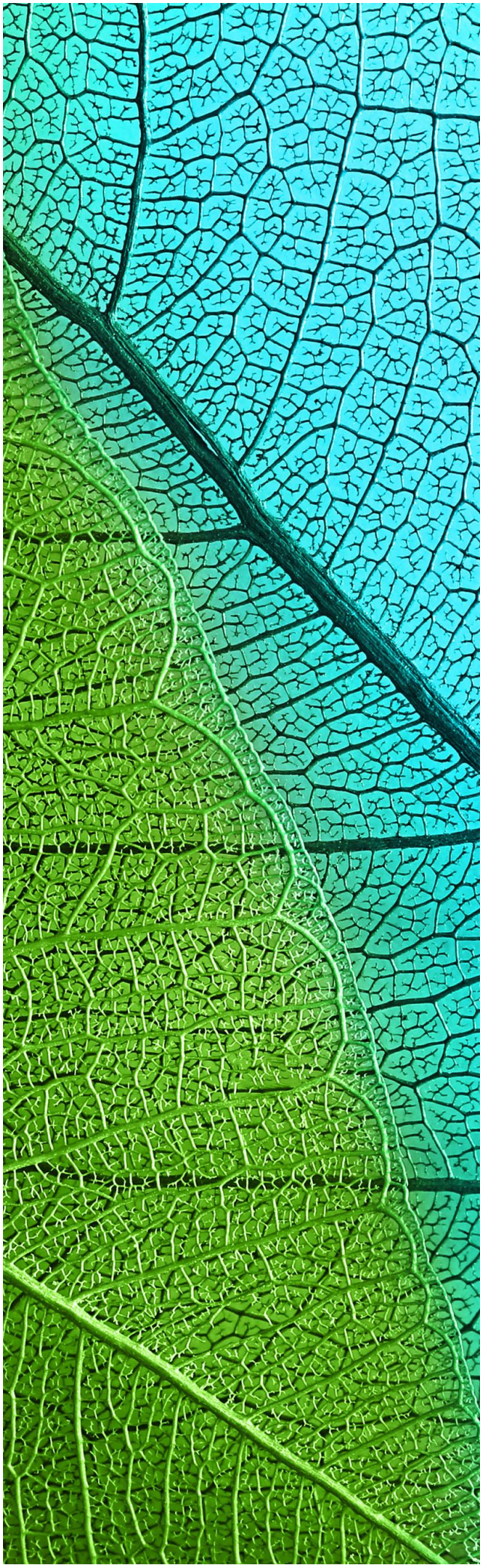

BIALA WIND FARM

BIRD AND BAT ADAPTIVE MANAGEMENT PROGRAM

Prepared for Newtricity Developments Biala Pty Ltd

March 2020
Report No. 17162(2.4)

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1. INTRODUCTION

1.1. Background

The Biala Wind Farm (BWF) project is located 14.5 kilometres south west of Crookwell and 8.5 kilometres east of Biala in the southern tablelands of New South Wales (Figure 1). Approval was granted to Newtricity Biala Property Ltd by the Department of Environment and Planning (NSW) on 12 April 2017 for a 31-turbine wind farm at this location, subject to conditions. Subsequently in October 2017, Newtricity Biala Developments Pty Ltd was sold to Beijing Jingneng Clean Energy (Hong Kong) Co. Ltd.

The Biala Wind Farm project was determined to be 'not a controlled action' under the *Environment Protection and Biodiversity Conservation Act 1999* on 6 May 2015. Therefore, there are no additional conditions on the project imposed by the Commonwealth government.

The condition of consent schedule 3, 21 (a) to (e) of the NSW approval requires the preparation of a Bird and Bat Adaptive Management Program (BBAMP). This BBAMP has been prepared to address all elements of the development consent schedule 3 Condition 21 and will be submitted for review by the Office of Environment and Heritage (BCD) before finalisation and approval by the Secretary of the Department of Environment and Planning (DPE).

1.2. Requirements of BBAMP

The specific requirements of the BBAMP from the project approval are presented in the compliance table below, together with how this plan responds to these requirements.

Table 1: Conditions of consent compliance table

21. *Prior to the commissioning of any wind turbines, the Applicant must prepare a Bird and Bat Adaptive Management Plan for the development in consultation with BCD and to the satisfaction of the secretary. This plan must include:*	
(a) *at least 12 months' worth of current (or updated) baseline data on threatened and 'at risk' bird and bat species and populations in the locality that could be affected by the project;*	Section 2.1.1, Section 3
(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;* • *prompt carcass removal;* • *controlling pests; and* • *using best practice methods for bat deterrence, including managing lighting impacts;*	Section 5

(c) *trigger levels for further investigation of the potential impacts of the projects on particular bird and bat species or populations;*	Sections 6.1.1 and 6.2.1
(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 or bat species or population, including the implementation of measures to:* • *reduce the mortality of these species or populations (such as restricting the operation of certain turbines during certain periods); or* • *enhance and propagate these species or population in the locality;*	Section 6
(e) *a detailed program to monitor and report on the effectiveness of these measures and any bird or bat strikes on the site.*	Sections 3, 4 and 6.4
Following the Secretary's approval, the Applicant must implement the Bird and Bat Adaptive Management Plan."	

This BBAMP fulfils the requirements of Conditions of consent schedule 3, 21 and, subject to BBAMP approval by the Secretary of DPE, will be implemented during the development and initial operation of the BWF. It includes two years of carcass searches and associated trials (not explicitly required in the consent conditions) to test whether regular impacts on species of concern occur and to quantify the impact of the project on birds and bats.

1.3. BBAMP Objectives

The overall aim of this BBAMP is to provide a program for monitoring the impacts on birds and bats of the wind turbines at the BWF and a strategy for managing and mitigating any significant bird and bat impacts arising from the operation of BWF.

This is achieved by establishing monitoring and management procedures consistent with the methods outlined by the Australian Wind Energy Association (AusWEA 2013) and endorsed in the Clean Energy Council's Best Practice Guidelines (CEC 2018).

The specific objectives of this BBAMP, derived from the conditions of approval, are set out below.

- To implement a monitoring program to estimate the impact of the project on at-risk birds and/ or bats that can reasonably be attributed to the operation of the project, including pre- and post-construction (operational) phases data collection;
- To directly record impacts on birds and bats through carcass surveys;

- To document an agreed notification framework that identifies impact triggers requiring a management response, unacceptable impact thresholds[1] and the kinds of management activities that should be considered;
- To detail mitigation measures and related implementation strategies to reduce impacts on birds and bats; and
- To identify matters to be addressed in periodic reports on the outcomes of monitoring, the application of the notification framework, mitigation measures and their success.

The strategy employed to ensure that any impact triggers and/or unacceptable impacts are detected includes the following:

- Pre-operational bird and bat utilisation surveys;
- Operational phase carcass searches under operating turbines;
- Statistical analysis of the results of carcass searches; and
- Reporting.

This program uses an adaptive management approach. Therefore, management measures can be amended to ensure more effective management and mitigation are implemented in response to the findings of monitoring. Personnel undertaking the carcass searches will be adequately trained ecologists. The expert approved by the Secretary DPE will be in charge of the design of monitoring, as well as training of personnel, data analysis, interpretation, formulating adaptive management measures and reporting.

This BBAMP is based on the experience gained from the preparation and implementation of approved management plans to monitor and mitigate the impacts of wind farm operation on birds and bats at numerous wind farms in New South Wales and Victoria. At the time of writing, Nature Advisory has prepared and/or implemented approved management plans for White Rock, Cullerin, Gullen Range, Taralga, Capital I and Woodlawn wind farms in NSW (BL&A 2011a & c, 2014, 2016), and Bald Hills, Macarthur, Berrybank, Crowlands, Hawkesdale, Lal Lal, Mt Gellibrand, Mt Mercer, Mortlake South and Ryan's Corner wind farms in Victoria (BL&A 2009, 2011b, 2012a-d, 2013a-c).

The approach developed for monitoring impacts on birds and bats has been refined from experience gained from other BBAMPs, their preparation, data review, and feedback from regulators and approval authorities. This BBAMP has incorporated learning and experience from past plans, and incorporates the latest approaches to monitoring wind farm impacts on birds and bats.

In order to ensure the efficacy of this adaptive management program, all activities undertaken will be subject to regular review and reporting by the suitably qualified expert who is approved by the DPE.

[1] Definitions of 'impact trigger' and 'unacceptable impact' is detailed in section 6.2.1.

1.4. Consultations in the development of the BBAMP

The Office of Environment and Heritage (BCD) now Biodiversity Conservation Division (BCD) was consulted in the development of this plan. This consultation included:

- Project meeting at BCD offices in Queanbeyan on 12th January 2018 to discuss the preparation of this BBAMP; and
- The survey methodology for the pre-construction bird utilisation surveys, eagle surveys and bat surveys has been emailed to BCD and discussed during a phone subsequent conference with BCD on the 17th January 2018. The revised methodology was provided in a follow up email on the 23rd January 2018.
- A draft BBAMP has been submitted to BCDBCD in December 2019 for their consideration and feedback.
- Feedback has been received on 19th February 2020. This was followed up by a phone call on 21st February 2020 with BCD.
- The feedback has been addressed in this version of the BBAMP, which was prepared for the Secretary's approval.

