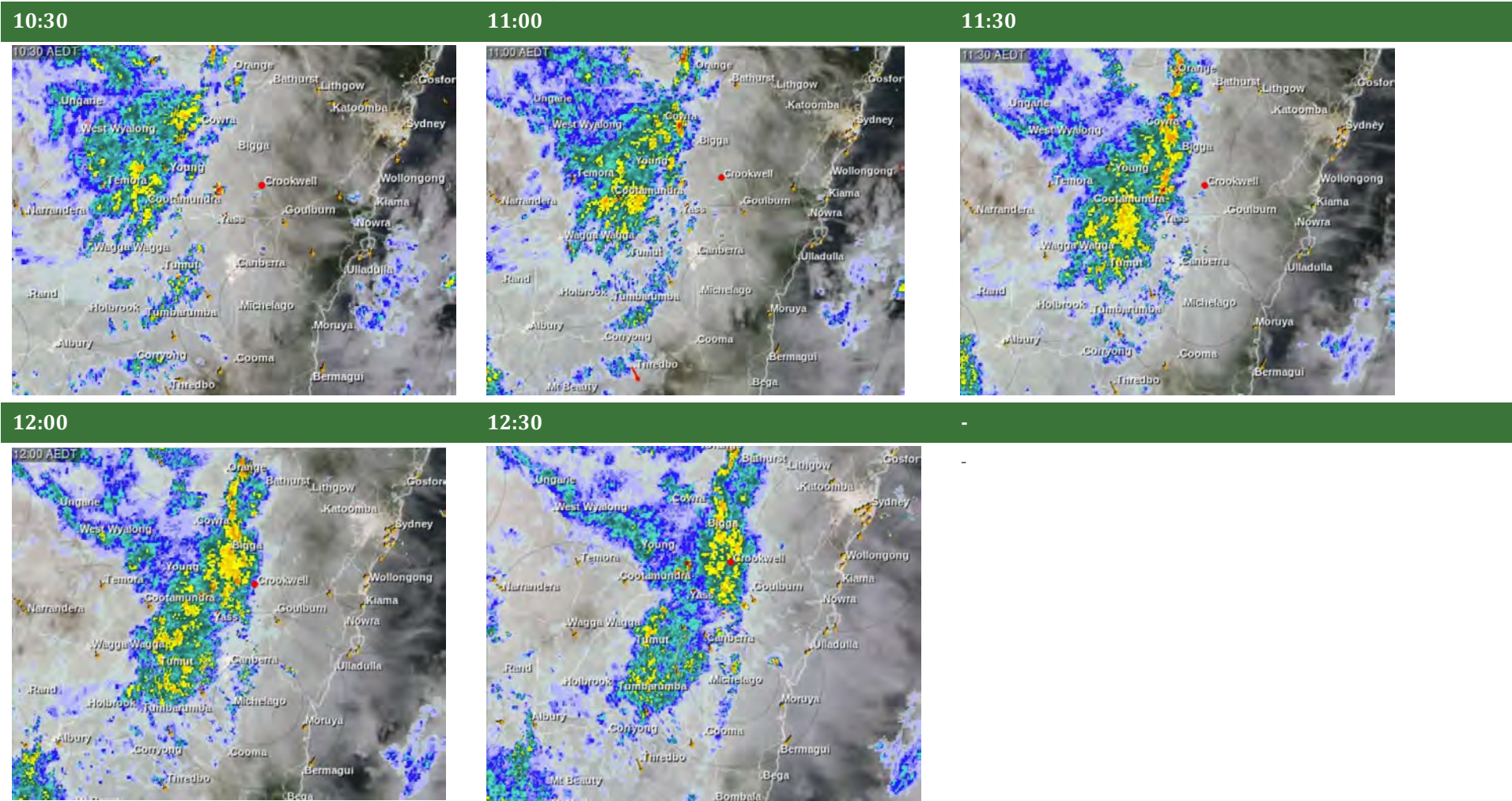
4.3.2 WHITE-THROATED NEEDLETAIL SURVEYS

One survey opportunity was found to be appropriate on 17 January 2024. For a storm front approaching from the west survey site FP1/RVP3 was selected as the most suitable location to survey as it is the highest point on the wind farm and has a clear westerly view. See **Table 19** below for a record of storm front images.

The survey began at 11:00 and ended at noon with no White-throated Needleetails observed. The ornithologist continued observations of the area for the species, beginning another targeted survey at 12:15, however, the oncoming storm hit at 12:30 preventing further surveying.

No observations of White-throated Needleetail were made throughout the BBAMP survey period.

TABLE 19: SATELLITE IMAGES FROM 17 JANUARY 2024 OF STORM FRONT SURVEYED FOR WHITE-THROATED NEEDLETAIL



Note: radar images were sourced from OzForcast to most easily see the oncoming front. Accessed from: <https://ozforecast.com.au/cgi-bin/weather.cgi?station=Crookwell.NSW> accessed on 17/01/2024.

4.3 Nocturnal surveys

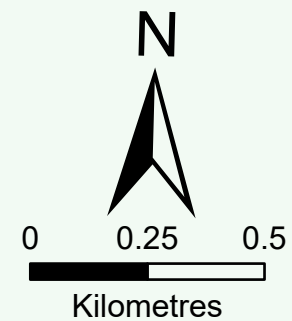
4.3.1 SPECIES OBSERVATIONS

Nocturnal surveys were conducted for six nights in the winter season (**Figure 23**), three nights in the spring season (**Figure 24**), six nights in the summer season (**Figure 25**) and six nights in the autumn season (**Figure 26**). Spring nocturnal surveys, like RVPS were constrained by poor weather conditions and ongoing spring storms. Nocturnal surveys were completed for a minimum of an hour from dusk through nightfall on each survey. Species observed during nocturnal surveys were common nocturnal species found throughout Australia, they include:

- Tawny Frogmouth;
- Barn Owl;
- Southern Boobook; and
- Australian Owlet-nightjar.

Other species observed included roosting diurnal species.

Observations made with a thermal camera indicated a very high population of Common Ringtail Possum, to the point of causing dieback on some eucalypts in some areas. Observations from ecologists note that this high population of this species that are prey for target owl species, Powerful Owl and Barking Owl, likely indicates a gap in the food chain where predators are absent.



Legend

- Project area
- Project footprint

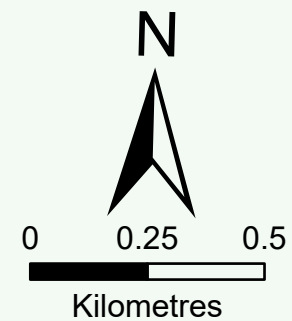
Winter nocturnal surveys

- 15 August 2023
- 15 August 2023
- 16 August 2023
- 23 August 2023
- 23 August 2023
- 24 August 2023
- 25 August 2023
- 28 August 2023



FIGURE 23: Winter nocturnal survey ecologists tracks

Imagery: Google Satellite
(5/2024 & 9/2024)
27/02/2024



Legend

- Project area
- Project footprint

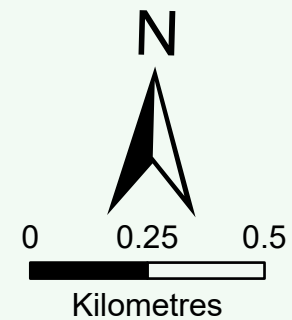
Spring nocturnal surveys

- 27 November 2023
- 28 November 2023
- 28 November 2023
- 30 November 2023



FIGURE 24: Spring nocturnal survey ecologists tracks

Imagery: Google Satellite
(5/2024 & 9/2024)
27/02/2024



Legend

- Project area
- Project footprint

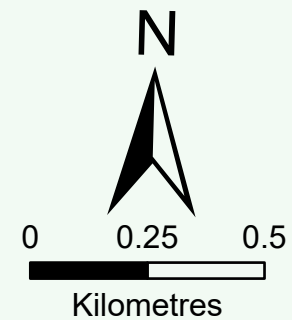
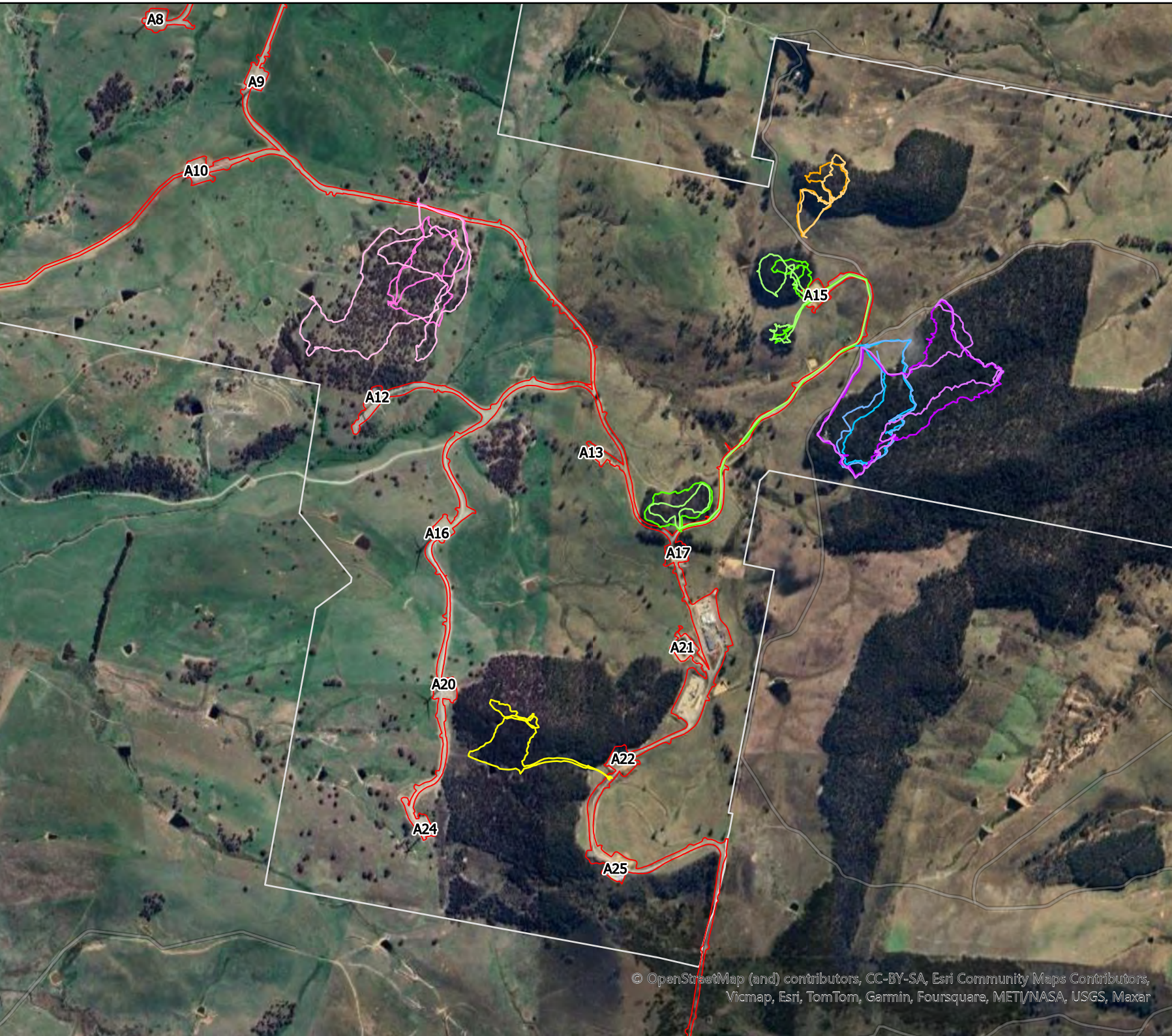
Summer nocturnal surveys

- 30 January 2024
- 30 January 2024
- 31 January 2024
- 31 January 2024
- 1 February 2024
- 6 February 2024
- 6 February 2024
- 7 February 2024
- 7 February 2024
- 8 February 2024
- 8 February 2024



FIGURE 25: Summer nocturnal survey ecologists tracks

Imagery: Google Satellite
(5/2024 & 9/2024)
27/02/2024



Legend

- Project area
- Project footprint

Autumn nocturnal surveys

- 12 March 2024
- 12 March 2024
- 13 March 2024
- 13 March 2024
- 8 April 2024
- 8 April 2024
- 9 April 2024
- 10 April 2024
- 10 April 2024
- 11 April 2024
- 11 April 2024



FIGURE 26: Autumn nocturnal survey ecologists tracks

Imagery: Google Satellite
(5/2024 & 9/2024)
30/04/2024

4.4 Incidental observations

Incidental observations of threatened species were recorded when observed outside of formal survey times or outside of the Project area but within species likely foraging or traversal range from the Project area to warrant note. This helps build a comprehensive understanding of the diversity of species living within and around the Project area that have the potential to utilise the Project area in the future.

Incidental observations of threatened species include:

- 11 August 2023 an incidental observation of one adult Little Eagle near the wind farm entrance on Graywood Siding Road flying between the heights of 8 – 10 m, exhibiting active flight behaviour (**Figure 8** Threatened sp. map ID LE1);
- Between 2 November 2023 and 20 February 2024, observations were made of one or two Little Eagles at or near Pejar Dam (including dates: 2 and 28 November 2023, 17 and 22 January 2024, and 1 and 20 February 2024);
- 17 December 2023 an incidental observation of one White-bellied Sea-Eagle at Pejar Dam;
- 25 January 2024 a group of 10 Dusky Woodswallow flying at a height of 20 m was observed at and above the canopy of a small patch of trees within the Project area near turbine A17 (**Figure 8** Threatened sp. map ID DW1);
- 31 January 2024 an incidental observation of four Superb Parrots flying at a flight height of 20 m high flying in a WNW direction, approximately 500 m south of the Graywood Siding Road intersection with Woodhouselee Road ((3 km southwest from turbine A24, **Figure 8** Threatened sp. map ID SP1);
- 2 February 2024 an incidental observation of three Superb Parrots approximately 12 km north of turbine A5;
- 8 March 2024 one incidental observation of a Black Falcon was made during other contracted works at C2WF, near the substation;
- 12 March 2024 one incidental observations of a male and female Scarlet Robin during RVPS at RFP1, next to turbine A25 (**Figure 8** Threatened sp. map ID SR13);
- 13 March 2024 an incidental observation of 15 to 25 Gang-gang Cockatoos moving between two small patches of forest adjacent to turbine A15 at dusk. During nocturnal survey the flock was observed to roost in the area over night (**Figure 8** Threatened sp. map ID GG17); and
- 12 April 2024 an incidental observation of one Little Eagle approximately 14 km north of turbine A5.

5 Bat survey results

5.1 Bat recordings

5.1.1 SURVEY SUITABILITY

Bat surveys were employed to capture bat diversity across the wind farm. The surveys aimed to capture the Large Bent-winged Bat spring migration to maternity caves Drum Cave in Bungonia State Recreation Area which is approximately 40 km to the south-east, and Church Cave in Wee-Jasper Nature Reserve which is approximately 100 km south-west of the Project area. The deployment of bat detection devices between the period of 9 November 2023 and 27 November 2023 and between 4 March 2024 and 22 March 2024 captured the calls of Large Bent-winged Bat at four and five ground survey site locations each season respectfully, therefore the survey was found to be suitable.

5.1.2 SPECIES OBSERVED

5.1.2.1 POSITIVELY IDENTIFIED

Bat detectors recorded 17,288 individual bat calls during November 2023 and 29,184 individual calls during the March 2024 season. During the November 2023, spring season approximately 48% (8254) of the calls were positively attributed to 11 species, plus an undifferentiated genus (refer to **Table 20**). During the March 2024, autumn season approximately 44% (12,736) of the calls were positively attributed to 11 distinct species plus the same undifferentiated genus (refer to **Table 21**). Over the two season nine species without a conservation listing were positively identified, including:

- Gould's Wattled Bat (2,995 total calls in spring, 2,057 total calls in autumn);
- Chocolate Wattled Bat (499, 484);
- A long-eared bat, either Lesser Long-eared Bat or Gould's Long-eared Bat based on likely distribution (64, 48);
- Inland Broad-nosed Bat (4, 12);
- Eastern Broad-nosed Bat (6 total calls in autumn);
- Large Forest Bat (3,607, 7662);
- Southern Forest Bat (39, 1703);
- Little Forest Bat (190, 158);
- White-striped Free-tailed Bat (656, 488); and
- Ride's Free-tailed Bat (24, 24).

Three threatened species of bat were positively identified by their calls, they included:

- Eastern False Pipistrelle (17, 3);
- Greater Broad-nosed Bat (2 total calls in spring); and
- Large Bent-winged Bat (157, 91).

The three threatened species positively identified in call data are discussed further in **Section 5.1.4**.

5.1.2.2 UNRESOLVED CALLS

Additional calls could not be positively attributed to a single species and instead fell within a multi-species group, for November 2023, 9,034 bat calls could not be attributed and for March 2024 16,448 calls could not be reliably identified. These multi-species groups are comprised largely of positively

identified species previously mentioned, however, several calls indicate the potential presence of additional species within the Project area, including:

Spring recordings

- Little Bent-wing Bat or Chocolate Wattled Bat:
 - The three calls assigned to this group were within the Little Bent-wing Bat frequency range, but these were very brief calls, and it is possible they were aberrant Chocolate Wattles Bat calls; and
 - Bat analyst suggests there is a low likelihood that Little Bent-wing Bat occurs in the Crookwell district.
- Eastern Broad-nosed Bat or Greater Broad-nosed Bat or Eastern False Pipistrelle:
 - 12 unresolved calls had similar pulse shape features to previously identified Eastern False Pipistrelle calls but were in a range closer to that of Greater Broad-nosed Bat, suggesting they may have been from either Eastern Broad-nosed Bat or one of the other two species.

Of the unresolved calls, more than half were assigned to the multi-group of either the undifferentiated long-eared bat genus or the Large Bent-winged Bat. Analysis and separating species calls from these two groups is always problematic as the species have significant overlapping characteristics in frequency and behavioural variability in pulse characteristics. Calls positively attributed to Large Bent-winged Bat have been run through a series of filters to ensure the reliability of the positive identifications, with all others left allocated to the unresolved grouping.

Autumn recordings

- Little Bent-wing Bat or Chocolate Wattled Bat:
 - The 13 calls assigned to this group were within the Little Bent-wing Bat frequency range. However, numerous calls have been reliably attributed to Chocolate Wattled Bat. The calls are potentially from either species; and
 - Bat analyst suggests there is a low likelihood that Little Bent-wing Bat occurs in the Crookwell district.
- Greater Broad-nosed Bat (or Inland Broad-nosed Bat or Eastern Broad-nosed Bat):
 - nine unresolved calls lack the typical shape of either Inland Broad-nosed Bat or Eastern Broad-nosed Bat. It is possible that these calls belong to Greater Broad-nosed Bat, but they could be aberrant calls from either previously mentioned species.

Of the unresolved calls, about one third were assigned to the multi-group of either the undifferentiated long-eared bat genus or the Large Bent-winged Bat.

TABLE 20: BAT DETECTION RESULTS FOR SPRING 2023

Site:	Metmast	A22	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Species Total
Detector:	724822	724823	743585	743587	743586	743588	743589	743590	
Positively identified calls									
Gould's Wattled Bat	9	3	877	1639	58	16	294	99	2995
Chocolate Wattled Bat	-	-	13	74	2	41	-	369	499
Eastern False Pipistrelle	-	-	3	13	1	-	-	-	17
A long-eared bat	-	-	13	2	2	2	1	44	64
Greater Broad-nosed Bat	-	-	-	2	-	-	-	-	2
Inland Broad-nosed Bat	-	-	2	-	2	-	-	-	4
Large Forest Bat	9	-	2200	193	319	3	4	879	3607
Southern Forest Bat	-	-	2	10	8	8	-	11	39
Little Forest Bat	-	-	75	81	7	1	3	23	190
Large Bent-winged Bat	-	-	80	35	18	-	-	24	157
White-striped Free-tailed Bat	243	55	18	141	4	2	169	24	656
Ride's Free-tailed Bat	5	1	4	5	2	-	7	-	24
Unresolved calls									
Gould's Wattled Bat or Ride's Free-tailed Bat	8	4	328	336	20	2	303	1	1002
Gould's Wattled Bat or Inland Broad-nosed Bat	-	-	7	2	1	-	-	1	11
Chocolate Wattle or Little Bent-wing Bat	-	-	-	1	-	-	-	2	3
Chocolate Wattled Bat or Little Forest Bat	-	-	211	160	31	32	4	642	1080
Eastern False Pipistrelle or Large Forest Bat	7	-	644	76	38	-	1	178	944
Large Forest Bat or Southern Forest Bat	-	-	704	89	164	20	4	416	1397
Southern Forest Bat or Little Forest Bat	-	-	4	8	-	12	1	2	27
A Forest Bat or Large Bent-winged Bat	-	-	1341	284	1210	7	11	1705	4558
Eastern False Pipistrelle or Eastern Broad-nosed Bat	-	-	-	1	-	-	-	2	3
Greater Broad-nosed Bat or Eastern Broad-nosed Bat	-	-	5	1	1	-	-	2	9
Site Total	281	63	6531	3153	1888	146	802	4424	17288

TABLE 21: BAT DETECTION RESULTS FOR AUTUMN 2024

Site:	Metmast	A22	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Species Total
Detector:	724822	724823	743585	743587	743586	743588	743589	743590	
Positively identified calls									
Gould's Wattled Bat	14	46	307	1142	93	-	391	64	2057
Chocolate Wattled Bat	3	-	51	152	8	117	45	108	484
Eastern False Pipistrelle	-	-	-	-	-	-	-	3	3
A long-eared bat	-	-	8	11	-	2	17	10	48
Inland Broad-nosed Bat	-	1	9	2	-	-	-	-	12
Eastern Broad-nosed Bat	-	-	-	4	-	-	1	1	6
Large Forest Bat	28	17	1306	496	302	119	294	5100	7662
Southern Forest Bat	-	-	40	78	35	598	598	354	1703
Little Forest Bat	1	-	43	58	15	5	20	16	158
Large Bent-winged Bat	-	-	4	27	4	-	30	26	91
White-striped Free-tailed Bat	265	81	4	61	4	-	60	13	488
Ride's Free-tailed Bat	8	9	-	3	1	-	3	-	24
Unresolved calls									
Gould's Wattled Bat or Ride's Free-tailed Bat	23	16	105	198	25	-	156	9	532
Gould's Wattled Bat or Inland Broad-nosed Bat	-	1	41	13	1	-	-	1	57
Chocolate Wattle or Little Bent-wing Bat	-	-	2	11	-	-	-	-	13
Chocolate Wattled Bat or Little Forest Bat	4	-	100	416	35	237	746	1962	3500
Eastern False Pipistrelle or Eastern Broad-nosed Bat	1	-	-	2	1	-	-	-	4
Eastern False Pipistrelle or Large Forest Bat	8	2	-	-	-	-	-	33	43
Inland Broad-nosed Bat or Eastern Broad-nosed Bat or Greater Broad-nosed Bat	-	-	3	2	-	-	4	-	9
Large Forest Bat or Southern Forest Bat	-	5	2253	785	266	1019	364	1998	6690
Southern Forest Bat or Little Forest Bat	2	-	26	45	9	9	36	3	130
A Forest Bat or Large Bent-winged Bat	25	1	192	144	46	77	894	3947	5326
A Forest Bat or A long-eared bat	-	-	44	8	3	8	38	43	144
Site Total	382	179	4538	3658	848	2191	3697	13691	29184

5.1.3 FLIGHT HEIGHTS

5.1.3.1 MONITORING AT GROUND LEVEL

All species observed were those observed at ground-level monitoring sites. Different sites show a varied distribution of species calls recorded, likely indicative of the presence of each species' preferred habitats and areas of foraging near the monitoring site.

5.1.3.2 MONITORING AT RSA HEIGHT

The species observed flying within RSA height were:

- Gould's Wattled Bat (12 total calls in spring, 60 total calls in autumn);
- Chocolate Wattled Bat (3 total calls in autumn);
- Inland Broad-nosed Bat (1 total calls in autumn);
- Large Forest Bat (9, 45);
- Little Forest Bat (1 total calls in autumn);
- White-striped Free-tailed Bat (298, 346); and
- Ride's Free-tailed Bat (6, 17).

More calls were observed at the Metmast site, however, recording at A22 was shortened due to issues with data storage.

Importantly no threatened species calls were recorded at RSA height at either monitoring site.

5.1.4 THREATENED SPECIES

The majority of species observed were species without a conservation listing, however, three threatened bat species were positively identified through call analysis.

5.1.4.1 LARGE BENT-WINGED BAT

The Large Bent-winged Bat is listed as Vulnerable under the BC Act in NSW. The species is distributed through the south-east of Australia with three large known maternity colonies found within NSW. Nearby maternity caves located in Drum Cave in Bungonia State Recreation Area is approximately 40 km to the south-east, and Church Cave in Wee-Jasper Nature Reserve is approximately 100 km south-west of the Project area (Mills, 2021). The species hunts moths and insects predominantly in forested areas flying above the canopy (OEH, 2019).

Calls from Large Bent-winged Bat were positively identified from five sites within the Project area, they include:

Spring season

- Site 1: 80 positively attributed calls to the species;
- Site 2: 35 positively attributed calls to the species;
- Site 3: 18 positively attributed calls to the species; and
- Site 6: 42 positively attributed calls to the species.

Autumn season

- Site 1: 4 positively attributed calls to the species;
- Site 2: 27 positively attributed calls to the species;
- Site 3: 4 positively attributed calls to the species;

- Site 5: 30 positively attributed calls to the species; and
- Site 6: 26 positively attributed calls to the species.

Due to the nature of the bat detection systems, we cannot infer the abundance of Large Bent-winged Bat from the number of calls recorded.

5.1.4.2 EASTERN FALSE PIPISTRELLE

The Eastern False Pipistrelle is listed as Vulnerable under the BC Act in NSW. The species is distributed on the south-east coast and ranges of Australia, and the Project area is within the expected distribution of the species (OEH, 2017b). The species generally roost in eucalyptus hollows or in the loose bark of trees and hunts flying insects above or just below the tree canopy. (OEH, 2017b).

Calls from the Eastern False Pipistrelle were positively identified from four sites within the Project area, including:

Spring season

- Site 1: 3 positively attributed calls to the species;
- Site 2: 13 positively attributed calls to the species; and
- Site 3: 1 positively attributed call to the species.

Autumn season

- Site 6: 3 positively attributed call to the species.

Due to the nature of the bat detection systems, we cannot infer the abundance of Eastern False Pipistrelle from the number of calls recorded.

5.1.4.3 GREATER BROAD-NOSED BAT

The Greater Broad-nosed Bat is listed as Vulnerable under the BC Act in NSW. The species is distributed along the east coast of the Australian mainland largely through the gullies and river systems that drain from the Great Dividing Range, the species is said not to occur above 500 m in altitude (OEH, 2022). The Project area would be on the edges of its ranges, and potentially an uncommon inhabitant at the approximate altitude of 800 – 900 m. The species favours open habitats for foraging that suit its slow and direct flying behaviours (OEH, 2022).

Calls from the Greater Broad-nosed Bat were positively identified from one site within the Project area:

Spring season

- Site 2: 2 positively attributed calls to the species.

Due to the nature of the bat detection systems, we cannot infer the abundance of Greater Broad-nosed Bat from the number of calls recorded.

6 Summary of findings

6.1 Baseline BUS

The major findings that can be drawn from the baseline BUS completed for the Project area are as follows:

- Species richness was lowest in the August 2023 surveys with 59 species recorded, compared to a higher species richness of 73 species in the October/November 2023 surveys and a species richness of 66 species in the January/February 2024 and in March 2024 surveys.
- Total abundance was highest in the January/February 2024 surveys with 5335 total bird observations, closely followed by March 2024 with 5201 observations, then August 2023 with 3895 total bird observations and October/November 2023 with 3161 total bird observations. Removing call observations, the highest abundance was in the January/February 2024 surveys with 4395 bird sightings, March 2024 with 4270 observations, followed by October/November 2023 with 2126 bird sightings and finally August 2023 with 1169 bird sightings.
- Total flight within RSA height (30 m to 160 m) for impact sites surveyed was calculated to be 13.9%, largely comparable to reference sites at 13.0%.
- The total percentage of flights within RSA height over each season was 9.3% in August 2023, 10.3% in October/November 2023, 14.7% in January/February 2024 and 14.5% in March 2024.
- A total of 37 species were observed flying within RSA height across, with the majority of these species consisting of cockatoo, corvid, raptor and waterbird species.
- Five threatened and one migratory listed species were recorded during the BUS: Dusky Woodswallow (13 individuals over three observations), Gang-gang Cockatoo (76 individuals over 24 observations), Little Eagle (one individual in one observation), Rufous Fantail (one individual in one observation), Scarlet Robin (46 individuals over 35 observations) and Varied Sittella (41 individuals in three observations).

6.2 Baseline RVPS

The major findings from the baseline RVPS completed are as follows:

- Surveys recorded 215 observations of raptors from the fixed-point locations during surveys. These included 66 observations during the winter season, 34 observations during the spring, 73 observations during the summer and 42 observations during the autumn season.
- A total of 64 observations were recorded at impact sites within the Project area, including 20 observations in winter, 13 observations in spring, 21 observations in summer and 10 observations in the autumn. External control sites recorded a total of 151 observations, this included 46 observations occurring in the winter season, 21 in the spring, 52 in the summer season and 32 in the autumn season.
- A total of nine raptor species were observed while conducting RVPS, the most abundant species observed were Wedge-tailed Eagle (102 observations), Nankeen Kestrel (40) and Brown Falcon (35).
- The calculated flight within RSA height was 68.8% for impact sites and 64.2% for control sites. Total flight height observations for RVPS yielded a 65.6% rate of raptors flying within RSA height.
- One threatened species was recorded during the RVPS: Little Eagle (one individual in one observation).

6.3 Baseline bat surveys

The summary of findings from the baseline bat surveys so far completed within the Project area are as follows:

- During November 2023 bat detectors recorded 17288 individual bat calls, and during March 2024 29184 individual bat calls were recorded within the Project area. Approximately 48% (8254) of the calls were positively attributed to eleven species, plus an undifferentiated genus during November 2023. Approximately 44% (12,736) of the calls were positively attributed to eleven species plus the same undifferentiated genus during March 2024 surveys.
- Three threatened species of bat were positively identified by their calls, they included Eastern False Pipistrelle (20), Greater Broad-nosed Bat (2), and Large Bent-winged Bat (248).
- The species observed flying within RSA height were Gould's Wattled Bat (72 total calls), Chocolate Wattled Bat (3), Inland Broad-nosed Bat (1), Large Forest Bat (54), White-striped Free-tailed Bat (644), and Ride's Free-tailed Bat (23).

6.4 Incidental findings

The major incidental findings that occurred during the baseline survey period so far are as follows:

- Three threatened species was recorded within the Project area: Dusky Woodswallow (ten individuals in one observation), Gang-gang Cockatoo (15-25 individuals in one observation) and Scarlet Robin (two individuals in one observation).
- Two threatened species were recorded close to the Project area: Little Eagle (one individual in one observation) and Superb Parrot (four individuals in one observation).
- Threatened species have been observed in the local area, particularly near Pejar Dam: Black Falcon (one individual in one observation), Little Eagle (one to two individuals each over seven observations), White-bellied Sea-Eagle (one individual in one observation) and Superb Parrot (three individuals in one observation).