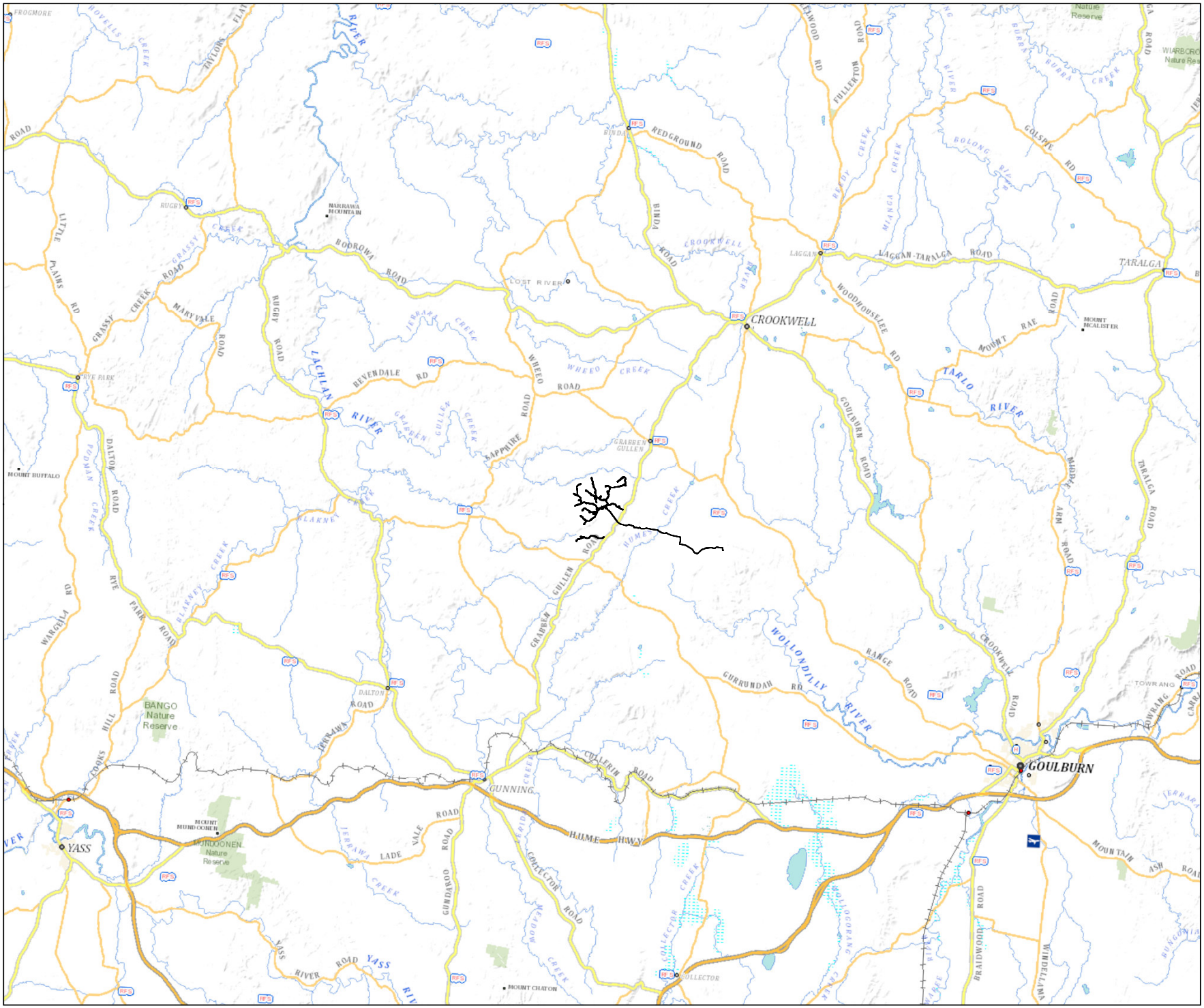

Figure 1: Regional location of Biala Wind Farm

Project: Biala Wind Farm
Client: Beijing Jingneng Clean Energy (Hong Kong) Co. Limited
Date: 13/03/2020

Legend

— Development layout

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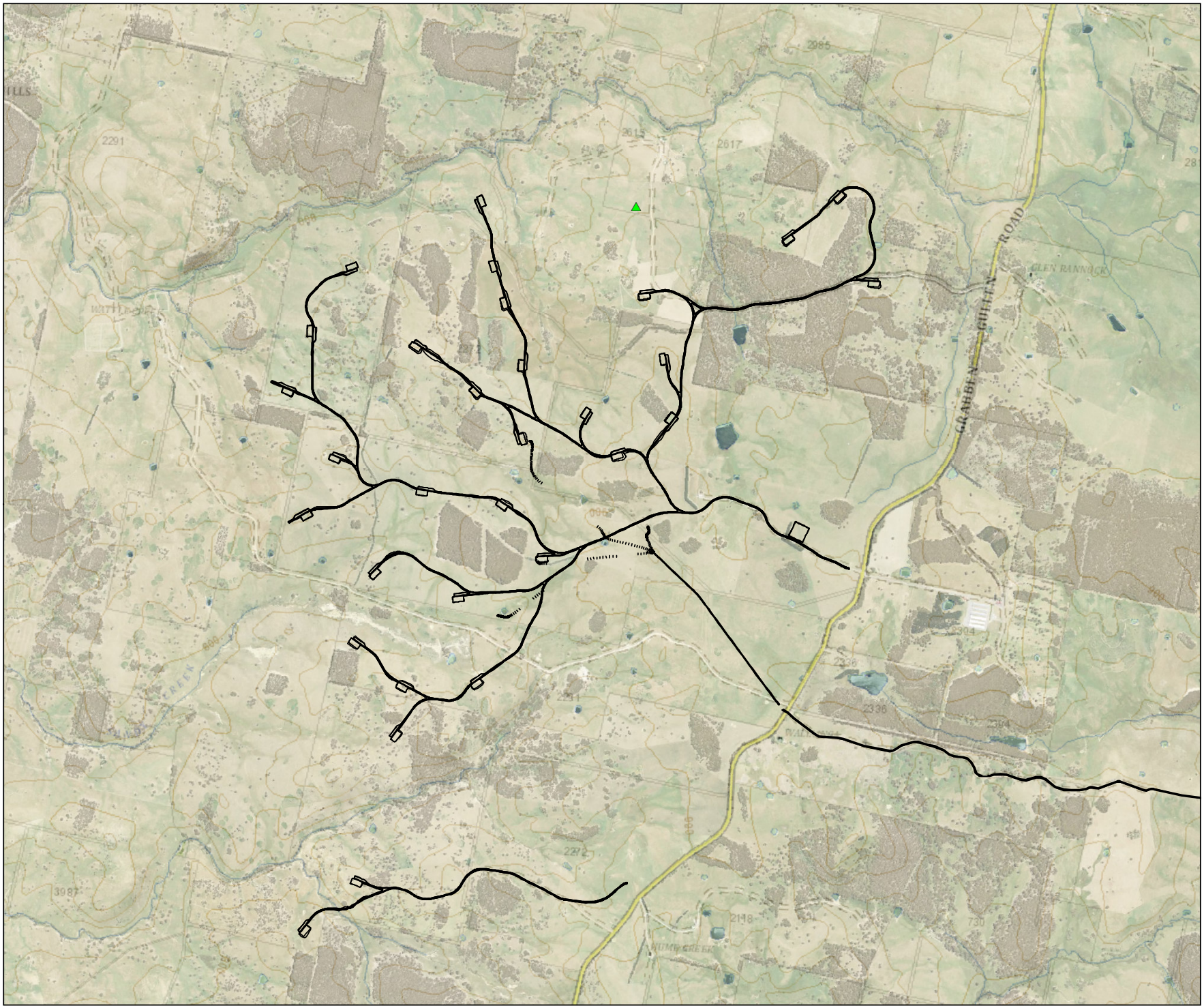

Figure 2: Layout of Biala Wind Farm

Project: Biala Wind Farm
Client: Beijing Jingneng Clean Energy (Hong Kong) Co. Limited
Date: 13/03/2020

Legend

- Development layout
- Met mast

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1.5. Site Description

The Biala Wind Farm site is located in the Southern Tablelands region of NSW (Figure 1), approximately 14 km south-west of Crookwell in the Upper Lachlan Shire. The turbines will extend seven kilometres north-south and four kilometres east-west. The individual turbine positions are on land with elevations between 900 and 1000 metres Australian Height Datum (AHD).

The site lies on a series of higher ridges and plateaux that have been used for decades for sheep and cattle grazing. The majority of the area has been either completely or partly cleared of its original native vegetation. As a consequence of the long grazing history, this vegetation generally lacks a diverse understorey and indigenous ground cover, and introduced pasture grasses have come to dominate the ground cover. Much of the area has been subject either to past clearing or selective timber-getting. Consequently, many of the trees are of a comparatively young age, or are of a species that have fewer hollows suitable for hollow-dependent fauna, such as possums, gliders and large owls. Larger, hollow-bearing trees are more restricted in occurrence on the site.

The avifauna of the site is typical of this part of NSW, with birds of open country, farmland and fragmented woodlands dominating. Knowledge of the bat fauna in the region is developing as more survey work is done as part of assessments for proposed wind farms in the area. Some woodland remnants at the Biala WF site support a relatively intact tree canopy that would provide foraging habitat for insectivorous bats. More details of the birds and bats of the site can be found in section 2 of this Program.

Habitat quality for birds and bats is considered to be low in the largely cleared parts of the site, and moderate in most wooded areas of the site.

1.6. Pre-construction investigations of birds and bats at Biala wind farm

During the pre-approval and pre-construction phases of the development, investigations of fauna were undertaken by Environmental Resources Management (ERM 2015). The data were collected during surveys between 29th October 2012 and 31st March 2014. The methods and results of these investigations were included in the Biala Wind Farm Environmental Impact Statement, specifically, Annex F – Ecology Impact Assessment (ERM Australia 2015), and are summarised in section 2.

Nature Advisory carried out additional bird utilisation surveys (BUS), bat surveys and raptor surveys that collected flight height data for birds and diversity and height data for bats. The results are set out in a more detailed report (BL&A 2018). BUS and raptor surveys were undertaken over all four seasons including the following.

BUS

- Spring 2017: 20th to 25th November 2017
- Summer 2018: 29th January to 2nd February 2018
- Autumn 2018: 16th to 20th April 2018
- Winter 2018: 30th July to 3rd August 2018.

Raptor

- Summer 2018: 29th January to 2nd February 2018
- Autumn 2018: 6th to 11th May 2018

- Winter 2018: 30th July to 4th August 2018
- Spring 2018: 14th to 19th October 2018.

1.7. Additional information

This BBAMP was prepared by a team from Nature Advisory (formerly Brett Lane & Associates Pty Ltd) including Jackson Clerke (Zoologist), Peter Lansley (Senior Zoologist), Khalid Al-Dabbagh (Senior Zoologist), Curtis Doughty (Senior Zoologist), Inga Kulik (Senior Ecologist and Project Manager) and Brett Lane (Principal Consultant).

2. PRE-CONSTRUCTION BIRD AND BAT INFORMATION

The results of investigations documented in Section 1.6 above are summarised in this section of the BBAMP. This information has informed the risk assessment in Section 3.

2.1. Bird utilisation surveys

2.1.1. 2012-2014 survey

Previously, bird surveys were carried out by ERM Australia (2015) and the methods used are outlined in their ecological assessment report. The data were collected from six survey periods covering all four seasons between 29th October 2012 and the 31st March 2014.

Bird surveys included the following.

- A total of 22 diurnal bird surveys were undertaken throughout the wind farm site, mostly using a two hectare – 40 minute census method, totalling 32.2 person-hours
- Targeted waterbird surveys at two suitable dams within the wind farm footprint totalling 2.8 person-hours
- Targeted raptor surveys over four seasons (64 person-hours)
- Four seasonal call playback surveys for nocturnal birds
- Spotlighting totalling 16 person-hours (included both forest owls and mammals)
- Incidental observations were also made while traversing around the site.

A total of 72 bird species were recorded on the wind farm site during the surveys, including five listed threatened species. Threatened species recorded are listed below.

- Blue-billed Duck
- Powerful Owl
- Scarlet Robin
- Varied Sittella
- White-fronted Chat.

An additional 13 threatened bird species listed below were identified as having the potential to occur within the wind farm area.

- Regent Honeyeater
- Gang-gang Cockatoo
- Spotted Harrier
- Little Eagle
- Little Lorikeet
- Painted Honeyeater
- Swift Parrot
- Hooded Robin
- Turquoise Parrot

- Barking Owl
- Flame Robin
- Australian Painted Snipe
- Diamond Firetail.

Two Little Eagles were recorded incidentally approximately 5.5km from the wind farm site boundary. They were considered as having the potential to occasionally pass through the wind farm site.

No migratory species were identified on site, but a several migratory species listed below were assessed as having the potential to occur on site.

- Fork-tailed Swift
- White-throated Needletail
- Satin Flycatcher
- Rufous Fantail
- Latham's Snipe.

A full listing of fauna species recorded during the 2012-14 surveys is presented in Annex E.3 of ERM Australia (2015).

2.1.2. 2017-2018 bird utilisation surveys

Nature Advisory carried out Bird Utilisation Survey (BUS) across four seasons which consisted of six 'impact' points and two 'reference' points over a six-day period. Impact points were sited in positions where turbines were planned to be situated. Reference sites were in similar terrain but at least 500 metres from a potential turbine site. At all sites eight replicate counts of birds were made, noting the flight heights of each bird in 10-metre intervals up to 60 metres, then 20-metre intervals up to 120 metres. All sightings above 120 metres were grouped.

A total of 77 bird species were recorded during the 2017-2018 BUS, and six species listed as threatened under the commonwealth *Environment Protection of Biodiversity and Conservation Act 1999* (EPBC Act) and/or the state *Biodiversity Conservation Act 2016* (BC Act) were recorded on the proposed wind farm site and are listed below.

- Superb Parrot (Vulnerable EPBC Act; Vulnerable BC Act)
- Dusky Woodswallow (Vulnerable BC Act)
- Flame Robin (Vulnerable BC Act)
- Scarlet Robin (Vulnerable BC Act)
- Varied Sittella (Vulnerable BC Act)
- White-fronted Chat (Vulnerable BC Act).

Birds were overwhelmingly recorded flying at heights below the proposed lower limit of the rotor-swept area of 40 metres. Approximately 96% of birds recorded during the BUS were observed flying below rotor swept area (RSA) heights.

The wind farm site supported potential foraging, roosting and breeding habitats for a wide variety of bird species. Hollow bearing trees, suitable for breeding and roosting by

birds and bats also occurred in a variety of areas. Habitat for wetland bird species was limited primarily to farm dams.

2.2. Birds of the wind farm site

Based on the combined results of ERM Australia and Nature Advisory, key findings include the following.

- Two owl species were recorded and listed below.
  - Powerful Owl (*Ninox strenua*)
  - Southern Boobook (*Ninox boobook*).
- Diurnal raptor species that were recorded are listed below.
  - Australian Hobby (*Falco longipennis*)
  - Black Falcon (*Falco subniger*)
  - Black-shouldered Kite (*Elanus axillaris*)
  - Brown Falcon (*Falco berigora*)
  - Brown Goshawk (*Accipiter fasciatus*)
  - Collared Sparrowhawk (*Accipiter cirrhocephalus*)
  - Little Eagle (*Hieraaetus morphnoides*)
  - Nankeen Kestrel (*Falco cenchroides*)
  - Peregrine Falcon (*Falco peregrinus*)
  - Swamp Harrier (*Circus approximans*)
  - Whistling Kite (*Haliastur sphenurus*)
  - Wedge-tailed Eagle (*Aquila audax*).
- Eleven species listed under the EPBC Act and/or BC Act were recorded and listed below.
  - Black Falcon (*Falco subniger*)
  - Blue-billed Duck (*Oxyura australis*)
  - Dusky Woodswallow (*Artamus cyanoptera*)
  - Flame Robin (*Petroica phoenicea*)
  - Little Eagle (*Hieraaetus morphnoides*)Powerful Owl (*Ninox strenua*)
  - Scarlet Robin (*Petroica boodang*)
  - Superb Parrot (*Polytelis swainsonii*)
  - Varied Sittella (*Daphoenositta chrysoptera*)
  - White-fronted Chat (*Epthianura albifrons*)
  - White-throated Needletail (*Hirundapus caudacutus*).
- Thirteen other threatened bird species for which the study area is likely to provide potential habitat are listed below. None were recorded at the wind farm site.
  - Regent Honeyeater (*Anthochaera phrygia*);

- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Brown Treecreeper (*Climacteris picumnus victoriae*);
- Little Lorikeet (*Glossopsitta pusilla*);
- Swift Parrot (*Lathamus discolor*).
- Hooded Robin (*Melanodryas cucullata cucullata*);
- Diamond Firetail (*Stagonopleura guttata*);
- Spotted Harrier (*Circus assimilis*);
- Painted Honeyeater (*Grantiella picta*);
- Hooded Robin (*Melanodryas cucullata*);
- Turquoise Parrot (*Neophema pulchella*);
- Barking Owl (*Ninox connivens*); and
- Australian Painted Snipe (*Rostratula australis*).

- Several species listed as migratory under the EPBC Act were identified as potentially occurring within the study area. These are listed below. However, none of these were recorded during surveys.
  - Black-faced Monarch (*Monarcha melanopsis*)
  - Fork-tailed Swift (*Apus pacificus*)
  - Latham's Snipe (*Gallinago hardwickii*)
  - Rufous Fantail (*Rhipidura rufifrons*)
  - Satin Flycatcher (*Myiagra cyanoleuca*).

2.3. Bat Utilisation studies

2.3.1. 2012-2014 Bat surveys

The methods and results of previous microbat surveys are outlined in ERM Australia (2015). The data were collected by four SongMeter (SM2Bat) units between 5th and 9th November 2012, by three Anabat units from 15th to 18th October 2013 and by handheld detector during spotlighting. These surveys totalled 29 bat recording nights.

A total of 13 microchiroptera bat species were identified as occurring on the wind farm site during surveys or within the locality (10km buffer around the wind farm site) from database searches. Of these two threatened species were identified as occurring within the wind farm area.

Non-listed bat species recorded on the wind farm site are listed below.

- White-striped Bat (*Austronomus australis*);
- Gould's Wattled Bat (*Chalinolobus gouldii*);
- Chocolate Wattled Bat (*Chalinolobus morio);*
- Western Broad-nosed Bat (*Scotorepens balstoni);*
- Little Broad-nosed Bat (*Scotorepens greyii*);

- Eastern Broad-nosed Bat (*Scotorepens orion);*
- Large Forest Bat (*Vespadelus darlingtonia);*
- Southern Forest Bat (*Vespadelus regulus*); and
- Little Forest Bat (*Vespadelus vulturnus*).

One bat species occurring within 10 kilometres of the proposed wind farm listed below.

- Greater Broad-nosed Bat (*Scoteanax rueppellii),* Vulnerable BC Act

Two threatened species recorded at the BWF are listed below.

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis)* Vulnerable BC Act
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis)* Vulnerable BC Act.

Calls attributed to the Eastern Bentwing-bat were identified as probable and could not be confirmed. These calls were recorded on six of seven nights in low numbers. The site falls within the species range and suitable habitat exists and so the species is considered to occur on the site.

Eastern False Pipistrelle was confirmed as occurring.

2.3.2. 2017-2018 spring and summer surveys

Nature Advisory (BL&A 2018) conducted bat surveys for the spring 2017 – autumn 2018 period comprising five SongMeters (SM4) over 56 nights, totalling to 2940 bat-recording hours. The early autumn survey was planned to coincide with the migration season of the threatened Eastern Bentwing-bat.

Twelve bat species and one species complex were identified utilising the wind farm site. This included three threatened species. The vast majority of calls identified were from common species of bats that are not of conservation concern (i.e. are not listed as threatened under any federal or state legislation).

Non-listed species recorded are listed below.

- White-striped Freetail Bat (*Austronomus australis*)
- Gould's Wattled Bat (*Chalinolobus gouldii*)
- Chocolate Wattled Bat (*Chalinolobus morio)*
- Eastern Freetail Bat (*Mormopterus (Ozimops) ridei)*
- Long-eared Bat (*Nyctophilus* spp.)
- Large Forest Bat (*Vespadelus darlingtonia)*
- Southern Forest Bat (*Vespadelus regulus*);

The following threatened species were recorded:

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Vulnerable BS Act
- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris),* Vulnerable BS Act
- Eastern Bentwing-bat/V. darlingtonia (species complex) *Miniopterus*: Vulnerable BS Act.

These threatened species were limited in their activity to one or two of the sites, with very low number of calls. This indicates very low numbers of those species occurring on site.

No threatened bat species were recorded at RSA height.

Most of the bat species were recorded at heights below RSA and are therefore considered to be exposed to a lower level of risk of collision with operating wind turbines.

2.4. Raptor surveys 2018

During the 2018 raptor studies a total of 96 observations were recorded from 11 raptor species at Biala Wind Farm. The Wedge–tailed Eagle was the most frequently recorded raptor species at the wind farm site, with two to three resident pairs utilising the wind farm site for foraging. It was regularly seen flying at RSA height. One nest has been identified in the study area which was active during the 2018 breeding season. The Wedge–tailed Eagle consisted of 44% of all raptor movements which puts it at greatest risk of collision with turbines.

The Nankeen Kestrel was also abundant at the site and was seen throughout the site during spring. None were seen during the autumn survey and few were observed during the summer and winter survey. In addition, the Brown Goshawk and Brown Falcon are at risk of collision with turbines due to activity levels and flight heights recorded.

Raptors are generally at risk of collision with turbines as they fly at RSA heights. Black-shouldered Kite, Collared Sparrowhawk, Swamp Harrier, Australian Hobby, Little Eagle, Black Falcon and to a lesser extent Peregrine Falcon are unlikely to collide with turbines due to low utilisation rates across the wind farm site. It is noted that Whistling Kite occurs in the region. Although it was not recorded during the raptor surveys; it was recorded in in early studies undertaken by ERM (2015).

3. RISK ASSESSMENT FOR BIALA WIND FARM

3.1. Introduction to the risk assessment

The aim of this risk assessment is to guide the development of the BBAMP for the BWF by identifying those species or groups considered at risk from either collision with turbines or disturbance from operating turbines. The outcomes of this risk assessment enable more targeted monitoring and management measures to be included in the BBAMP, focussing on species and groups at greater risk.

Wind farm impacts on birds and bats can arise from three pathways:

- Direct collision of birds and bats with operating wind turbine blades or towers at rotor swept area (RSA) heights;
- Disturbance effects that exclude birds and bats from habitat; and
- Barrier effects that limit bird and bat movements between essential resources, such as foraging and roosting areas.

The risk assessment has followed the procedure for risk assessment of AS/NZS ISO 31000 2009. The assessment has been undertaken as follows:

- Species or groups of concern have been short-listed based on their likelihood of occurrence at the site;
- Two impact pathways have been assessed: a) collision with turbines; and b) indirect effects (including both disturbance and barrier effects);
- Impact likelihood criteria have been developed and applied to each impact pathway for each species or group of concern;
- Impact consequence criteria have been developed and applied to each impact pathway for each species or group of concern; and
- The risk level for each species or group of concern from the two impact pathways has been determined consistent with a risk matrix.