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Appendix A: Supporting Data

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A1 Fauna species observed from within Project area

Type	Common	Scientific	Family	Exotic	BC Act listing	EPBC Act listing
Bird	Yellow-rumped Thornbill	<i>Acanthiza chrysorrho</i>	Acanthizidae	-	-	-
Bird	Striated Thornbill	<i>Acanthiza lineata</i>	Acanthizidae	-	-	-
Bird	Yellow Thornbill	<i>Acanthiza nana</i>	Acanthizidae	-	-	-
Bird	Brown Thornbill	<i>Acanthiza pusilla</i>	Acanthizidae	-	-	-
Bird	Buff-rumped Thornbill	<i>Acanthiza reguloides</i>	Acanthizidae	-	-	-
Bird	White-throated Gerygone	<i>Gerygone olivacea</i>	Acanthizidae	-	-	-
Bird	White-browed Scrubwren	<i>Sericornis frontalis</i>	Acanthizidae	-	-	-
Bird	Weebill	<i>Smicrornis brevirostris</i>	Acanthizidae	-	-	-
Bird	Brown Goshawk	<i>Accipiter fasciatus</i>	Accipitridae	-	-	-
Bird	Wedge-tailed Eagle	<i>Aquila audax</i>	Accipitridae	-	-	-
Bird	Black-shouldered Kite	<i>Elanus axillaris</i>	Accipitridae	-	-	-
Bird	Little Eagle	<i>Hieraaetus morphnoides</i>	Accipitridae	-	Vulnerable	-
Bird	Australian Owlet-nightjar	<i>Aegotheles cristatus</i>	Aegothelidae	-	-	-
Bird	Eurasian Skylark	<i>Alauda arvensis</i>	Alaudidae	Exotic	-	-
Bird	Laughing Kookaburra	<i>Dacelo novaeguineae</i>	Alcedinidae	-	-	-
Bird	Sacred Kingfisher	<i>Todiramphus sanctus</i>	Alcedinidae	-	-	-
Bird	Grey Teal	<i>Anas gracilis</i>	Anatidae	-	-	-
Bird	Pacific Black Duck	<i>Anas superciliosa</i>	Anatidae	-	-	-
Bird	Australian Wood Duck	<i>Chenonetta jubata</i>	Anatidae	-	-	-
Bird	Australasian Shoveler	<i>Spatula rhynchotis</i>	Anatidae	-	-	-
Bird	Australian Shelduck	<i>Tadorna tadornoides</i>	Anatidae	-	-	-
Bird	Australasian Darter	<i>Anhinga novaehollandiae</i>	Anhingidae	-	-	-
Bird	White Faced Heron	<i>Egretta novaehollandiae</i>	Ardeidae	-	-	-
Bird	Dusky Woodswallow	<i>Artamus cyanopterus</i>	Artamidae	-	Vulnerable	-
Bird	Pied Butcherbird	<i>Cracticus nigrogularis</i>	Artamidae	-	-	-

Type	Common	Scientific	Family	Exotic	BC Act listing	EPBC Act listing
Bird	Grey Butcherbird	<i>Cracticus torquatus</i>	Artamidae	-	-	-
Bird	Australian Magpie	<i>Gymnorhina tibicen</i>	Artamidae	-	-	-
Bird	Pied Currawong	<i>Strepera graculina</i>	Artamidae	-	-	-
Bird	Grey Currawong	<i>Strepera versicolor</i>	Artamidae	-	-	-
Bird	Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	Cacatuidae	-	-	-
Bird	Little Corella	<i>Cacatua sanguinea</i>	Cacatuidae	-	-	-
Bird	Long-billed Corella	<i>Cacatua tenuirostris</i>	Cacatuidae	-	-	-
Bird	Gang-Gang Cockatoo	<i>Callocephalon fimbriatum</i>	Cacatuidae	-	Endangered	Endangered
Bird	Galah	<i>Eolophus roseicapilla</i>	Cacatuidae	-	-	-
Bird	Yellow-tailed Black-Cockatoo	<i>Zanda funerea</i>	Cacatuidae	-	-	-
Bird	Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	Campephagidae	-	-	-
Bird	White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>	Campephagidae	-	-	-
Bird	Masked Lapwig	<i>Vanellus miles</i>	Charadriidae	-	-	-
Bird	Golden-headed Cisticola	<i>Cisticola exilis</i>	Cisticolidae	-	-	-
Bird	White-throated Treecreeper	<i>Cormobates leucophaea</i>	Climacteridae	-	-	-
Bird	Crested Pigeon	<i>Ocyphaps lophotes</i>	Columbidae	-	-	-
Bird	Common Bronzewing	<i>Phaps chalcoptera</i>	Columbidae	-	-	-
Bird	White-winged Chough	<i>Corcorax melanorhamphos</i>	Corcoracidae	-	-	-
Bird	Australian Raven	<i>Corvus coronoides</i>	Corvidae	-	-	-
Bird	Little Raven	<i>Corvus mellori</i>	Corvidae	-	-	-
Bird	Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>	Cuculidae	-	-	-
Bird	Horsfield's Bronze-Cuckoo	<i>Chalcites basalis</i>	Cuculidae	-	-	-
Bird	Pallid Cuckoo	<i>Heteroscenes pallidus</i>	Cuculidae	-	-	-
Bird	Mistletoebird	<i>Dicaeum hirundinaceum</i>	Dicaeidae	-	-	-
Bird	Red-browed Finch	<i>Neochmia temporalis</i>	Estrildidae	-	-	-
Bird	Brown Falcon	<i>Falco berigora</i>	Falconidae	-	-	-
Bird	Nankeen Kestrel	<i>Falco cenchroides</i>	Falconidae	-	-	-

Type	Common	Scientific	Family	Exotic	BC Act listing	EPBC Act listing
Bird	Australian Hobby	<i>Falco longipennis</i>	Falconidae	-	-	-
Bird	Peregrine Falcon	<i>Falco peregrinus</i>	Falconidae	-	-	-
Bird	European Goldfinch	<i>Carduelis carduelis</i>	Fringillidae	Exotic	-	-
Bird	Welcome Swallow	<i>Hirundo neoxena</i>	Hirundinidae	-	-	-
Bird	Fairy Martin	<i>Petrochelidon ariel</i>	Hirundinidae	-	-	-
Bird	Tree Martin	<i>Petrochelidon nigricans</i>	Hirundinidae	-	-	-
Bird	Superb Fairy-wren	<i>Malurus cyaneus</i>	Maluridae	-	-	-
Bird	Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	Meliphagidae	-	-	-
Bird	Red Wattlebird	<i>Anthochaera carunculata</i>	Meliphagidae	-	-	-
Bird	Yellow-faced Honeyeater	<i>Caligavis chrysops</i>	Meliphagidae	-	-	-
Bird	Noisy Miner	<i>Manorina melanocephala</i>	Meliphagidae	-	-	-
Bird	Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	Meliphagidae	-	-	-
Bird	White-eared Honeyeater	<i>Nesoptilotis leucotis</i>	Meliphagidae	-	-	-
Bird	Noisy Friarbird	<i>Philemon corniculatus</i>	Meliphagidae	-	-	-
Bird	White-plumed Honeyeater	<i>Ptilotula penicillata</i>	Meliphagidae	-	-	-
Bird	Black Honeyeater	<i>Sugomel nigrum</i>	Meliphagidae	-	-	-
Bird	Rainbow Bee-eater	<i>Merops ornatus</i>	Meropidae	-	-	-
Bird	Magpie-lark	<i>Grallina cyanoleuca</i>	Monarchidae	-	-	-
Bird	Restless Flycatcher	<i>Myiagra inquieta</i>	Monarchidae	-	-	-
Bird	Leaden Flycatcher	<i>Myiagra rubecula</i>	Monarchidae	-	-	-
Bird	Australasian Pipit	<i>Anthus novaeseelandiae</i>	Motacillidae	-	-	-
Bird	Varied Sittella	<i>Daphoenositta chrysoptera</i>	Neosittidae	-	Vulnerable	-
Bird	Olive-backed Oriole	<i>Oriolus sagittatus</i>	Oriolidae	-	-	-
Bird	Grey Shrikethrush	<i>Colluricincla harmonica</i>	Pachycephalidae	-	-	-
Bird	Golden Whistler	<i>Pachycephala pectoralis</i>	Pachycephalidae	-	-	-
Bird	Rufous Whistler	<i>Pachycephala rufiventris</i>	Pachycephalidae	-	-	-
Bird	Spotted Pardalote	<i>Pardalotus punctatus</i>	Pardalotidae	-	-	-

Type	Common	Scientific	Family	Exotic	BC Act listing	EPBC Act listing
Bird	Striated Padalote	<i>Pardalotus striatus</i>	Pardalotidae	-	-	-
Bird	Eastern Yellow Robin	<i>Eopsaltria australis</i>	Petroicidae	-	-	-
Bird	Scarlet Robin	<i>Petroica boodang</i>	Petroicidae	-	Vulnerable	-
Bird	Little Pied Cormorant	<i>Microcarbo melanoleucos</i>	Phalacrocoracidae	-	-	-
Bird	Great Cormorant	<i>Phalacrocorax carbo</i>	Phalacrocoracidae	-	-	-
Bird	Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	Phalacrocoracidae	-	-	-
Bird	Great Pied Cormorant	<i>Phalacrocorax varius</i>	Phalacrocoracidae	-	-	-
Bird	Stubble Quail	<i>Coturnix pectoralis</i>	Phasianidae	-	-	-
Bird	Tawny Frogmouth	<i>Podargus strigoides</i>	Podargidae	-	-	-
Bird	Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	Podicipedidae	-	-	-
Bird	Crimson Rosella	<i>Platycercus elegans</i>	Psittaculidae	-	-	-
Bird	Eastern Rosella	<i>Platycercus eximius</i>	Psittaculidae	-	-	-
Bird	Red-rumped Parrot	<i>Psephotus haematonotus</i>	Psittaculidae	-	-	-
Bird	Eurasian Coot	<i>Fulica atra</i>	Rallidae	-	-	-
Bird	Grey Fantail	<i>Rhipidura albiscapa</i>	Rhipiduridae	-	-	-
Bird	Willie Wagtail	<i>Rhipidura leucophrys</i>	Rhipiduridae	-	-	-
Bird	Rufous Fantail	<i>Rhipidura rufifrons</i>	Rhipiduridae	-	-	Migratory
Bird	Southern Boobook	<i>Ninox boobook</i>	Strigidae	-	-	-
Bird	Common Myna	<i>Acridotheres tristis</i>	Sturnidae	Exotic	-	-
Bird	Common Starling	<i>Sturnus vulgaris</i>	Sturnidae	Exotic	-	-
Bird	Barn Owl	<i>Tyto alba</i>	Tytonidae	-	-	-
Bird	Silvereye	<i>Zosterops lateralis</i>	Zosteropidae	-	-	-
Mammal (bat)	Little Bent-wing Bat (Unresolved)	<i>Miniopterus australis</i>	Miniopteridae	-	Vulnerable	-
Mammal (bat)	Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	Miniopteridae	-	Vulnerable	-
Mammal (bat)	White-striped Free-tailed Bat	<i>Austronomus australis</i>	Molossidae	-	-	-

Type	Common	Scientific	Family	Exotic	BC Act listing	EPBC Act listing
Mammal (bat)	Ride's Free-tailed Bat	<i>Ozimops ridei</i>	Molossidae	-	-	-
Mammal (bat)	Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	Vespertilionidae	-	-	-
Mammal (bat)	Chocolate Wattled Bat	<i>Chalinolobus morio</i>	Vespertilionidae	-	-	-
Mammal (bat)	Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	Vespertilionidae	-	Vulnerable	-
Mammal (bat)	Lesser Long-eared Bat (Unresolved)	<i>Nyctophilus geoffroyi</i>	Vespertilionidae	-	-	-
Mammal (bat)	Gould's Long-eared Bat (Unresolved)	<i>Nyctophilus gouldi</i>	Vespertilionidae	-	-	-
Mammal (bat)	Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	Vespertilionidae	-	Vulnerable	-
Mammal (bat)	Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>	Vespertilionidae	-	-	-
Mammal (bat)	Eastern Broad-nosed Bat	<i>Scotorepens orion</i>	Vespertilionidae	-	-	-
Mammal (bat)	Large Forest Bat	<i>Vespadelus darlingtoni</i>	Vespertilionidae	-	-	-
Mammal (bat)	Southern Forest Bat	<i>Vespadelus regulus</i>	Vespertilionidae	-	-	-
Mammal (bat)	Little Forest Bat	<i>Vespadelus vulturnus</i>	Vespertilionidae	-	-	-
Mammal	Red Fox	<i>Vulpes vulpes</i>	Canidae	Exotic	-	-
Mammal	Eastern Grey Kangaroo	<i>Macropus giganteus</i>	Macropodidae	-	-	-
Mammal	Red-necked Wallaby	<i>Notamacropus rufogriseus</i>	Macropodidae	-	-	-
Mammal	Common Wallaroo	<i>Osphranter robustus</i>	Macropodidae	-	-	-
Mammal	Sugar Glider	<i>Petaurus breviceps</i>	Petauridae	-	-	-
Mammal	Common Brushtail Possum	<i>Trichosurus vulpecula</i>	Phalangeridae	-	-	-
Mammal	Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	Pseudocheiridae	-	-	-
Mammal	Wild Boar	<i>Sus scrofa</i>	Suidae	Exotic	-	-

Type	Common	Scientific	Family	Exotic	BC Act listing	EPBC Act listing
Mammal	Short-beaked Echidna	<i>Tachyglossus aculeatus</i>	Tachyglossidae	-	-	-
Mammal	Bare-nosed Wombat	<i>Vomatus ursinus</i>	Vombatidae	-	-	-
Reptile	Eastern Bearded Dragon	<i>Pogona barbata</i>	Agamidae	-	-	-
Reptile	Tussock Skink	<i>Pseudemoia pagenstecheri</i>	Scincidae	-	-	-
Amphibian	Peron's Tree Frog	<i>Litoria peronii</i>	Hylidae	-	-	-
Amphibian	Screaming Tree Frog	<i>Litoria quiritatus</i>	Hylidae	-	-	-
Amphibian	Whistling Tree Frog	<i>Litoria verreauxii</i>	Hylidae	-	-	-
Amphibian	Eastern Bango Frog	<i>Limnodynastes dumerilii</i>	Limnodynastidae	-	-	-
Amphibian	Striped March Frog	<i>Limnodynastes peronii</i>	Limnodynastidae	-	-	-
Amphibian	Spotted Grass Frog	<i>Limnodynastes tasmaniensis</i>	Limnodynastidae	-	-	-
Amphibian	Eastern Sign-bearing Frog	<i>Crinia parinsignifera</i>	Myobatrachidae	-	-	-
Amphibian	Common Eastern Froglet	<i>Crinia signifera</i>	Myobatrachidae	-	-	-
Amphibian	Bibron's Toadlet	<i>Pseudophryne bibronii</i>	Myobatrachidae	-	-	-
Amphibian	Smooth Toadlet	<i>Uperoleia laevigata</i>	Myobatrachidae	-	-	-

Note: Bird species nomenclature follows Birddata Working List of Australian Birds (Version 4.3)

A2 Raptor vantage point survey information

Date	Season	Site	Ob. 1	Ob. 2	Start	End	Temp.	Wind Speed	Direction	Cloud Cover	Precipitation	Sightings	Notes
10/08/2023	Winter	RCP3	GD	EZ	10:15	11:15	12	10	W	Overcast	0	N	-
10/08/2023	Winter	RVP1	GD	EZ	11:40	12:40	14.3	10	W	Partly	0	N	Sheltered site, some sun
10/08/2023	Winter	RVP3	GD	EZ	13:27	14:27	15.1	40-60	SW	Partly	0	N	Very winding
11/08/2023	Winter	RVP2	GD	EZ	10:55	11:56	14.7	0-5	W	Clear	0	Y	-
11/08/2023	Winter	RCP1	GD	EZ	13:15	14:15	20	5	NW	Clear	0	Y	-
11/08/2023	Winter	RCP3	GD	EZ	15:00	16:00	18.4	5	W	Clear	0	N	-
12/08/2023	Winter	RVP2	EZ	-	13:38	14:38	12	10	W	Overcast	0	N	-
12/08/2023	Winter	RCP2	EZ	-	11:50	12:50	9.6	10	W	Overcast	0	Y	-
15/08/2023	Winter	RVP1	GD	BS	10:40	11:40	8	8	E	Overcast	0	Y	-
15/08/2023	Winter	RVP3	GD	BS	12:00	13:00	13	8	W	Partly	0	Y	-
15/08/2023	Winter	RCP1	GD	BS	13:58	14:38	12	10	S	Partly	0	Y	-
15/08/2023	Winter	RCP3	GD	BS	15:10	16:10	13	8	NE	Partly	0	Y	-
16/08/2023	Winter	RVP2	EZ	BS	10:00	11:00	8.7	5	E	Partly	0	Y	-
16/08/2023	Winter	RCP1	EZ	BS	12:10	13:10	12	10	NW	Patchy	0	Y	-
16/08/2023	Winter	RCP2	EZ	BS	13:35	14:35	15	10	N	Patchy	0	Y	-
17/08/2023	Winter	RCP2	GD	BS	9:40	10:40	12	7	NNE	Clear	0	Y	-
17/08/2023	Winter	RCP1	GD	BS	11:12	11:12	12	15	N	Clear	0	Y	Potential LE
17/08/2023	Winter	RVP3	GD	BS	13:44	14:44	14	15-20	NW	Patchy	0	Y	-
17/08/2023	Winter	RVP1	GD	BS	15:00	16:00	14	10	NW	Patchy	0	Y	-
23/08/2023	Winter	RVP1	GD	BP	10:05	11:05	10	<5	NW	Partly	0	N	-
23/08/2023	Winter	RVP3	GD	BP	11:26	12:26	10	10	NW	Overcast	0	N	-
23/08/2023	Winter	RCP2	GD	BP	13:20	14:20	12	10	NW	Overcast	0	Y	-
23/08/2023	Winter	RCP1	GD	BP	14:41	15:41	12	<5	Nw	Overcast	0	Y	-
24/08/2023	Winter	RCP3	GD	BP	11:34	12:34	12	10	NW	Clear	0	Y	-

Date	Season	Site	Ob. 1	Ob. 2	Start	End	Temp.	Wind Speed	Direction	Cloud Cover	Precipitation	Sightings	Notes
24/08/2023	Winter	RCP2	GD	BP	12:50	13:50	13	5	NW	Clear	0	Y	-
24/08/2023	Winter	RVP3	GD	BP	15:39	16:39	15	5	W	Clear	0	Y	-
25/08/2023	Winter	RCP3	GD	BP	10:40	11:40	14	15	NW	Clear	0	Y	-
25/08/2023	Winter	RVP2	GD	BP	13:30	14:30	14	15	NW	Clear	0	Y	-
25/08/2023	Winter	RVP1	GD	BP	14:40	15:40	15	5	NW	Clear	0	N	-
29/08/2023	Winter	RVP2	GD	EZ	12:02	13:02	15	20	SW	Patchy	0	N	-
17/10/2023	Spring	RVP2	GD	NH	13:23	14:23	14	20	SW	Partly	0	N	-
18/10/2023	Spring	RVP1	GD	NH	10:05	11:05	13	30	E	Overcast	0	Y	-
18/10/2023	Spring	RVP3	GD	NH	13:20	14:21	16	30	E	Partly	0	N	-
20/11/2023	Spring	RCP1	GD	DR	11:00	12:00	18	15	NE	Overcast	0	Y	-
20/11/2023	Spring	RCP2	GD	DR	12:20	13:20	20	20	NW	Overcast	0	N	-
20/11/2023	Spring	RVP2	GD	DR	15:00	16:00	17	20	W	Overcast	0	N	-
21/11/2023	Spring	RVP1	GD	DR	10:45	11:45	16	15	E	Clear	0	N	Previous night precipitation
21/11/2023	Spring	RVP3	GD	DR	11:55	12:55	20	15	S	Clear	0	Y	-
21/11/2023	Spring	RCP2	GD	DR	13:32	14:32	20	20	SE	Patchy	0	N	-
21/11/2023	Spring	RCP3	GD	DR	14:48	15:48	21	15	SE	Patchy	0	Y	-
22/11/2023	Spring	RCP3	GD	DR	10:30	11:30	20	20	E	Clear	0	Y	-
22/11/2023	Spring	RCP1	GD	DR	11:42	12:42	21	20	E	Partly	0	N	-
22/11/2023	Spring	RVP2	GD	DR	13:50	14:50	22	20	E	Partly	0	Y	-
23/11/2023	Spring	RCP3	BP	DR	10:15	11:15	15	30	SE	Overcast	0	Y	-
23/11/2023	Spring	RCP1	BP	DR	11:35	12:35	15	30	SE	Overcast	0	Y	-
23/11/2023	Spring	RCP2	BP	DR	12:58	13:58	16	30	SE	Overcast	Very light rain	N	-
23/11/2023	Spring	RVP1	BP	DR	14:45	15:45	17	30	SE	Overcast	Light rain	N	0mm measured on BOM
27/11/2023	Spring	RCP1	BP	DR	12:20	13:20	23	30	E	Partly	0	Y	-
27/11/2023	Spring	RCP2	BP	DR	13:37	14:37	25	30	E	Partly	0	Y	-
27/11/2023	Spring	RVP2	BP	DR	15:23	16:23	23	25	E	Partly	0	N	-

Date	Season	Site	Ob. 1	Ob. 2	Start	End	Temp.	Wind Speed	Direction	Cloud Cover	Precipitation	Sightings	Notes
28/11/2023	Spring	RVP3	BP	DR	10:35	11:35	17	25	NE	Overcast	0	Y	-
28/11/2023	Spring	RVP1	BP	DR	11:45	12:45	18	25	E	Overcast	Rain	N	-
28/11/2023	Spring	RCP3	BP	DR	13:40	14:40	18	25	N	Partly	0	Y	-
30/11/2023	Spring	RVP3	BP	DR	10:30	11:30	15	25	WNW	Overcast	0	Y	-
30/11/2023	Spring	RCP1	BP	DR	11:54	12:54	18	25	WNW	Overcast	0	Y	-
30/11/2023	Spring	RCP2	BP	DR	13:08	14:08	20	25	SW	Overcast	Light rain	Y	-
30/11/2023	Spring	RVP1	BP	DR	14:30	15:30	21	25	SW	Overcast	0	Y	-
16/01/2024	Summer	RVP3	GD	NH	11:06	12:06	20	20	ENE	Overcast	Light rain	Y	-
16/01/2024	Summer	RCP1	GD	NH	12:50	13:50	20	20	E	Partly	0	Y	-
16/01/2024	Summer	RCP2	GD	NH	14:07	15:07	22	20	E	Partly	0	Y	-
17/01/2024	Summer	RVP3	GD	NH	12:00	13:00	23	30	NW	Overcast	oncoming storm front	Y	-
18/01/2024	Summer	RCP3	GD	NH	12:15	13:15	24	50	NW	Patchy	0	Y	-
18/01/2024	Summer	RVP1	GD	NH	13:49	14:49	24	40	NW	Clear	0	N	-
19/01/2024	Summer	RVP1	GD	EZ	13:20	14:20	21	20	W	Clear	0	Y	-
19/01/2024	Summer	RVP3	GD	EZ	14:36	15:36	19	30	W	Patchy	0	N	-
30/01/2024	Summer	RCP2	GD	BP	10:50	11:50	18	15-20	E	Overcast	0	Y	-
30/01/2024	Summer	RCP1	GD	BP	12:10	13:10	17	15-20	E	Overcast	0	N	-
30/01/2024	Summer	RVP2	GD	BP	14:18	15:18	20	15	E	Overcast	0	Y	-
31/01/2024	Summer	RCP3	GD	BP	10:15	11:15	19	15	E	overcast	0	Y	-
31/01/2024	Summer	RVP3	GD	BP	12:10	13:10	19	25	ENE	Overcast	0	N	-
31/01/2024	Summer	RVP1	GD	BP	13:25	14:25	19	25	ENE	Overcast	0	N	heavy fog rolled in
1/02/2024	Summer	RVP2	GD	BP	10:08	11:08	23	10	W	Partly	0	Y	
1/02/2024	Summer	RCP2	GD	BP	11:58	12:58	23	20	W	Partly	0	Y	-
1/02/2024	Summer	RCP1	GD	BP	13:30	14:30	23	15	W	Partly	0	N	-
2/02/2024	Summer	RCP2	BP	DR	10:50	11:50	24	10	W	Clear	0	Y	-
2/02/2024	Summer	RCP1	BP	DR	12:05	13:05	24	10	W	Clear	0	N	-

Date	Season	Site	Ob. 1	Ob. 2	Start	End	Temp.	Wind Speed	Direction	Cloud Cover	Precipitation	Sightings	Notes
2/02/2024	Summer	RVP2	BP	DR	13:40	14:40	29	20	WNW	Clear	0	Y	-
6/02/2024	Summer	RCP3	BP	TF	10:00	11:00	19	still	-	Overcast	Light rain	Y	-
6/02/2024	Summer	RVP3	BP	TF	12:15	13:15	20	10	S	Overcast	Rain	N	-
7/02/2024	Summer	RVP2	BP	TF	13:30	14:30	20	25	E	Partly	0	Y	-
8/02/2024	Summer	RCP1	BP	TF	11:00	12:00	17	25	NE	Partly	0	Y	-
8/02/2024	Summer	RCP2	BP	TF	12:20	13:20	18	25	NE	Partly	0	Y	-
8/02/2024	Summer	RVP2	BP	TF	14:20	15:20	17	30	NE	Overcast	0	Y	-
9/02/2024	Summer	RCP3	BP	TF	10:00	11:00	17	15	SE	Overcast	0	Y	-
9/02/2024	Summer	RVP1	BP	TF	12:00	13:00	15	10	NE	Overcast	0	Y	-
15/02/2024	Summer	RVP1	EZ	-	12:38	13:38	16	15	ENE	Overcast	0	Y	-
15/02/2024	Summer	RCP3	EZ	-	14:17	13:17	19	10	ENE	Overcast	0	Y	-
12/03/2024	Autumn	RVP1	GD	DR	10:00	11:00	18	Still	-	Clear	0	N	Incidental- pair Scarlet Robin
12/03/2024	Autumn	RCP1	GD	DR	13:00	14:00	28	24	W	Clear	0	N	Incidental - 1 Scarlet Robin
12/03/2024	Autumn	RCP2	GD	DR	14:15	15:15	28	24	W	Clear	0	Y	-
13/03/2024	Autumn	RVP2	GD	DR	10:17	11:17	21	13	NE	Patchy	0	Y	-
13/03/2024	Autumn	RCP3	GD	DR	12:25	13:25	16	19	N	Patchy	0	Y	-
13/03/2024	Autumn	RCP1	GD	DR	13:37	14:37	28	19	NE	Patchy	0	Y	-
14/03/2024	Autumn	RCP3	GD	BP	10:00	11:00	18	5	NW	Overcast	0	Y	-
14/03/2024	Autumn	RCP2	GD	BP	11:10	12:10	21	20	W	Clear	0	Y	-
14/03/2024	Autumn	RVP3	GD	BP	13:00	14:00	25	20	W	Clear	0	Y	-
14/03/2024	Autumn	RVP1	GD	BP	14:07	15:07	23	20	W	Patchy	0	N	-
15/03/2024	Autumn	RCP1	DR	BP	10:00	11:00	16	25	NE	Overcast	Mist	Y	-
15/03/2024	Autumn	RCP2	DR	BP	12:00	13:00	17	30	ESE	Partly	0	Y	-
15/03/2024	Autumn	RVP2	DR	BP	14:00	13:00	19	30	E	Partly	0	N	-
18/03/2024	Autumn	RVP2	GD	-	10:05	12:05	18	10	S	Partly	Mist	Y	-
19/03/2024	Autumn	RVP3	GD	-	11:18	12:18	22	10	W	Patchy	0	Y	-

Date	Season	Site	Ob. 1	Ob. 2	Start	End	Temp.	Wind Speed	Direction	Cloud Cover	Precipitation	Sightings	Notes
19/03/2024	Autumn	RVP1	GD	-	12:35	13:35	24	10	W	Patchy	0	Y	-
20/03/2024	Autumn	RVP2	GD	-	12:21	13:21	18	20	W	Overcast	Light rain	N	-
26/03/2024	Autumn	RVP2	DR	-	14:00	15:00	24	29	NE	Clear	0	Y	-
9/04/2024	Autumn	RCP3	DR	TF	11:00	12:00	14	10	NNE	Overcast	0	Y	-
9/04/2024	Autumn	RVP3	DR	TF	13:00	14:00	12	35	SSE	Overcast	Rain	Y	-
10/04/2024	Autumn	RVP3	DR	TF	10:00	11:00	11	14	SSW	Partly	0	N	-
10/04/2024	Autumn	RVP1	DR	TF	11:12	12:12	13	16	S	Partly	0	N	-
10/04/2024	Autumn	RCP3	DR	TF	13:00	14:00	13	20	SSW	Partly	0	Y	-
10/04/2024	Autumn	RCP1	DR	TF	14:10	15:10	14	14	SSW	Patchy	0	N	-
11/04/2024	Autumn	RCP2	DR	TF	10:10	11:10	10	5	SSW	Patchy	0	Y	-
11/04/2024	Autumn	RCP1	DR	TF	11:50	12:50	13	<5	SSW	Patchy	0	N	-
11/04/2024	Autumn	RVP3	DR	TF	13:50	14:50	18	<5	SSW	Patchy	0	Y	-
11/04/2024	Autumn	RVP1	DR	TF	15:15	16:15	18	<5	SSW	Patchy	0	Y	-
12/04/2024	Autumn	RCP2	DR	TF	10:02	11:02	15	7	NNW	Clear	0	Y	-
12/04/2024	Autumn	RCP3	DR	TF	11:17	12:17	16	10	WNW	Patchy	0	Y	-

A3 Raptor vantage point survey data

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
11/08/2023	Winter	RVP2	NK3	Nankeen Kestrel	11:06	11:06	50	50-100	200	S	Active flight	In transit	Adult	-	Y
11/08/2023	Winter	RVP2	WE1	Wedge-tailed Eagle	11:23	11:24	100	70-120	2000	Circling	Circling/soaring	-	Adult	Pair	Y
11/08/2023	Winter	RVP2	WE2	Wedge-tailed Eagle	11:23	11:25	70	70-150	2000	Circling	Circling/soaring	-	Adult	Pair	Y
11/08/2023	Winter	RCP1	NK4	Nankeen Kestrel	13:16	13:19	30	20-30	60	SE	Hovering	Hunting	Adult	-	Y
11/08/2023	Winter	RCP1	BrF1	Brown Falcon	13:32	13:39	2	2-100	100	N	Perched to flight	Traveling	Adult	-	Y
11/08/2023	Winter	RCP1	WE3	Wedge-tailed Eagle	13:40	13:43	200	>200	100	Circling	Circling/soaring	-	Adult	Pair	N
11/08/2023	Winter	RCP1	WE4	Wedge-tailed Eagle	13:40	13:43	200	>200	100	Circling	Circling/soaring	-	Adult	Pair	N
11/08/2023	Winter	Incidental	LE1	Little Eagle	14:32	14:32	8	8-10m	30	E	Active flight	-	Adult	-	N
12/08/2023	Winter	RCP2	WE5	Wedge-tailed Eagle	12:40	12:41	50	30-70	1500	SE	Active flight	Attacked by Magpies	Adult	-	Y
15/08/2023	Winter	RVP1	WE6	Wedge-tailed Eagle	11:18	11:20	55	55-70	1000	NE	Circling/soaring	-	Adult	Pair	Y
15/08/2023	Winter	RVP1	WE7	Wedge-tailed Eagle	11:18	11:20	55	55-70	1000	NE	Circling/soaring	-	Adult	Pair	Y
15/08/2023	Winter	RVP1	WE8	Wedge-tailed Eagle	11:30	11:34	70	50-100	1500	NE	Circling/soaring	-	Adult	Pair	Y
15/08/2023	Winter	RVP1	WE9	Wedge-tailed Eagle	11:30	11:34	70	50-100	1500	NE	Circling/soaring	-	Adult	Pair	Y
15/08/2023	Winter	RVP3	NK5	Nankeen Kestrel	12:13	12:14	10	10-20	25	SE	Active flight	in transit	-	-	N

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
15/08/2023	Winter	RVP3	WE10	Wedge-tailed Eagle	12:24	12:27	200	200-600	1000	SW	Circling/soaring	-	-	-	N
15/08/2023	Winter	RVP3	NK6	Nankeen Kestrel	12:58	12:59	40	30-40	800	NE	Hovering	Hunting	-	-	Y
15/08/2023	Winter	RCP1	NK7	Nankeen Kestrel	14:10	15:10	7	1-8	160	Perched	Flight to perch	Perching	-	-	N
15/08/2023	Winter	RCP1	WE11	Wedge-tailed Eagle	14:52	14:55	40	40-100	300	W to N	Circling/soaring	-	Adult	Pair	Y
15/08/2023	Winter	RCP1	WE12	Wedge-tailed Eagle	14:52	14:55	40	40-100	300	W to N	Circling/soaring	-	Adult	Pair	Y
15/08/2023	Winter	RCP1	WE13	Wedge-tailed Eagle	14:52	14:55	40	40-100	300	W to N	Circling/soaring	-	Juvenile	-	Y
15/08/2023	Winter	RCP3	WE14	Wedge-tailed Eagle	15:33	15:40	80	80-100	1400	NW	Active flight	Attacked by Magpies	Adult	-	Y
15/08/2023	Winter	RCP3	WE15	Wedge-tailed Eagle	15:33	15:40	80	80-100	1400	SW	Active flight	Attacked by Magpies	Adult	-	Y
15/08/2023	Winter	BUS	AH1	Australian Hobby	8:10	8:30	6	6-50	30	W to E	Perched to flight to perch	Perched	-	Flew back to same perch	Y
15/08/2023	Winter	BUS	AH2	Australian Hobby	14:55	14:55	30	4-30	50	N	Flight to perch	Perching	-	-	Y
15/08/2023	Winter	Incidental	NK8	Nankeen Kestrel	8:01	8:01	0	0-30	20	N	Ground to flight	Fleeing	-	On road	Y
16/08/2023	Winter	RVP2	WE16	Wedge-tailed Eagle	10:36	10:44	70	50-200	1500	S	Circling/soaring	-	Adult	Pair	Y
16/08/2023	Winter	RVP2	WE17	Wedge-tailed Eagle	10:36	10:44	70	50-200	1500	S	Circling/soaring	-	Adult	Pair	Y
16/08/2023	Winter	Incidental	NK9	Nankeen Kestrel	11:17	11:25	15	4-15	60	S	Flight to hollow	Hollow use	Adult	Pair - near compound, seen mating	N

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
16/08/2023	Winter	Incidental	NK10	Nankeen Kestrel	11:17	11:23	35	6-35	60	NE	Flight to perch	Mating	Adult	Pair - near compound, seen mating	Y
16/08/2023	Winter	Incidental	WE18	Wedge-tailed Eagle	11:28	11:29	200	150-200	500	Circling	Circling/soaring	-	Adult	Pair	Y
16/08/2023	Winter	Incidental	WE19	Wedge-tailed Eagle	11:28	11:29	200	150-200	500	Circling	Circling/soaring	-	Adult	Pair	Y
16/08/2023	Winter	Incidental	NK11	Nankeen Kestrel	11:37	11:38	25	20-40	50	Circling	Circling/hovering	Hunting	Adult	-	Y
16/08/2023	Winter	RCP1	NK12	Nankeen Kestrel	12:13	12:39	15	0-30	100	N	Perched to flight	Calling and hovering	Adult	-	Y
16/08/2023	Winter	RCP1	BrF2	Brown Falcon	12:58	13:09	70	50->200	250	S	Circling/soaring	-	Adult	-	Y
16/08/2023	Winter	RCP1	NK13	Nankeen Kestrel	13:09	13:10	10	10-60	200	S	Active flight	Flighting a Magpie	Adult	Pair	Y
16/08/2023	Winter	RCP1	NK14	Nankeen Kestrel	13:09	13:10	20	20-60	200	S	Active flight	Flighting a Magpie	Adult	Pair	Y
16/08/2023	Winter	RCP2	WE20	Wedge-tailed Eagle	14:00	14:08	100	70-150	2000	N to E	Gliding	Traveling	Adult	Likely pair and juvenile	Y
16/08/2023	Winter	RCP2	WE21	Wedge-tailed Eagle	14:00	14:08	100	70-150	2000	N to E	Gliding	Traveling	Adult	Likely pair and juvenile	Y
16/08/2023	Winter	RCP2	WE22	Wedge-tailed Eagle	14:00	14:08	100	70-150	2000	N to E	Gliding	Traveling	Likely Juvenile	Likely pair and juvenile	Y
17/08/2023	Winter	RCP2	WE23	Wedge-tailed Eagle	9:44	9:47	80	70-120	2000	S	Gliding	Traveling	Adult	-	Y
17/08/2023	Winter	RCP2	WE24	Wedge-tailed Eagle	9:44	9:47	80	80-120	2000	N	Gliding	Traveling	Adult	-	Y
17/08/2023	Winter	RCP2	WE25	Wedge-tailed Eagle	9:49	9:49	30	30-100	2000	NE	Diving	-	-	-	Y