This chapter presents the results of this risk assessment under the headings below.

Section 3.2 summarises the sources of information used to understand the likelihood of occurrence of each species or group on the BWF site and their likely behaviour on the site;

Section 3.3 lists the species of concern that have been subject to this risk assessment.

Section 3.4 provides an overview of the risk assessment method adopted, including the likelihood and consequence criteria and the risk matrix;

Section 3.5 presents the results and conclusions of the risk assessment and identifies the focus for the BBAMP for BWF.

3.2. Sources of Information

To ascertain the species of concern that may occur on the BWF site the following sources were used:

- The NSW Bionet Atlas Search tool (BCD 2018a), using a 40 by 40-kilometre search region centred over the proposed BWF site, with limits being -34.35° to -34.74°S, 149.15° to 149.60°E (searched in January 2018)

- The EPBC Act Protected Matters Search Tool (PMST) using a search region that included the proposed site with a 15-kilometre radius from the approximate central point of -34.59°S, 149.36°E (Department of the Environment and Energy 2018) and
- The Ecological Assessment of the BWF site during 2012-14 (ERM Australia 2015).

There are currently several nearby operational wind farms within 50 kilometres of the study area, notably the Gullen Range Wind Farm and Crookwell I Wind Farm. The Crookwell II Wind Farm is currently under construction. The publicly available documentation on these existing and planned wind farms was scrutinised and relevant information has been incorporated into this risk assessment.

3.3. Species and groups of concern

Species of concern are those that are known, likely or have the potential to occur on the wind farm site that are listed as threatened or migratory on biodiversity legislation or that are known to be particularly vulnerable to wind turbine impacts. These species have been the subject of this risk assessment. They include the following:

- Species listed as threatened on legislation or according to an authoritative source;
- Species known to be particularly prone to collision with operating turbines or sensitive to disturbance;
- Species for which a population concentration, or a population of significance, occurs on the site and that species may exhibit "risk behaviour" and potentially interact with the operation of wind turbines; or
- Native bird and bat species known to occupy the BWF site considered to have moderate to high collision risk by ERM Australia (2015).

From the foregoing information sources, a list of species with potential to occur in the search region was generated. Of these, a shortlist of species of concern was then generated based on the likelihood of occurrence on the BWF site itself given the habitat present on the site, the known habitat preferences of species and the regularity of occurrence of the species in the search region (see Appendix 1).

The original site assessments (ERM Australia 2015) identified listed threatened and migratory species likely to occur on the site, some of which were detected during on-site survey work. Although this has been taken into consideration, a number of additional species and groups, including non-threatened species/groups, have been identified in the current review that were not originally considered.

Most listed threatened and migratory waterbirds have been excluded from consideration on the basis of a lack of suitable habitat on the Biala Wind Farm site, with the exception of Latham's Snipe which is known to occur around wetlands at moderate to high altitudes in south-eastern Australia (Higgins and Davies 1996). Most such species occur along open coastal shorelines or inland lakes sometimes requiring dense vegetation and muddy substrate (e.g. Australian Painted Snipe); these habitats are absent and therefore the species excluded are unlikely to occur at the site and be impacted.

The short-listed species and groups are listed in Table 2.

Table 2: Risk assessment - Assessed bird and bat species

EPBC Act Listed Migratory Species
▪ Black-faced Monarch ▪ Fork–tailed Swift ▪ Latham's Snipe ▪ Rufous Fantail ▪ Satin Flycatcher ▪ White-throated Needletail
EPBC Act and BC Act listed threatened birds
▪ Painted Honeyeater (Vulnerable – EPBC & Vulnerable – BC) ▪ Regent Honeyeater (Critically Endangered – EPBC & BC) ▪ Swift Parrot (Endangered – EPBC & Critically Endangered BC Act) ▪ Superb Parrot (Vulnerable – EPBC & Vulnerable – BC)
EPBC Act and BC Act listed threatened bats
▪ Grey-headed Flying-fox (Vulnerable – EPBC & BC Act)
BC Act listed threatened birds
▪ Barking Owl (Vulnerable) ▪ Black Falcon (Vulnerable) ▪ Blue-billed Duck (Vulnerable) ▪ Brown Treecreeper (Vulnerable) ▪ Diamond Firetail (Vulnerable) ▪ Dusky Woodswallow (Vulnerable) ▪ Flame Robin (Vulnerable) ▪ Gang-gang Cockatoo (Vulnerable) ▪ Glossy Black Cockatoo (Vulnerable) ▪ Hooded Robin (Vulnerable) ▪ Little Eagle (Vulnerable) ▪ Little Lorikeet (Vulnerable) ▪ Powerful Owl (Vulnerable) ▪ Scarlet Robin (Vulnerable) ▪ Speckled Warbler (Vulnerable) ▪ Spotted Harrier (Vulnerable) ▪ Varied Sittella (Vulnerable) ▪ White-fronted Chat (Vulnerable)
BC Act listed threatened bats
▪ Eastern Bentwing-bat (Vulnerable) ▪ Eastern False Pipistrelle (Vulnerable) ▪ Yellow-bellied Sheathtail Bat (Vulnerable)
Bird species (NSW National Parks and Wildlife Act)
▪ Raptors – includes Black-shouldered Kite, Brown Falcon, Brown Goshawk, Collared Sparrowhawk, Nankeen Kestrel, Peregrine Falcon, Swamp Harrier, Wedge–tailed Eagle, Whistling Kite ▪ Waterbirds – includes ducks, herons, swans, ibis and other wetland associated species.
Bat species (NSW National Parks and Wildlife Act)
▪ Gould's Wattled Bat

- White-striped Freetail Bat

A risk assessment was undertaken for each of the foregoing species and groups.

3.4. Risk Assessment Process

The risk assessment process was based on the Risk Evaluation Matrix Model used to measure the overall risk of a potential impact event, in this case birds or bats striking wind turbine blades or being deterred from using part of the wind farm due to disturbance or barrier effects. The assessment is based on the *likelihood* of that event, and, should it occur, its *consequences*. This model is currently used across a wide range of industry sectors, in particular for assessing environmental risk.

The Risk Evaluation Matrix Model also complies with the AS/NZS ISO 31000 Risk Assessment Standard 2009.

The assessment requires criteria to be developed for likelihood and consequence. These criteria are provided respectively in Table 2 and Table 4.

Table 5 shows the risk levels used and how they are determined from the assessed likelihood and consequence levels.

Table 3: Likelihood criteria for a risk event to occur

Likelihood	Description
Certain	It is very probable that the risk event could occur in any year (>95%)
Almost Certain	It is more probable than not that the risk event could occur in any year (>50%)
Likely	It is equally probable that the risk event could or could not occur in any year (50%)
Unlikely	It is less probable than not that the risk event could occur in any year (<50%)
Rare	It is improbable that the risk event could occur in any year. (<5%) The risk event is only theoretically possible, or would require exceptional circumstances to occur.

Table 4: Consequence Criteria

Negligible	Low	Moderate	High	Severe
Occasional individuals lost but no reduction in local or regional population viability.	Repeated loss of small numbers of individuals but no reduction in local or regional population viability.	Moderate loss in numbers of individuals, leading to minor reduction in localised or regional population viability for between one and five years.	Major loss in numbers of individuals, leading to reduction in regional or state population viability for between five and ten years.	Extreme loss in numbers of individuals, leading to reduction in regional or state population viability for a period of at least 10 years

Table 5: Risk matrix defining risk level based on likelihood and consequence

		Consequence				
		Negligible	*Low*	*Moderate*	*High*	*Severe*
Likelihood	*Certain*	*Negligible*	*Low*	*High*	*Severe*	*Severe*
	Almost Certain	*Negligible*	*Low*	*Moderate*	*High*	*Severe*
	Likely	*Negligible*	*Low*	*Moderate*	*High*	*High*
	Unlikely	*Negligible*	*Negligible*	*Low*	*Moderate*	*High*
	Rare	*Negligible*	*Negligible*	*Negligible*	*Low*	*Low*

The relevant likelihood and consequence levels were determined by using data recorded from the wind farm site and with reference to any available information on the local and regional status of the species and bird groups concerned.

3.5. Risk Assessment Results

Table 6 provides the complete results of the risk assessment, including evaluation of the impacts of the project on each species against the foregoing likelihood and consequence criteria. It includes the following information as part of the risk assessment process:

- Environmental value to be protected
- Reasons for Inclusion
- Threatened species status
- Hazard (i.e. turbine collision or indirect disturbance)
- Consequence and likelihood scores for each hazard
- Risk rating
- Comments relating to risk rating scores

The risk associated with wind turbine collision and indirect effects at the BWF for most assessed bird and bat species was rated as **negligible**. The exceptions are described below.

The White-throated Needletail flies regularly at turbine height and flocks may pass over the BWF site during the summer months. Collisions have been recorded at wind farms elsewhere in NSW and eastern Australia. The risk to this species from the BWF is considered to be **low** as the species is widespread in eastern and south-eastern Australia.

Yellow-bellied Sheath-tailed Bat was recorded across the site (at four recorder locations) in relatively low numbers, compared with more common species such as White-striped Freetail Bat. This bat is a summer migrate to south east Australia and although wide spread, is usually not common in this part of its range. The species is known to fly above

the canopy and may collide with turbines resulting in moderate population consequences at the local scale. Risk to this species is considered to be **low.**

Eastern Bentwing Bat was recorded through eight confirmed calls at three sites and 34 species complex calls recorded at two sites (one additional site to the confirmed call locations). As it was confirmed as being present during Autumn there is potential that the species passes through the wind farm site during the migration period from its maternity caves in Wee Jasper to wintering habitat closer to the coast. Given the low numbers of calls recorded, it is unlikely that individuals were moving through the site in large concentrations. As such, risk to the species is considered to be **low**.

Given the occurrence of collisions involving Wedge-tailed Eagle (WTE) at many wind farms, this species is addressed in this risk assessment. There is a low incidence of disturbance and WTEs occur at most wind farms, including successfully breeding within 200 metres of operating turbines (BL&A, unpubl. data). Thus, risks to this species arise from likely collisions but not indirect disturbance. The risk to the Wedge-tailed Eagle was therefore considered to be **moderate**.

The Little Eagle was recorded incidentally, approximately 5.5km outside of the Biala WF site during the pre-construction survey of 2012-14 (ERM Australia 2015). This species has shown a 50% decline in numbers in NSW over three generations and is considered to have a low recruitment rate (Debus 2017). It may occur at Biala WF at low frequency and/or density, but should a collision occur this would have moderate consequences. The risk to the Little Eagle was therefore considered to be **low**.

Based on experience at other wind farms in eastern Australia, collisions of more commonly occurring raptor species are likely. Commonly occurring raptor species recorded to collide with turbines include Nankeen Kestrel, Brown Falcon and Black-shouldered Kite (BL&A, unpubl. data). The Whistling Kite is also recorded at the Biala WF site and should be added to this group of concern. These species appear not to be deterred by the presence of operating wind turbines and occur regularly at other wind farms in NSW (BL&A, unpubl. data). Overall, the risk from collision with turbines to these raptors is considered to be **low** as these species are widespread and common, making population impacts unlikely.

Table 6: Bird and Bat Risk Assessment – Biala Wind Farm

Value to be Protected	Reasons for Inclusion	Threatened species status	Hazard	Likelihood of Risk Event	Consequence	Risk Rating	Comments
Barking Owl Nixon connivens connivens	Species considered to possibly occur on the Biala WF site (ERM Australia 2015)	Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Low	Negligible	There is some potential for the species to occur as there is suitable habitat and Biala falls within the species range. Collision is likely to be very infrequent, if at all, due to the species' tendency to stick to treed habitats or to fly below turbine height over open habitats where it often obtains prey.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Black Falcon *Falco subniger*	Species recorded in search region (BCD 2018a); potential to occur within area	Vulnerable BC Act	Collision with operating wind turbines.	Almost certain	Low	Low	Mostly occurs in the western plains and in the drier lowland parts of NSW. There is one record in BioNet for the search region (OEH 2018a), so the species may occasionally reach the Biala WF area. Collision is likely to be very infrequent due to infrequent occurrence but in irruption years collision is almost certain given experience elsewhere in southern NSW.. Consequences would be low due to the widespread distribution of the species (all of northern and eastern Australia; Menkhorst et al. 2017).
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Black-faced Monarch *Monarcha melanopsis*	Species or species habitat likely to occur within area (DoEE 2018)	Listed migratory species EPBC Act	Collision with operating wind turbines.	Unlikely	Negligible	Negligible	This is an insectivorous species of rainforests and wet gullies along the eastern seaboard of Australia; it spends winter in north Queensland and New Guinea (Higgins et al. 2006). Habitat is likely to be suboptimal around Biala WF although the occasional bird occurs west of the divide. It is unlikely to collide with turbines at Biala WF which is outside its core distribution. If a collision occurred, overall consequences to its widespread and non-threatened population would be minimal.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Blue-billed Duck *Oxyura australis*	This species was recorded at the Biala WF site (ERM Australia 2015)	Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Negligible	Negligible	The Blue-billed Duck breeds in deep, vegetated swamps in south-eastern and south-western Australia. It disperses to more open and extensive wetlands outside the breeding season, occasionally occurring on farm dams, including in the study area (Marchant & Higgins 1990; ERM Australia 2015; OEH 2017a). It is unlikely to collide with turbines regularly (most waterbirds recorded colliding with wind turbines are much more common and widespread, BL&A, unpubl. data) but may be at some risk at night when undertaking dispersive movements.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Brown Treecreeper *Climacteris picumnus victoriae*	Species recorded in search region (OEH 2018a); potential to occur within area	Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Negligible	Negligible	It occurs in woodlands dominated by eucalyptus, especially stringybarks or other rough-barked eucalypts, usually with an open, grassy understorey (Higgins *et al.* 2001). This species has potential to occur at the BWF site since there are two records from the search region (OEH 2018a). Usually occurs in the lower canopy and is unlikely to fly at RSA height.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Diamond Firetail *Stagonopleura guttata*	Species recorded in search region (OEH 2018a); potential to occur within area	Vulnerable BC Act	Collision with operating wind turbines.	Rare	Negligible	Negligible	Found in woodlands, dry open forests and lightly timbered farmland where it feeds on native grasses (Higgins et al. 2006). There are 10 records from the Biala WF search region (OEH 2018a) and it has been recorded regularly in farmland around wind turbines in southern NSW where it has never been observed flying at RSA height or colliding with turbines (BL&A unpublished data).
			Indirect disturbance, including barrier effects.	Rare	Negligible	Negligible	
Dusky Woodswallow *Artamus cyanopterus cyanopterus*	Species recorded in search region (OEH 2018a); potential to occur within area	* Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Negligible	Negligible	Occurs in dry open sclerophyll forests and woodlands, usually dominated by eucalypts. Often found on the edges or in clearings of forest and woodland and sometimes recorded in shrubland and heathland and other various modified landscapes (Higgins et al. 2006). There are three records from the Biala WF search region (OEH 2018a). This species may occasionally fly at RSA height but usually flies within the canopy. Any collision would likely have minimal population impact since this species is still moderately common across most of its range.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Flame Robin *Petroica phoenicea*	Species recorded in search region (OEH 2018a); potential to occur within area	Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Negligible	Negligible	Breeds in forests in south-eastern Australia, usually in the hills or high-country. Migrates in autumn and winter to lower altitudes and more open habitat, such as farmlands, plains and some urban areas (Higgins and Peter 2002). There are four records from the Biala WF search region (OEH 2018a). Collisions with turbines have yet to be recorded, but an isolated collision would not impact the population greatly.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Fork-tailed Swift *Apus pacificus*	Species or species habitat likely to occur within area (DoEE 2018)	Listed migratory species EPBC Act	Collision with operating wind turbines.	Unlikely	Negligible	Negligible	This species is aerial, over inland plains, sometimes above foothills or in coastal areas, over cliffs and urban areas (Higgins 1999). It occurs over much of Australia and infrequently in the Biala area, often following weather fronts. it flies at turbine height. Collision is likely to be infrequent due to the irregularity of its occurrence – there are no records to date from the Biala WF search region (OEH 2018a). Small numbers possibly affected do not represent a significant proportion of the total population, estimated as at least in the tens of thousands (Department of the Environment 2015b).
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	

Value to be Protected	Reasons for Inclusion	Threatened species status	Hazard	Likelihood of Risk Event	Consequence	Risk Rating	Comments
Gang-gang Cockatoo *Callcephalon fimbriatum*	Species recorded in search region (OEH 2018a); potential to occur within area	Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Low	Negligible	This species occurs in forest along the coast and ranges from the Hunter Valley of NSW to south-west Victoria; it moves to lower altitudes in autumn-winter (Higgins 1999). There are four records from the Biala WF search region (OEH 2018a). This species is known to fly at turbine height, but appears to occur rarely around Biala WF, with no records from ERM Australia or this study. Therefore, collisions are likely to be infrequent and limited in their overall impact on its population.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Glossy Black Cockatoo *Calyptorhynchus lathami*	Species considered to possibly occur by ERM Australia (2015)	Vulnerable BC Act	Collision with operating wind turbines.	Rare	Negligible	Negligible	Occurs in forest and woodlands with casuarinas, from central Queensland to far eastern Victoria on the coast and ranges including inland slopes; an isolated population occurs in the Riverina and on Kangaroo Island, South Australia (Higgins 1999; OEH 2017b). The paucity of its preferred sheoak foraging trees in and around Biala WF and lack of records in the vicinity so far (OEH 2018a), suggests the species is unlikely to occur and therefore would be at minimal risk.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Hooded Robin *Melanodryas cucullata cucullata*	Species recorded in search region (OEH 2018a); potential to occur within area	Vulnerable BC Act	Collision with operating wind turbines.	Rare	Negligible	Negligible	This species occurs mostly in lightly timbered habitats such as dry woodlands with an open shrubby understorey, sparse grasses and patches of bare ground and leaf-litter, with scattered dead and fallen timber for foraging perches (Higgins and Peter 2002). Two records have been obtained from the Biala WF search region (OEH 2018a). As a perch and pounce forager from branches or logs/posts to the ground, this species is unlikely to fly at RSA height and so is unlikely to be impacted by the operating wind turbines.
			Indirect disturbance, including barrier effects.	Rare	Negligible	Negligible	
Latham's Snipe *Gallinago hardwickii*	Listed migratory species - species or species habitat may occur within area (DoEE 2018)	Listed migratory species EPBC Act	Collision with operating wind turbines.	Unlikely	Negligible	Negligible	Latham's Snipe breeds mostly in Japan and migrates to Australia from late August to March. While in Australia it occupies wetlands and roosts in nearby dense vegetation during the day. It may occur in very small patches of habitat, such as alpine bogs and roadside ditches (Higgins and Davies 1996). Some birds may pass through the Biala WF area stopping at vegetated farm dams, but the area provides no optimum habitat so visits are likely to be rare. It is therefore considered to be unlikely to collide with turbines in the area. Should a collision occur, there would be little impact on the overall population estimated at a minimum 25,000 birds (Wetlands International 2018)
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Little Eagle *Hieraaetus morphnoides*	This species was recorded at the Biala WF site (ERM Australia 2015)	Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Moderate	Low	The Little Eagle is distributed throughout the Australian mainland except in the most densely forested parts of the Great Dividing Range (Marchant and Higgins 1993). Turbine strikes of this raptor species could occur and the species has been recorded within 5.5km of BWF (ERM Australia 2015) and in the wider search region (OEH 2018a). It is expected that regular collision is unlikely in NSW given its very low population densities. In the 1990s, the Little Eagle was estimated globally as numbering tens of thousands to as many as 100 000 birds (Ferguson-Lees & Christie 2001), but in recent decades, the Little Eagle is believed to have undergone a moderate reduction in population size in NSW (OEH species listing advice).
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Little Lorikeet *Glossopsitta pusilla*	This species was recorded at the Biala WF site (ERM Australia 2015)	Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Negligible	Negligible	The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat (OEH 2016b). Little Lorikeet are at risk colliding with turbines given they may fly at RSA height, particularly when moving between feeding areas. There are no records of Little Lorikeets colliding with wind turbines. Their wide distribution and episodic occurrence in the area coinciding with eucalypt flowering events, which are sporadic. This would ensure they would only occasionally collide with turbines.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Painted Honeyeater *Grantiella picta*	Species or species habitat likely to occur within area (DoEE 2018)	Vulnerable EPBC Act Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Low	Negligible	This species is strongly associated with mistletoe around the margins of open forests and woodlands; it occurs from Gulf of Carpentaria to southern Victoria and eastern South Australia, mostly inland of the Great Divide (Higgins *et al*. 2001). There are no records from the Biala WF search region (OEH 2108a). This species usually flies within the tree canopy and would rarely visit the BWF site.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	