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
17/08/2023	Winter	RCP2	WE26	Wedge-tailed Eagle	10:01	10:01	30	30-50	2000	N	Diving	-	-	-	Y
17/08/2023	Winter	RCP2	BSK1	Black-shouldered Kite	10:22	10:25	40	20-40	500	N	Hovering, circling	Hunting	Adult	-	Y
17/08/2023	Winter	RCP2	BSK2	Black-shouldered Kite	10:40	10:40	1.5	perched	200	-	Perched	-	Adult	-	P
17/08/2023	Winter	RCP1	WE27	Wedge-tailed Eagle	11:17	11:20	50	50-200	500	S	Gliding	-	Adult	-	Y
17/08/2023	Winter	RCP1	BrF3	Brown Falcon	11:21	11:22	20	perched	400	Perched	Perched	-	Adult	-	P
17/08/2023	Winter	RCP1	WE28	Wedge-tailed Eagle	11:28	11:29	80	20-80	800	E	Defensive flight	Being attacked	-	Landed in canopy	Y
17/08/2023	Winter	RCP1	WE29	Wedge-tailed Eagle	12:10	12:11	100	80-100	1500	S	Circling	-	Adult	Pair	Y
17/08/2023	Winter	RCP1	WE30	Wedge-tailed Eagle	12:10	12:11	80	80-100	1500	S	Circling	-	Adult	Pair	Y
17/08/2023	Winter	RVP3	NK15	Nankeen Kestrel	13:49	15:50	40	20-40	200	E	Hovering	Hunting	Adult	-	Y
17/08/2023	Winter	RVP3	WE31	Wedge-tailed Eagle	14:00	14:06	100	80-140	2000	NW	Circling	-	Adult	Pair	Y
17/08/2023	Winter	RVP3	WE32	Wedge-tailed Eagle	14:00	14:06	100	80-140	2000	NW	Circling	-	Adult	Pair	Y
17/08/2023	Winter	RVP3	NK16	Nankeen Kestrel	14:10	14:13	30	30-100	180	NW to S	Gliding	-	Adult	-	Y
17/08/2023	Winter	RVP1	WE33	Wedge-tailed Eagle	15:13	15:14	60	20-60	1000	S	Gliding/Diving	-	Adult	Pair	Y
17/08/2023	Winter	RCP1	WE34	Wedge-tailed Eagle	15:13	15:14	60	20-60	1000	S	Gliding/Diving	-	Adult	Pair	Y
17/08/2023	Winter	RCP1	NK17	Nankeen Kestrel	14:51	15:40	30	20-30	400	-	Hovering	Hunting	Adult	Pair	Y
17/08/2023	Winter	RVP1	NK18	Nankeen Kestrel	14:51	15:40	30	20-30	400	-	Hovering	Hunting	Adult	Pair	Y

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
17/08/2023	Winter	BUS	BrF4	Brown Falcon	10:15	-	2	2-10m	200	N	Perched to flight	-	Adult	-	N
17/08/2023	Winter	BUS	NK19	Nankeen Kestrel	14:15	-	20	20-30	300	E	Active flight	Traveling	Adult	Pair	Y
17/08/2023	Winter	BUS	NK20	Nankeen Kestrel	14:15	-	20	10-30	300	E	Active flight	Traveling	Adult	Pair	Y
17/08/2023	Winter	BUS	WE35	Wedge-tailed Eagle	14:01	14:08	100	100->200	200	N to S	Rollercoaster/soaring	-	Adult	Pair	Y
17/08/2023	Winter	BUS	WE36	Wedge-tailed Eagle	14:01	14:08	100	100->200	200	N to S	Rollercoaster/soaring	-	Adult	Pair	Y
23/08/2023	Winter	RCP2	Fsp1	Falcon sp.	13:51	14:00	25	25-50	500	Circling	Active flight	Hunting	-	-	Y
23/08/2023	Winter	RCP2	WE37	Wedge-tailed Eagle	13:55	13:57	200	>200	700	Circling	Defensive flight	Attacked by Birds	-	-	N
24/08/2023	Winter	RCP3	WE40	Wedge-tailed Eagle	12:28	12:30	20	0-20	600	Circling	Defensive flight	Being attacked	-	-	N
24/08/2023	Winter	RCP3	NK23	Nankeen Kestrel	12:30	12:33	40	40-50	500	SE	Soaring	-	-	-	Y
24/08/2023	Winter	RCP3	NK24	Nankeen Kestrel	12:00	12:33	40	40-50	500	SE	Soaring	-	-	-	Y
24/08/2023	Winter	RCP3	Unsp1	Unknown sp.	12:30	12:35	50	40-100	500	Circling	Territorial Fight	-	-	-	Y
24/08/2023	Winter	RCP3	Unsp2	Unknown sp.	12:30	12:35	50	40-100	500	Circling	Territorial Fight	-	-	-	Y
24/08/2023	Winter	RCP3	Unsp3	Unknown sp.	12:30	12:35	50	40-100	500	Circling	Territorial Fight	-	-	-	Y
24/08/2023	Winter	RCP3	Unsp4	Unknown sp.	12:30	12:35	50	40-100	500	Circling	Territorial Fight	-	-	-	Y
24/08/2023	Winter	RCP2	NK25	Nankeen Kestrel	13:30	13:50	3	3-10	100	-	Perch/hovering	Hunting from stag	Adult	Pair	N
24/08/2023	Winter	RCP2	NK26	Nankeen Kestrel	13:30	13:50	3	3-10	100	-	Perch/hovering	Hunting from stag	Adult	Pair	N

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
24/08/2023	Winter	RVP3	WE41	Wedge-tailed Eagle	15:50	15:52	1000	1000	1000	Circling	Circling/soaring	Climbing thermals	-	-	N
24/08/2023	Winter	BUS	BrG1	Brown Goshawk	17:10	17:10	1.5	1-10	20	S	Roosting to flight	Attacked by Miners	Adult	-	N
24/08/2023	Winter	BUS	NK27	Nankeen Kestrel	7:52	7:55	2	2-20	300	Perched	Perched to flight	Calling	-	Pair	N
24/08/2023	Winter	BUS	NK28	Nankeen Kestrel	7:52	7:55	3	3-20	300	Perched	Perched to flight	Calling	-	Pair	N
24/08/2023	Winter	Incidental	NK29	Nankeen Kestrel	8:25	8:25	10	10-20	50	NE	Active flight	-	-	-	N
16/08/2023	Winter	Incidental	BSK3	Black-shouldered Kite	15:38	15:40	Perched	Perched	30	Perched	Perched	-	Adult	Pair	P
16/08/2023	Winter	Incidental	BSK4	Black-shouldered Kite	15:38	15:40	Perched	Perched	30	Perched	Perched	-	Adult	Pair	P
8/08/2023	Winter	Incidental	BrF5	Brown Falcon	13:26	13:26	Perched	Perched	10	Perched	Perched	-	Adult	Perched on powerlines	P
25/08/2023	Winter	RCP3	NK30	Nankeen Kestrel	10:48	10:50	Perched	Perched	250	Perched	Perched	-	-	-	P
25/08/2023	Winter	RCP3	NK31	Nankeen Kestrel	10:55	10:57	30	30-50	20	S	Circling, active flight	Hunting	-	-	Y
25/08/2023	Winter	RCP3	WE42	Wedge-tailed Eagle	10:57	11:05	300	100-300	900	Circling	Circling, active flight	Attacked by Ravens	-	-	Y
25/08/2023	Winter	RCP3	BrF6	Brown Falcon	11:19	11:20	200	200-300	250	NW	In transit	Traveling	-	-	N
25/08/2023	Winter	RVP2	NK32	Nankeen Kestrel	14:04	14:05	25	20-60	25	SW	In transit	Traveling	-	-	Y
25/08/2023	Winter	Incidental	NK33	Nankeen Kestrel	8:52	8:55	20	20-50	-	Circling	Circling	-	-	-	Y
25/08/2023	Winter	Incidental	NK34	Nankeen Kestrel	15:25	15:25	15	15-20	-	SE	In transit	Traveling	-	-	N

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
29/08/2023	Winter	Incidental	WE43	Wedge-tailed Eagle	14:04	14:04	300	300	-	Circling	Soaring	-	-	-	N
29/08/2023	Winter	Incidental	WE44	Wedge-tailed Eagle	16:24	16:25	100	60-100	-	SW	In transit	Traveling - attacked by birds	-	-	Y
29/08/2023	Winter	Incidental	NK35	Nankeen Kestrel	14:29	14:33	15	15-30	-	Circling	Circling/hovering	Hunting	-	-	Y
17/10/2023	Spring	Incidental	AH3	Australian Hobby	17:10	17:10	30	30	200	E	In transit	Traveling	Adult	-	Y
18/10/2023	Spring	RVP1	WE45	Wedge-tailed Eagle	10:40	10:48	150	100-400	400	W-NE	Gliding then catching thermals	-	-	-	Y
18/10/2023	Spring	RVP1	NK36	Nankeen Kestrel	10:26	10:28	50	50	200	NE	Direct flight and called 3 times	Traveling	-	-	Y
18/10/2023	Spring	BUS	BrF7	Brown Falcon	16:10	16:12	100	100-150	300	NE	Circling	-	-	-	Y
8/11/2023	Spring	BUS	NK37	Nankeen Kestrel	9:30	9:52	20	20-45	50	Circling	Hovering, active flight	Hunting	Adult	-	Y
8/11/2023	Spring	BUS	NK38	Nankeen Kestrel	10:40	10:46	40	40-10	-	N - W	Hovering, active flight	-	Adult	-	Y
8/11/2023	Spring	BUS	NK39	Nankeen Kestrel	10:53	10:53	40	40-5	-	NNE	Direct flight to hollow	-	-	-	Y
8/11/2023	Spring	BUS	NK40	Nankeen Kestrel	17:15	17:20	40	40 +	-	-	Hovering	Hunting	-	-	Y
8/11/2023	Spring	BUS	NK41	Nankeen Kestrel	17:33	17:33	40	40 +	-	-	Active flight	Traveling	-	-	Y
9/11/2023	Spring	BUS	BrG2	Brown Goshawk	17:48	17:59	40	40-200	-	-	Soaring	-	-	Soaring among martins	Y

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
10/11/2023	Spring	BUS	NK42	Nankeen Kestrel	9:09	9:12	50	50-75	-	Circling	Circling	Courtship	Adult	Over FP7 and compound	Y
10/11/2023	Spring	BUS	NK43	Nankeen Kestrel	9:09	9:12	50	50-75	-	Circling	Circling	Courtship	Adult	Over FP7 and compound	Y
10/11/2023	Spring	BUS	LE2	Little Eagle	17:00	17:00	80	80-100	500	-	-	-	-	-	Y
10/11/2023	Spring	BUS	NK44	Nankeen Kestrel	17:04	17:05	30	30	20	N	Active flight	-	-	-	Y
20/11/2023	Spring	RCP1	NK45	Nankeen Kestrel	11:16	11:19	15	15	100	W - E	Hovering	Hunting	-	-	N
20/11/2023	Spring	RCP1	NK46	Nankeen Kestrel	11:29	11:31	20	10-20	100	NW	-	Hunting	-	-	N
20/11/2023	Spring	RCP1	BrF8	Brown Falcon	11:36	11:39	300	300-400	200	N	Soaring, circling	-	-	-	N
20/11/2023	Spring	RCP1	Fsp2	Falcon sp.	11:58	12:00	10	10-20	200	S	Perched to flight	-	-	-	N
20/11/2023	Spring	RCP1	Fsp3	Falcon sp.	11:58	12:00	10	10-20	200	S	Perched to flight	-	-	-	N
21/11/2023	Spring	RVP3	WE46	Wedge-tailed Eagle	12:01	12:13	200	200-400	500	E	Circling	-	-	-	N
21/11/2023	Spring	RCP3	WK1	Whistling Kite	3:20	3:24	30	30-100	100	SW	Circling	-	Juvenile	-	Y
21/11/2023	Spring	RCP3	NK47	Nankeen Kestrel	15:35	3:38	50	50-120	100	SW	Circling	-	-	-	Y
22/11/2023	Spring	RCP3	NK48	Nankeen Kestrel	11:13	11:14	15	0-15	200	E-W	-	-	-	-	N
22/11/2023	Spring	RVP2	NK49	Nankeen Kestrel	14:06	14:09	6	6-40	30	NE	Active flight	Courtship	-	Flew in opposite direction to partner	Y

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
22/11/2023	Spring	RVP2	NK50	Nankeen Kestrel	14:06	14:09	40	6-40	30	SW	Active flight	Courtship	-	Flew in opposite direction to partner	Y
23/11/2023	Spring	RCP3	WE47	Wedge-tailed Eagle	10:15	10:20	150	100-300	1500	Circling	Soaring, circling	Hunting	-	-	Y
23/11/2023	Spring	RCP1	BrF9	Brown Falcon	11:50	12:00	50	50-5	150	SE	Flight to perch	Perching	Adult	-	Y
27/11/2023	Spring	RCP1	BrF10	Brown Falcon	12:38	12:46	80	30-200	-	-	Gliding and landing on nest	-	Adult	-	Y
27/11/2023	Spring	RCP1	BrF11	Brown Falcon	12:41	12:43	100	100-180	-	NE	Gliding	-	-	-	Y
27/11/2023	Spring	RCP2	BrF12	Brown Falcon	13:53	13:56	50	0-80	-	N-NW	Gliding and active flight	Hunting	-	-	Y
27/11/2023	Spring	RCP2	Fsp4	Falcon sp.	13:53	14:05	50	5-100	-	-	Active flight to perch	-	-	-	Y
28/11/2023	Spring	RVP3	WE48	Wedge-tailed Eagle	10:39	10:41	100	50-150	300	N	-	-	-	-	Y
28/11/2023	Spring	RVP3	Fsp5	Falcon sp.	10:50	10:50	100	100-0	300	Dive	Dive	Hunting	-	-	Y
28/11/2023	Spring	RCP3	WE49	Wedge-tailed Eagle	14:17	14:24	200	200-400	300	Circling	Active flight	Attacked by ravens	-	-	N
28/11/2023	Spring	RCP3	WE50	Wedge-tailed Eagle	14:17	14:24	200	200-400	300	Circling	Active flight	Attacked by ravens	-	-	N
30/11/2023	Spring	RVP3	BrF13	Brown Falcon	10:50	10:54	250	150-300	800	ESE	Soaring and active flight	-	Adult	Chased by Nankeen at top of blade height	Y

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
30/11/2023	Spring	RVP3	BrF14	Brown Falcon	10:50	10:54	250	150-300	800	ESE	Soaring and active flight	-	Adult	Chased by Nankeen at top of blade height	Y
30/11/2023	Spring	RVP3	NK51	Nankeen Kestrel	10:50	10:54	250	150-300	800	ESE	Active flight	-	Adult	Attacking Brown falcons	Y
30/11/2023	Spring	RCP1	BrF15	Brown Falcon	12:15	12:25	Perched	-	-	-	-	Perched	Adult	-	P
30/11/2023	Spring	RCP1	NK52	Nankeen Kestrel	12:30	12:33	70	70-100	500	-	Active flight	Hunting	Adult	-	Y
30/11/2023	Spring	RCP1	BrF16	Brown Falcon	12:35	12:54	Perched		150	-	-	Perched	Adult	-	P
30/11/2023	Spring	RCP1	WE51	Wedge-tailed Eagle	12:41	12:43	200	200	1500	W - E	Gliding	-	Adult	-	N
30/11/2023	Spring	RCP2	BrF17	Brown Falcon	13:10	-	Perched	-	300	-	-	Perched	-	-	P
30/11/2023	Spring	RVP1	WE52	Wedge-tailed Eagle	14:30	14:32	100	100-1000	1500	E-W	Active flight, Soaring	-	-	-	Y
30/11/2023	Spring	RVP1	WE53	Wedge-tailed Eagle	14:30	14:35	1500	1000-1500	2000	Circling	Soaring	-	-	-	N
30/11/2023	Spring	RVP1	WE54	Wedge-tailed Eagle	14:54	14:57	400	400-600	800	Circling	Soaring	-	-	-	N
6/12/2023	Summer	Incidental	NK53	Nankeen Kestrel	9:50	9:50	0	0-20	20	SE	Fleeing	Ground to flight	Adult	-	N
6/12/2023	Summer	Incidental	NK54	Nankeen Kestrel	9:50	9:50	0	0-40	20	SE	Fleeing	Ground to flight	Adult	-	Y
6/12/2023	Summer	Incidental	WE55	Wedge-tailed Eagle	10:37	10:38	40	40-100	50	W	Gliding	-	Adult	-	Y
16/01/2024	Summer	BUS	NK55	Nankeen Kestrel	9:34	9:34	20	20	20	E	Slow flight	-	-	Flight E directly over FP4	N

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
16/01/2024	Summer	BUS	NK56	Nankeen Kestrel	9:33	9:35	25	15-25	50	Circling	-	Hunting	-	-	N
16/01/2024	Summer	BUS	NK57	Nankeen Kestrel	9:33	9:35	25	15-25	50	Circling	-	Hunting	-	-	N
16/01/2024	Summer	BUS	NK58	Nankeen Kestrel	9:33	9:35	25	15-25	50	Circling	-	Hunting	-	-	N
16/01/2024	Summer	BUS	PF1	Peregrine Falcon	10:40	10:44	30	0-30	-	-	-	Hunting	-	Hunting CR, caught & escaped, likely would have killed CR	Y
16/01/2024	Summer	BUS	NK59	Nankeen Kestrel	11:11	11:30	0	0	40	On ground	Feeding	Eating kill	-	Eating Pipit underneath A8	P
18/01/2024	Summer	BUS	WE56	Wedge-tailed Eagle	8:26	8:55	10	10-200	25-1000	S	Soaring	-	Adult	Pair - Flying together	Y
18/01/2024	Summer	BUS	WE57	Wedge-tailed Eagle	8:26	8:55	10	10-200	25-1000	S	Soaring	-	Adult	Pair - flying together	Y
18/01/2024	Summer	BUS	Fsp6	Falcon sp.	8:50	8:50	100	100	-	S	Very fast flight	Traveling	-	Flying fast >100m/s towards WE56 & WE57	Y
18/01/2024	Summer	BUS	NK60	Nankeen Kestrel	16:14	16:21	25	0-25	-	-	Hovering, circling	Hunting	-	-	N
18/01/2024	Summer	BUS	PF2	Peregrine Falcon	16:42	16:56	6	15	200	Circling	Perched and active flight	Hunting	-	Hunting Crimson Rosella	N
19/01/2024	Summer	BUS	Fsp7	Falcon sp.	16:40	16:40	30	15-30	150	W	Gliding	Traveling	-	Flying away and down, couldn't ID from hilltop	Y

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
19/01/2024	Summer	BUS	WE58	Wedge-tailed Eagle	17:13	17:16	200	200-250	500	Circling	Soaring, circling	-	-	-	N
19/01/2024	Summer	BUS	BrF18	Brown Falcon	18:04	18:05	10	50-10	50	Circling, N	Active flight, climbing	-	-	Flight out of veg patch	Y
19/01/2024	Summer	BUS	BrF19	Brown Falcon	18:26	18:30	60	60-200	200	NE	Soaring	-	-	Gaining altitude	Y
19/01/2024	Summer	Incidental	WE59	Wedge-tailed Eagle	18:10	18:11	40	40-10	100	S	Active flight	Attacked by Ravens	-	-	Y
23/01/2024	Summer	BUS	BrF20	Brown Falcon	14:40	14:40	10	10-25	30	NE	Active flight	Traveling	-	-	N
23/01/2024	Summer	BUS	NK61	Nankeen Kestrel	8:21	8:23	10	0- 10	70	NE	Hovering	Hunting	-	Flying above road, likely hunting insects	N
23/01/2024	Summer	BUS	WE60	Wedge-tailed Eagle	17:50	-	40	40-350	-	Circling W	Soaring	-	-	-	Y
23/01/2024	Summer	BUS	BrF21	Brown Falcon	17:52	-	30	30-120	-	W	Active flight	-	-	-	Y
23/01/2024	Summer	BUS	BrG3	Brown Goshawk	8:50	9:09	20	20-perch	20	S	Flight to perch	Perching	Adult	Pair	N
23/01/2024	Summer	BUS	BrG4	Brown Goshawk	8:50	9:09	Perched	Perched	-	S	Perched	Perching	Adult	Pair	P
23/01/2024	Summer	BUS	BrG5	Brown Goshawk	16:10	16:11	20	10	-	Circling	Circling	Likely courtship	Adult	Pair	N
23/01/2024	Summer	BUS	BrG6	Brown Goshawk	16:10	16:11	20	10	-	Circling	Circling	Likely courtship	Adult	Pair	N
23/01/2024	Summer	BUS	WE61	Wedge-tailed Eagle	16:15	16:15	4	10	200	S	Active flight	-	-	-	N
24/01/2024	Summer	BUS	NK62	Nankeen Kestrel	7:54	-	25	-	-	NE	Active flight	-	-	-	N

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
24/01/2024	Summer	BUS	BrG7	Brown Goshawk	15:44	-	Perched	Perched	100	-	Perched	Calling	-	Calling, potentially territorial dispute with other BG pair nearby (BG8 & BG9)	P
24/01/2024	Summer	BUS	BrG8	Brown Goshawk	15:44	-	15	25	-	-	Flight to perch	-	-	Flying inside canopy then out to meet BG7	N
24/01/2024	Summer	BUS	BrG9	Brown Goshawk	15:44	-	10	5	-	-	-	-	-	Flying inside canopy	N
25/01/2024	Summer	BUS	BrF22	Brown Falcon	16:39	16:47	10	-	-	W	Perched to flight	Attacked my magpies	-	-	N
1/02/2024	Summer	BUS	WE62	Wedge-tailed Eagle	17:45	-	35	35-200	500	SE	Soaring	Courting	Adult	-	Y
1/02/2024	Summer	BUS	WE63	Wedge-tailed Eagle	17:45	-	35	35-200	500	SE	Soaring	Courting	Adult	-	Y
1/02/2024	Summer	BUS	NK63	Nankeen Kestrel	15:15	-	15	30	70	S	Gliding	-	-	-	Y
1/02/2024	Summer	BUS	BrG10	Brown Goshawk	16:06	16:26	Perched	Perched	200	-	Perched	-	-	-	P
1/02/2024	Summer	BUS	BrG11	Brown Goshawk	16:06	16:26	Perched	Perched	200	-	Perched	-	-	-	P
16/01/2024	Summer	RVP3	NK64	Nankeen Kestrel	11:55	11:59	15	0-15	800	Circling	Hovering, diving	Hunting	-	-	N
16/01/2024	Summer	RCP1	WE64	Wedge-tailed Eagle	13:04	13:10	50	50-200	250	N	Soaring	-	-	-	Y
16/01/2024	Summer	RCP2	BrF23	Brown Falcon	14:14	14:17	30	30-150	50	E	Soaring , gliding	-	-	-	Y
16/01/2024	Summer	RCP2	BrF24	Brown Falcon	14:37	14:39	10	0-15	150	N	Active flight	Attacked by magpies	-	-	N

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
16/01/2024	Summer	RCP2	NK65	Nankeen Kestrel	14:30	14:30	10	10	20	S	Active flight	Chasing BrF	-	-	N
16/01/2024	Summer	RCP2	NK66	Nankeen Kestrel	14:59	14:59	Perched	Perched	7	Perched	Perched	-	-	-	P
17/01/2024	Summer	RVP1	PF3	Peregrine Falcon	12:15	12:15	15	15	0	E	Direct flight	Traveling	-	-	N
18/01/2024	Summer	RCP3	WE65	Wedge-tailed Eagle	12:20	12:28	50	10-100	700	W	Soaring	-	-	-	Y
18/01/2024	Summer	RCP3	WE66	Wedge-tailed Eagle	12:20	12:28	50	10-100	700	W	Soaring	-	-	-	Y
18/01/2024	Summer	RCP3	WE67	Wedge-tailed Eagle	12:40	12:48	100	100-150	700	N	Soaring	-	-	-	Y
18/01/2024	Summer	RCP3	WE68	Wedge-tailed Eagle	12:40	12:48	100	100-150	700	N	Soaring	-	-	-	Y
18/01/2024	Summer	RCP3	WE69	Wedge-tailed Eagle	12:40	12:48	100	100-150	700	N	Soaring	-	-	-	Y
18/01/2024	Summer	RCP3	BrF25	Brown Falcon	12:50	12:56	100	50-100	50-600	W	Soaring	-	-	-	Y
19/01/2024	Summer	RVP1	NK67	Nankeen Kestrel	13:22	13:22	20	20	1000	W	Active flight	-	-	-	N
19/01/2024	Summer	RVP1	NK68	Nankeen Kestrel	13:29	13:30	300	300	Overhead	N	Soaring	-	-	-	N
30/01/2024	Summer	RCP2	NK69	Nankeen Kestrel	10:53	10:58	10	50-5	50	N	Hovering	-	-	-	Y
30/01/2024	Summer	RCP2	NK70	Nankeen Kestrel	10:53	10:58	10	50-5	50	N	Hovering	-	-	-	Y
30/01/2024	Summer	RCP2	WK2	Whistling Kite	10:53	10:55	50	50-80	150	N	Soaring	-	-	-	Y
30/01/2024	Summer	RCP2	WE70	Wedge-tailed Eagle	10:55	11:04	60	60-100	0	E	Active flight	Flight practice	Juvenile	-	Y
30/01/2024	Summer	RCP2	WE71	Wedge-tailed Eagle	10:55	11:04	60	60-100	0	E	Active flight	Flight practice	Juvenile	-	Y
30/01/2024	Summer	RCP2	WE72	Wedge-tailed Eagle	10:55	11:04	60	60-100	0	E	Active flight	Flight practice	Juvenile	-	Y

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
30/01/2024	Summer	RCP2	WE73	Wedge-tailed Eagle	10:55	11:04	60	60-100	0	E	Active flight	Flight practice	Juvenile	-	Y
30/01/2024	Summer	RCP2	WE74	Wedge-tailed Eagle	10:55	11:04	60	60-100	0	E	Active flight	Flight practice	Juvenile	-	Y
30/01/2024	Summer	RCP2	WE75	Wedge-tailed Eagle	10:55	11:04	60	60-100	0	E	Active flight	Flight practice	Juvenile	-	Y
30/01/2024	Summer	RCP2	BrF26	Brown Falcon	11:28	11:45	Perched	Perched	15	-	Perched	-	-	-	P
30/01/2024	Summer	RCP2	BrF27	Brown Falcon	11:28	11:45	Perched	Perched	15	-	Perched	-	-	-	P
30/01/2024	Summer	RVP2	WE76	Wedge-tailed Eagle	14:36	14:40	100	100-200	200	W	Soaring, circling	-	Adult	-	Y
30/01/2024	Summer	RVP2	WE77	Wedge-tailed Eagle	14:45	14:46	250	250-300	1000	E	Soaring	-	-	-	N
30/01/2024	Summer	RVP2	WE78	Wedge-tailed Eagle	15:00	15:10	700	700-1000	500-2000	E	Soaring	-	-	-	N
31/01/2024	Summer	RCP3	WE79	Wedge-tailed Eagle	10:53	10:55	50	50-20	500	E	-	Hunting	-	-	Y
1/02/2024	Summer	RVP2	LE3	Little Eagle	10:14	10:17	50	50-150	350	E	Soaring	-	-	-	Y
1/02/2024	Summer	RVP2	WE80	Wedge-tailed Eagle	10:16	10:19	200	200-400	500	SE	Soaring	-	-	-	N
1/02/2024	Summer	RVP2	WE81	Wedge-tailed Eagle	10:56	10:59	1200	1200	800	W	Soaring	-	-	-	N
1/02/2024	Summer	RVP2	WE82	Wedge-tailed Eagle	10:56	10:59	1200	1200	800	W	Soaring	-	-	-	N
1/02/2024	Summer	RCP2	BrF28	Brown Falcon	11:58	12:50	5	5- to perch	50	E	Perching	Perching	-	-	N
2/02/2024	Summer	RCP2	BrF29	Brown Falcon	11:00	11:50	Perched	Perch to 3	150	N-S	Gliding, active flight, perching	Hunting	-	-	N

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
2/02/2024	Summer	RCP2	BrF30	Brown Falcon	11:08	11:12	Perched	5- to perch	150	N-S	Gliding, active flight, perching	Hunting	-	-	N
2/02/2024	Summer	RCP2	BSK5	Black-shouldered Kite	11:23	11:50	10	10	220	W	Active flight	-	-	-	N
2/02/2024	Summer	RCP2	BSK6	Black-shouldered Kite	11:23	11:50	10	10	220	W	Active flight	-	-	-	N
2/02/2024	Summer	RVP2	BrF31	Brown Falcon	14:20	14:40	50	50-3	150	W	Soaring, active flight to perch	Perching	-	-	Y
2/02/2024	Summer	RVP2	BrF32	Brown Falcon	14:20	14:40	50	50-3	150	W	Soaring, active flight to perch	-	-	-	Y
2/02/2024	Summer	RVP2	PF4	Peregrine Falcon	14:23	14:27	60	40-100	60	E	Soaring, gliding, active flight	Hunting	-	-	Y
2/02/2024	Summer	RVP2	PF5	Peregrine Falcon	14:24	14:27	70	40-100	120	E	Soaring, gliding, active flight	Hunting	-	-	Y
6/02/2024	Summer	RCP3	WE83	Wedge-tailed Eagle	10:08	11:00	2	2-perch	500	N	Gliding	Perch	Adult	Perched in same stag	N
6/02/2024	Summer	RCP3	WE84	Wedge-tailed Eagle	10:08	11:00	Perched	Perched	500	-	-	Perch	Adult	Perched in same stag	P
6/02/2024	Summer	RCP3	WE85	Wedge-tailed Eagle	10:26	11:00	Perched	Perched	500	-	-	Perch	Juvenile	Perched in same stag	P
7/02/2024	Summer	RVP2	WE86	Wedge-tailed Eagle	13:38	14:30	400	5-500	1500	S	Soaring	To perch	-	-	Y
7/02/2024	Summer	RVP2	WE87	Wedge-tailed Eagle	13:38	14:30	400	5-500	1500	S	Soaring	To perch	-	-	Y
7/02/2024	Summer	RVP2	WE88	Wedge-tailed Eagle	13:38	13:48	400	200-500	1500	W	Soaring	Hunting	Juvenile	-	N
8/02/2024	Summer	RCP1	WE89	Wedge-tailed Eagle	11:13	11:50	80	20-300	2000	SE	Gliding	To perch	-	-	Y
8/02/2024	Summer	RCP1	WE90	Wedge-tailed Eagle	11:13	11:50	80	20-300	2000	SE	Gliding	To perch	-	-	Y

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
8/02/2024	Summer	RCP1	WE91	Wedge-tailed Eagle	11:24	11:26	100	100	250	NW	Gliding	-	-	-	Y
8/02/2024	Summer	RCP2	BSK7	Black-shouldered Kite	12:22	12:26	Perched	Perched	500	-	-	Perched	-	-	P
8/02/2024	Summer	RCP2	BSK8	Black-shouldered Kite	12:22	12:26	Perched	Perched	500	-	-	Perched	-	-	P
8/02/2024	Summer	RCP2	BrF33	Brown Falcon	12:25	12:26	50	80-10	500	W	Active flight	-	-	-	Y
8/02/2024	Summer	RCP2	PF6	Peregrine Falcon	12:25	12:30	50	80-250	500	E	Gliding, active flight	Hunting	-	-	Y
8/02/2024	Summer	RCP2	PF7	Peregrine Falcon	12:25	13:40	50	80-250	500	W	Gliding, active flight	-	-	-	Y
8/02/2024	Summer	RCP2	BrF34	Brown Falcon	12:32	12:50	10	0-10	250	-	Active flight	Perch to hunting	-	-	N
8/02/2024	Summer	RCP2	BSK9	Black-shouldered Kite	12:55	13:20	Perched	perched	800	-	-	Perched	-	-	P
8/02/2024	Summer	RCP2	BSK10	Black-shouldered Kite	12:55	13:20	Perched	perched	800	-	-	Perched	-	-	P
8/02/2024	Summer	RCP2	NK71	Nankeen Kestrel	13:10	13:20	50	0-100	80	Circling	Hovering, active flight	Hunting	-	-	Y
8/02/2024	Summer	RVP2	WE92	Wedge-tailed Eagle	14:58	14:58	150	150	2000	W	Gliding	-	-	-	Y
9/02/2024	Summer	RCP3	WE93	Wedge-tailed Eagle	10:05	10:30	600	500-600	2500	E	Soaring	-	-	-	N
9/02/2024	Summer	RCP3	WE94	Wedge-tailed Eagle	10:45	10:55	50	50-800	2500	W	Active flight, soaring	-	-	-	Y
9/02/2024	Summer	RCP3	WE95	Wedge-tailed Eagle	10:45	10:55	50	50-800	2500	W	Active flight, soaring	-	-	-	Y
9/02/2024	Summer	RVP1	WE96	Wedge-tailed Eagle	12:05	13:00	150	10-150	2300	NW	Soaring	To perch	-	-	Y

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
15/02/2024	Summer	RVP1	PF8	Peregrine Falcon	12:58	13:04	20	20 to 2	500	Circling	Active flight	Attacking cockatoo, flight to perch	Adult	-	N
15/02/2024	Summer	RCP3	BrF35	Brown Falcon	14:30	14:31	Perched	Perched	200	-	-	Perched	-	-	P
15/02/2024	Summer	RCP3	WE97	Wedge-tailed Eagle	14:36	14:27	100	70-150	600	Circling	Soaring	-	-	-	Y
15/02/2024	Summer	RCP3	WE98	Wedge-tailed Eagle	14:36	14:27	100	70-150	600	Circling	Soaring	-	-	-	Y
15/02/2024	Summer	RCP3	WE99	Wedge-tailed Eagle	14:40	14:43	70	70-300	1000	W	Soaring	Climbing	-	-	Y
15/02/2024	Summer	RCP3	WE100	Wedge-tailed Eagle	15:14	15:17	30	30-100	100	Circling	Gliding	-	Adult	Pair	Y
15/02/2024	Summer	RCP3	WE101	Wedge-tailed Eagle	15:14	15:17	30	30-100	100	Circling	Gliding	-	Adult	Pair	Y
12/03/2024	Autumn	RCP2	WE102	Wedge-tailed Eagle	14:40	14:42	500	500	500	Circling	Soaring	-	-	Pair	N
12/03/2024	Autumn	RCP2	WE103	Wedge-tailed Eagle	14:40	14:42	500	500	500	Circling	Soaring	-	-	Pair	N
12/03/2024	Autumn	RCP2	BrF36	Brown Falcon	14:42	14:48	100	50-100	50	NE	Soaring	Hunting	-	-	Y
12/03/2024	Autumn	RCP2	WE104	Wedge-tailed Eagle	14:44	14:48	150	100-150	200	NE	Active flight after BrF36	-	-	-	Y
12/03/2024	Autumn	RCP2	WE105	Wedge-tailed Eagle	15:05	15:08	1000	900-1500	1800	NE	Soaring	-	-	Pair	N
12/03/2024	Autumn	RCP2	WE106	Wedge-tailed Eagle	15:05	15:08	1000	900-1500	1800	NE	Soaring	-	-	Pair	N
13/03/2024	Autumn	RVP2	BSK11	Black-shouldered Kite	10:48	10:49	40	40-50	50	NE	Active flight	-	-	-	Y
13/03/2024	Autumn	RCP3	WE107	Wedge-tailed Eagle	12:27	12:45	40	40-1000	800	S	Soaring	-	-	-	Y
13/03/2024	Autumn	RCP3	Fsp8	Falcon sp.	12:38	12:40	1100	900-1100	1000	NW	Active flight	Harassing WE107	-	-	N

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
13/03/2024	Autumn	RCP3	NK72	Nankeen Kestrel	13:00		20	20-40	600	W-NW	Flight to perches	Perching	-	-	Y
13/03/2024	Autumn	RCP1	WE108	Wedge-tailed Eagle	14:18	14:29	20	15-2000	5	SW	Soaring	Attacked by ravens	-	-	Y
13/03/2024	Autumn	RCP1	WE109	Wedge-tailed Eagle	14:18	14:29	20	15-2000	5	NW	Soaring	-	-	-	Y
14/03/2024	Autumn	RCP3	NK73	Nankeen Kestrel	10:10	10:30	15	-	50	W	Active flight	Flight to perch feeding	-	-	N
14/03/2024	Autumn	RCP3	WE110	Wedge-tailed Eagle	10:33	10:37	100	100-200	300	Circling	Gliding	-	-	-	Y
14/03/2024	Autumn	RCP3	BrF37	Brown Falcon	10:38	10:40	50	50-150	50	N	Soaring	-	-	-	Y
14/03/2024	Autumn	RCP2	WE111	Wedge-tailed Eagle	11:50	11:54	50	50-200	100	E	-	-	-	-	Y
14/03/2024	Autumn	RCP2	WE112	Wedge-tailed Eagle	11:50	11:54	50	50-200	100	E	-	-	-	-	Y
14/03/2024	Autumn	RCP2	WE113	Wedge-tailed Eagle	11:50	11:54	50	50-200	100	S	-	-	-	-	Y
14/03/2024	Autumn	RCP2	BrF38	Brown Falcon	12:01	12:05	40	40-60	100	Circling	-	-	-	Pair	Y
14/03/2024	Autumn	RCP2	BrF39	Brown Falcon	12:01	12:05	40	40-60	100	Circling	-	-	-	Pair	Y
14/03/2024	Autumn	RVP3	BrF40	Brown Falcon	13:00	13:01	60	60	200	W	-	-	-	-	Y
14/03/2024	Autumn	RVP3	PF9	Peregrine Falcon	13:19	13:26	50	50-600	80	E	-	-	-	-	Y
15/03/2024	Autumn	RCP1	NK74	Nankeen Kestrel	11:35	11:37	15	15-30	80	S	Active flight	-	-	-	Y
15/03/2024	Autumn	RCP1	NK75	Nankeen Kestrel	11:36	11:37	30	15-30	250	N	Active flight	-	-	-	Y
15/03/2024	Autumn	RCP2	BSK12	Black-shouldered Kite	12:04	13:00	Perched	Perch-15	500	-	Perch to flight	Hunting	-	-	N

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
15/03/2024	Autumn	RCP2	BSK13	Black-shouldered Kite	12:04	13:00	Perched	Perch-15	500	-	Perch to flight	Hunting	-	-	N
18/03/2024	Autumn	BUS	WE114	Wedge-tailed Eagle	13:59	14:05	150	150-500	-	W	Gliding	-	-	-	Y
19/03/2024	Autumn	BUS	BSK14	Black-shouldered Kite	17:39	-	30	5-30	-	E	Flight to perch	Perching	-	Pair	Y
19/03/2024	Autumn	BUS	BSK15	Black-shouldered Kite	17:41	-	30	5-30	-	E	Flight to perch	Perching	-	Pair	Y
19/03/2024	Autumn	BUS	NK76	Nankeen Kestrel	9:15	9:25	25	10-25	50	N	Active flight	-	Adult	Flying and calling around nest tree - Pair	N
19/03/2024	Autumn	BUS	NK77	Nankeen Kestrel	9:15	9:25	25	10-25	50	N	Active flight	-	Adult	Flying and calling around nest tree - Pair	N
20/03/2024	Autumn	BUS	WE115	Wedge-tailed Eagle	9:45	-	100	10-100	-	N	Soaring	-	-	Pair	Y
20/03/2024	Autumn	BUS	WE116	Wedge-tailed Eagle	9:45	-	100	10-100	-	N	Soaring	-	-	Pair	Y
20/03/2024	Autumn	BUS	WE117	Wedge-tailed Eagle	10:09	10:11	100	100	-	W	Soaring	-	-	Pair	Y
20/03/2024	Autumn	BUS	WE118	Wedge-tailed Eagle	10:09	10:11	100	100	-	W	Soaring	-	-	Pair	Y
20/03/2024	Autumn	BUS	WE119	Wedge-tailed Eagle	14:58	15:06	100	100-200	-	NW	Soaring	-	-	Pair	Y
20/03/2024	Autumn	BUS	WE120	Wedge-tailed Eagle	14:58	15:06	100	100-200	-	W	Soaring	-	-	Pair	Y
20/03/2024	Autumn	BUS	WE121	Wedge-tailed Eagle	15:48	15:50	50	50-200	-	E	Soaring	-	-	-	Y
18/03/2024	Autumn	RVP2	WE122	Wedge-tailed Eagle	11:25	11:28	100	100-250	1000	W	-	-	-	-	Y

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
19/03/2024	Autumn	RVP3	BrF41	Brown Falcon	11:30	12:18	Perched	Perched	300	-	Perched	Perched	-	-	P
19/03/2024	Autumn	RVP1	BrF42	Brown Falcon	13:20	13:21	50	50	100	W	Straight flight	in transit	-	-	Y
26/03/2024	Autumn	RVP2	WE123	Wedge-tailed Eagle	14:40	14:42	100	80-100	700	Circling	Soaring	Hunting	-	-	Y
28/03/2024	Autumn	BUS	BrF43	Brown Falcon	8:40	-	20	20	-	-	Flight to perch	-	-	Flight to perch then flight again	N
28/03/2024	Autumn	BUS	NK78	Nankeen Kestrel	17:09	17:18	18	8-18	-	SE	Hovering	Hunting	Adult	-	N
28/03/2024	Autumn	BUS	NK79	Nankeen Kestrel	17:32	17:53	30	10-30	-	N	Soaring	Hunting	-	-	Y
28/03/2024	Autumn	BUS	NK80	Nankeen Kestrel	17:32	17:53	30	10-30	-	N	Soaring	Hunting	-	-	Y
9/04/2024	Autumn	RCP3	WE124	Wedge-tailed Eagle	11:57	12:00	140	130-350	400	N	Soaring	-	-	-	Y
9/04/2024	Autumn	RVP3	PF10	Peregrine Falcon	13:45	13:47	40	10-40	30	SW	Hovering, active flight	Hunting	-	-	Y
10/04/2024	Autumn	RCP3	AH4	Australian Hobby	13:30	13:37	40	20-80	600	E	Active flight	-	-	-	Y
10/04/2024	Autumn	RCP3	WE125	Wedge-tailed Eagle	13:40	13:44	60	40-100	800	S	Soaring	-	-	-	Y
11/04/2024	Autumn	RCP2	BSK16	Black-shouldered Kite	10:20	11:10	15	0-30	300	Circling	Flight to perch, hovering	Hunting	-	-	Y
11/04/2024	Autumn	RCP2	WE126	Wedge-tailed Eagle	11:00	11:02	50	40-80	400	E	Active flight	Hunting	-	-	Y
11/04/2024	Autumn	RCP1	AH5	Australian Hobby	12:30	12:35	30	20-35	500	SE	Active flight	-	-	-	Y
11/04/2024	Autumn	RVP3	BrF44	Brown Falcon	14:47	14:50	Perched	Perched	200	-	Perched	Perched	-	-	P
11/04/2024	Autumn	RVP1	WE127	Wedge-tailed Eagle	15:30	15:35	20	20-25	35	SW	Active flight	In transit	-	-	N

Date	Season	Site	Map ID	Common Name	First observed	Last observed	Flight height (1st)	Flight (min-max m)	Distance	Direction	Behaviour	Activity	Age	Notes	RSA
12/04/2024	Autumn	RCP2	BSK17	Black-shouldered Kite	10:25	11:02	Perched	Perched	400	-	Perched	Perched	-	-	P
12/04/2024	Autumn	RCP2	BSK18	Black-shouldered Kite	10:20	10:30	10	0-10	400	-	Flight to perch	Hunting from perch	-	-	N
12/04/2024	Autumn	RCP2	BrG12	Brown Goshawk	10:55	10:56	5	5-10	3	NE	Active flight	In transit	-	-	N

Appendix B: Microbat Call Identification Report (Balance! Environmental)

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Microbat Call Identification Report

Prepared for ("Client"):	Ecology Consulting Pty Ltd
Survey location/project name:	Crookwell 3 wind farm
Survey dates:	9-27 November 2023
Client project reference:	
Job no.:	ECC-2401
Report date:	7 February 2024

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Methods

Data received

Balance! Environmental received 38799 ultrasonic acoustic files, recorded between 9th and 27th November 2023. Eight Anabat detectors, including two Swift and six Chorus units (Titley Scientific, Brisbane), were deployed to sample eight separate sites. The Swift unit deployed on the met-mast recorded data in full-spectrum format (.WAV files), while all other detectors recorded in zero-crossing analysis format (.ZC files).

Bat-call analysis

Analyses were performed in *Anabat Insight* (Version 2.0.8; Titley Scientific, Brisbane), as follows:

1. All files were processed with a filter to remove files that contained only non-bat noise and/or fewer than three recognisable bat call pulses.
2. The Decision Tree Analysis tool was used to scan, group and label the remaining files according to the average zero-crossing metrics of calls within each file. Separation was based primarily on the characteristic frequency (Fc) metric, but metrics such as pulse duration (Dur), slope of characteristic section (Sc) and time between pulses (TBC) were included to further refine call recognition by the Decision Tree.
3. Species present within each Decision Tree group were then confirmed using a combination of further species-specific metric-based filters and manual review of the call spectrograms. This was achieved by comparing visual properties of call spectrograms and derived metrics of the files with those of regionally relevant reference calls and/or with published call descriptions (e.g., Pennay *et al.* 2004).

The likelihood of species' occurrence in the survey area was confirmed by referring to relevant distributional information (e.g., Australasian Bat Society 2021; Churchill 2008; Baker & Gynther 2023).

Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at <http://www.ausbats.org.au/>.

Species nomenclature follows Armstrong *et al.* (2020).

Results & Discussion

The noise-filtration and short-call removal process reduced the analysis dataset to 17155 files, within which a total of 17288 individual bat calls were identified.

Some 48% (8254) of the calls were positively attributed to eleven distinct species plus the undifferentiated *Nyctophilus* genus (see **Table 1**, upper section). Two *Nyctophilus* species – *N. geoffroyi* and *N. gouldi* – potentially occur in the study area.

The other 9034 calls could not be reliably identified and were assigned to several multi-species groups (refer to bottom portion of **Table 1**). Most of those groups represent species that were otherwise positively identified from more diagnostic calls; however, several calls possibly indicate the presence of up to three additional species, viz.:

- *Miniopterus australis* or *Chalinolobus morio*
 - o Both species produce calls with steep, curvilinear pulses that have a distinctive downward-sweeping tail, with *M. australis* typically having characteristic frequency (Fc) above ~56 kHz and *C. morio* Fc below 54 kHz
 - o The three calls assigned to this group were within the *M. australis* frequency range, but these were very brief calls and it is possible they were aberrant *C. morio* calls
 - o There is a low likelihood that *M. australis* occurs in the Crookwell district
- *Scotorepens orion* or *Scoteanax rueppellii* or *Falsistrellus tasmaniensis*
 - o *F. tasmaniensis* was reliably identified from calls with no tails or down-swept tails and Fc~38-40 kHz
 - o *S. rueppellii* was identified from similar calls at Fc~35 kHz
 - o 12 unresolved calls had similar pulse shape features but Fc was ~36 kHz, suggesting they may have been from either *S. orion* or one of the other two species

More than half of the unresolved calls were assigned to a group representing the *Vespadelus* spp. and *Miniopterus orianae oceanensis*. This group is always problematic to identify due to significant overlap in characteristic frequency (Fc in the range 43-47 kHz) and behavioural variability in pulse characteristics. That variability can result in *M. o. oceanensis* calls (e.g. when foraging close to vegetation or investigating habitat structures) looking like those more “typical” of *Vespadelus* spp. Similarly, when *Vespadelus* spp. are foraging in uncluttered air-space, their calls can take on similar pulse-shape characteristics to those more “typical” of *M. o. oceanensis*.

Positive identifications for this species group were based on “typical” call characteristics described in Pennay *et al.* (2004). Exploratory statistics were then run on a subset of calls that were assigned with high confidence to the various species to discover additional combinations of call metrics that could be used to find additional *M. o. oceanensis* calls in the unresolved call set. After running a series of further filters based on the discovered metrics, this process yielded a less-than-5% increase in reliable *M. o. oceanensis* call identifications. Consequently, the remaining calls were left undiagnosed.

Sample spectrograms of each identified call type are presented in **Appendix 1**.

References

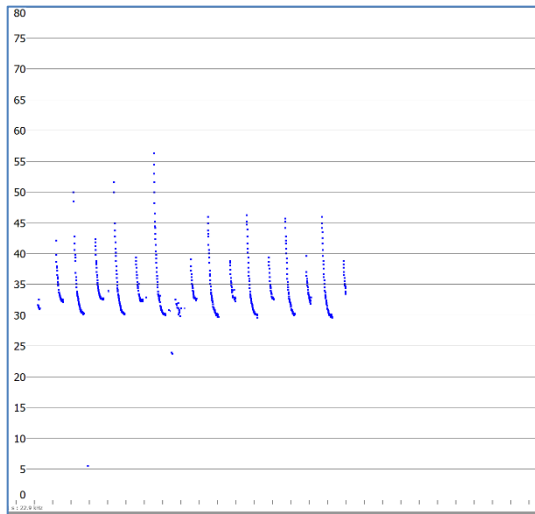
- Armstrong, K.N., Reardon, T.B., and Jackson, S.M. (2020). A current taxonomic list of Australian Chiroptera. Australasian Bat Society. Version 2020-06-09.
URL: <http://ausbats.org.au/species-list/4593775065>
- Australasian Bat Society (2021), *BatMap*. <http://ausbats.org.au/batmap>. Accessed 5/5/2022.
- Baker, A. and Gynther, I. (ed.) (2023). *Strahan's Mammals of Australia*. 4th edition; New Holland; Sydney.
- Churchill, S. (2008). *Australian Bats*. Jacana Books, Allen & Unwin; Sydney.
- Reardon, T. (2003). Standards in bat detector based surveys. *Australasian Bat Society Newsletter* **20**, 41-43.
- Pennay, M., Law, B. and Reinhold, L. (2004). *Bat Calls of New South Wales*. Department of Environment and Conservation, Hurstville.

Table 1 Bats recorded at Crookwell 3 wind farm, November 2023.

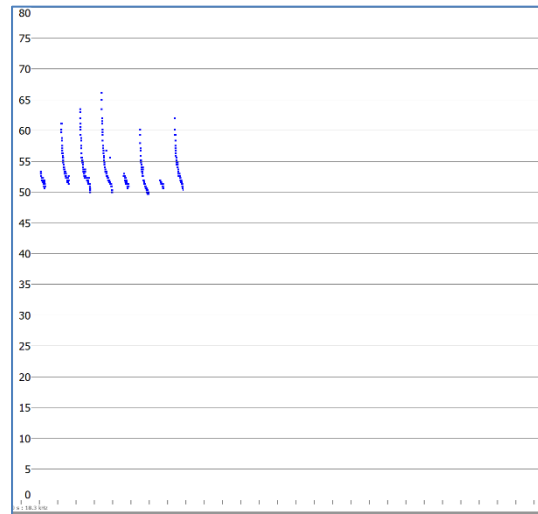
Number of calls allocated per species per site.

Site: Detector:	MetMast 724822	A22 724823	Site1 743585	Site2 743587	Site3 743586	Site4 743588	Site5 743589	Site6 743590	Species Total
Positively identified calls									
<i>Chalinolobus gouldii</i>	9	3	877	1639	58	16	294	99	2995
<i>Chalinolobus morio</i>			13	74	2	41		369	499
<i>Falsistrellus tasmaniensis</i>			3	13	1				17
<i>Nyctophilus</i> sp.			13	2	2	2	1	44	64
<i>Scoteanax rueppellii</i>				2					2
<i>Scotorepens balstoni</i>			2		2				4
<i>Vespadelus darlingtoni</i>	9		2200	193	319	3	4	879	3607
<i>Vespadelus regulus</i>			2	10	8	8		11	39
<i>Vespadelus vulturnus</i>			75	81	7	1	3	23	190
<i>Miniopterus orianae oceanensis</i>			80	35	18			24	157
<i>Austronomus australis</i>	243	55	18	141	4	2	169	24	656
<i>Ozimops ridei</i>	5	1	4	5	2		7		24
Unresolved calls									
<i>C. gouldii</i> or <i>O. ridei</i>	8	4	328	336	20	2	303	1	1002
<i>C. gouldii</i> or <i>S. balstoni</i>			7	2	1			1	11
<i>C. morio</i> or <i>Miniopterus australis</i>				1				2	3
<i>C. morio</i> or <i>V. vulturnus</i>			211	160	31	32	4	642	1080
<i>F. tasmaniensis</i> or <i>Scotorepens orion</i>				1				2	3
<i>F. tasmaniensis</i> or <i>V. darlingtoni</i>	7		644	76	38		1	178	944
<i>S. rueppellii</i> or <i>S. orion</i>			5	1	1			2	9
<i>V. darlingtoni</i> or <i>V. regulus</i>			704	89	164	20	4	416	1397
<i>V. regulus</i> or <i>V. vulturnus</i>			4	8		12	1	2	27
<i>Vespadelus</i> sp. or <i>M. o. oceanensis</i>			1341	284	1210	7	11	1705	4558
Site Total	281	63	6531	3153	1888	146	802	4424	17288

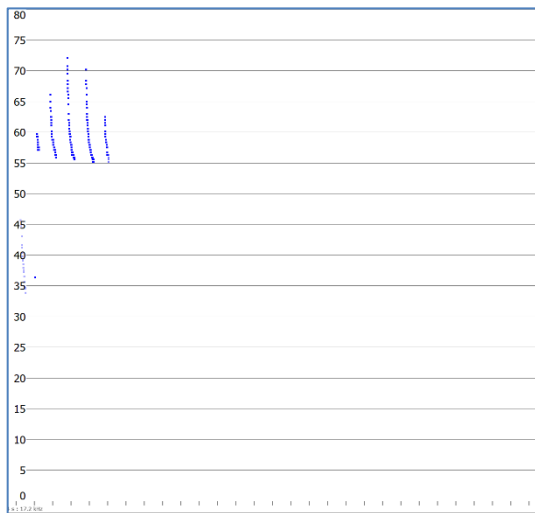
Appendix 1 Representative call sequences from the Crookwell 3 WF surveys, November 2023.
x-axis = 10 ms per tick-mark; time between pulses removed ("compressed")



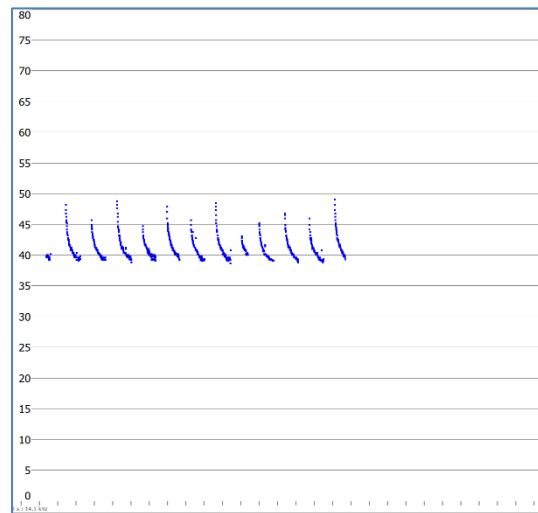
Chalinolobus gouldii



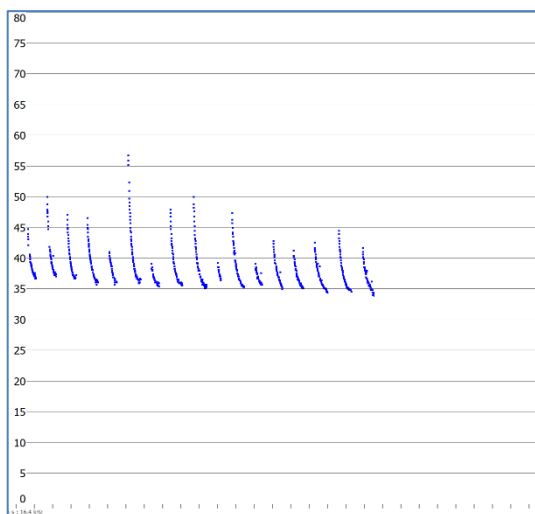
Chalinolobus morio



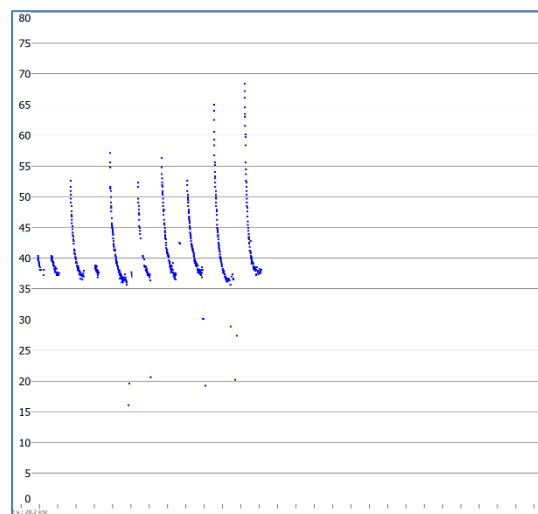
C. morio or *Miniopterus australis*



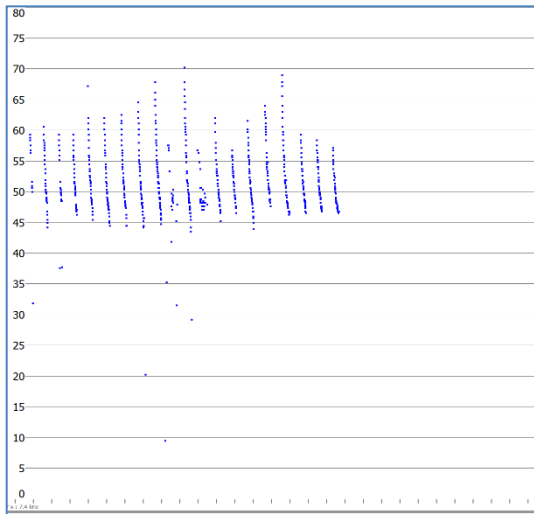
Falsistrellus tasmaniensis



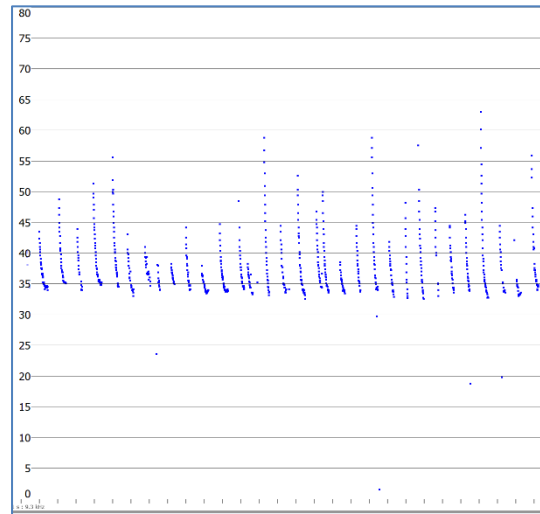
Scoteanax rueppellii



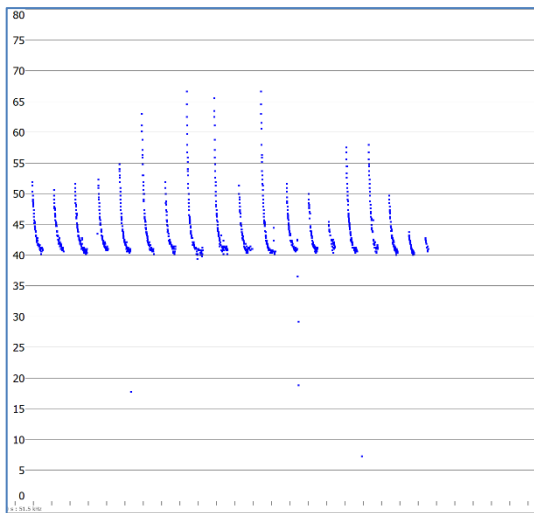
S. rueppellii or *S. orion*



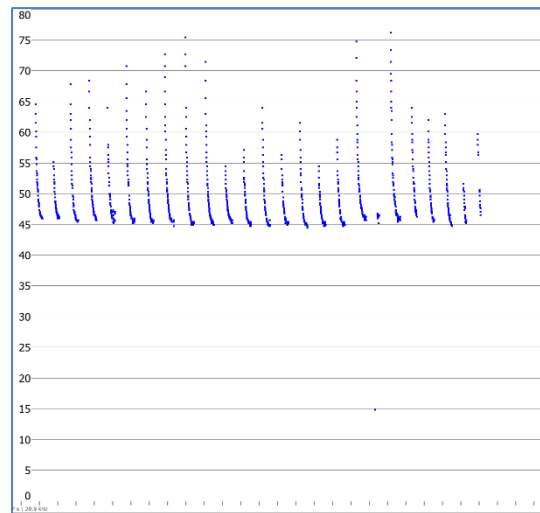
Nyctophilus sp.



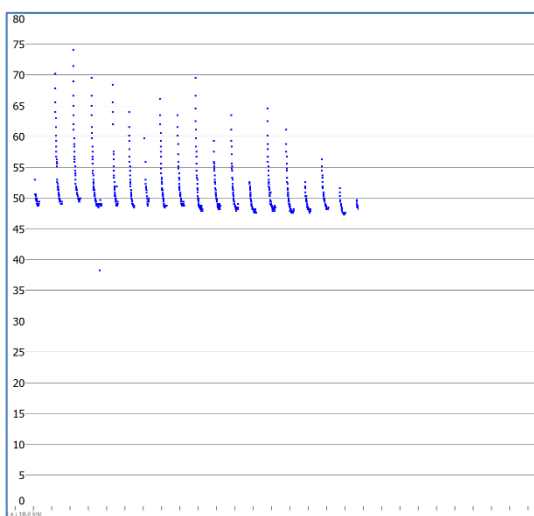
Scotorepens balstoni



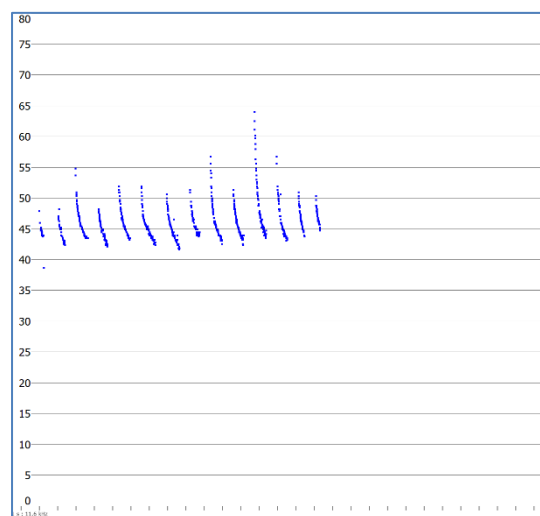
Vespadelus darlingtoni



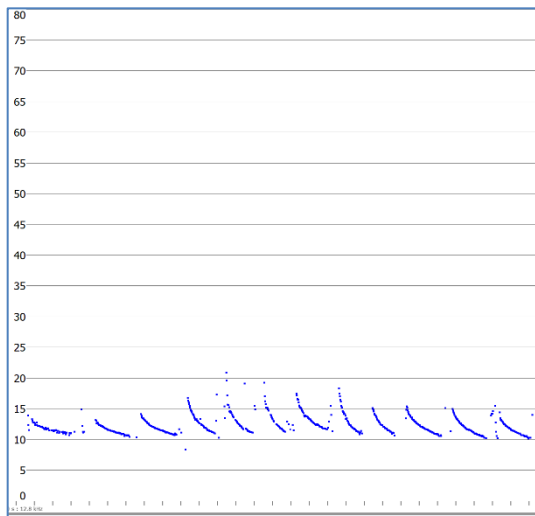
Vespadelus regulus



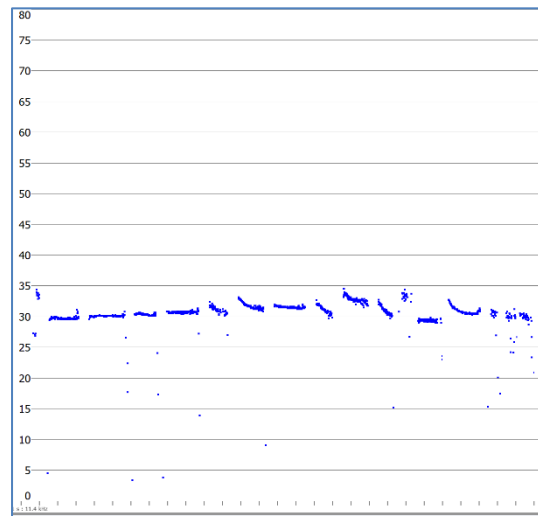
Vespadelus vulturnus



Miniopterus orianae oceanensis



Austronomus australis



Ozimops ridei



Microbat Call Identification Report

Prepared for ("Client"):	Ecology Consulting Pty Ltd
Survey location/project name:	Crookwell 3 wind farm Autumn 2024
Survey dates:	2024
Client project reference:	
Job no.:	ECC-2402
Report date:	23 May 2024

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Methods

Data received

Balance! Environmental received 79,773 ultrasonic acoustic files, recorded between 3rd and 22nd March 2024. Eight Anabat detectors, including two Swift and six Chorus units (Titley Scientific, Brisbane), were deployed to sample eight separate sites. The detector deployed site A22 (Swift, SN724823) recorded data in full-spectrum format (.WAV files), while all other detectors recorded in zero-crossing analysis format (.ZC files).

Bat-call analysis

Analyses were performed in *Anabat Insight* (Version 2.1.1; Titley Scientific, Brisbane), as follows:

1. All files were processed with a filter to remove files that contained only non-bat noise and/or fewer than three recognisable bat call pulses.
2. The Decision Tree Analysis tool was used to scan, group, and label the remaining files according to the average zero-crossing metrics of calls within each file. Separation was based primarily on the characteristic frequency (Fc) metric, but metrics such as pulse duration (Dur), slope of characteristic section (Sc) and time between pulses (TBC) were included to further refine call recognition by the Decision Tree.
3. Species present within each Decision Tree group were then confirmed using a combination of further species-specific metric-based filters and manual review of the call spectrograms. This was achieved by comparing visual properties of call spectrograms and derived metrics of the files with those of regionally relevant reference calls and/or with published call descriptions (e.g., Pennay *et al.* 2004).