Value to be Protected	Reasons for Inclusion	Threatened species status	Hazard	Likelihood of Risk Event	Consequence	Risk Rating	Comments
Powerful Owl *Ninox strenua*	This species was recorded at the Biala WF site (ERM Australia 2015)	Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Low	Negligible	The Powerful Owl occurs mainly on the coastal side of the Great Dividing Range from Mackay to the extreme south-east of South Australia. This species inhabits open and tall wet sclerophyll forests with sheltered gullies and old growth forest with dense understorey. It is also found in dry forests with box and ironbark eucalypts and River Red Gum. Large old trees with hollows are required by this species for nesting (Higgins 1999; Soderquist *et al*. 2002). For most of its life, the Powerful Owl restricts its activities to forested habitat and does not fly often over open country. Dispersing juvenile owls may fly longer distances, including over open country, such as where turbines are located. There are six records from the Biala WF search region and three from the wind farm site (ERM Australia 2015; OEH 2018a, Nature Advisory 2018). The small number of birds are likely to inhabit BWF and nearby areas, and the limited activity beyond forested areas make collision and disturbance unlikely.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Regent Honeyeater *Anthochaera phrygia*	Species or species habitat known to occur within area (DoEE 2018); one record in search region (OEH 2018a)	Critically endangered EPBC Act Endangered BC Act	Collision with operating wind turbines.	Rare	Moderate	Negligible	Inhabits dry eucalypt forests and River Sheoak near rivers and creeks on inland slopes of the Great Dividing Range; also occurs intermittently along the NSW coast in Swamp Mahogany forest. It could also occur in small remnant patches or in mature trees in farmland or partly cleared agricultural land (Higgins *et al*. 2001; OEH 2017b). There is one record from the Biala WF search region (OEH 2018a). This species usually flies within the tree canopy and would rarely visit the BWF site.
			Indirect disturbance, including barrier effects.	Rare	Negligible	Negligible	
Rufous Fantail *Rhipidura rufifrons*	Species or species habitat likely to occur within area (DoEE 2018)	Listed migratory species EPBC Act	Collision with operating wind turbines.	Unlikely	Negligible	Negligible	Occurs in wetter forests, woodlands and gullies along the coast and ranges along the eastern seaboard of mainland Australia. Sometimes occur on the inland slopes, especially on migration (Higgins et al. 2006). No records from the Biala WF search region. This species usually forages in the foliage or understorey layers and given limited suitable habitat and low densities in the Biala region, is unlikely to be impacted by turbines.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Satin Flycatcher *Myiagra cyanoleuca*	This species was recorded at the Biala WF site (ERM Australia 2015)	Listed migratory species EPBC Act	Collision with operating wind turbines.	Unlikely	Negligible	Negligible	This species occurs in forest and woodlands along the eastern seaboard of Australia including Tasmania (Higgins et al. 2006). After breeding in south-eastern Australia, it migrates to north Queensland and New Guinea during autumn and winter. This species is fairly common and so any collisions with turbines at Biala WF is unlikely to cause measurable impacts to its population.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Scarlet Robin *Petroica boodang*	This species was recorded at the Biala WF site (ERM Australia 2015; this study)	Vulnerable BC Act	Collision with operating wind turbines.	Rare	Negligible	Negligible	The Scarlet Robin lives in open forests and woodlands in Australia. During winter, it will visit more open habitats such as grasslands and will be seen in farmland and urban parks and gardens at this time. Flight height studies at another wind farm in NSW (ELA 2011) indicate that Scarlet Robin flies at heights of 20 metres or less. This is below the RSA height; there are unlikely to be measurable impacts on its population.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Speckled Warbler *Chthonicola sagittata*	Species recorded in search region (OEH 2018a); potential to occur within area	Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Negligible	Negligible	It inhabits dry eucalypt forests and woodlands, especially those with box-ironbark eucalypt associations and abundant fallen timber. It is also found in River Red Gum woodlands (Higgins and Peter 2002). There are two records in the Biala WF search region (OEH 2018a). This species inhabits the lower vegetation strata and the ground and it is not known to fly at RSA height.
			Indirect disturbance, including barrier effects.	Unlikely	Unlikely	Negligible	
Spotted Harrier *Circus assimilis*	Species considered to possibly occur by ERM Australia (2015)	Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Negligible	Negligible	Prefers open woodlands that do not obstruct low flight, and natural and exotic grasslands in arid and semi arid areas (Higgins & Davies 1996). Suitable habitat for the species exists but there are no records of the species in the search region. Collision with turbines is therefore very unlikely and collision very infrequent, if at all. Risks to this species are therefore negligible.
			Indirect disturbance, including barrier effects.	Unlikely	Unlikely	Negligible	
Superb Parrot *Polytelis swainsonii*	Species recorded in search region (OEH 2018a); recorded at the Biala WF site (this study)	Vulnerable EPBC Act Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Low	Low	Occupies open woodlands of the inland slopes and southern Riverina of New South Wales and north-central Victoria. Breeding occurs in large eucalypts with hollows in the Riverina and south-west slopes regions; a proportion of the population moves north in autumn-winter (Higgins 1999; OEH 2017b). Although listed under EPBC and BC Acts, Garnett et al. 2010 did not consider the species threatened citing new information that the population is over 10,000 birds and not declining. Since Biala WF is close to the edge of its range and is not optimum habitat, it is probable that only a few birds pass through the area regularly. There are unlikely to be major consequences arising from turbine collisions
			Indirect disturbance, including barrier effects.	Unlikely	Unlikely	Negligible	

Value to be Protected	Reasons for Inclusion	Threatened species status	Hazard	Likelihood of Risk Event	Consequence	Risk Rating	Comments
Swift Parrot *Lathamus discolor*	Species or species habitat likely to occur within area	Critically endangered EPBC Act Endangered BC Act	Collision with operating wind turbines.	Unlikely	Low	Negligible	In NSW it is a non-breeding autumn-winter visitor from its breeding grounds in Tasmania. It prefers a narrow range of eucalypts including Boxes, Ironbarks, Blakely's Red-gum, Swamp Mahogany, Blackbutt, Red Bloodwood and Spotted Gum (Higgins 1999; OEH 2017b). It spends winter mostly inland of the Great Dividing Range but some years reaches the coast (Higgins 1999; Kennedy and Tzaros 2005). Potential to pass through Biala WF however there are no records from BWF or the surrounding region (OEH 2018a).
			Indirect disturbance, including barrier effects.	Unlikely	Unlikely	Negligible	
Varied Sittella *Daphoenositta chrysoptera*	This species was recorded at the Biala WF site (ERM Australia 2015)	Vulnerable BC Act	Collision with operating wind turbines.	Rare	Negligible	Negligible	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction over recent decades (OEH 2018b). It inhabits eucalypt forests and woodlands flying at canopy level. The Varied Sittella forages in groups, flying into the tree canopy and working down the branches and trunks, probing through the bark in search of insects (Pizzey & Knight 2003). This species is unlikely to fly at RSA height.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Wedge-tailed Eagle *Aquila audax*	This species was recorded at the Biala WF site (ERM Australia 2015).	N/A	Collision with operating wind turbines.	Almost certain	Moderate	Moderate	The Wedge-tailed Eagle is the species most exposed to collision risk due to its common habit of soaring and circling at height while foraging. Several birds of this species have been struck at other wind farms in NSW. Disturbance is not an issue, with the eagle breeding successfully as close as 200 metres from operating wind turbines.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
White-fronted Chat *Epthianura albifrons*	This species was recorded at the Biala WF site (ERM Australia 2015; this study)	Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Negligible	Negligible	This species inhabits of open country, grasslands and low shrublands especially open wetlands and low fringing vegetation across southern Australia including southern NSW (Higgins et al. 20006; OEH 2018b). The species is known to occur in the southern part of Biala WF (this study). Although recorded at several other wind farms in NSW, Victoria and South Australia, indicating a tolerance of operating wind turbines. It is unlikely to be affected by turbine strike as it rarely flies high enough, being a ground bird.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
White-throated Needletail *Hirundapus caudacutus*	Species or species habitat likely to occur within area	Listed migratory species, Vulnerable EPBC Act	Collision with operating wind turbines.	Likely	Low	Low	This species is known to follow storm systems and fronts. Occasional mortality has been reported at other wind farms where it occurs. It typically flies at and above RSA height. Loss of a small number of individuals each year is not considered to be of significance as the species is still numerous in Australia. Although not yet recorded around Biala WF (OEH 2018a), it is considered likely to occur there regularly.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Other raptors	Common occurring raptor species were recorded at the Biala WF site (ERM Australia 2015)	N/A	Collision with operating wind turbines.	Almost certain	Low	Low	Turbine strikes by commonly occurring raptors, such as Brown Falcon, Nankeen Kestrel and Black-shouldered Kite are likely, based on experience at other wind farms in south-eastern Australia. The widespread and common status of these species makes population impacts unlikely. These species appear not to be deterred by the presence of operating wind turbines and occur regularly at other wind farms in NSW.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Waterbirds	Common occurring waterbird species were recorded at the Biala WF site (ERM Australia 2015)	N/A	Collision with operating wind turbines.	Unlikely	Low	Negligible	Habitats on the BWF site for waterbirds are limited to small farm dams. No large concentrations of waterbirds occur nearby. Experience at other wind farms in NSW indicates few waterbirds collide with turbines, even near large waterbird concentrations (e.g. Lake George), where birds confine most of their activities to the wetlands and don't often move across farmland.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	This species was probably recorded at the Biala WF site (ERM Australia 2015)	Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Moderate	Low	This species migrates from maternity caves in Autumn and then returns in Spring, the nearest known site being Wee Jasper located approximately 80km south west of Biala. It roosts in caves during the day, dispersing over a range of habitats at night. Its feeding areas tend to be associated with forests, wetlands and waterways. This species could collide with turbines as it is known to fly occasionally at RSA height. Individuals pass through the Biala WF area during migration between maternity caves and the wintering areas of the coast but are unlikely to do so in large concentrations given the low number of calls confirmed (eight in total at three sites and 13 in total identified to a species complex level at two sites) and the distance from the nearest maternity cave. Population consequences are therefore considered to be moderate.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Eastern False Pipistrelle		Vulnerable	Collision with operating wind turbines.	Unlikely	Low	Negligible	This species prefers moist habitats with trees taller than 20 m. It roosts in tree hollows but has also been found roosting in buildings or under loose

Value to be Protected	Reasons for Inclusion	Threatened species status	Hazard	Likelihood of Risk Event	Consequence	Risk Rating	Comments
Falsistrellus tasmaniensis	This species was recorded at the Biala WF site (ERM Australia 2015)	BC Act	Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	bark. The species was recorded from 2 calls at a single site and not recorded at 50m. Flies within or just below the canopy in gaps, along tracks, and also in open areas (Churchill 2008). It is possible for the species to fly higher when foraging in open areas however given its preferred habitat and foraging habits, collision is considered unlikely.
Gould's Wattled Bat *Chalinolobus gouldii*	This species was recorded at the Biala WF site (ERM Australia 2015)	Not listed	Collision with operating wind turbines.	Likely	Negligible	Negligible	A common and widespread species. Juveniles disperse from December or January which may result in higher rates of collision. It nests in tree hollows or buildings and flies within canopy and sub canopy but will pass over open areas and can forage up to 15km from roosts (ELA 2011). It has been recorded colliding with turbines at other wind farms. As a common and widespread species population impacts are unlikely.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Grey-headed Flying-fox *Pteropus poliocephalus*	Species or species habitat likely to occur within area	Vulnerable EPBC Act	Collision with operating wind turbines.	Unlikely	Negligible	Negligible	This fruit bat occurs in the eastern mainland states from southern Queensland to Victoria, mostly along the coast and Great Diving Range (Churchill 2008). It is predicted to occur but has not yet been recorded in the area surrounding Biala WF (OEH 2018b). The species occupies large roosting colonies or camps numbering hundreds or thousands, often congregating in large towns or cities and other locations with abundant year-round food supply (Churchill 2008). The loss of a stray individual from turbine strike would not impact the overall population significantly.
		Vulnerable BC Act	Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
White-striped Freetail Bat *Tadarida australis*	This species was recorded at the Biala WF site (ERM Australia 2015)	N/A	Collision with operating wind turbines.	Almost certain	Low	Low	This species is found across Australia. It migrates to northern regions during winter and does not hibernate. It flies above the canopy and roosts in hollows. It ranges up to 50kms in a night. Juveniles disperse from January which may result in higher mortalities (ELA 2011). It has been recorded colliding with turbines at other wind farms. As a common and widespread species population impacts are unlikely.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	
Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris*	This species was recorded at the Biala WF site (BL&A 2018)	Vulnerable BC Act	Collision with operating wind turbines.	Unlikely	Moderate	Low	This species inhabits a range of habitats across northern and eastern Australia. It may be susceptible to turbine blade collision as it is known to fly above the canopy when foraging. recorded at all recorder sites from several calls (between four and 13 calls) but no calls were recorded at a height of 50 metres above ground. This bat is migratory and a summer visitor to south-eastern Australia and although wide spread, is usually not common in this part of its range Given the occurrence of this bat across the site but relatively low numbers of calls collision is considered to be unlikely and population impacts moderate.
			Indirect disturbance, including barrier effects.	Unlikely	Negligible	Negligible	

Notes: TSC Act = Biodiversity Conservation Act; EPBC Act = Environment and Protection of Biodiversity and Conservation Act; * = Preliminary Determination by the NSW Scientific Committee.

3.6. Conclusions from the Risk Assessment for Biala Wind Farm

The surveys of the BWF and surrounding wind farm sites to date, combined with the knowledge generated at operating wind farms elsewhere in Australia (BL&A unpubl. data), indicate that collision rates are typically very low and this risk assessment indicates that no significant population impacts are anticipated for species of concern.

Raptors are known to be vulnerable to collision with operating wind turbines. A number of raptor species have been recorded at the BWF site during surveys. The Wedge-tailed Eagle is the most exposed to collision risk due to its common habit of soaring and circling at height while foraging. Nankeen Kestrel, Brown Falcon, Brown Goshawk, Black-shouldered Kite and Whistling Kite may also be at low risk from collision with turbines.

White-throated Needletail is a migratory species considered to have similar flight behaviour to raptors. It should be noted that White-throated Needletail is listed as a migratory species under the EPBC Act. It is unlikely to be locally common. Its conservation status is listed as Vulnerable both at a Commonwealth level.

The Superb Parrot may sometimes fly at RSA height. It has been recorded once in the Biala WF search region and once on the wind farm site at the southern end in open woodland in November 2017. ERM (2015) found the dominant trees in patches across the wind farm site consisted of primarily of Broad-Leaved Peppermint, Brittle Gum, Red Stringy Bark, along with a small patch of Ribbon Gum & Snow Gum. It is possibly only an occasional visitor to area since the area mostly lacks the box-gum woodland preferred by the species. Preferred breeding habitat includes; Blakely's Red Gum, Yellow Box, Apple Box and Red Box (BCD 2020), none of which were found on site. Given the preceding, the habitat on site for Superb parrot is considered sub-optimal. The risk rating of low is considered as highly conservative given there have been two observations of the species at the site across four BUS efforts and the suboptimal on-site habitat for Superb Parrot. As a precaution, a targeted survey during the Superb Parrot breeding season will be undertaken in the first year after construction of the wind farm.

Yellow-bellied Sheathtail Bat is known to be migratory, moving to southern parts of its range during the summer months. The species was recorded across the wind farm site with a low number of calls and is known to fly at RSA height. It is therefore at risk of collision, however given its widespread distribution across Australia and low numbers of calls recorded on site, collision events are expected to be infrequent and not result in significant population impacts.

Eastern Bent-wing Bat was recorded on site during its Autumn migration period, indicating that it passed through the site on the way to wintering habitat on the coast. The low number of calls however, indicates that this was not in large concentrations. Therefore, collision is expected to be infrequent and it is considered to be at low risk from the operation of the wind farm.

Many of the species listed under the BC Act screened in this risk assessment are not evaluated to be at risk from the operation of BWF. Most threatened woodland birds and bats do not regularly fly at RSA height and therefore do not encounter turbines very often.

This risk assessment indicates that a small proportion of the species and groups of concern (five out of 31 birds or bird groups and three out five of bats) have more than a negligible risk rating of being affected by collision with operating turbines once the BWF is constructed. No birds or bats are at risk from indirect effects, such as disturbance or barrier effects.

The BBAMP for the BWF will therefore focus on monitoring for collisions with turbines of the White-throated Needletail, Little Eagle, Wedge-tailed Eagle, other raptors, Yellow-Bellied Sheathtail Bat, Eastern Bent-wing Bat and White-striped Freetail Bat. Further surveys in autumn during the migration season of the Eastern Bent-wing Bat will show whether the risk rating for this species will change, depending on the survey results.

4. OPERATIONAL PHASE SURVEYS

A range of approaches will be utilised post-construction, i.e. the operational phase of the project, to meet the requirements of the relevant condition of approval (21).

The main approaches to implementing the BBAMP will be:

- Specific management contingencies for key species and groups identified in the risk assessment and/or initiated due to a specific impact trigger (see section 6);
- A statistically robust carcass–monitoring program (random or stratified random sampling design) to detect birds and bats that collide fatally with wind turbines as a basis for an estimate of overall bird and bat mortality rates at the BWF;
- Mitigation measures to reduce the possible interactions between birds and bats, and operating wind turbines.

Sections 4.1 to 4.3 describe the survey methodologies to be implemented once Biala wind farm becomes operational.

Carcass-searches are expected to be carried out for a total of two years immediately following the erection of the turbines (i.e. once turbines are spinning) of the BWF. This may require a staggered monitoring approach if some turbines begin spinning before others. A review and compilation of all monitoring data gathered in the first year to determine if further, more targeted, surveys will be required in the second year, or if reduced monitoring effort is justified will be undertaken.

4.1. Monitoring 'at risk' groups

Baseline information was generated in the initial surveys in 2012-14 and in 2017/2018 on bird utilisation of the site including seasonal raptor surveys in 2018. A review of this information combined with information from other sources has been collated in the risk assessment and is considered to provide an adequate pre-construction baseline to compare future changes.

The key "at risk" groups have been identified through the risk assessment (see Section 3). These include:

- **Wedge-tailed Eagles (WTE).** A moderate risk to WTE has been assessed (Table 6). Accordingly, it is important that mitigation measures are implemented to reduce WTE being attracted to the vicinity of the turbines and that further information is compiled on the WTE population on the wind farm site and the flight behaviours that could present a risk to WTE.
- **Other raptors and White-throated Needletail**. On site occurrence of these species was recorded during the targeted eagle surveys described Section 2.4.
- **Yellow**-bellied Sheathtail Bat and Eastern Bent-wing Bat. A low risk has been assessed for both species (Table 6).

In the event that threatened birds or threatened bats are found during carcass searches, or incidentally, an appropriate response will be identified in consultation with BCD, as described in the procedure in Section 6 of this BBAMP.

4.1.1. Birds of Prey (Raptors)

This group includes the diurnal raptors than have been recorded at Biala Wind Farm, namely Black Falcon and Little Eagle (listed Vulnerable in NSW), Wedge-tailed Eagle and other raptors (Black-shouldered Kite, Brown Falcon, Brown Goshawk, Collared Sparrowhawk, Nankeen Kestrel, Peregrine Falcon, Swamp Harrier, Whistling Kite). It will also apply to any other species of diurnal raptor that may occur at Biala WF in future.

After operations commence, monthly monitoring of eagle flight movements and breeding activity (during the breeding season) is required to determine whether operating turbines affect the behaviour of Wedge-tailed and Little Eagle in particular. This raptor monitoring can be incorporated into the initial two-year monthly carcass monitoring program and will initially operate for the first two years of operational monitoring.

Monitoring will involve searching for flying eagles from the turbine search sites during searches (one scan every minute or so of searching) and incidental recording of raptors when moving between search sites.

Information recorded will include, as a minimum:

- Date location and duration of observation period (i.e. carcass search vs incidental),
- Time and duration of flight,
- No. and age of birds,
- Flight height above ground (range),
- Flight behaviour,
- Habitat over which the flight was observed,
- Flight behaviour observed included soaring, directional flight (flapping), kiting, circling, gliding and diving, and
- Other occasional behaviours included feeding, territorial displays, fighting and perching.

Flight paths will be plotted as accurately as possible on large-scale aerial photographs of the site.

In addition, nesting activity will also be recorded. Based on eagle flight behaviour observed while on site it will be possible to locate prospective areas within the wind farm for these nests. Any eagle nest locations will be recorded with GPS and revisited during the breeding season to monitor nesting activity and outcome (in August and November for Wedge-tailed Eagle).

The monitoring of birds as outlined above is likely to vary with potentially higher utilisation in spring-summer-autumn. However, consistent monitoring across all seasons will enable the identification of possible seasonal changes.

A series of adaptive management measures are proposed in this BBAMP to reduce the potential for high numbers of raptors to use the site. These are outlined in Section 5 of this document.

4.1.2. Migratory Bird Species

White-throated Needletail typically flies at and above RSA height. The initial two-year monthly carcass monitoring will monitor their presence (during the appropriate season, October to early April) and any impacts likely to occur from the BWF (see section 3.3).

In addition, during the monthly carcass monitoring searches, if a flock of Needletails moves through the site, the numbers of birds and the zone of movement (where ascertainable) will be plotted on the large-scale aerial photographs of the site.

The same information will be recorded for any observed flight paths of Needletails as described above for raptors.

4.1.3. Other species of concern

All other bird species were considered to be at a 'negligible' risk rating. These species would be subject to the standard protocols post construction, i.e. any bird found during the carcass searches (Section 4,4) or by wind farm staff incidentally would be reported and stored in a freezer on site for confirmation of its identity and for use in trials.

4.2. Operational Bird Utilisation Surveys

Pre-construction surveys were conducted at BWF. These surveys will be repeated once the wind farm is operational, with monitoring in Spring and Summer-Autumn to replicate the initial surveys. These surveys will seek to demonstrate whether the site continues to be utilised by the range of species identified in the pre-construction surveys.

4.3. Bat Surveys

Initial pre-construction phase surveys (ERM Australia 2015; BL&A 2018) detected a variety of bat species including three BC Act listed species, the Eastern Bent-wing Bat and Yellow-bellied Sheathtail Bat, which have been assessed as being at low risk from wind farm operation and Eastern False Pipistrelle. One none-threatened bat species, White-striped Freetail Bat was assessed as above a negligible risk (Table 6). Therefore, operational phase bat carcass monitoring for bats is considered necessary.

Bat survey will be undertaken during the migratory periods of the Eastern Bent-wing Bat during the first year of the operation phase of the wind farm (Autumn 2021).