The likelihood of species' occurrence in the survey area was confirmed by referring to relevant distributional information (e.g., Australasian Bat Society 2021; Churchill 2008; Baker & Gynther 2023).

Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at <http://www.ausbats.org.au/>.

Species nomenclature follows Armstrong *et al.* (2020).

Results & Discussion

The noise-filtration and short-call removal process reduced the analysis dataset to 28,884 files, within which a total of 29,184 individual bat calls were identified.

Some 44% (12,736) of the calls were positively attributed to eleven distinct species plus the undifferentiated *Nyctophilus* genus (see **Table 1**, upper section). Two *Nyctophilus* species – *N. geoffroyi* and *N. gouldi* – potentially occur in the study area.

The other 16,448 calls could not be reliably identified and were assigned to several multi-species groups (refer to bottom portion of **Table 1**). Most of those groups represent species that were otherwise positively identified from more diagnostic calls; however, several calls possibly indicate the presence of up to two additional species, viz.:

- *Miniopterus australis* (unresolved group with *Chalinolobus morio*)
 - o *M. australis* and *C. morio* produce calls with steep, curvilinear pulses that have a distinctive down-ward-sweeping tail, with *M. australis* typically having characteristic frequency (Fc) above ~56 kHz and *C. morio* Fc below 54 kHz.
 - o Numerous calls were reliably attributed to *C. morio*, while 13 calls with Fc~55 kHz were thought to potentially be from either species.
 - o There is a low likelihood that *M. australis* occurs in the Crookwell district.
- *Scoteanax rueppellii* (unresolved group with *Scotorepens balstoni* and *S. orion*)
 - o *S. balstoni* was reliably identified from calls with slightly hooked bodies, Fc≤35 kHz and knee frequency (Fk) <37 kHz.
 - o *S. orion* calls had similar pulse shapes to those of *S. balstoni* but with Fc>35 kHz and Fk>38 kHz.
 - o The unresolved calls in this group lacked the typical hooked body shape of the *Scotorepens* spp., having a straighter or only slightly curved body, with intermediate values for Fc and Fk. It is possible that these calls belonged to *S. rueppellii*, but they could have been aberrant calls from either of the *Scotorepens* spp.

About one-third of the unresolved calls were assigned to a group representing the *Vespadelus* spp. and *Miniopterus orianae oceanensis*. This group is always problematic to identify due to significant overlap in characteristic frequency (Fc in the range 43-47 kHz) and behavioural variability in pulse characteristics. That variability can result in *M. o. oceanensis* calls (e.g. when foraging close to vegetation or investigating habitat structures) looking like those more “typical” of *Vespadelus* spp. Similarly, when *Vespadelus* spp. are foraging in uncluttered air-space, their calls can take on similar pulse-shape characteristics to those more “typical” of *M. o. oceanensis*.

Positive identifications for this species group were based on “typical” call characteristics described in Pennay *et al.* (2004). Exploratory statistics were then run on a subset of calls that were assigned with high confidence to the various species to discover additional combinations of call metrics that could be used to find additional *M. o. oceanensis* calls in the unresolved call set. After running a series of further filters based on the discovered metrics, this process yielded about a 10% increase in reliable *M. o. oceanensis* call identifications. The remaining calls were left undiagnosed.

Sample spectrograms of each identified call type are presented in **Appendix 1**.

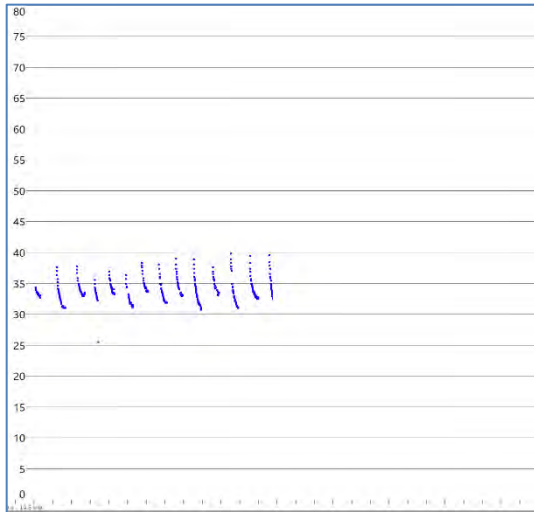
References

- Armstrong, K.N., Reardon, T.B., and Jackson, S.M. (2020). A current taxonomic list of Australian Chiroptera. Australasian Bat Society. Version 2020-06-09.
URL: <http://ausbats.org.au/species-list/4593775065>
- Australasian Bat Society (2021), *BatMap*. <http://ausbats.org.au/batmap>. Accessed 5/5/2022.
- Baker, A. and Gynther, I. (ed.) (2023). *Strahan's Mammals of Australia*. 4th edition; New Holland; Sydney.
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- Reardon, T. (2003). Standards in bat detector based surveys. *Australasian Bat Society Newsletter* **20**, 41-43.
- Pennay, M., Law, B. and Reinhold, L. (2004). *Bat Calls of New South Wales*. Department of Environment and Conservation, Hurstville.

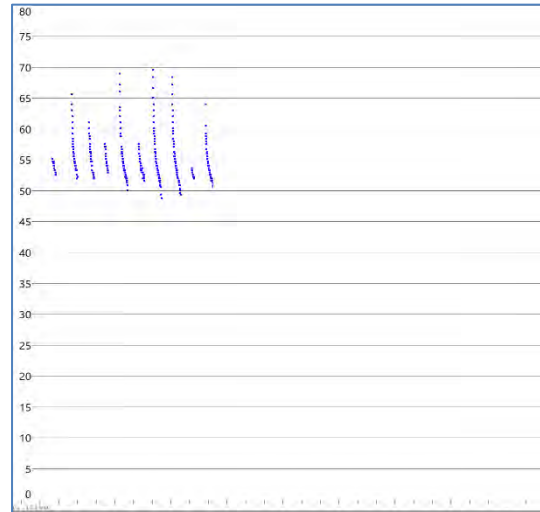
Table 1 Bats recorded at Crookwell 3 wind farm, 3rd-22nd March 2024.
Number of calls allocated per species per site.

Site:	MetMast	A22	Site1	Site2	Site3	Site4	Site5	Site6	Species Total
Positively identified calls									
<i>Chalinolobus gouldii</i>	14	46	307	1142	93		391	64	2057
<i>Chalinolobus morio</i>	3		51	152	8	117	45	108	484
<i>Falsistrellus tasmaniensis</i>								3	3
<i>Nyctophilus</i> sp.			8	11		2	17	10	48
<i>Scotorepens balstoni</i>		1	9	2					12
<i>Scotorepens orion</i>				4			1	1	6
<i>Vespadelus darlingtoni</i>	28	17	1306	496	302	119	294	5100	7662
<i>Vespadelus regulus</i>			40	78	35	598	598	354	1703
<i>Vespadelus vulturnus</i>	1		43	58	15	5	20	16	158
<i>Miniopterus orianae oceanensis</i>			4	27	4		30	26	91
<i>Austronomus australis</i>	265	81	4	61	4		60	13	488
<i>Ozimops ridei</i>	8	9		3	1		3		24
Unresolved calls									
<i>C. gouldii</i> or <i>O. ridei</i>	23	16	105	198	25		156	9	532
<i>C. gouldii</i> or <i>S. balstoni</i>		1	41	13	1			1	57
<i>C. morio</i> or <i>Miniopterus australis</i>			2	11					13
<i>C. morio</i> or <i>V. vulturnus</i>	4		100	416	35	237	746	1962	3500
<i>F. tasmaniensis</i> or <i>S. orion</i>	1			2	1				4
<i>F. tasmaniensis</i> or <i>V. darlingtoni</i>	8	2						33	43
<i>S. balstoni</i> or <i>S. orion</i> or <i>Scoteanax rueppellii</i>			3	2			4		9
<i>V. darlingtoni</i> or <i>V. regulus</i>		5	2253	785	266	1019	364	1998	6690
<i>V. regulus</i> or <i>V. vulturnus</i>	2		26	45	9	9	36	3	130
<i>Vespadelus</i> sp. or <i>M. o. oceanensis</i>	25	1	192	144	46	77	894	3947	5326
<i>Vespadelus</i> sp. or <i>Nyctophilus</i> sp.			44	8	3	8	38	43	144
Site Total	382	179	4494	3650	845	2183	3659	13648	29040

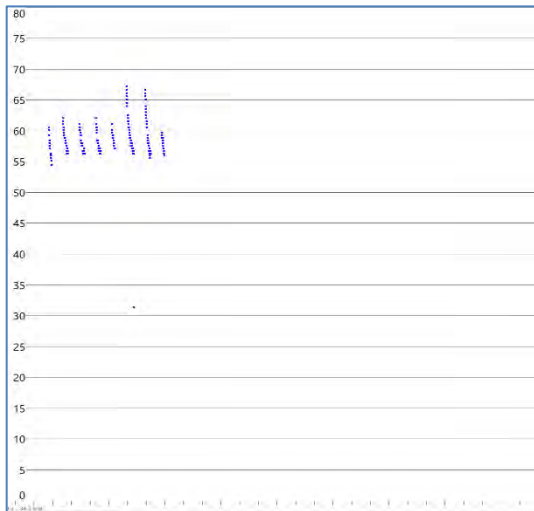
Appendix 1 Representative call sequences from the Crookwell 3 WF surveys, 3-22 March 2024.
x-axis = 10 ms per tick-mark; time between pulses removed ("compressed")



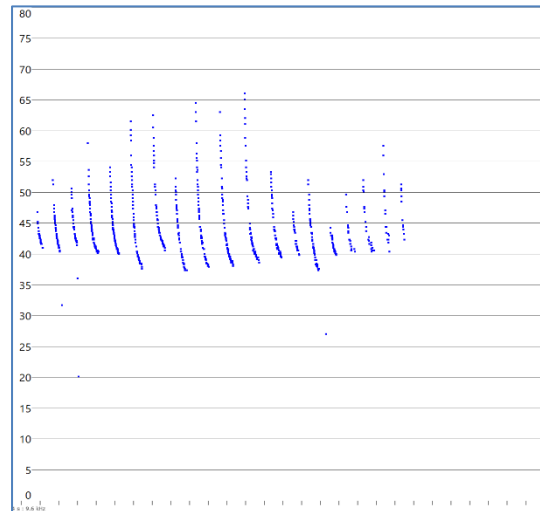
Chalinolobus gouldii



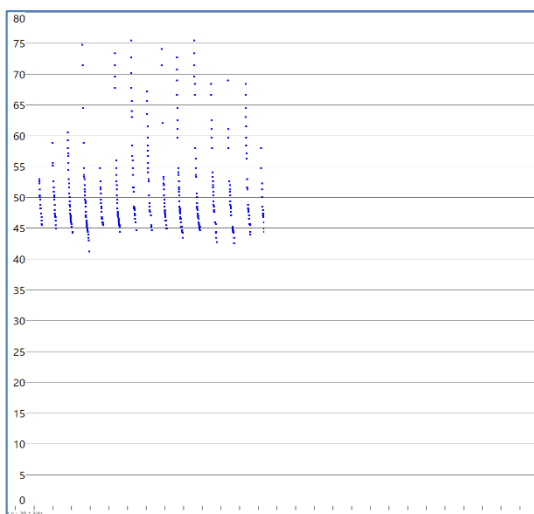
Chalinolobus morio



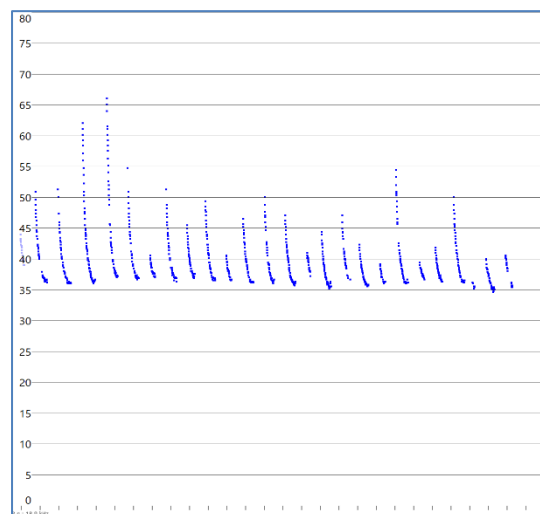
C. morio or Miniopterus australis



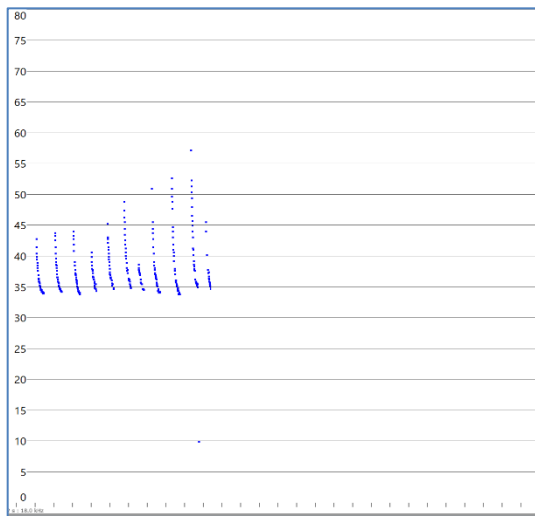
Falsistrellus tasmaniensis



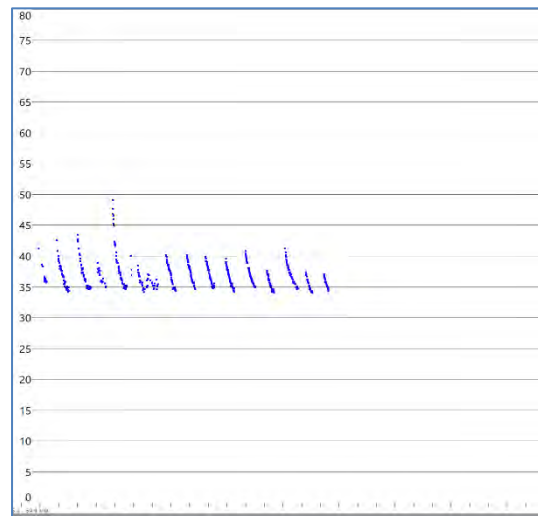
Nyctophilus sp.



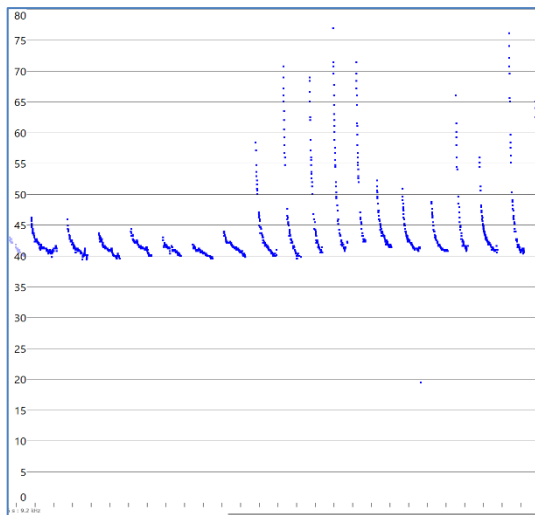
Scotorepens orion



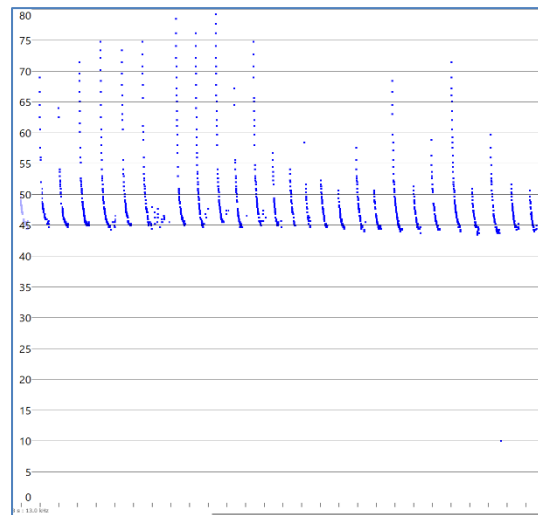
Scotorepens balstoni



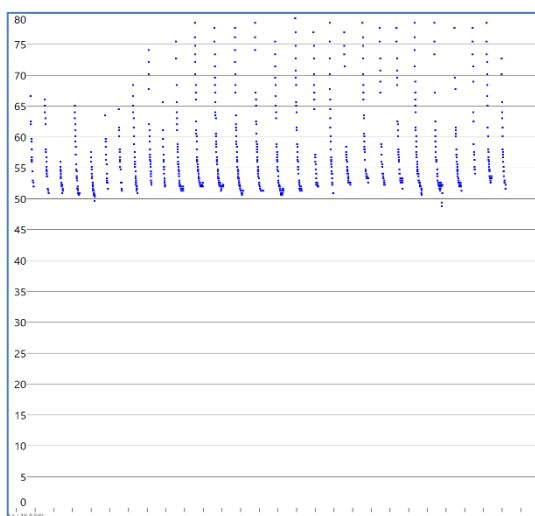
S. balstoni or *Scoteanax rueppellii*



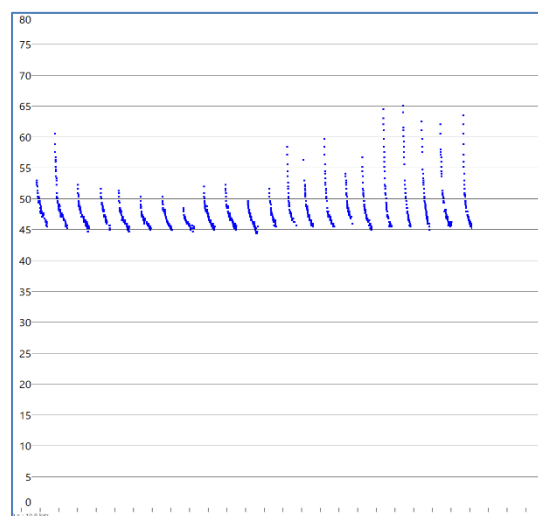
Vespadelus darlingtoni



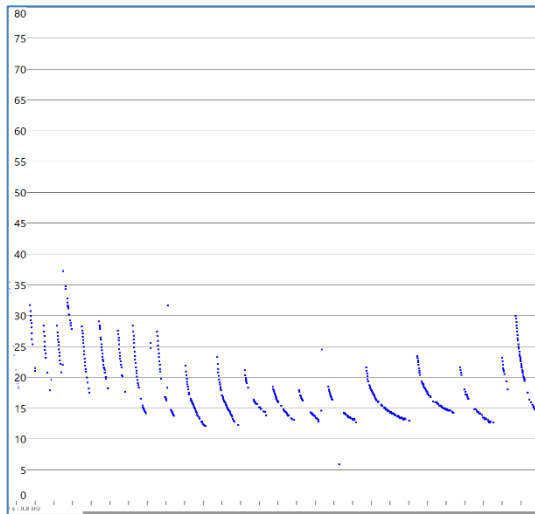
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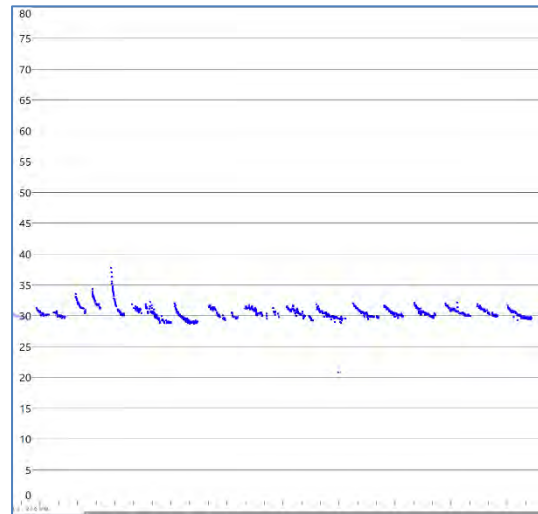
Vespadelus vulturnus



Miniopterus orianae oceanensis



Austronomus australis



Ozimops ridei



Bird and Bat Risk Assessment Report

Crookwell 3 Wind Farm

Prepared for Global Power Generation Australia Pty Ltd

Prepared by Emily Zouch

24 May 2024



ABOUT THIS DOCUMENT

This document has been prepared by Project Ecologist Emily Zouch and Senior Ecologist Simon Vinson, Accredited Biodiversity Assessor NSW licence BAAS23004.

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DOCUMENT TRACKING

Version	Date	Author	Reviewed	Details
DRAFT v0.1	21/03/2024	Emily Zouch, Shu Lee	Simon Vinson	Draft for client review
DRAFT v0.2	09/04/2024	Emily Zouch	Simon Vinson	Draft report released for external review DCCEEW(NSW)
Provisional v1.0	29/04/2024	Emily Zouch	Simon Vinson	Report for release
Provisional v1.1	24/05/2024	Emily Zouch		Incorporation of autumn data. Report for final release.

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Shortened forms

BAM	Biodiversity Assessment Method
BBAMP	Bird and Bat Adaptive Management Plan
BC Act	<i>Biodiversity Conservation Act 2016</i> (NSW)
BUS	bird utilisation survey
C2WF	Crookwell 2 Wind Farm
DCCEEW	Department of Climate Change, Energy, Environment and Water (NSW)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth)
km	kilometres
m	metres
NSW	New South Wales
sp.	species
RSA	rotor swept area
RVPS	raptor vantage point survey
SPRAT	Species Profile and Threats Database

1 Introduction

The bird and bat risk assessment aims to identify species or groups of species considered to be potentially 'at risk' from collision with turbines or otherwise impacted by operating turbines at the Project. This document has been prepared in consideration of the requirement to assess 'wind turbine strikes on protected animals' as prescribed impacts as outlined in section 8.3.5 of the Biodiversity Assessment Method (BAM) (DPIE, 2020). The outcome of this risk assessment will inform species used in the turbine risk assessment in **Section 4** of the Bird and Bat Adaptive Management Plan (BBAMP) and can enable targeted monitoring and management measures that focus on species or groups of species at greater risk of impact.

1.1 Determining species for risk assessment

Species and groups of species included for assessment have been determined through one of two pathways:

- threatened species assessed as having a 'likely' or higher likelihood of occurrence within the Project area (refer to **Appendix A**); and/or
- species that have been observed Crookwell 3 Wind Farm (the Project) or Crookwell 2 Wind Farm (C2WF).

Importantly, species and groups of concern that are proportionally highly impacted by turbine strike will be assessed, including Wedge-tailed Eagle, White-striped Freetail Bat and a group representing 'other non-threatened raptor species' observed within the Project area.

2 Method

The potential risks to bird and bat populations vary between species based on multiple factors, including flight characteristics and other behaviours, preferred habitats, broader geographic distributions, migration patterns, breeding behaviours, population size, and the demographic capacity to replace mortality. Lumsden *et al.* (2019) provides a risk-based method for assessing ‘species of concern’ and their risk of turbine collision that incorporates the aforementioned factors. The Lumsden *et al.* (2019) risk assessment method was adopted for this BBAMP to allow for thorough analysis and justification of the variety of factors that influence the likelihood and consequence of collision risk.

2.1 Risk Assessment Method

Six criteria (criteria A to F) were used by Lumsden *et al.* (2019) for the assessment of the (Table 1):

- likelihood of risk (criteria A and B); and
- likelihood of consequence (criteria C to F).

The bird and bat risk assessment employed for the BBAMP is largely comparable to that of the source material, with a few adaptations as appropriate for site-specific use for the Project area.

Each species will be ranked within each criterion as ‘low’, ‘moderate’ or ‘high’ relative to the particulars of that criterion. Each species will be assessed in consideration of the species’ ecology, observed or predicted utilisation of the Project area, and a literature review.

TABLE 1: CRITERIA FROM LUMSDEN ET AL. (2019) AND USED IN RISK ASSESSMENT

	Criteria	Description	Method
Criteria used to ascribe likelihood of risk	Criterion A	Known or likely frequency of flight within rotor swept area (RSA) height.	Section 2.1.1
	Criterion B	Habitat preference and status of frequency of occurrence within the Project area.	Section 2.1.2
Criteria used to ascribe consequence of risk	Criterion C	Highly localised or concentrated population (for whole or part of lifecycle), such that siting of wind farm could have significant consequence to regional, national or international populations.	Section 2.1.3
	Criterion 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).	Section 2.1.4
	Criterion E	Known or estimated size of national or global population.	Section 2.1.5
	Criterion F	Listed conservation status under the Biodiversity Conservation Act 2016 (BC Act) and/or the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act).	Section 2.1.6

2.1.1 CRITERION A (FLIGHT HEIGHT)

This criterion assesses a primary factor that influences collision risk. Collision risk is the potential and frequency that a species flies within RSA height (30 to 160 m) within the Project area, specifically within areas where turbines are located. These locations are inclusive of both open environments and along the edges of areas with canopy vegetation.

Flight height data collected within the Project area during pre-operational surveys will be utilised where available. Additional records of flight height data from other Australian wind farms will be used to create a more comprehensive view of a species’ likely flight behaviour. Where data has been scant, relevant literature has been sought out to estimate flight behaviours and determine likelihood of flight into RSA height. Criterion A ranking will be as presented in **Table 2**.

TABLE 2: CRITERION A RANKING

Low	Moderate	High
Species that rarely flies within RSA height.	Species with majority of flight activity that occurs: - below RSA height, though does fly at RSA height during some activities, or - this aspect is uncertain.	Species in which a high proportion of its flight activity is within RSA height.

2.1.2 CRITERION B (HABITAT PREFERENCE AND STATUS WITHIN THE PROJECT AREA)

This criterion assesses the known general habitat preference that might influence the likelihood of a species to encounter turbines within the Project area. Habitat preference information from the likelihood of occurrence table was used to inform species' likely utilisation of turbine areas. Additionally, this assessment considers the observed status or estimated frequency of occurrence of the species in the Project area. Criterion B ranking will be as presented in **Table 3**.

TABLE 3: CRITERION B RANKING

Low	Moderate	High
Species rarely occurs in the Project area, or inhabits environments in a predominantly sedentary manner, in that it is largely confined to those environments (e.g. shrubland, forest).	Species occasionally occurs within or occasionally moves through the Project area. Species may fly through turbine areas when moving between preferred habitats.	Species regularly occurs within or regularly moves through the Project area. Species regularly utilises environments that will increase the likelihood of entering turbine areas.

2.1.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

This criterion estimates the degree to which a species' population may be geographically concentrated and how this population may be put at risk by the location of a wind farm. Geographic concentration may be due to life-cycle aggregations, migratory paths, or restrictions to preferred habitat types. It does not necessarily mean that a very high density of individuals occurs, just that a geographic population likely significant to the species is present for a portion of time, sometimes seasonally. Criterion C ranking will be as presented in **Table 4**.

TABLE 4: CRITERION C RANKING

Low	Moderate	High
Species is widely dispersed within areas of suitable habitat that itself is relatively widely distributed.	Species may be widespread or have greater flexibility in its range of suitable habitat availability, though where a high proportion of the population is likely occur, it is concentrated at sites where they do occur. This may include highly restricted habitat availability.	Species that have major aggregations, very restricted distributions or may be seasonally restricted to very small locations. This includes migratory pathways and cave areas for bats.

2.1.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

This criterion assesses the species' life-history traits that influence the relevant population's capacity to replace collision victims. Species breeding biology and demographic functions such as the fecundity and availability of breeding territories will influence the capacity to replace lost individuals. Criterion D ranking will be as presented in **Table 5**.

TABLE 5: CRITERION D RANKING

Low	Moderate	High
Species that form breeding territories, and have a reasonable proportion of the population as non-breeding 'floaters' which can rapidly replace breeding territorial adults; or species may not form breeding territories and that are short-lived and have high fecundity; or species that have capacity for long-range or widespread juvenile or sub-adult dispersal.	Species with life-history characteristics which fall between the low and high descriptions here.	Species that form breeding territories, though have limited capacity for a lost breeding adult to be readily replaced; or species that does not form breeding territories, and are long-lived and/or have low fecundity; or species that may have short-distance juvenile or sub-adult dispersal capacity only.

2.1.5 CRITERION E (POPULATION SIZE)

This criterion accounts for the possibility that a reduction of a population, even a very small loss, could have serious consequences for sensitive populations. This information will be based on accepted census information where available for threatened species, where information is less known, an estimation will be made based on available information and expert assessment. For this assessment, the numbers for these categories have been altered from source material to indicate risk more accurately. Criterion E ranking will be as presented in **Table 6**.

TABLE 6: CRITERION E RANKING

Low	Moderate	High
The total population (i.e. Australian population or migrant's relevant subpopulation) is estimated to number more than 20,000 individuals.	The total population is estimated to number between 5,000 and 20,000 individuals.	The total population is estimated to number less than 5,000 individuals.

2.1.6 CRITERION F (LISTED CONSERVATION STATUS)

This criterion refers to the conservation status of the species undergoing assessment. In the instance where a species has different listings between the BC Act and EPBC Act, the higher threatened category listing will be selected for this assessment. Species listed as 'migratory' under the EPBC Act are categorised according to their listed threatened status. Species that are listed as migratory under the EPBC Act that have not been assigned a threat status are not assigned a rank for this criterion. Criterion F ranking will be as presented in **Table 7**.

TABLE 7: CRITERION F RANKING

Low	Moderate	High
Species is not listed under the BC Act or the EPBC Act.	Species is listed as Vulnerable under the BC Act, and/or the EPBC Act.	Species is listed as Endangered or Critically Endangered under the BC Act, and/or the EPBC Act.

2.2 Estimating overall risk

To determine overall likelihood and consequence, a generally additive process is employed with the elements of likelihood of collision questions (Criterion A and B) and consequence of collision questions (Criterion C to F). The assessment applied is drawn from the source material Lumsden *et al.* (2019), with the exception being that risks will be assessed at the relevant spatial scale (i.e., at the Project area scale).

2.2.1 LIKELIHOOD OF COLLISION

For estimations of the overall risk associated with the likelihood of collision to be categorised as 'high' at least one of the criteria must be considered 'high' and neither criteria categorised 'low'. To be categorised as 'low', both criteria must be 'low'. All other category combinations are considered to be 'moderate'. As in Lumsden *et al.* (2019), this approach effectively selects the modal response and follows the precautionary principle whereby the highest risk rating will be selected.

2.2.2 CONSEQUENCE OF COLLISION

For the estimation of the overall risk associated with the consequence of collision, the modal response of rankings across Criterion C to F will be used. Where a risk rating has the majority of risk allocations (i.e. three criteria in a risk category), that risk category is selected. In cases where the risks were split between two rankings, the higher ranking was selected. Where risks were spread across all three levels, a 'moderate' risk was selected with the exception of cases where the risk is associated with Criterion C for localised concentration was 'high'. As in Lumsden *et al.* (2019), the consequences of high mortality due to wind turbine collision for a species with limited distribution and/or high concentration, are sufficiently large. Consequently, if a species' risk is associated with 'high', then the overall consequence should also be set to 'high'.

2.2.3 OVERALL RISK

To determine the overall risk rating for the likelihood and consequence of collision for the assessed species within the Project area, the results are placed into a risk matrix to determine the level of risk. Five categories of overall risk will be used based on the combination of the scores for likelihood and consequence, they include 'negligible', 'low', 'moderate', 'high' and 'severe', as presented in **Table 8**.

TABLE 8: RISK MATRIX FOR 'AT RISK' SPECIES

		Consequence of collisions		
		Low	Moderate	High
Likelihood of collision	Low	Negligible	Low	Moderate
	Moderate	Low	Moderate	High
	High	Moderate	High	Severe

3 Species-specific risk assessments

3.1 Summary of pre-operational bird and bat observations

The following summarises pre-operational bird and bat observations. Further details on surveys, methods and findings that inform this risk assessment are provided in **Attachment 1**.

3.1.1 BIRD UTILISATION SURVEYS

Flight height data for relevant 'at-risk' species observed within the Project area during bird utilisation surveys (BUS) can be found in **Table 10**.

The following five threatened and one migratory listed species were recorded during the BUS;

- Dusky Woodswallow (13 individuals over three observations);
- Gang-gang Cockatoo (76 individuals over 24 observations);
- Little Eagle (one individual in one observation);
- Rufous Fantail (one individual in one observation);
- Scarlet Robin (46 individuals over 35 observations); and
- Varied Sittella (41 individuals in three observations).

3.1.2 RAPTOR VANTAGE POINT SURVEYS

Flight height observation data for raptor vantage point surveys (RVPS) is presented in **Table 9**. Flight within RSA height for raptors during these surveys were determined through the flight minimum and maximum of each species record, and whether the individual entered the RSA height range during flight observation.

One observation of a threatened species was recorded during the RVPS, Little Eagle (one individual in one observation).

3.1.3 INCIDENTAL SURVEYS

Incidental flight height data for raptors observed from within the Project area is presented within **Table 9**, with flight within RSA height being determined in the same manner as RVPS data. Flight data of other incidental bird observations are presented in **Table 10**.

The following three threatened species were incidentally observed and recorded within or close to the Project with full data collection:

- Dusky Woodswallow (10 individuals in one observation)
- Gang-gang Cockatoo (15-25 individuals in one observation);
- Little Eagle (one individual in one observation);
- Scarlet Robin (two individuals in one observation); and
- Superb Parrot (four individuals in one observation).

An additional four threatened species were observed incidentally in the local area but within foraging and traversal range of the Project area. They were recorded without additional flight information:

- Black Falcon (one individual in one observation);
- Little Eagle (nine individuals over seven observations);
- White-bellied Sea-Eagle (one individual in one observation); and
- Super Parrot (three individuals in one observation).

TABLE 9: RVPS AND INCIDENTAL RAPTOR OBSERVATIONS DATA FOR PROJECT AREA

Species observed	Within RSA	Outside RSA	Perched	Grand Total
Wedge-tailed Eagle	26	13	-	39
Nankeen Kestrel	16	8	-	24
Brown Falcon	6	-	3	9
Peregrine Falcon	4	2	-	6
Black-shouldered Kite	1	-	2	3
Little Eagle	1	1	-	2
Australian Hobby	1	-	-	1
Falcon sp.	1	-	-	1
Grand Total	56	24	5	85

3.1.4 BAT SURVEY

Bat call data is presented in **Table 10**. Bat data is separated into two categories for flight height analysis; calls recorded at ground-level monitoring sites, or calls recorded at RSA height monitoring sites.

The following three threatened species were positively identified in recordings at ground level monitoring sites:

- Large Bent-winged Bat (248 calls across five monitoring sites);
- Eastern False Pipistrelle (20 calls across four monitoring sites); and
- Greater Broad-nosed Bat (two calls at one site).

No threatened species were positively identified through call analysis at RSA height monitoring sites.

TABLE 10: FLIGHT HEIGHT DATA FOR 'AT RISK' SPECIES OBSERVED DURING BIRD UTILISATION SURVEYS, INCIDENTAL BIRD OBSERVATIONS AND BAT SURVEYS IN THE PROJECT AREA

Species observed	Call	Not flyin g	Below RSA					Within RSA										Above RSA			Grand Total observations
			<10	10	15	20	25	30	35	40	45	50	60	70	80	100	150	200	300	500	
Birds																					
Australian Hobby	-	-	-	-	-	-	-	2	1	-	-	-	-	-	1	-	-	-	-	-	4
Black-shouldered Kite	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2	
Brown Falcon	-	-	-	2	-	1	1	1	-	-	-	1	1	-	-	1	-	-	-	8	
Brown Goshawk	4	1	1	4	-	6	-	-	-	1	-	-	-	-	-	-	-	-	-	17	
Dusky Woodswallow	1	-	-	-	-	22	-	-	-	-	-	-	-	-	-	-	-	-	-	23	
Falcon sp.	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	2	
Gang-gang Cockatoo	30	1	6	-	10	21	10	-	-	-	-	-	-	-	-	-	-	-	-	79	
Little Eagle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	
Nankeen Kestrel	5	3	1	4	1	8	8	8	-	4	1	4	-	-	-	-	-	-	-	47	
Peregrine Falcon	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	2	
Rufous Fantail	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
Scarlet Robin	25	-	12	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46	
Superb Parrot	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	4	
Varied Sittella	-	-	-	-	26	15	-	-	-	-	-	-	-	-	-	-	-	-	-	41	
Wedge-tailed Eagle	-	-	1	-	-	-	-	1	2	1	-	5	-	-	-	7	3	1	1	24	
Woodswallow sp.	-	-	-	-	-	-	-	-	-	50	-	-	-	-	-	-	-	-	-	50	
Bats																					
Eastern False Pipistrelle	20	Calls occurred at ground level monitoring sites at site 1 (near A8), site 2 (at A12), site 3 (at A24) and site 6 (A22). Confirmed calls included only.																	-	20	
Greater Broad-nosed Bat	2	Calls occurred at ground level monitoring sites at site 2 (at A12). Confirmed calls included only.																	-	2	
Large Bent-winged Bat	248	Calls occurred at ground level monitoring sites at site 1 (near A8), site 2 (at A12), site 3 (at A24), site 5 (A17) and site 6 (at A22). Confirmed calls included only.																	-	248	
White-striped Freetail Bat	1144	644 calls recorded between two RSA height monitoring sites and calls occurring at all ground level monitoring sites.																	-	1144	

3.2 Little Eagle

3.2.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There are two published reports (three records) of Little Eagle blade strike as well as multiple sightings of Little Eagle flying at RSA height (Smales 2015; Moloney *et al.* 2019). Moloney *et al.* (2019) reported one record of blade strike of Little Eagle from post-construction mortality monitoring of 15 wind farms in Victoria between 2003 to 2018. Smales (2015) reported two records of blade strike of Little Eagle from monitoring of eight wind farms in south-eastern Australia (i.e., Victoria and South Australia). These reports are likely referring to the same record of blade strikes in Victoria. Rye Park Wind Farm has recorded a Little Eagle flying within RSA height at 60 to 79 m, while White Rock Wind Farm has recorded a Little Eagle flying at 50 to 100 m (Umwelt, 2023; and BL&A, 2019).

3.2.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

Little Eagle has historically been observed within the Project area in 2013 and on Graywood Siding Road in 2022 (ERM, 2013; and Ecology Consulting, 2022). One carcass of Little Eagle was found at turbine 21 at C2WF on 26 March 2020 (Nature Advisory, 2020a). Little Eagle has been recorded flying at 80 m high at C2WF through an incidental observation in March 2019, and eight observations with no flight height information provided during point-count surveys of 'at risk' monitoring between the period of July 2020 to September 2020 (Nature Advisory, 2021). Nature Advisory (2021) notes that all observations of Little Eagle occur in areas close to the south edge of the wind farm site close to Pejar Dam.

There have been three observations of Little Eagle within or near the Project area. They include, on:

- 11 August 2023, an incidental sighting of one Little Eagle at the entrance of the Project area at a flight height between 8 to 10 m;
- 10 November 2023, an observation during a BUS of one Little Eagle flying within a range of 80 m and 100 m high approximately one kilometre west of turbine A15; and
- 1 February 2024, an observation during a raptor vantage point survey of one Little Eagle flying within a range of 50 m and 150 m high within the Project area.

In addition to these observations, regular incidental observations have been made of a pair and/or single Little Eagle at or near Pejar Dam by ecologists between 2 November 2023 and 20 February 2024. Another incidental observation of a Little Eagle was made to the north of the Project area (approximately 14 km) on the 12 April 2024.

Based on documents from other consultants and confirmed blade strikes, it is likely that the flight activity observed from within the Project area is an appropriate representation of flight height for the species. Therefore, the Little Eagle is likely to spend a high proportion of its flight time within RSA height whilst within the Project area.

The observations of the species were either associated with areas of canopy vegetation or travelling between these habitat patches. However, based on the broad habitat requirements, the wide range of foraging ability for the species and the highly mobile nature of the species there is potential for the species to occur at any location within the Project area.

3.2.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the Little Eagle is 'high', as seen in **Table 11** with a 'high' likelihood and a 'moderate' consequence of blade strike. The 'high' likelihood for Little Eagle is due to the records of the species within the Project area and the species' flight behaviour. A 'moderate' consequence of collision is conservatively based on both 'low' and 'moderate' risk scores for Criteria C to F, with each criterion discussed further below.

TABLE 11: RISK RATING FOR LITTLE EAGLE

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	High	High	-	-	-	-	High	-	High
Moderate	-	-	-	Moderate	-	Moderate	-	Moderate	-
Low	-	-	Low	-	Low	-	-	-	-

3.2.3.1 CRITERION A (FLIGHT HEIGHT)

Little Eagle is known to soar up to 500 m high while searching for prey or uses an elevated exposed perch (ACT Government, 2013). A high proportion of flight data observed for the species has been within RSA height, additionally, multiple records of the species impacted by blade strike indicate it likely spends a high proportion of its flight activity within RSA height.

3.2.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

The species has been detected within the Project area, with suitable foraging habitat throughout the Project area. There is likely a local pair of Little Eagles near Pejar Dam, where one or both individuals utilise the Project area for foraging. The species likely regularly utilises environments that will increase the likelihood of coming into turbine areas.

3.2.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is mostly widely dispersed within areas of suitable habitat, of which is relatively widely distributed.

3.2.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

The Little Eagle is a resident, territorial species that is long-lived with low breeding productivity. The species breeding pairs are monogamous. Given the low reproductive rate of 0.5 to 1.0 young per pair per year, maturity at two or three years, and a floating population of juvenile and immature eagles, mature individuals probably comprise less than three-quarters of the population (NSW TSSC, 2010). The species most aptly falls into the 'moderate' risk rating for Criterion D.

3.2.3.5 CRITERION E (POPULATION SIZE)

The population size estimate of Little Eagle was estimated to be 10,000 to 100,000 mature individuals in 2009 (BirdLife International, 2024).

3.2.3.6 CRITERION F (LISTED CONSERVATION STATUS)

The Little Eagle is listed as Vulnerable in New South Wales (NSW) under the BC Act.

3.3 Black Falcon

3.3.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

Black Falcon has been recorded flying within RSA height, and as in wind turbine strike mortality. Rye Park 2018/2019 surveys recorded two instances of Black Falcon within RSA height, one flying at 40 to 59 m and another flying at 80 to 99 m (Umwelt, 2023). Bodangora Wind Farm recorded an incidental finding of a Black Falcon carcass under a turbine prior to the commencement of the first-year monitoring period (Nature Advisory, 2021c). Macarthur Wind Farm in southwestern Victoria recorded one mortality (Australian Ecological Research Services, 2014).

3.3.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

There have been no historic sightings of Black Falcon within the Project area, however, C2WF has recorded multiple Black Falcon wind strike mortalities and flights within RSA height. Three Black Falcon carcasses were found during the January 2019 to December 2020 post-construction monitoring period (Nature Advisory, 2021a). Black Falcon was recorded 13 times during incidental observations, of which 7 flights were within RSA height between June 2019 and September 2020 (Nature Advisory, 2021a).

Ecology Consulting conducted works for C2WF on 8 March 2024, during these works a Black Falcon was incidentally observed in flight near to the substation (Ecology Consulting, 2024).

No observations of the species were made within or near the Project area during surveys for the production of the BBAMP.

3.3.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for Black Falcon is 'high', as presented in **Table 12** with a 'high' likelihood and a 'moderate' consequence of blade strike. A 'high' likelihood rating for Black Falcon is due to the records of the species and impacts at C2WF, potential habitat present and the species' flight behaviour. A 'moderate' consequence of collision is based on both 'low' and 'moderate' risk scores for criteria C to F, with each criterion discussed further below.

TABLE 12: RISK RATING FOR BLACK FALCON

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	High	-	-	-	-	-	High	-	High
Moderate	-	Moderate	-	Moderate	Moderate	Moderate	-	Moderate	-
Low	-	-	Low	-	-	-	-	-	-

3.3.3.1 CRITERION A (FLIGHT HEIGHT)

A high proportion of Black Falcon's flight activity has been recorded within RSA height.

3.3.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

Black Falcon inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. The species is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. Suitable habitat is present amongst agricultural land and some woodland throughout the Project area. Due to the no sightings of the species during current surveys, it is likely the species would only occasionally occur within the Project area.

3.3.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is mostly widely dispersed within areas of suitable habitat, of which is relatively widely distributed.

3.3.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Black Falcon is a resident, territorial species that is long-lived with low breeding productivity (Debus and Zuccon, 2013). The age at first breeding is unknown but considered likely to be several years and generation length is unknown but estimated at six years for the similar Grey Falcon and seven years for the Peregrine Falcon (Debus, 2023). Given the population size estimation of less than 10,000 and estimation of 3,000 to 5,000 mature individuals, there is a floating population of juvenile and immature falcons (TSSC, 2013).

The life-history characteristics of Black Falcon overlap with certain aspects of both the descriptions for a 'low' and 'high' rating.

3.3.3.5 CRITERION E (POPULATION SIZE)

The national population size of the Black Falcon was estimated in the 1990s to be in the upper thousands to possibly 10,000 or more birds. It is likely that the population size of the Black Falcon in NSW is moderately low, numbering fewer than 10,000 individuals. (NSW DCEEW, 2013)

3.3.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Black Falcon is listed as Vulnerable in NSW under the BC Act.

3.4 White-bellied Sea-Eagle

3.4.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

White-bellied Sea-Eagle has been recorded as blade strike mortality and frequently within RSA height. Published data has recorded four blade strike mortalities, with one found in a Victorian wind farm between 2003 to 2018 (Moloney *et al.* 2019). The three other mortalities were recorded at Bluff Point Wind Farm in Tasmania (Hull *et al.* 2012). Biosis research analysed White-bellied Sea-Eagle movements during 160 flights recorded from four wind farm sites in Tasmania, finding that 70% of movement was within RSA height (30 to 120 m) (Smales, 2005).

3.4.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

There are no historical sightings of White-bellied Sea-Eagle within the Project area. However, an incidental observation of the species was made at C2WF by Nature Advisory (2021). On 24 February 2020 one individual was recorded at a flight height of approximately 200 m. Based on the flight map the observation is 6 km to the nearest Project turbine.

No sightings of the species have been made from within the Project area during BBAMP surveys. However, an incidental observation of an individual was made at Pejar Dam on 17 December 2023. Although the observations of the species were made outside of the Project area, the observation has been included for risk assessment.

3.4.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the White-bellied Sea-Eagle is 'moderate', as presented in **Table 13** with a 'moderate' likelihood and a 'moderate' consequence of blade strike. The 'moderate' likelihood for White-bellied Sea Eagle is due to the records of the species within the region and the species' flight behaviour. A 'moderate' consequence of collision is based on both 'low' and 'moderate' risk scores for Criteria C to F, with each criterion discussed further below.

TABLE 13: RISK RATING FOR WHITE-BELLIED SEA EAGLE

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	High	-	-	-	-	-	-	-	-
Moderate	-	-	-	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Low	-	Low	Low	-	-	-	-	-	-

3.4.3.1 CRITERION A (FLIGHT HEIGHT)

Biosis Research has found that 70% of movements by White-bellied Sea-Eagles at four wind farm sites were between 30 to 120 m above ground level (Smales, 2005). The species therefore has a high proportion of its flight activity within RSA height.

3.4.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

The Project area does not contain large bodies of water required by White-bellied Sea-Eagle, however, the species has been observed at Pejar Dam within 6 km of the Project area. The species may likely rarely move through the Project area when moving between preferred habitats.

3.4.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is mostly widely dispersed within areas of suitable habitat, of which is relatively widely dispersed.

3.4.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

White-bellied Sea-Eagle first breed at approximately six years old, forming solitary and monogamous pairs that mate for life and defend a breeding territory. The species is long-lived, however, there is a high mortality rate amongst newly independent birds. Immature birds and some adult birds undertake dispersal that consists of extremely long distances (Marchant & Higgins, 1993). There is a floating population of juvenile and immature individuals (NSW TSSC, 2016).

The life-history characteristics of the White-bellied Sea-Eagle overlap with certain aspects of both the descriptions for a 'low' and 'high' rating.

3.4.3.5 CRITERION E (POPULATION SIZE)

The species' NSW population size was estimated at more than 2,500 but fewer than 10,000 individuals (NSW TSSC, 2016). The Australian population is likely greater than 5,000 individuals.

3.4.3.6 CRITERION F (LISTED CONSERVATION STATUS)

White-bellied Sea-Eagle is listed as Vulnerable in NSW under the BC Act.

3.5 White-throated Needletail

3.5.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

White-throated Needletail is frequently detected at RSA height and turbine strikes have been documented at multiple wind farms. Boco Rock Wind Farm recorded two blade strikes of the species (NGH, 2023). Rye Park Wind Farm north of Yass documented 14 sightings at 30 to 99 m above ground (Umwelt, 2023). Forest Wind documented great numbers of White-throated Needletail, with seven records of more than ten individuals within RSA height and the largest flock consisting of 327 individuals (Fox and Co Environmental, 2020). Hull (2012) documented 22 mortalities detected at two wind farms in Tasmania, while Moloney *et al.* (2019) found five mortalities across 15 wind farms in Victoria.

Within the Southern Tablelands region, the species has been recorded within 20 km of the Project area at Gullen Range Wind Farm in Bannister, NSW (BL&A, 2016). White-throated Needletail was observed during the BUS conducted in summer 2012, where ten individuals were observed on two separate occasions, once below RSA height, and the second time at RSA height.

3.5.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

There has been one historic observation of White-throated Needletail within the Project area. Four individuals were opportunistically observed flying over within 50 m of the turbine A12 location during surveys conducted in 2013 (ERM, 2013).

No observations of the species have been recorded during pre-operational surveys for the production of the BBAMP.

3.5.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for White-throated Needletail is conservatively estimated as 'high' as presented in **Table 14**, with a 'high' likelihood and a moderate consequence of blade strike. The 'moderate' likelihood of White-throated Needletail is due to the species' widespread use of environments, the records of the species within the region and the species' flight behaviour. A 'moderate' consequence of collision is based on 'moderate' risk scores for Criteria C to F, with each criterion discussed further below.

TABLE 14: RISK RATING FOR WHITE-THROATED NEEDLETAIL

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	High	-	-	-	-	-	High	-	High
Moderate	-	Moderate	Moderate	Moderate	Moderate	Moderate	-	Moderate	-
Low	-	-	-	-	-	-	-	-	-

3.5.3.1 CRITERION A (FLIGHT HEIGHT)

White-throated Needletail is known to fly within RSA height frequently.

3.5.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

The species regularly utilises various environments, including most often above wooded areas and travelling ahead of storm fronts (TSSC, 2019) that will increase the likelihood of entering turbine areas. Suitable foraging habitat for the species occurs within the Project area, though it may only be occasionally present.

3.5.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species has a very large range, however it may have preferred foraging areas or use particular migratory paths.

3.5.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

The life-history characteristics of White-throated Needletail overlap with certain aspects of both the descriptions for a 'low' and 'high' rating (TSSC, 2019).

3.5.3.5 CRITERION E (POPULATION SIZE)

The population size has not been quantified, but it is not believed to approach the thresholds for Vulnerable under the population size criterion (< 10,000 mature individuals with a continuing decline estimated to be >10% in ten years or three generations, or with a specified population structure) (BirdLife International, 2024).

3.5.3.6 CRITERION F (LISTED CONSERVATION STATUS)

The White-throated Needletail is listed as Vulnerable and Migratory throughout Australia under the EPBC Act.

3.6 Powerful Owl

3.6.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There have been no published records of Powerful Owl blade strikes at Australian wind farms. It has been recorded twice below RSA height with one record in the Southern Tablelands at Gullen Range Wind Farm at 20 m above ground, and another record at 10 m above ground at Lotus Creek Wind Farm (Central Queensland) (BL&A, 2017b; and Nature Advisory, 2022b).

3.6.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

There are historical observations from July to August 2013 by ERM (2013) during spotlight and call playback surveys.

There have been no sightings of the species within the Project area during nocturnal surveys during preparation of the BBAMP. However, the observed overpopulation of prey species, Eastern Ringtail Possum, suggests that there may be a key missing predator species within the ecosystem.

3.6.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for Powerful Owl is 'moderate', as presented in **Table 15**, with a 'moderate' likelihood and a 'moderate' consequence of blade strike. The 'moderate' likelihood for Powerful Owl is due to the cautious application of risk due to the historic occurrence of the species within the Project area and likely species' flight behaviour. A 'moderate' consequence of collision is based on both 'low', 'moderate', and 'high' risk scores for Criteria C to F, with each criterion discussed further below.

TABLE 15: RISK RATING FOR POWERFUL OWL

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	-	-	-	High	High	-	-	-	-
Moderate	Moderate	Moderate	-	-	-	Moderate	Moderate	Moderate	Moderate
Low	-	-	Low	-	-	-	-	-	-

3.6.3.1 CRITERION A (FLIGHT HEIGHT)

A moderate rating has been chosen for this criterion based on the expert opinions collated by the Arthur Rylah Institute for Environmental Research (Lumsden *et al.* 2019).

3.6.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

If Powerful Owl is present, it is likely largely confined to its preferred environment, forests which is present within the southern and eastern sections of the Project area. The species may fly through turbine areas when moving between preferred environments. A 'moderate' risk rating has been attributed as a precaution.

3.6.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

Species is widely dispersed within areas of suitable habitat that itself is relatively widely distributed.

3.6.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Powerful Owls are long-lived and have low fecundity. A high rating has been chosen for this criterion based on the expert opinions collated by the Arthur Rylah Institute for Environmental Research (Lumsden *et al.* 2019).

3.6.3.5 CRITERION E (POPULATION SIZE)

The population was estimated at 3,250 to 4,250 individuals in 2000 (BirdLife International, 2024).

3.6.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Powerful Owl is listed as Vulnerable in NSW under the BC Act.

3.7 Barking Owl

3.7.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There are no published records of blade strike on or flight within RSA height for Barking Owl.

3.7.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

There have been no observations of Barking Owl within either C2WF or the Project area.

3.7.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for Barking Owl is ‘moderate’, as seen in **Table 16** with a ‘moderate’ likelihood and a ‘moderate’ consequence of blade strike. The ‘moderate’ likelihood for Barking Owl is due to the potential occurrence of the species within the Project area and the species’ flight behaviour. A ‘moderate’ consequence of collision is based on a spread of ‘low’, ‘moderate’ and ‘high’ risk scores for Criteria C to F, with each criterion discussed further below.

TABLE 16: RISK RATING FOR BARKING OWL

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	-	-	-	High	-	-	-	-	-
Moderate	Moderate	-	-	-	Moderate	Moderate	Moderate	Moderate	Moderate
Low	-	Low	Low	-	-	-	-	-	-

3.7.3.1 CRITERION A (FLIGHT HEIGHT)

Barking Owl rely on large trees as hunting perches, occasionally flying above canopies which may include flight within RSA height. There is no available data for the species flight behaviour, a ‘moderate’ risk is assigned due to this uncertainty.

3.7.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

Potential forest habitat is present within the southern and eastern sections of the Project area, However, no observations or evidence indicates that the species has been present within the Project area, therefore it is likely that the species rarely occurs and a ‘low’ risk rating has been applied.

3.7.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is mostly widely dispersed within areas of suitable habitat, of which is relatively widely dispersed.

3.7.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Barking Owl is socially monogamous and territorial, with no known cases of long-range movement (Olsen and Marks, 2023). The species has a low reproduction rate (NSW TSSC, 1998). The life-history information available indicates characteristics of the Barking Owl most align with a ‘high’ rating.

3.7.3.5 CRITERION E (POPULATION SIZE)

The total population of Barking Owl has not been quantified, however, it is believed to be above 10,000 individuals (BirdLife International, 2024).

3.7.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Barking Owl is listed as Vulnerable in NSW under the BC Act.

3.8 Gang-gang Cockatoo

3.8.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There has been one record of Gang-gang Cockatoo blade strike available from the Southern Tablelands region at the Taralga Wind Farm (BL&A, 2018c). Two individual Gang-gang Cockatoos have been observed flying at RSA height (30 to 240 m) at Paling Yards Wind Farm (Hunter Ecology, 2022). Reports produced for other wind farms indicate that there are additional unpublished data of the species consistently flying at RSA height (BL&A, 2017a).

3.8.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

Gang-gang Cockatoos have historically been observed within the Project area in 2013 and 2020 (ERM, 2013 and Cumberland Ecology, 2022). Gang-gang Cockatoo was recorded frequently during bird utilisation surveys and through incidental observation at the Project area. Gang-gang Cockatoo was observed during all seasons surveyed around the forested areas of the landscape. These include, on:

- 24 August 2023 two Gang-gang Cockatoos heard calling,
- 25 August 2023 a male and female Gang-gang Cockatoo flew at an average of 20 m high,
- 17 October 2023 Gang-gang Cockatoo call heard in incidental observation,
- 8 November 2023 two individuals observed on the ground,
- 16 January 2024 Gang-gang Cockatoo call heard,
- 17 January 2024 Gang-gang Cockatoo call heard,
- 18 January 2024 Gang-gang Cockatoo call heard,
- 23 January 2024 a group of Gang-gang Cockatoo heard, estimated to be approximately 12 individuals,
- 24 January 2024 four separate survey observations:
 - an observation in morning surveys of a group of 10 seen flying at an average height of 25 m high,
 - an observation of a group of 14 in afternoon surveys flying at an average height of 20 m high,
 - an observation of a group calling (recorded as one call observation), and
 - an observation of an individual calling (recorded as one call observation), and
- On 25 January 2024 two separate survey observations:
 - a group of six individuals flying at 8 m high, and
 - two individuals at another location flying at 15 m high.
- 13 March an incidental observation of 15 to 25 Gang-gang Cockatoos were settling to roost in a patch of forest next to turbine A15.
- 19 March 2024 three separate survey observations occurred:

- Gang-gang Cockatoo call heard,
- Gang-gang Cockatoo call heard, and
- Gang-gang Cockatoo call heard.
- 20 March 2024 three separate survey observations:
 - Two Gang-gang Cockatoo observed flying at a flight height of 15 m high,
 - Six Gang-gang Cockatoo observed flying at a flight height of 15 m high, and
 - Gang-gang Cockatoo call heard.
- 26 March 2024 two observations:
 - Gang-gang Cockatoo call heard, and
 - Five Gang-gang Cockatoo observed flying at a flight height of 20 m high.
- 28 March 2024 two observations:
 - Gang-gang Cockatoo call heard, and
 - Gang-gang Cockatoo call heard.

Based on information from other consultants and confirmed blade strikes, it is likely that the height range of flight observed within the Project area does not correspond with the maximum flight height for the species.

The observations of the species were largely constrained to areas of canopy vegetation and observations of Gang-gang Cockatoos travelling between forest and/or woodland patches of habitat. Observations from Cumberland Ecology (2022) indicate that there are plenty of suitable hollows for breeding throughout the forested areas in the south and southeast of the Project area. Although the species is more likely to occur near these habitat areas, the species is highly mobile and has a reasonably wide distribution throughout the Southern Tablelands region. The Gang-gang Cockatoo is likely to spend a high proportion of time at RSA height whilst flying within the Project area.

3.8.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the Gang-gang Cockatoo is 'high' as presented in **Table 17**, with a 'high' likelihood and a 'moderate' consequence of blade strike. The 'high' likelihood for Gang-gang Cockatoo is due to the regular occurrence of the species within the Project area and the species' flight behaviour. A 'moderate' consequence of collision is based on a spread of both 'low' and 'high' risk scores for Criteria C to F, with each criterion discussed further below.

TABLE 17: RISK RATING FOR GANG-GANG COCKATOO

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	High	High	-	High	-	High	High	-	High
Moderate	-	-	-	-	-	-	-	Moderate	-
Low	-	-	Low	-	Low	-	-	-	-

3.8.3.1 CRITERION A (FLIGHT HEIGHT)

A high proportion of Gang-gang Cockatoo flight activity has been observed to be at RSA or near-to RSA height both within observations made at the Project area and within other wind farm flight height and blade strike data.

3.8.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

Gang-gang Cockatoo has been observed to regularly occur within the Project area, with suitable breeding and foraging habitat present in the south and eastern forested areas.

3.8.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is mostly widely dispersed within areas of suitable habitat, of which is relatively widely dispersed.

3.8.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Like other cockatoo species, the life-history characteristics of Gang-gang Cockatoo is characterised by long life spans and have a generation time calculated to be 6.9 years (DAWE, 2022). The species breeding pairs are monogamous, which can be seen in small groups of up to 25 individuals. The life-history of Gang-gang Cockatoo is long-lived, has a low fecundity and most aptly falls into the 'high' risk rating for Criterion D.

3.8.3.5 CRITERION E (POPULATION SIZE)

The population size estimate for Gang-gang Cockatoo is numbered to be 25,300 mature individuals (Cameron *et al.* 2021).

3.8.3.6 CRITERION F (LISTED CONSERVATION STATUS)

The Gang-gang Cockatoo is listed as Endangered throughout Australia under the EPBC Act and listed as Vulnerable in NSW under the BC Act.

3.9 Superb Parrot

3.9.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

Superb Parrots have been recorded at multiple wind farms flying within RSA height, however, there are no records of blade strike of Superb Parrot in the available literature. Groups of five to ten individuals have been recorded flying 30 to 50 m above ground at Coppabella Wind Farm, Rye Park Wind Farm and Bodangora Wind Farm (NGH, 2017; Umwelt, 2023; and Nature Advisory, 2021c).

3.9.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

There are no historical sightings of Superb Parrot in the Project area or C2WF mentioned in accessible documents. Superb Parrots were not observed within any prescribed bird surveys conducted on-site, however, two incidental observations of the species were made near the Project area and have been included for risk assessment. These include, on:

- 31 January 2024 four individuals were observed 500 m south of Graywood Siding Road and Woodhouselee intersection, approximately 3 km SW of turbine A24. Superb Parrots flying WNW at approximately 20 m high, and
- 2 February 2024 three individuals were observed approximately 12 km north of turbine A5.

3.9.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the Superb Parrot is 'moderate' as presented in **Table 18**, with a 'moderate' likelihood and a 'moderate' consequence of blade strike. The 'moderate' likelihood of Superb Parrot is due to the cautious occasional occurrence of the species near the Project area and the species' flight behaviour. A 'moderate' consequence of collision is based on 'moderate' risk scores for Criteria C to F, with each criterion discussed further below.

TABLE 18: RISK RATING FOR SUBURB PARROT

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	-	-	-	-	-	-	-	-	-
Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Low	-	-	-	-	-	-	-	-	-

3.9.3.1 CRITERION A (FLIGHT HEIGHT)

It is likely that Superb Parrot regularly flies below RSA height and has been observed occasionally flying at RSA height.

3.9.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

The Project area contains potentially suitable habitat, however, the location of the Project area would be considered on the edges of the Superb Parrot population's range of South West Slopes and Southern Tablelands bioregions. It is therefore likely that the species occasionally occurs within or moves through the Project area (TSSC, 2016).

3.9.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

There are three main breeding population areas for Superb Parrot, the closest to the Project area is the areas of the South West Slopes, bounded by Molong, Rye Park, Yass, Coolac, Cootamundra and Young (TSSC, 2016). Outside the breeding season, the populations may migrate with plant productivity into other parts of NSW, including northern NSW (TSSC, 2016). Therefore, the species has portions of time where its population is likely to be somewhat concentrated within a region despite flexibility with its range and suitable habitat, and a 'medium' risk rating has been applied.

3.9.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

The life history characteristics of Superb Parrot fall between the 'high' and 'low' descriptions of this criterion (TSSC, 2016).

3.9.3.5 CRITERION E (POPULATION SIZE)

The most recent population estimate in 2016 was for 10,000 to 20,000 individuals, however, agreement on population estimates is lacking amongst experts (BirdLife International, 2024).

3.9.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Superb Parrot is listed as Vulnerable throughout Australia under the EPBC Act and Vulnerable in NSW under the BC Act.

3.10 Scarlet Robin

3.10.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There are no published records of blade strike or flight within RSA height on Scarlet Robin. Multiple records of Scarlet Robin flying below RSA height have been documented including 41 sightings at Yarram Wind Farm, 55 records at Bango Wind Farm and 22 records at Gullen Range Wind Farm (BL&A, 2006; Nature Advisory, 2021b; and BL&A, 2017).

3.10.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

Scarlet Robins have historically been observed within the Project area in 2013 and 2020 (ERM, 2013; and Cumberland Ecology, 2022). Scarlet Robin was recorded multiple times throughout the bird utilisation surveys, particularly through the winter surveys season. Observations of the species include, on:

- 15 August 2023 three observations: two sighted observations of a male and female Scarlet Robin with a flight height average of 2 m high and a call observation of two Scarlet Robins,
- 16 August 2023 three observations: one observation of a male Scarlet Robin flying at a flight height of 1 m high, one observation of a Scarlet Robin with a flight height of 2 m and an observation of two Scarlet Robins calling,
- 17 August 2023 three observations: one Scarlet Robin calling, another observation of two Scarlet Robin calling, and one Scarlet Robin was observed flying at 3 m high,
- 24 August 2023 one observation of two Scarlet Robins heard calling,
- 25 August 2023 Scarlet Robin's call was observed during three surveys,
- 28 August 2023 one observation of Scarlet Robin's call,
- 17 October 2023 one observation of Scarlet Robin's call,
- 18 March 2024 three observations: one Scarlet Robin calling, another male and female adult Scarlet Robin observed at a flight height of 10 m, and another observation, likely of the same pair within a mixed species flock at a flight height of 5 m high,
- 19 March 2024 two observations of Scarlet Robin heard calling,
- 20 March 2024 two observations: two Scarlet Robin observed at a flight height of 2 m in a mixed species flock, and two Scarlet Robin observed within a classic winter mixed species flock with a flight height of 0 – 10 m,
- 26 March 2024 four observations: one Scarlet Robin within a mixed species flock with a flight height of 10 m, a Scarlet Robin heard calling, one Scarlet Robin observed with a flight height of 5 m, and one Scarlet Robin (likely the previous observed) with a flight height of 15 m,
- 27 March 2024 six observations: five observations of Scarlet Robin heard calling and one observation of one Scarlet Robin in a mixed species flock with a flight height of 15 m,
- 28 March 2024 three observations: two observations of Scarlet Robin heard calling, and two Scarlet Robin observed within a mixed species flock with a flight height of 10 m.

Many of these observations of the species were constrained to areas of canopy vegetation, in particular, low in the strata utilising fallen timber and low branches. Other observations included the species in association with a winter mixed species flock, foraging in derived native grasslands and shrubby areas on the edges of forested areas.

3.10.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the Scarlet Robin is 'low' as presented in **Table 19**, with a 'low' likelihood and a 'moderate' consequence of blade strike. The 'low' likelihood of Scarlet Robin is due to the sedentary nature of the species within its habitats and the species' flight behaviour. A 'moderate' consequence of collision is based on both 'low' and 'moderate' risk scores for criteria C to F, with each criterion discussed further below.

TABLE 19: RISK RATING FOR SCARLET ROBIN

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	-	-	-	-	-	-	-	-	-
Moderate	-	-	-	-	Moderate	Moderate	-	Moderate	-
Low	Low	Low	Low	Low	-	-	Low	-	Low

3.10.3.1 CRITERION A (FLIGHT HEIGHT)

There are multiple records of Scarlet Robin flying below RSA height and no published records of flight at RSA height.

3.10.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

Scarlet Robin has been recorded regularly within the Project area, though inhabits environments in a largely sedentary manner, mostly restricted to forested areas and below the canopy.

3.10.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is widely dispersed within areas of suitable habitat, of which is relatively widely distributed.

3.10.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Scarlet Robin are a short-lived species and have a high fecundity, potentially raising two or three broods in each season (Debus, 2006).

3.10.3.5 CRITERION E (POPULATION SIZE)

The population size has not been quantified but is not believed to be less than 10,000 individuals (BirdLife International, 2024).

3.10.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Scarlet Robin is listed as Vulnerable in NSW under the BC Act.

3.11 Flame Robin

3.11.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There are two published records of blade strike on Flame Robin. A record of single mortality is from Bluff Point Wind Farm in Tasmania, and another single mortality from Oaklands Hill Wind Farm in Victoria (Hull *et al.* 2013 and Australian Ecological Research Services, 2021). Eco Logical (2022) reported two Flame Robin observed below RSA height at Crudine Wind Farm. BL&A (2006) observed 16 Flame Robin flying below the proposed RSA height (< 20 m) for assessing Yarram Wind Farm in Victoria.

3.11.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

There have been no observations of this species within the Project area.

3.11.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the Scarlet Robin is 'low' as presented in **Table 20**, with a 'low' likelihood and a 'moderate' consequence of blade strike. The 'low' likelihood of Scarlet Robin is due to the sedentary nature of the species within its habitats and the species' flight behaviour. A 'moderate' consequence of collision is based on both 'low' and 'moderate' risk scores for criteria C to F, with each criterion discussed further below.

TABLE 20: RISK RATING FOR FLAME ROBIN

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	-	-	-	-	-	-	-	-	-
Moderate	Moderate	Moderate	-	-	-	Moderate	Moderate	-	-
Low	-	-	Low	Low	Low	-	-	Low	Low

3.11.3.1 CRITERION A (FLIGHT HEIGHT)

There are multiple records of Flame Robin flying below RSA height and records of the species being impacted by blade strike, it is likely that the Flame Robin predominantly flies below RSA height with some flight activity occurring within RSA height.

3.11.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

Flame Robin has not been recorded within the Project area. There is suitable habitat present within the south and eastern forested areas of the Project area. If the species does utilise the environments within the Project area, it likely will only occasionally move through turbine areas when transiting between preferred habitats.

3.11.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is widely dispersed within areas of suitable habitat that itself is relatively widely distributed.

3.11.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Flame Robin is a short-lived species and has a high fecundity, potentially raising up to three broods in each season (Boles, 2020).

3.11.3.5 CRITERION E (POPULATION SIZE)

The population size is very large and has been quantified to 8,700,000 mature individuals, ranging between 1,200,000 to 9,600,000 (BirdLife International, 2024).

3.11.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Flame Robin is listed as Vulnerable in NSW under the BC Act.

3.12 Rufous Fantail

3.12.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There have been two records of blade strike on Rufous Fantail in south eastern NSW at Boco Rock Wind Farm (NGH, 2023). There have been records of the species flying under RSA height at Lotus Creek Wind Farm (Nature Advisory, 2022b).

3.12.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

There are no historical sightings of Rufous Fantail within the Project area or C2WF mentioned in accessible documents. one Rufous Fantail was observed on 1 February 2024 in a bird utilisation survey during the summer survey season. Rufous Fantail was observed with an average flight height of 4 m.

3.12.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for Rufous Fantail is 'moderate' as presented in **Table 21**, with a 'moderate' likelihood and a 'moderate' consequence of blade strike. The 'moderate' likelihood for Rufous Fantail is

due to the detection of the species within the Project area and the species' flight behaviour. A 'moderate' consequence of collision is based on both 'low' and 'moderate' risk scores for criteria C to F, with each criterion discussed further below.

TABLE 21: RISK RATING FOR RUFOUS FANTAIL

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	-	-	-	-	-	-	-	-	-
Moderate	Moderate	Moderate	-	Moderate	Moderate	-	Moderate	Moderate	Moderate
Low	-	-	Low	-	-	Low	-	-	-

3.12.3.1 CRITERION A (FLIGHT HEIGHT)

There are few records of Rufous Fantail flight activity, but the records indicate activity of the species is primarily below RSA height and may occasionally fly within RSA height.

3.12.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

Rufous Fantail is a migratory species within the region, observations within the Project area are likely associated with species transiting between preferred wet sclerophyll habitats (DEH, 2006). Therefore, Rufous Fantail are likely to occasionally move through the Project area.

3.12.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is widely dispersed within areas of suitable habitat, of which is relatively widely distributed.

3.12.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

The life-history characteristics of Rufous Fantail overlap with certain aspects of both the descriptions for a 'low' and 'high' rating (Boles *et al.* 2023).

3.12.3.5 CRITERION E (POPULATION SIZE)

The population size has not been quantified but is not believed to be less than 10,000 individuals (BirdLife International, 2024).

3.12.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Rufous Fantail is listed as Migratory throughout Australia under the EPBC Act.

3.13 Varied Sittella

3.13.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There are no published records of blade strike or flight within RSA height for Varied Sittella, and many records of the species flying below RSA height. Records within the NSW Southern Tablelands include 12 recorded less than 30 m above ground at Collector Wind Farm, 34 records below RSA height at Bango Wind Farm, eight records flying 10 to 29 m above ground at Rye Park Wind Farm, and 101 records below RSA height at Gullen Range Wind Farm (BL&A, 2014; Nature Advisory, 2021b; Umwelt, 2023; and BL&A, 2017b).

3.13.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

Varied Sittella have historically been observed within or near the Project area in 2013, 2017, 2019 and 2020 (ERM, 2013; BL&A 2018b; Nature Advisory, 2020a; and Cumberland Ecology, 2022). All

observations of the species that have flight height data included record the species to be flying below RSA height.

Three observations of Varied Sittella were made during March 2024 BUS surveys, with one observation likely surveyors counting the same flock of birds from a different area. The observations of the species include:

- 26 March 2024 one observation of 16 Varied Sittella flying at a flight height of 15 m,
- 26 March 2024 (from same observation site and start time, likely same flock) one observation of 15 Varied Sittella at a flight height of 20 m, and
- 27 March 2024 one observation of 10 Varied Sittella at a flight height of 15 m high in a mixed species flock.

3.13.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the Varied Sittella is ‘moderate’ as presented in **Table 22**, with a ‘moderate’ likelihood and a ‘moderate’ consequence of blade strike. The ‘moderate’ likelihood of Varied Sittella is due to the historic detection of the species within the Project area and the species’ flight behaviour. A ‘low’ consequence of collision is based on both ‘low’ and ‘moderate’ risk scores for criteria C to F, with each criterion discussed further below.

TABLE 22: RISK RATING FOR VARIED SITTELLA

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	-	-	-	-	-	-	-	-	-
Moderate	-	Moderate	-	-	Moderate	Moderate	Moderate	Moderate	Moderate
Low	Low	-	Low	Low	-	-	-	-	-

3.13.3.1 CRITERION A (FLIGHT HEIGHT)

It is likely that Varied Sittella will rarely fly at RSA height within the Project area.

3.13.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

Varied Sittella has historically been recorded within the Project area with forest present in the southern and eastern sections of the Project area providing suitable habitat. Species utilise the entire canopy of forested habitat, potentially moving through turbine area when moving between preferred habitats.

3.13.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is widely dispersed within areas of suitable habitat, of which is relatively widely distributed.

3.13.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Given that Varied Sitella is not long-lived, has relatively high fecundity and a high capacity to replace individuals lost (Higgins and Peter, 2002). The species most aptly falls into the ‘low’ risk rating for Criterion D.

3.13.3.5 CRITERION E (POPULATION SIZE)

The total population of Varied Sittella has not been quantified, however, it is believed to be above 10,000 individuals (BirdLife International, 2024).

3.13.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Varied Sittella is listed as Vulnerable in NSW under the BC Act.

3.14 Dusky Woodswallow

3.14.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There is one record of blade strike and multiple records of flight within RSA height for Dusky Woodswallow. Moloney *et al.* (2019) reported one blade strike at Victorian wind farms during post-construction mortality monitoring between 2003 and 2018. Multiple records of Dusky Woodswallow flight within RSA height include Silvertown Wind Farm, Crudine Ridge Wind Farm and Rye Park Wind Farm (Biosis, 2021; Eco Logical Australia, 2022; and Umwelt, 2023).

3.14.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

Dusky Woodswallow has historically been observed within the Project area in 2013, 2017 and 2020 (ERM, 2013; BL&A, 2018b; and Cumberland Ecology, 2022). The species also was recorded at C2WF during 2017 BUS and 2019 BUS with the majority of flight observations recorded below RSA height (BL&A, 2018b; and Nature Advisory, 2020a). Observations of Dusky Woodswallow within the Project area include:

- 25 January 2024 an incidental observation of a group of approximately 10 Dusky Woodswallow flew at a height of 20 m, at and above the canopy of a small patch of trees,
- 19 March 2024 an observation of 10 Dusky Woodswallow flying at a flight height of 20 m high. Additionally, an observation of a Dusky Woodswallow call was recorded for this same site and start time, this is likely the same group observed, and
- 20 March 2024 an observation of two Dusky Woodswallow at a flight height of 20 m high.

Another observation of a flock of approximately 50 Woodswallow sp. was observed during BUS surveys flying at a height of 40 m high, however confirmation on whether this was Dusky Woodswallow could not be ascertained. Flight height between Woodswallow spp. is likely comparable.

3.14.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the Dusky Woodswallow is ‘moderate’ as presented in **Table 23**, with a ‘high’ likelihood and a ‘low’ consequence of blade strike. The ‘high’ likelihood for Dusky Woodswallow is due to the detection of the species within the Project area and the species’ flight behaviour. A ‘low’ consequence of collision is based on both ‘low’ and ‘moderate’ risk scores for criteria C to F, with each criterion discussed further below.

TABLE 23: RISK RATING FOR DUSKY WOODSWALLOW

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	High	-	-	-	-	-	High	-	-
Moderate	-	Moderate	-	-	-	Moderate	-	-	Moderate
Low	-	-	Low	Low	Low	-	-	Low	-

3.14.3.1 CRITERION A (FLIGHT HEIGHT)

A high proportion of Dusky Woodswallow activity is likely at RSA height.

3.14.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

Dusky Woodswallow has been recorded within the Project area and suitable habitat is present in forest areas within the southern and eastern sections. The species may fly through turbine areas when moving between these preferred habitats.

3.14.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is widely dispersed within areas of suitable habitat, of which is relatively widely distributed.

3.14.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Dusky Woodswallow is not long-lived, has relatively high fecundity and a high capacity to replace individuals lost (Higgins *et al.* 2006). The species most aptly falls into the 'low' risk rating for Criterion D.

3.14.3.5 CRITERION E (POPULATION SIZE)

The total population size has not been quantified, however, the NSW TSSC consider the total population in NSW unlikely to be low or moderately low using published density estimates in 2014 that estimate population size of approximately 200,000 adults in NSW (NSW TSSC, 2015).

3.14.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Dusky Woodswallow is listed as Vulnerable in NSW under the BC Act.

3.15 Diamond Firetail

3.15.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There are no published records of Diamond Firetail blade strike or flight within RSA height. Crystal Brook Energy Park recorded 24 individuals on the ground foraging and drinking (EBS Ecology, 2018). Surveying for the proposed Winterbourne Wind Farm project found nine individuals flying at less than 40 m above ground (NGH, 2022).

3.15.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

There are historic records of Diamond Firetail in 2017 and 2019 (BL&A, 2018b; and Nature Advisory, 2020a). BL&A (2018b) indicate that records are incidental sightings made between the Project area and C2WF in the cable corridor area. Nature Advisory (2020a) records some 2019 C2WF BUS counts where the species was observed flying below RSA height. However, there have been no observations within the Project area during BBAMP surveys.

3.15.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the Diamond Firetail is 'low' as presented in **Table 24**, with a 'moderate' likelihood and a 'low' consequence of blade strike. The 'moderate' likelihood for Diamond Firetail is due to the species' wide use of habitats, historical observations and the species' flight behaviour. A 'low' consequence of collision is based on predominately 'low' risk scores for criteria C to F, with each criterion discussed further below.

TABLE 24: RISK RATING FOR DIAMOND FIRETAIL

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	-	High	-	-	-	-	-	-	-
Moderate	-	-	-	-	-	Moderate	Moderate	-	-
Low	Low	-	Low	Low	Low	-	-	Low	Low

3.15.3.1 CRITERION A (FLIGHT HEIGHT)

It is likely that Diamond Firetail will rarely fly within RSA height.

3.15.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

Potential habitat for Diamond Firetail is present throughout the Project area, in the form of areas of canopy vegetation, scattered trees and farmland (DCCEEW, 2023b).

3.15.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is widely dispersed within areas of suitable habitat, of which is relatively widely distributed.

3.15.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Diamond Firetail has relatively high fecundity (Immelman, 1982).

3.15.3.5 CRITERION E (POPULATION SIZE)

BirdLife International estimates the total population to consist of 68,000 to 272,000 individuals (BirdLife International, 2024).

3.15.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Diamond Firetail is listed as Vulnerable throughout Australia under the EPBC Act and listed as Vulnerable in NSW under the BC Act.

3.16 Southern Whiteface

3.16.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There are no published records of blade strike or activity within RSA height for Southern Whiteface, however there are multiple records of activity below RSA height. The Ararat Wind Farm in western Victoria reported two observations of Southern Whiteface below 30 m above ground (BL&A, 2018a). Silverton Wind Farm in northwestern NSW recorded 104 individuals below RSA height (Biosis, 2021).

3.16.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

There have been no observations of this species within the Project area.

3.16.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the Southern Whiteface is 'negligible' as presented in **Table 25**, with a 'low' likelihood and a 'low' consequence of blade strike. The 'low' likelihood for Southern Whiteface is due to the species' sedentary nature within its habitats and flight behaviour. A 'low' consequence of collision is based on predominately 'low' risk scores for criteria C to F, with each criterion discussed further below.

TABLE 25: RISK RATING FOR SOUTHERN WHITEFACE

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	-	-	-	-	-	-	-	-	-
Moderate	-	-	-	-	-	Moderate	-	-	-
Low	Low	Low	Low	Low	Low	-	Low	Low	Negligible

3.16.3.1 CRITERION A (FLIGHT HEIGHT)

Southern Whiteface rarely flies within RSA height.

3.16.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

Potential habitat for Southern Whiteface is available within the areas of canopy vegetation and shrubby areas within the Project area, however, the species is almost exclusively found foraging on the ground in its understory habitats (DCCEW, 2023a). The species therefore inhabits environments in a predominantly sedentary manner, largely confining to those environments.

3.16.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is widely dispersed within areas of suitable habitat, of which is relatively widely distributed.

3.16.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Southern Whiteface are short-lived with a high fecundity, as can be seen from their estimated generation length of 2.8 years (Bird *et al.* 2020).

3.16.3.5 CRITERION E (POPULATION SIZE)

The population has been estimated at 477,000 individuals (BirdLife International, 2024).

3.16.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Southern Whiteface is listed as Vulnerable throughout Australia under the EPBC Act and listed as Vulnerable in NSW under the BC Act.

3.17 White-fronted Chat

3.17.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There has been one published record of a blade strike and one of flight within RSA height for White-fronted Chat. One carcass was recorded by Hull (2012) during a study of avian collisions at two wind farms in Tasmania, while Rye Park Wind Farm recorded 19 individuals flying at 30 to 59 m above ground (Umwelt, 2023).

3.17.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

White-fronted Chat had one historic observation within the Project area in 2013, with two individuals sighted in the pasture near the entrance to the Project area (ERM, 2023). There have been no observations of this species within the Project area during surveys for the production of the BBAMP.

3.17.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the White-fronted Chat is 'moderate' as presented in **Table 26**, with a 'moderate' likelihood and a 'moderate' consequence of blade strike. The 'moderate' likelihood of White-fronted Chat is due to the species' potential occurrence within the Project area and flight behaviour. A

‘moderate’ consequence of collision is based on both ‘low’ and ‘moderate’ risk scores for criteria C to F, with each criterion discussed further below.

TABLE 26: RISK RATING OF WHITE-FRONTED CHAT

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	-	-	-	-	-	-	-	-	-
Moderate	Moderate	Moderate	-	-	Moderate	Moderate	Moderate	Moderate	Moderate
Low	-	-	Low	Low	-	-	-	-	-

3.17.3.1 CRITERION A (FLIGHT HEIGHT)

Rye Park Wind Farm records of White-fronted Chat consist of 67 records below 30 m, and 19 records above 30 m above ground level. The flight activity of this species is likely to predominantly occur below RSA height though occasionally at RSA height.

3.17.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

Potential habitat exists within the Project area in the form of open grasslands and shrubs bordering wetland areas within the Project area. White-fronted Chat has been recorded at Pejar dam within 4 km of the Project area and a historic observation for the species exists within the Project area. Likely, the species occasionally occurs within the Project area.

3.17.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is widely dispersed within areas of suitable habitat, of which is relatively widely distributed.

3.17.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Given that White-fronted Chat is not long-lived, has relatively high fecundity and a high capacity to replace individuals lost (Higgins *et al.* 2001), the species most aptly falls into the ‘low’ risk rating for Criterion D.

3.17.3.5 CRITERION E (POPULATION SIZE)

The population has not been quantified, but it is not believed to be less than 10,000 mature individuals (BirdLife International, 2024).

3.17.3.6 CRITERION F (LISTED CONSERVATION STATUS)

The White-fronted Chat is listed as Vulnerable in NSW under the BC Act.

3.18 Large Bent-winged Bat

3.18.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There is one published record of blade strike and one record of activity within RSA height for Large Bent-winged Bat. Boco Rock Wind Farm recorded four carcasses during carcass searches, while Bango Wind Farm recorded a call using a bat acoustic recorder placed at 50 m above ground (NGH, 2023; and Nature Advisory, 2021b). A report for Rye Park Wind Farm indicates that there is unpublished data on Large Bent-winged Bat blade strikes within southeast NSW (Umwelt, 2023).

3.18.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

Large Bent-winged Bat had historic identification in 2020 during microchiropteran bat surveys conducted by Cumberland Ecology (2022). Large Bent-winged Bat/Forest bat multi-species complex have been observed in 2017 at C2WF and the Project area (BL&A, 2018b), with both observations from ground monitoring sites.

Calls from Large Bent-winged Bat were positively identified from four sites within the Project area during spring 2023 monitoring period. They include:

- Site 1: 80 positively attributed calls to the species;
- Site 2: 35 positively attributed calls to the species;
- Site 3: 18 positively attributed calls to the species; and
- Site 6: 42 positively attributed calls to the species.

Calls from Large Bent-winged Bat were positively identified from five sites within the Project area during autumn 2024 monitoring period, including:

- Site 1: 4 positively attributed calls to the species;
- Site 2: 27 positively attributed calls to the species;
- Site 3: 4 positively attributed calls to the species;
- Site 5: 30 positively attributed calls to the species; and
- Site 6: 26 positively attributed calls to the species.

Due to the nature of the bat detection systems, the abundance of Large Bent-winged Bat cannot be inferred from the number of calls recorded. All recordings were confirmed from ground monitoring sites.

3.18.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the Large Bent-winged Bat is 'severe' as presented in **Table 27**, with a 'high' likelihood and a 'high' consequence of blade strike. The 'high' likelihood of Large Bent-winged Bat is due to the species' detection within the Project area and flight behaviour. A 'high' consequence of collision is due to a 'high' risk score for Criterion C, which indicates a potential risk of high mortality to a species with limited distribution or potential high concentration. Each criterion is discussed further below.

TABLE 27: RISK RATING FOR LARGE BENT-WINGED BAT

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	High	-	High	-	-	-	High	High	Severe
Moderate	-	Moderate	-	Moderate	-	Moderate	-	-	-
Low	-	-	-	-	Low	-	-	-	-

3.18.3.1 CRITERION A (FLIGHT HEIGHT)

Large Bent-winged Bat has a flight record at RSA height and multiple blade strike have occurred on the species. It has been conservatively assessed that the species likely has a high proportion of its flight activity within RSA height.

3.18.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

The species has been recorded within the Project area. The species is a seasonal migrant and likely, the occurrence of Large Bent-winged Bat is only during spring and autumn migrations to and from maternity

caves (Mills, 2021). Therefore, the species occasionally move through the Project area, and a 'moderate' risk rating is applied.

3.18.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

Large Bent-winged Bats are seasonal migrants that likely utilise migratory pathways when moving to large aggregations within maternity caves.

3.18.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

The life-history characteristics of Large Bent-winged Bat overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D.

3.18.3.5 CRITERION E (POPULATION SIZE)

The total population of the species is likely over 20,000 individuals (Mills, 2021).

3.18.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Large Bent-winged Bat is listed as Vulnerable in NSW under the BC Act.

3.19 Eastern False Pipistrelle

3.19.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There are multiple records of blade strike on Eastern False Pipistrelle. Two carcasses were found under turbines during carcass searches at Morton's Lane Wind Farm, eight carcasses at Salt Creek Wind Farm, and 28 carcasses were found across 15 wind farms in Victoria (Biosis, 2020a; Biosis, 2020b; and Moloney *et al.* 2019).

3.19.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

There have been no historic recordings of Eastern False Pipistrelle within the Project area or C2WF in accessible documents.

Calls from the Eastern False Pipistrelle were positively identified from three sites within the Project area during the spring 2023 monitoring period, including:

- Site 1: 3 positively attributed calls to the species;
- Site 2: 13 positively attributed calls to the species; and
- Site 3: 1 positively attributed call to the species.

Calls from the Eastern False Pipistrelle were positively identified from one site within the Project area during the autumn monitoring period:

- Site 6: 3 positively attributed call to the species.

Due to the nature of the bat detection systems, the abundance of Eastern False Pipistrelle cannot be inferred from the number of calls recorded. All recordings were confirmed from ground monitoring sites.

3.19.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the Eastern False Pipistrelle is 'high' as presented in **Table 28**, with a 'high' likelihood and a 'moderate' consequence of blade strike. The 'high' likelihood of Eastern False Pipistrelle is due to the species' occurrence within the Project area and flight behaviour. A 'moderate' consequence of collision is based on both 'low' and 'moderate' risk scores for criteria C to F, with each criterion discussed further below.

TABLE 28: RISK RATING FOR EASTERN FALSE PIPISTRELLE

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	High	High	-	-	-	-	High	-	High
Moderate	-	-	-	Moderate	Moderate	Moderate	-	Moderate	-
Low	-	-	Low	-	-	-	-	-	-

3.19.3.1 CRITERION A (FLIGHT HEIGHT)

Due to the large number of carcasses of Eastern False Pipistrelle found at multiple wind farms the species likely spends a large proportion of its flight activity within RSA height.

3.19.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

The species has been recorded within the Project area, with suitable hunting habitat present in the areas of canopy vegetation.

3.19.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is widely dispersed within areas of suitable habitat, of which is relatively widely distributed.

3.19.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Like most bat species, Eastern False Pipistrelle have a slow life-history and only one young each litter. However, they have the capacity for long-range dispersal as they have large home ranges of up to 136 ha (Churchill, 2008). The life-history characteristics of the Eastern False Pipistrelle overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D.

3.19.3.5 CRITERION E (POPULATION SIZE)

Given that there are no population estimates for this species, Criterion E is conservatively assigned 'moderate'.

3.19.3.6 CRITERION F (LISTED CONSERVATION STATUS)

The Eastern False Pipistrelle is listed as Vulnerable in NSW under the BC Act.

3.20 Yellow-bellied Sheath-tail-bat

3.20.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There are two records of blade strike on Yellow-bellied Sheath-tail-bat. White Rock Wind Farm recorded one carcass find and Bodangora Wind Farm Recorded two fatalities (BL&A, 2019; and Nature Advisory, 2021c).

3.20.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

Yellow-bellied Sheath-tail-bat has historically been observed within the Project area and C2WF in 2017 by BL&A (2018b) with all observations recorded from ground level monitoring sites. Cumberland Ecology (2022) recorded the species in the Project area in 2020 during microchiropteran bat surveys.

The species has not been recorded during the spring 2023 or autumn 2024 bat monitoring period during the preparation of the BBAMP.

3.20.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the Yellow-bellied Sheathtail-bat is 'high' as presented in **Table 29**, with a 'high' likelihood and a 'moderate' consequence of blade strike. The 'high' likelihood of Yellow-bellied Sheathtail-bat is due to the species' detection within the Project area and flight behaviour. A 'moderate' consequence of collision is based on both 'low' and 'moderate' risk scores for criteria C to F, with each criterion discussed further below.

TABLE 29: RISK RATING FOR YELLOW-BELLIED SHEATHTAIL-BAT

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	-	High	-	-	-	-	High	-	High
Moderate	Moderate	-	-	Moderate	Moderate	Moderate	-	Moderate	-
Low	-	-	Low	-	-	-	-	-	-

3.20.3.1 CRITERION A (FLIGHT HEIGHT)

Yellow-bellied Sheathtail-bat likely regularly flies below RSA height and occasionally within RSA height.

3.20.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

The species has historically been recorded within the Project area, with suitable hunting habitat present in areas of canopy vegetation and open habitat.

3.20.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is widely dispersed within areas of suitable habitat, of which is relatively widely distributed.

3.20.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Like most bat species, Yellow-bellied Sheathtail-bat has a slow life-history, are long-lived and only produce one young per litter. They are likely to be territorial, however, they have the capacity for long-range dispersal as they have a very wide range and are known to migrate in winter to warmer northern areas from South Australia (Churchill, 2008). The life-history characteristics of Yellow-bellied Sheathtail-bat overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D.

3.20.3.5 CRITERION E (POPULATION SIZE)

Given that there are no population estimates for this species, Criterion E is conservatively assigned moderate.

3.20.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Yellow-bellied Sheathtail-bat is listed as Vulnerable in NSW under the BC Act.

3.21 Greater Broad-nosed Bat

3.21.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There are no records of blade strike or activity within RSA height for Greater Broad-nosed Bat. However, there are records of the species identified within Bodangora Wind Farm with no records of blade strike despite a relatively high rate of bat mortality (68 bat and 276 flying fox carcasses found) (Nature Advisory, 2021c).

3.21.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

There are no historical observations of Greater Broad-nosed Bat within the Project area or C2WF.

Calls from Greater Broad-nosed Bat were positively identified from one site within the Project area during spring 2023 monitoring period:

- Site 2: 2 positively attributed calls to the species

Due to the nature of the bat detection systems, the abundance of Greater Broad-nosed Bat cannot be inferred from the number of calls recorded. All recordings were confirmed from ground monitoring sites.

3.21.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the Greater Broad-nosed Bat is ‘low’ as presented in **Table 30**, with a ‘low’ likelihood and ‘moderate’ consequence of blade strike. The ‘low’ likelihood of Greater Broad-nosed Bat is due to the species’ unlikely occurrence within the Project area and flight behaviour. A ‘moderate’ consequence of collision is based on both ‘low’ and ‘moderate’ risk scores for criteria C to F, with each criterion discussed further below.

TABLE 30: RISK RATING FOR GREATER BROAD-NOSED BAT

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	-	-	-	-	-	-	-	-	-
Moderate	-	-	-	Moderate	Moderate	Moderate	-	Moderate	-
Low	Low	Low	Low	-	-	-	Low	-	Low

3.21.3.1 CRITERION A (FLIGHT HEIGHT)

Greater Broad-nosed Bat regularly fly within 20 m of ground level (Blackthorn, 2013). It is likely that the species rarely flies within RSA height.

3.21.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

The species has been detected within the Project area during the current survey period. The species is said not to occur above 500 m in altitude (DEH, 2024). The Project area would be on the edges of its ranges, and potentially an uncommon inhabitant at the approximate altitude of 800 to 900 m. It is likely that the species rarely occurs within the Project area.

3.21.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is widely dispersed within areas of suitable habitat, of which is relatively widely distributed.

3.21.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Like most bat species, Greater Broad-nosed Bat has a slow life-history, is long-lived and only produces one young per litter (Churchill, 2008). As little is known about the species, Criterion D is conservatively assigned ‘moderate’.

3.21.3.5 CRITERION E (POPULATION SIZE)

Given that there are no population estimates for this species, Criterion E is conservatively assigned ‘moderate’.

3.21.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Greater Broad-nosed Bat is listed as Vulnerable in NSW under the BC Act.

3.22 Wedge-tailed Eagle

3.22.1 INFORMATION ON SPECIES

There are multiple records of Wedge-tailed Eagle blade strikes and activity at RSA height, it is often reported as one of the most common mortalities during monitoring. Records include but are not limited to:

- 58 carcasses across 15 Victorian wind farms, where it was reported as the second most common mortality (Moloney et al. 2019);
- 18 carcasses across two Tasmanian wind farms reported by Hull (2012);
- nine carcasses found at Gullen Range Wind Farm, as well as 11 individuals flying at RSA height (comprising 78.57% of recorded flights during monitoring) (BL&A, 2017b);
- nine carcasses found at White Rock Wind Farm in northern NSW, where it was the most commonly found bird carcass (BL&A, 2019); and
- ten records of RSA height flight activity at Biala Wind Farm located within 26 km of the Project area (Nature Advisory, 2022a).

3.22.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

Wedge-tailed Eagles have consistently been recorded within the Project area. Nature Advisory (2021a) recorded five Wedge-tailed Eagle carcasses at C2WF over a 24-month monitoring period between January 2019 and December 2020.

During the surveys for the production of the BBAMP a total of 56 observations of Wedge-tailed Eagles have been made from within the Project area, of these, 41 exhibited flight activity within RSA height. Importantly, RVPS yielded an overall percentage of 76.0% of observations occurring within RSA height during all 125 observations for the species.

Wedge-tailed Eagles were observed actively flying, gliding and soaring throughout many areas, travelling along ridges and above the larger patches of forest. Although no Wedge-tailed Eagle nests have been found it is likely that there is at least one pair of the species with a nest nearby as often two adult Wedge-tailed Eagles have been observed in flight together.

3.22.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for Wedge-tailed Eagle is 'moderate' as seen in **Table 31**, with a 'high' likelihood and a 'low' consequence of blade strike. The 'high' likelihood of Wedge-tailed Eagle is due to the species' presence within the Project area and flight behaviour. A 'low' consequence of collision is based on both 'low' and 'moderate' risk scores for criteria C to F, with each criterion discussed further below.

TABLE 31: RISK RATING FOR WEDGE-TAILED EAGLE

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	High	High	-	-	-	-	High	-	-
Moderate	-	-	-	Moderate	-	-	-	-	Moderate
Low	-	-	Low	-	Low	Low	-	Low	-

3.22.3.1 CRITERION A (FLIGHT HEIGHT)

Wedge-tailed Eagle has a high proportion of its flight activity within RSA height.

3.22.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

The species has been observed throughout the majority of the Project area and suitable habitat is present across it.

3.22.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is widely dispersed within areas of suitable habitat, of which is relatively widely distributed.

3.22.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Wedge-tailed Eagles reach sexual maturity at 3 years and have been known to live up to 40 years in captivity. Reproductive success varies regionally, with 0.7 to 1.2 young fledged per clutch laid in southwest Australia and 0.19 to 0.46 young fledged per year in southeast Australia. Juveniles are dispersive, they commonly wander off 200 km and up to 850 km (Debus and Kirwan, 2020). The life-history characteristics of the Wedge-tailed Eagle overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D.

3.22.3.5 CRITERION E (POPULATION SIZE)

The total population of the species is described as very large by BirdLife International (2024), the total population likely exceeds 20,000 individuals.

3.22.3.6 CRITERION F (LISTED CONSERVATION STATUS)

Wedge-tailed Eagle does not currently have a conservation listing under either the EPBC Act or BC Act. Wedge-tailed Eagles are protected as a native species in NSW under the BC Act.

3.23 Other non-threatened raptors

Other non-threatened raptor species will be assessed for potential likelihood of collision and consequence of collision due to evidence of potential impacts on the group due to flight height within RSA height data. This group will be represented by the species present within the Project area, including Nankeen Kestrel, Brown Falcon, Brown Goshawk, Peregrin Falcon and Australian Hobby.

3.23.1 SPECIES INFORMATION FROM AUSTRALIAN WIND FARMS

There have been multiple records of blade strike and flight at RSA height for the following non-threatened raptor species:

- Nankeen Kestrel: 23 carcasses were found at Morton's Lane Wind Farm, five carcasses were found at White Rock Wind Farm, 54 carcasses were found across 15 Victorian wind farms (Biosis, 2021b; BL&A, 2019; and Moloney et al. 2019);
- Brown Falcon: eight carcasses were found at Morton's Lane Wind Farm, one carcass was found at White Rock Wind Farm and 48 carcasses were found across 15 Victorian wind farms (Biosis, 2021b; BL&A, 2019; and Moloney et al. 2019);
- Brown Goshawk: three carcasses were found at Biala Wind Farm and one carcass was found at White Rock Wind Farm (Nature Advisory, 2022a; and BL&A, 2019);
- Black-shouldered Kite: two carcasses were found at Biala Wind Farm (Nature Advisory, 2022a);
- Peregrine Falcon: two carcasses were found across 15 Victorian wind farms, one carcass was found at Dundonnell Wind Farm and one flight within RSA height was observed at Silverton Wind Farm (Moloney et al. 2019; Biosis, 2022; and Biosis, 2021); and

- Australian Hobby: one carcass was found at Bodangora Wind Farm, one flight within RSA height was observed at Kiata Wind Farm, one carcass was found across 15 Victorian wind farms (Nature Advisory, 2021b; BL&A, 2015; and Moloney et al. 2019).

3.23.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

There have been observations of non-threatened raptor species at C2WF throughout the monitoring of the wind farm. Nature Advisory (2021a) recorded carcasses of Brown Falcon (5), Nankeen Kestrel (4) and Peregrine Falcon (1) during the January 2019 to December 2020 monitoring period.

Observations of non-threatened raptors from within the Project area during surveys for BBAMP production include:

- Nankeen Kestrel: 45 total observations of the species, with 27 observations with flight activity within RSA height,
- Brown Falcon: 12 total observations of the species, with eight observations with flight activity within RSA height,
- Brown Goshawk: 11 total observations of the species, with one observation of flight activity within RSA height,
- Black-shouldered Kite: five total observations of the species, with three observations of flight activity within RSA height;
- Peregrine Falcon: six total observations of the species, with three observations with flight activity within RSA height; and
- Australian Hobby: three total observations of the species with all three observations occurring within RSA height.

A total of 307 raptor observations were recorded across RVPS, BUS and incidental observations. Of these 63.2% of raptors observed flew within RSA height.

3.23.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for other non-threatened raptors is 'moderate' as presented in **Table 32**, with a 'high' likelihood and a 'low' consequence of blade strike. The 'high' likelihood of the group is due to the species' presence within the Project area and flight behaviour. A 'low' consequence of collision is based on 'low' risk scores for criteria C to F, with each criterion discussed further below.

TABLE 32: RISK RATING FOR OTHER NON-THREATENED RAPTORS

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	High	High	-	-	-	-	High	-	-
Moderate	-	-	-	-	-	-	-	-	Moderate
Low	-	-	Low	Low	Low	Low	-	Low	-

3.23.3.1 CRITERION A (FLIGHT HEIGHT)

For observed non-threatened raptors it is likely the group generally exhibits a high proportion of their flight activity within RSA height.

3.23.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

Various raptor species have been observed throughout the Project area, non-threatened raptor species regularly occur within or regularly move through the Project area.

3.23.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

Non-threatened raptor species are widely dispersed within areas of suitable habitat that itself is relatively widely distributed.

3.23.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Non-threatened raptors described are widely dispersed within areas of suitable habitat, of which is relatively widely distributed.

3.23.3.5 CRITERION E (POPULATION SIZE)

BirdLife International (2024) describes the Nankeen kestrel as having an extremely large population, Brown Falcon, Australian Hobby and Black-shouldered Kite are described as having a very large populations, Brown Goshawk population is unknown but not believed to be approaching 10,000. Peregrine Falcon population in Australia is undescribed. All likely described non-threatened raptors have species populations greater than that of 20,000 individuals.

3.23.3.6 CRITERION F (LISTED CONSERVATION STATUS)

All non-threatened raptors described are protected in NSW under the BC Act, though do not have a conservation listing.

3.24 White-striped Freetail Bat

3.24.1 INFORMATION ON SPECIES

There are multiple records of White-striped Freetail Bat blade strikes and activity within RSA height, they are often the most common bat mortality. A review of mortality across 15 Victorian wind farms that found 67% of all recorded bat mortality was of this species (Moloney *et al.* 2019). Biala Wind Farm detected 16 carcasses during first-year monitoring surveys and 14 during a 24-month post-operational monitoring period (Nature Advisory, 2022a). During post-operational monitoring, Bodangora Wind Farm recorded 10 fatalities in 2021, while Dundonnell Wind Farm found 34 carcasses in 2022 (Nature Advisory, 2021c; and Biosis, 2022).

3.24.2 STATUS AND FLIGHT BEHAVIOUR IN THE PROJECT AREA

White-striped Freetail Bat has historically been recorded within the Project area and C2WF in March 2017 and November-December 2017 during BL&A bat monitoring surveys, with the species found flying at RSA height during November-December 2017 surveys (BL&A, 2018b). The species was also recorded during 2020 Cumberland Ecology (2020) microchiropteran bat surveys.

Calls from the White-striped Freetail Bat were positively identified from all eight sites within the Project area during spring 2023 monitoring period, including:

- Meteorological mast: 243 positively attributed calls to the species;
- Turbine A22: 55 positively attributed calls to the species;
- Site 1: 18 positively attributed calls to the species;
- Site 2: 141 positively attributed calls to the species;
- Site 3: 4 positively attributed call to the species;
- Site 4: 2 positively attributed calls to the species;
- Site 5: 169 positively attributed calls to the species; and
- Site 6: 24 positively attributed calls to the species.

Calls from the White-striped Freetail Bat were positively identified from all seven sites within the Project area during autumn 2024 monitoring period, including:

- Meteorological mast: 265 positively attributed calls to the species;
- Turbine A22: 81 positively attributed calls to the species;
- Site 1: 4 positively attributed calls to the species;
- Site 2: 61 positively attributed calls to the species;
- Site 3: 4 positively attributed call to the species;
- Site 5: 60 positively attributed calls to the species; and
- Site 6: 13 positively attributed calls to the species.

Due to the nature of the bat detection systems, the abundance of White-striped Freetail Bat cannot be inferred from the number of calls recorded. Recordings were confirmed from ground monitoring sites and Meteorological mast (50 m high) and turbine hub height (95 m high).

3.24.3 LIKELIHOOD AND CONSEQUENCE OF IMPACTS

The overall risk rating for the White-striped Freetail Bat is 'moderate', as seen in **Table 33** with a 'high' likelihood and a 'low' consequence of blade strike. The 'high' likelihood for White-striped Freetail Bat is due to the species' detection within the Project area and flight behaviour. A 'low' consequence of collision is based on both 'low' and 'moderate' risk scores for criteria C to F, with each criterion discussed further below.

TABLE 33: RISK RATING FOR WHITE-STRIPED FREETAIL BAT

	Criteria						Likelihood	Consequence	Overall
	A	B	C	D	E	F			
High	High	High	-	-	-	-	High	-	-
Moderate	-	-	-	Moderate	-	-	-	-	Moderate
Low	-	-	Low	-	Low	Low	-	Low	-

3.24.3.1 CRITERION A (FLIGHT HEIGHT)

White-striped Freetail Bat typically flies higher above the ground than most other species of Victorian bats (Moloney *et al.* 2019). They typically intercept their prey 50 m or more above ground (Churchill, 2008). The species is the most common bat mortality at wind farms and has a high proportion of its flight activity within RSA height.

3.24.3.2 CRITERION B (HABITAT PREFERENCE WITHIN THE PROJECT AREA)

The species has been detected within the Project area and is found in most habitats including but not limited to areas of canopy vegetation and open agricultural landscapes with scattered stands of trees and grasslands.

3.24.3.3 CRITERION C (GEOGRAPHIC POPULATION CONCENTRATION)

The species is widely dispersed within areas of suitable habitat that itself is relatively widely distributed.

3.24.3.4 CRITERION D (DEMOGRAPHIC RESILIENCE)

Like most bat species, White-striped Freetail Bat has a slow life-history, is long-lived and only produces one young per litter. However, they have the capacity for long-range dispersal as they are known to migrate in summer to cooler areas (Churchill, 2008). The life-history characteristics of the White-striped

Freetail Bat overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D.

3.24.3.5 CRITERION E (POPULATION SIZE)

Given the very large distribution of the species, the total population is likely to exceed 20,000 individuals.

3.24.3.6 CRITERION F (LISTED CONSERVATION STATUS)

The White-striped Freetail Bat does not currently have a conservation listing under either the EPBC Act or BC Act. White-strip Freetail Bats are protected as a native species in NSW under the BC Act.

4 Conclusion

Of the 23 species assessed, one is considered to be at 'severe' risk, six are considered a 'high' risk, and eleven are considered a 'moderate' risk of being impacted by the Project (**Table 34**). The resultant risk rating is primarily due to their confirmed or likely presence and their predicted or observed flight behaviour within the Project area, as well as their known susceptibility to blade strike at wind farms in southeast Australia in the context of the potential consequence of risk for each species (estimated through the ascribed ratings for the relevant criteria).

The one 'severe' rating can be attributed to a 'high' risk rating for Criterion C and the consequence of potential impacts on population concentration. In this case, for Large Bent-winged Bat the life-cycle aggregations of bats seasonally to maternity caves create considerable risk with high proportions of the population likely utilising migratory pathways in short periods of time to very restricted locations (i.e. caves). This is precautionary, until greater information is gathered to determine whether the species regularly is recorded utilising the Project area.

All species rated as 'high' overall risk were considered to have a 'high' likelihood and a 'moderate' consequence of collisions. Species rated as 'high' risk include two raptor, one migratory, one parrot and two bat species. The 'high' risk rating for Little Eagle, Black Falcon and Gang-gang Cockatoo aptly reflects the potential impacts of the Project, these species have been recorded within or near the Project area or have been previously impacted at C2WF.

The 'high' risk rating assigned to White-throated Needletail reflects the 'high' likelihood of collision of the species given their known susceptibility to blade strike due to their flight activity at other wind farms and their historic detection within the Project area. The risk rating for Eastern False Pipistrelle and Yellow-bellied Sheath-tail-bat reflects the 'high' likelihood of collision given their flight activity and detection within the Project area.

Despite a ranked consequence of collision as 'low', all assessed non-threatened species or groups produced an overall risk rating of 'moderate' due to a 'high' likelihood of collision. This is considered an appropriate reflection of the risk of potential impacts attributed to the Project as these species and groups are likely to comprise a large proportion of blade strike mortalities.

TABLE 34: CROOKWELL 3 WIND FARM SPECIES RISK RATING SUMMARY

Common name	Scientific name	Likelihood	Consequence	Overall risk rating
Little Eagle	<i>Hieraaetus morphnoides</i>	High	Moderate	High
Black Falcon	<i>Falco subniger</i>	High	Moderate	High
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	Moderate	Moderate	Moderate
White-throated Needletail	<i>Hirundapus caudacutus</i>	High	Moderate	High
Powerful Owl	<i>Ninox strenua</i>	Moderate	Moderate	Moderate
Barking Owl	<i>Ninox connivens</i>	Moderate	Moderate	Moderate
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	High	Moderate	High
Superb Parrot	<i>Polytelis swainsonii</i>	Moderate	Moderate	Moderate
Scarlet Robin	<i>Petroica boodang</i>	Low	Moderate	Low
Flame Robin	<i>Petroica phoenicea</i>	Moderate	Low	Low
Rufous Fantail	<i>Rhipidura rufifrons</i>	Moderate	Moderate	Moderate
Varied Sittella	<i>Daphoenositta chrysoptera</i>	Moderate	Moderate	Moderate
Dusky Woodswallow	<i>Artamus cyanopterus</i>	High	Low	Moderate
Diamond Firetail	<i>Stagonopleura guttata</i>	Moderate	Low	Low
Southern Whiteface	<i>Aphelocephala leucopsis</i>	Low	Low	Negligible
White-fronted Chat	<i>Epthianura albifrons</i>	Moderate	Moderate	Moderate
Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	High	High	Severe
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	High	Moderate	High
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	High	Moderate	High
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	Low	Moderate	Low
Wedge-tailed Eagle	<i>Aquila audax</i>	High	Low	Moderate
Other non-threatened raptors	n/a	High	Low	Moderate
White-striped Freetail Bat	<i>Austronomus australis</i>	High	Low	Moderate

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Appendix A: Likelihood of occurrence assessment

An assessment of likelihood of occurrence was made for species listed under the Commonwealth EPBC Act and/or the NSW BC Act. Information on distribution and habitat preference for each species was taken from the following sources: NSW Government Office of Environment and Heritage, Threatened Species Profiles; and Threatened Biota Data Collection; Australian Government, Department of Climate Change, Energy, Environment and Water SPRAT profiles and the approved conservation advice and listing assessment for each species. The terms for likelihood of occurrence are defined below:

- **Known** = the species was or has been observed on the site
- **Likely** = a medium to high probability that a species uses the site
- **Potential** = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- **Unlikely** = a very low to low probability that a species uses the site
- **No** = habitat within the study area and in the vicinity is unsuitable for the species

The following analysis also incorporates data accessed (22 May 2024) from a variety of sources including:

- EPBC Protected Matters Search Tool
- threatened community/species profiles published by the NSW Department of Environment and Heritage: <https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species>
- Atlas of Living Australia (ALA) for the area within a 10 km radius of the study area
- BioNet Atlas of NSW Wildlife for the area within a 10 km radius of the study area
- eBird Hotspots Pejar Dam and Narrangarril Nature Reserve
<https://ebird.org/hotspot/L2556353>
and <https://ebird.org/hotspot/L4929266>

A1 Threatened bird species

Scientific Name	Common Name	Cth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	Reference site (ebird)	Comment about species preferences and habitat in the Project area	Likely presence
<i>Anthochaera Phrygia</i>	Regent Honeyeater	CE	CE	Yes	Yes	No	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak (<i>Casuarina cunninghamiana</i>). The species prefers old-growth sites with abundant mistletoe. Mistletoe is present, though mostly in low density. Very limited areas of old-growth within the Project area. This species may forage in the area.	Potential
<i>Aphelocephala leucopsis</i>	Southern Whiteface	V	V	Yes	Yes	Yes	Inhabits a wide range of woodlands and open-forests dominated by acacias or eucalyptus occurring on ranges, lowlands, foothills and plains. Almost exclusively forages on the ground. The Project area has limited midstory usually associated with canopied areas that this species may use for shelter and foraging. Species known to nest and roost in living and dead tree hollows which are abundant throughout woodland. Known records within 10 km of the Project area and experienced ecologists indicate the species may utilise the area for breeding and foraging.	Likely
<i>Artamus cyanopterus</i>	Dusky Woodswallow	—	V	Yes	Yes	Yes	Primarily inhabits dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forests or rainforests. Also found in farmland, usually at the edges of forest or woodland. Suitable habitat is present across the Project area and this species has been recorded within the Project area.	Known – Species observed in the Project area
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E	No	No	No	Wetland specialist that favours permanent freshwater wetlands with tall, dense vegetation, especially bullrushes. Habitats available within the Project area are not suitable for this species and there are no known records within 10 km.	No
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	V (M)	—	Yes	No	Yes	Habitat includes fresh and hypersaline environments, where the species feeds along the edge of water on mudflats, coastal and inland wetlands, and sewage ponds. The species may also feed on agricultural pasture following rain events. The Project area presents limited habitat for foraging in areas around agricultural dams.	Potential
<i>Calidris ferruginea</i>	Curlew Sandpiper	CE (M)	E	No	No	No	Migratory shorebird most often found in littoral and estuarine habitats. Sometimes found in inland swamps and lakes during annual migration to and from Siberia. Habitats available within the	No

Scientific Name	Common Name	Cth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	Reference site (ebird)	Comment about species preferences and habitat in the Project area	Likely presence
							Project area are not suitable for this species and there are no known records within 10 km.	
<i>Callocephalon fimbriatum</i>	Gang-Gang Cockatoo	E	E	Yes	Yes	No	Distinctive parrot found from southern Victoria through south- and central-eastern NSW. In Spring and summer, the species is generally found in tall mountain forests and woodlands especially wet sclerophyll forests. In autumn and winter often moves to lower altitudes in drier and more open forests and woodlands. They prefer to roost in old growth forests and to nest in hollows with a 10+ cm diameter at least 9 m above ground level. Suitable breeding habitat and low-quality foraging habitat is present. This species has been recorded within the Project area.	Known – species observed in the Project area
<i>Calyptorhynchus lathami lathami</i>	South-eastern Glossy Black-Cockatoo	V	V	No	No	No	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of Sheoak occur. Black Sheoak (<i>Allocasuarina littoralis</i>) and Forest Sheoak (<i>A. torulosa</i>) are important foods. There has been no observation of foraging opportunities for this species in the Project area. Though this species may use this area during transit across the landscape.	Unlikely
<i>Circus assimilis</i>	Spotted Harrier	—	V	Yes	No	No	Inhabits grassy open woodland. Found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree. Preys on terrestrial mammals (e.g. bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion. Foraging may occur in the open areas of the Project area.	Potential
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V	V	No	No	No	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest. Mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey. Hollows in standing dead or live trees and tree stumps are essential for nesting. No known records within 10 km of the Project area, and habitat present is of low quality for this species.	Unlikely
<i>Daphoenositta chrysoptera</i>	Varied Sittella	—	V	Yes	Yes	Yes	Woodland specialist that lives in eucalypt forests and woodland, mallee and Acacia woodland. Feeds on slaters and other arthropods extracted from crevices in bark and dead wood. Found across most of mainland Australia including the vast majority of NSW. This species has been recorded both within the Project area and within 10 km.	Known – species observed in the Project area
<i>Epthianura albifrons</i>	White-fronted Chat	—	V	Yes	No	Yes	Passerine bird usually found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands or lightly timbered lands. They are also observed in estuarine and marshy grounds with low vegetation, and along the	Known – Species observed in

Scientific Name	Common Name	Cth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	Reference site (ebird)	Comment about species preferences and habitat in the Project area	Likely presence
							margins of rivers. They have been noted to be sensitive to human disturbances and not likely found in built up areas. There is suitable habitat for the species found in the form of open grasslands and pasture, however, no wetlands or salt marshes are present within the Project area. Wet areas are present along creek areas and agricultural dams during wet seasons.	previous study
<i>Falco hypoleucos</i>	Grey Falcon	V	V	No	No	No	Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions. Sometimes found in open woodlands near the coast and near wetlands where surface water attracts prey. No known records within 10km of area, and optimal habitat, particularly wetlands is not present.	Unlikely
<i>Falco subniger</i>	Black Falcon	—	V	Yes	Yes	No	Habitat is usually in the arid and semi-arid zones but inhabits a very wide but sparsely populated distribution across NSW. It is usually found near watercourses or utilizing patches of isolated trees. It hunts over open wooded grasslands, saltbush plains, bluebush plains and other low vegetation. Multiple known records within 10 km of the Project area, including at C2WF, and suitable foraging habitat is present within the Project area.	Likely
<i>Gallinago hardwickii</i>	Latham's Snipe	V (M)	—	Yes	No	Yes	Occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g., swamps, flooded grasslands or heathlands, around bogs and other water bodies). Foraging habitat characterised by areas of mud either exposed or covered by very shallow water, and some form of low dense vegetation for cover. Limited suboptimal habitat available within the Project area in the form of agricultural dams.	Potential
<i>Grantiella picta</i>	Painted Honeyeater	V	V	No	No	No	Inhabits Boree/ Weeping Myall (<i>Acacia pendula</i>), Brigalow (<i>A. harpophylla</i>) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> . No known records with 10km. Mistletoe present within the Project area, however mostly in low densities.	Unlikely
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	—	V	Yes	Yes	Yes	Habitats characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). There are known records for this species at Pejar Dam and observations at C2WF. Although suitable habitat does not fall within the Project area, the proximity to suitable habitat indicates it is likely the species may transit through the Project area or forage in the area.	Likely

Scientific Name	Common Name	Cth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	Reference site (ebird)	Comment about species preferences and habitat in the Project area	Likely presence
<i>Hieraaetus morphnoides</i>	Little Eagle	—	V	Yes	Yes	Yes	Occupies open eucalypt forest, woodland or open woodland. Sheoak or <i>Acacia</i> woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Suitable habitat for breeding and foraging present within the Project area, and the species observed multiple times within or near Project area.	Known – species observed in the Project area
<i>Hirundapus caudacutus</i>	White-throated Needletail	V (M)	V	Yes	No	No	Almost exclusively aerial species that forages for insects up to 1 km above ground, usually in large flocks. Only occurs in Australia between late spring and early autumn, breeds in north Asia. Species has been observed within the Project area and there is potential that the species forages throughout the area ahead of storm fronts while in Australia.	Known – Species observed in previous study
<i>Lathamus discolor</i>	Swift Parrot	CE	E	No	No	No	Distinctive parrot that breeds in Tasmania during spring and summer and migrates to the mainland for autumn and winter, where they are found in areas with eucalypts that flower profusely in winter or that have abundant lerp (sap-sucking bugs) infestations. Some favourite flowering trees include but not limited to Swamp Mahogany (<i>Eucalyptus robusta</i>), and Spotted Gum (<i>Corymbia maculata</i>), Red Bloodwood (<i>C. gummifera</i>). Some foraging habitat present with the Project area, however no records found within 10 km of the Project area and the area is not mapped as important Swift Parrot habitat.	Potential
<i>Melanodryas cucullata</i>	Hooded Robin (south-eastern form)	E	E	Yes	No	No	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings and some small shrubs, and a ground layer of moderately tall native grasses. Species has been identified within 10 km, with areas of suitably complex structured habitat limited to forest areas within the Project area.	Potential
<i>Neophema chrysostoma</i>	Blue-winged Parrot	V	V	No	No	No	Inhabit a range of habitats from coastal, sub-coastal and inland areas, through to semi-arid zones. They tend to favour grasslands and grassy woodlands and are often found near wetlands both near the coast and in semi-arid zones. Can also occur in modified environments such as paddocks, golf courses etc. feeding on a range of native and exotic grasses, forbs, and shrubs. Species has a primary breeding range in Tasmania and Victoria, with unclear migratory patterns through Vic, SA, central NSW and Southern Qld during winter. There are no known records within 10 km. As a partial migrant into semi-arid and coastal areas, the species may	Unlikely

Scientific Name	Common Name	Cth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	Reference site (ebird)	Comment about species preferences and habitat in the Project area	Likely presence
							not be suited to winter migrations into the high-altitude region of the Project area.	
<i>Neophema pulchella</i>	Turquoise Parrot	—	V	Yes	No	No	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Mostly inhabits box or box-ironbark woodlands, with a positive association with <i>E. albens</i> . Also found in ecotones between woodland and grasslands, riparian woodland or coastal forest and heath. Nests in tree hollows, logs or posts, from August to December. There are known records within 10 km, limited box woodland can be found within the Project area, however, it is not comprised of <i>E. albens</i> .	Potential
<i>Ninox connivens</i>	Barking Owl	—	V	Yes	Yes	No	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Preferentially hunts small arboreal mammals. Requires very large permanent territories in most habitats due to sparse prey densities. There are known records within 10 km and suitable foraging habitat present. Large hollows have been mapped within the Project area making the area potential breeding habitat.	Likely
<i>Ninox strenua</i>	Powerful Owl	—	V	Yes	Yes	No	Inhabits a range of vegetation types, from woodland and open sclerophyll forests to tall open wet forests and rainforests. Requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. Roosts by day in dense vegetation. Foraging habitat present. Large hollows have been mapped within the Project area making the area potential breeding habitat. The species has been observed within the Project area.	Known – Species observed in previous study
<i>Numenius madagascariensis</i>	Eastern Curlew	CE (M)	—	No	No	No	Freshwater specialist that prefers the fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. There are no known records within 10 km and limited suitable habitat is present within the Project area in the form of agricultural dams.	Unlikely
<i>Oxyura australis</i>	Blue-billed Duck	—	V	Yes	No	Yes	Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. There are known records within 10 km. Residing and foraging habitat present in the Project area in the form of agricultural dams that provide suboptimal habitat with limited deep water, and sparse vegetation along water's edge.	Potential
<i>Petroica boodang</i>	Scarlet Robin	—	V	Yes	Yes	Yes	A season altitudinal migrant, breeding in high altitude forests in the spring and summer and migrating to lower open woodlands for autumn and winter. Prefers sites with abundant logs and fallen timber, though sometimes found in grazed paddocks with	Known – species observed in

Scientific Name	Common Name	Cth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	Reference site (ebird)	Comment about species preferences and habitat in the Project area	Likely presence
							scattered trees. Habitat within forest is provides suitably complex structures for forging, including abundant fallen timber. Species has been observed within the Project area.	the Project area
<i>Petroica phoenicea</i>	Flame Robin	—	V	Yes	Yes	Yes	Species is generally seasonally migratory between their more alpine and subalpine ranges. Breeds in upland tall moist eucalypt forests during spring and summer and moving to open grasslands and open woodlands in the autumn and winter. The species forages for insects from perched positions from course woody debris, logs or other favoured perches. Recorded within 10 km. Autumn and winter foraging habitat present within the Project area, with complex foraging structures present within wooded areas.	Likely
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	No	No	No	Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. They nest in the hollows of large trees (dead or alive). May forage up to 10 km from nesting sites, primarily in grassy box woodland. There are no known records within 10 km of the Project area. There is some Box-Gum present throughout the Project area, however it has largely been cleared leaving sparse paddock trees. Hollows suitable for breeding have been mapped within the Project area. Four individuals observed approximately 3 km away from A24 on Woodhouselee Road.	Likely
<i>Pycnoptilus floccosus</i>	Pilotbird	V	—	No	No	No	Strictly terrestrial species, living on the ground in dense forests with heavy undergrowth. Habitat critical to their survival includes wet sclerophyll forests in temperate zones in moist gullies with dense undergrowth, and dry sclerophyll forests and woodlands occupying dry slopes and ridges. Adults build a domed nest on or near the ground in which they usually lay two eggs. There are no known records within 10 km of the Project area and limited suitable habitat is present.	Unlikely
<i>Pyrrholaemus sagittatus</i>	Speckled Warbler	—	V	Yes	Yes	No	Ground-dwelling bird living in a wide range of Eucalyptus dominated communities with a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees. Areas of some suitable habitat present within Project area, predominantly within or near to forest areas where disturbances from agriculture is lessened. There are records within 10 km of the Project area, and	Potential

Scientific Name	Common Name	Cth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	Reference site (ebird)	Comment about species preferences and habitat in the Project area	Likely presence
							there is potential for the species to forage and inhabit the Project area.	
<i>Rostratula australis</i>	Australian Painted Snipe	E	E	No	No	No	A small freshwater wader. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. There are no known records within 10 km of the Project area, however some suitable habitat in the form of agricultural dams is present. Experienced ecologists note observations of the species within the region and suggest the potential for the species to be present within the Project area.	Potential
<i>Stagonopleura guttata</i>	Diamond Firetail	V	V	Yes	Yes	Yes	Distinctive ground-feeding bird found in grasslands and grassy eucalyptus woodlands, riparian areas, and sometimes lightly wooded farmland. Has been recorded in some towns and near farmhouses. This species has been recorded both within the Project area and within 10 km. Suitable habitat for species is present and the species has been observed in previous studies.	Known – Species observed in previous study
<i>Stictonetta naevosa</i>	Freckled Duck	—	V	Yes	No	Yes	Prefers permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move to lakes, reservoirs, farm dams and sewage ponds. Generally shelter in dense cover during the day, usually in deep water. Nests are usually located in dense vegetation at or near water level. Limited residing and foraging habitat present in the Project area in the form of agricultural dams that provide suboptimal habitat with sparse vegetation and cover along water's edge.	Potential
Species count		20	31	35 species across all jurisdictions				

A2 Threatened bat species

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	Reference site (ebird)	Comment about species preferences and habitat in the Project area	Likely presence
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	E	V	No	No	n/a	Inhabits well-timbered areas with extensive cliffs and caves. Breeds in sandstone caves/overhangs and will return to same nursery sites over many years. No known records within 10 km, no sandstone cliffs or caves present within or near to Project area for nursery sites to be near to Project area.	Unlikely
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	—	V	No	No	n/a	Prefers moist habitats, with trees taller than 20 m. Generally, roosts in eucalypt hollows but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils, and other flying insects above or just below the tree canopy. There are no known records of the species within 10 km of the Project area and the habitat is comprised of canopy approximately 15 to 25 m tall dry forest. However, 17 calls have been confirmed across three ground sites within the Project area.	Known – species observed in the Project area
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	—	V	Yes	Yes	n/a	Found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in man-made structures. Usually, solitary. There are known records within 10 km of the Project area. Hollows for roosting and forest habitat for foraging present within the Project area.	Potential
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	—	V	No	Yes	n/a	Prefers to roost in caves but may also use derelict mines, storm-water tunnels, and similar man-made structures. Breeding or roosting colonies can number from 100 to 150,000 individuals. This species has been recorded both within the Project area and within 10 km. Nearby maternity caves located in Drum Cave in Bungonia State Recreation Area is approximately 40 km to the south-east, and Church Cave in Wee-Jasper Nature Reserve is approximately 100 km south-west of the Project area. Previous observations of the species in the Project area occurred during migration periods. Ground monitoring confirmed 157 calls across four sites within the Project area.	Known – species observed in the Project area

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	Reference site (ebird)	Comment about species preferences and habitat in the Project area	Likely presence
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	No	Yes	n/a	Roosts communally in large camps often located in a gully close to water under dense canopy cover. May travel 20–50 km when foraging for foods, giving a home range of ~785,000 ha. Favourite food plants include flowering native trees (Eucalyptus, Melaleuca and Banksia), fruiting rainforest trees and vines, urban gardens, and cultivated fruit crops. No records within 10km. Limited habitat present in the Project area and no camps are present, though species may use area for rest on long travels.	Potential
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	—	V	Yes	Yes	n/a	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees; appear to defend an aerial territory. Records within 10km. Hollows for roosting present within Project area and foraging opportunities throughout Project area. Species recorded on multiple occasions within Project area during previous studies.	Known – Species observed in previous study
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	—	V	Yes	Yes	n/a	Does not likely occur at altitudes above 500 m. Utilises a variety of habitats, though mostly observed in tall wet forest on coastal plains and foothills. Usually roosts in tree hollows and has also been found in buildings. Open woodland habitat and open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects. Records within 10km and two calls confirmed from one ground level monitoring site within the Project area. Habitat present within the Project area presents potentially suitable habitat for foraging and hollows for roosting.	Known – species observed in the Project area
Species count		2	7				7 species across all jurisdictions	

A3 Listed Migratory bird species

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	E bird Pejar*	Comment about species preferences and habitat in the Project area	Likely presence
Marine birds								
<i>Apus pacificus</i>	Fork-tailed Swift	M	—	No	No	No	Species is almost exclusively aerial and feeds on insects in mid-air, only landing occasionally where it nests on mountain cliffs and cliff faces. The species forages aerially across many types of habitat but more often occurs in areas of updrafts, especially around cliffs, and follow along the edges of low-pressure systems. The species arrives in Australia around October and can be seen in NSW until March. No known records within 10 km, the species preferred habitat of cliffs is not present in or near the Project area.	Unlikely
Terrestrial birds								
<i>Hirundapus caudacutus</i> *	White-throated Needletail	M (V)	V	Yes	No	No	Almost exclusively aerial species that forages for insects up to 1 km above ground, usually in large flocks. Only occurs in Australia between late spring and early autumn, breeds in north Asia. Species has been observed within the Project area and there is potential that the species forages throughout the area ahead of storm fronts while in Australia.	Known – Species observed in previous study
<i>Monarcha melanopsis</i>	Black-faced Monarch	M	—	No	No	No	Widespread in eastern Australia, mainly occurring in rainforest ecosystems. Also sometimes found in nearby open eucalypt forests (mainly wet sclerophyll forests), especially in gullies with a dense, shrubby understorey as well as in dry sclerophyll forests and woodlands, often with a patchy understorey. No known records within 10 km. Very limited dense shrubby habitat present.	Unlikely
<i>Motacilla tschutschensis</i>	Eastern Yellow Wagtail	M	—	No	No	No	Found in open country near water, such as wet meadows, wetlands or estuaries where it feeds on invertebrates and nests in tussocks. No records within 10 km. No wetlands or estuaries are found within the Project area, therefore the habitat is unlikely to be suited to the species.	Unlikely
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	M	—	No	No	No	Species inhabits heavily vegetated gullies in tall wet eucalypt forests near water and may forage through a diverse range of ecosystems nearby. No known records within 10 km. Habitat within the Project area is characterised as dry sclerophyll forest that is app, not tall wet sclerophyll forest, therefore it is unlikely this is a preferred habitat for this species.	Unlikely
<i>Rhipidura rufifrons</i>	Rufous Fantail	M	—	No	No	No	Species is found coastal areas or inland forest with predominantly in wet eucalypt forests, swamp woodlands, mangroves or damp forest gullies. No records within 10km. Limited habitat present, but	Known – species observed

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	E bird Pejar*	Comment about species preferences and habitat in the Project area	Likely presence
							experienced ecologist and records from inland areas such as Canberra note the species can be observed during east coast north-south migration.	in the Project area
Wetlands birds								
<i>Actitis hypoleucos</i>	Common Sandpiper	M	—	No	No	No	Wetland specialist. Utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. No records within 10 km of the Project area and no suitable habitat in Project area.	No
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	M(V)	—	Yes	No	Yes	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, salt pans and hypersaline salt lakes inland. Records for the species residing within 10 km of the Project area. Additionally, limited habitat for foraging in areas around agricultural dams is present.	Potential
<i>Calidris ferruginea</i> *	Curlew Sandpiper	M(CE)	E	No	No	No	Migratory shorebird most often found in littoral and estuarine habitats. Sometimes found in inland swamps and lakes during annual migration to and from Siberia. No records within 10 km of the Project area and no suitable habitat in Project area.	No
<i>Calidris melanotos</i>	Pectoral Sandpiper	M	—	No	No	No	Wetlands specialist, usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation. They forage in shallow water or soft mud at the edge of wetlands. No records within 10 km of the Project area and no suitable habitat in Project area.	No
<i>Gallinago hardwickii</i>	Latham's Snipe	M(V)	—	Yes	No	Yes	Prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains, and artificial wetlands. Foraging habitat characterised by areas of mud either exposed or covered by very shallow water, and some form of low dense vegetation for cover. Known records of the species within 10 km of the Project area, however limited suboptimal habitat available within the Project area in the form of agricultural dams and creeks.	Potential
<i>Numenius madagascariensis</i>	Eastern Curlew	M (CE)	—	No	No	No	Freshwater specialist that prefers the fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. There are no known records within 10 km	Unlikely

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA record s within 10 km	BioNet records within 10km	E bird Pejar*	Comment about species preferences and habitat in the Project area	Likely presence
							and limited suitable habitat is present within the Project area in the form of agricultural dams.	
	Species count	12	2				12 species across all jurisdictions	