If an impact trigger occurs during routine carcass monitoring (see Section 6), additional surveys will likely be needed to inform a management response.

4.4. Carcass searches

The purpose of carcass searches is to determine the actual impact of the wind farm on birds and bats by attempting to estimate the annual number of birds and bats that collide fatally with turbines. Mortality rates can be estimated for all bird species combined, and all bat species combined. If threatened species are found underneath a turbine, the mortality rate for that particular threatened species may also be estimated, subject to sufficient data being available.

Mortality is defined as any dead bird or bat detected under a wind turbine and within a distance of the turbine in which carcasses could potentially fall if struck. Detection can be either during the formal carcass searches (designed to generate an estimate in accordance with a statistically rigorous sampling design) or at other times (incidental observation, often by wind farm operational staff). A protocol is triggered whenever a carcass is found, either within the formal searches or incidentally to collect consistent and useful data on the fatality event (see below).

Collision by birds and bats with wind turbines will be monitored through a statistically rigorous carcass-search program for a minimum period of two years. This will involve systematic,

monthly searches for dead bird and bat carcasses under a random selection of turbines (see details below). This will ensure statistically useable and robust results are generated from the carcass monitoring program that include an estimate of both bird and bat mortality rates, together with an estimate of sampling precision.

It will be assumed that any intact dead bird or bat, or bird feather spot (defined as a clump of five feathers or more), detected beneath a turbine has died as a result of collision or interaction with a turbine, unless there are obvious signs of another cause of death (e.g. being shot). Feather spots will be assumed to be remains of a bird carcass after scavenging and the scavenger correction factor will not be applied to them (see later).

Ongoing monitoring of mortality from blade strike at operating wind farms typically serves to (i) provide data that can inform adaptive management of the collision risk (i.e. patterns of mortality related to seasonal changes or local conditions); and (ii) detect mortality of threatened and non-threatened bird and bat species, which can be used to understand actual bird and bat impacts.

The search protocol (see Section 4.4.2 below) has been designed to detect optimally species and groups of concern that have a higher than negligible risk of impact, as well as any other species that have fatally collided with turbines. The consistent application of this protocol will ensure that statistically robust, spatially and temporally consistent data are collected on bird and bat mortality.

To derive accurate mortality rates, it is essential that the program is scientifically and statistically robust. A number of factors, such as carcass scavenging and carcass detectability, can affect mortality rate estimates and must be measured and included in any estimate of overall mortality rates.

A scavenged carcass may increase the variability in mortality rate estimates and thus carcasses will be assessed for possible scavenging and rates will be estimated from experimental trials (section 4.4.3).

Human detectability of carcasses is also a potential confounding variable and protocols have been developed to control for this factor in the final mortality estimates. Section 4.4.4 provides more detail on this issue.

The practical considerations that have informed the design of the carcass search program and associated trials are listed below.

- Very few carcasses are found under wind turbines in Australia compared with Northern Hemisphere wind farms (i.e. on average, less than half the number in the Northern Hemisphere based on BL&A data across ten wind farms);
- Carcasses of a suitable range of sizes for scavenger and detectability trials are difficult to source and usually involve a combination of carcasses found under turbines and those found along roads and other legal sources. It is illegal to source un-cleaned carcasses from poultry producers.
- For statistical reasons, it is likely to be very difficult to determine more than the grossest of differences in scavenging rate or detectability across the year and there is no evidence in the literature for significant differences between seasons in scavenger activity. Therefore, annual scavenger and detectability correction factors will be generated and applied.

- It is known that detectability will be easier in short grass at the dry time of the year compared with in longer grass at the wet time of the year, and detectability trials have been scheduled accordingly (see Section 4.4.4).

Similar methods have been recommended in a number of other approved bird and bat monitoring programs in New South Wales and Victoria (see section 1.1 for examples). Implementation of bird and bat monitoring programs in Australia continues to develop (since 1998), and the techniques described here are based on lessons from a number of such programs already implemented (e.g. Hull *et al*. 2013, BL&A unpubl. data from ten projects), knowledge of experimental design and statistical analysis, and recent feedback from the regulatory authorities.

After two years of mortality monitoring, a detailed report will be prepared reviewing the mortality detection program and providing recommendations for the future in response to confirmed issues.

The following sections outline:

- **Turbine site selection for survey** (Section 4.4.1): how the wind turbines will be selected for the search
- **Search protocol** (section 4.4.2): the size of area beneath turbines to be searched and how this area will be systematically searched and results recorded
- **Scavenger rates and trials** (Section 4.4.3): definition of scavenging and how experimental trials will be conducted
- **Detectability and trials** (Section 4.4.4): definition of detectability and the experimental trial methodology
- **Incidental search protocol:** (Section 4.4.5): outlining the procedure to be adopted in the event of an incidental carcass or feather spot find by wind farm personnel outside the formal carcass-searches.
- **Analysis and mortality estimation** (Section 4.4.6): general outline of how the data will be analysed to gain estimates of bird and bat mortality.

4.4.1. Turbine Selection

The BWF comprises 31 turbines. All of these (North east (T01-T06), North west (T07-T17), Central (T18 – T29) and South west (T30 – T31) – comprising all the ridges of the wind farm – will be searched during every scheduled search.

Each turbine will have the following recorded:

- Location (easting, northing)
- Distance to nearest other turbine
- Identification number of nearest turbine
- Local vegetation (type, height, and density during each search to document change in vegetation cover over time)
- Distance to key habitat feature, such as dam/wetland or waterway, or woodland remnant.

4.4.2. Search protocol

The search area beneath each turbine has been determined to best detect bats and medium to large bird carcasses, based on the turbine dimensions (Hull & Muir 2010). Based on the Hull and Muir model (2010) 95% of bat carcasses are found within 65 metres of the turbine, and carcasses of medium to large birds are reasonably evenly distributed out to 100 metres. Carcasses of very large birds (Wedge-tailed Eagle) may be found a little further out, but 95% are within 115 metres of the turbine.

Given this evidence, inner and outer circular search zones have been designated. The inner zone targets the detection of carcasses of bats and small to medium and large sized birds. In the inner zone, a circle is formed with a 60-metre radius from the turbine and transects are spaced every six metres across this circle (Figure 3).

The outer zone will comprise the zone between the 60-metre and 120-metre radius circles. Although they are still recorded in the inner zone, the outer zone will ensure the adequate detection of carcasses of medium to larger sized birds, which can fall further away from turbines. Search transects in the outer zone are spaced at 12 metres and carried out from the edge of the inner zone out to the edge of the outer zone (see Figure 4). Given that the defined transect spacing and total search area are based on experience and evidence from previous studies (e.g. Arnett *et al*. 2005, Hull and Muir 2010) they are considered to be ample to detect bats and the bird species of concern arising out of the risk assessment.

All turbines will be searched out to 120 metres once per month. A second follow-up search, a 'pulse search' will be undertaken to 60 metres once a month within several days of the first search to detect additional mortality of bats and birds. The order of turbines searched will be randomized between searches.

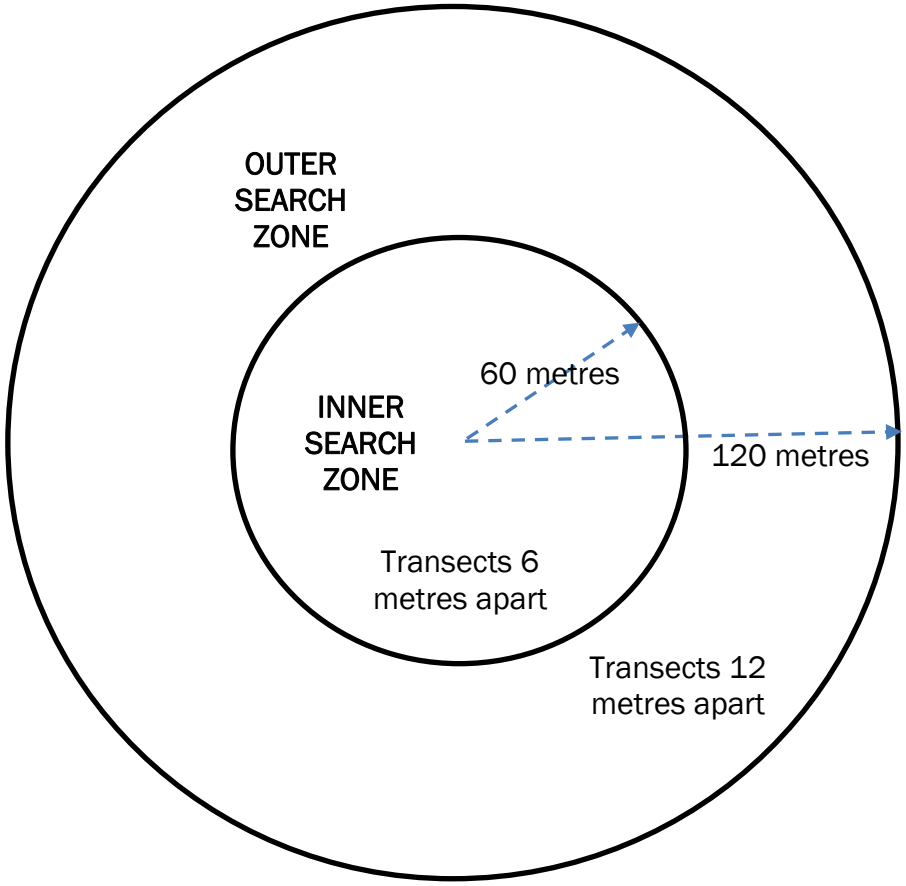
All searchers will operate under the supervision of a qualified ecologist experienced in wind farm bird and bat monitoring, who will ensure adequate training in the monitoring methods and reporting requirements.

The search method will involve either:

- Searches on foot along pre-determined transects by a trained searcher; or
- Searches by a trained scent dog.

The alternative method involving a scent dog will be undertaken by commencing the search on the downwind side of the search area and steadily moving forward in left and right sweeps across the 120 m search area, moving forward every 10-20 metres. The scent dog will carry a GPS tracker and the search route will be recorded.

Figure 3: Inner and outer carcass search zones underneath the turbines



Carcass detection protocol

If a carcass is detected (a 'find') the following variables will be recorded in the carcass search data sheet (see Appendix 2):

- GPS position, distance in metres and compass bearing of the carcass from the base of the wind turbine tower;
- Substrate and vegetation, particularly if it was found on a track or hard-stand area without vegetation as this may assist in quantifying the number of carcasses not found in areas where ground cover makes carcasses less visible;
- Species, age, number, sex (if possible) signs of injury and estimated date of strike;
- Weather (including recent extreme weather events, if any), visibility, maintenance to the turbine and any other factors that may affect carcass discovery; and
- If the species is not able to be immediately identified as there is not a qualified ecologist on-site (i.e. an incidental find), photographs will be provided to the qualified ecologist within 2 business days of the find for identification and the ecologist must reply within 5 business days for the possible reporting of an impact on a threatened species within 2 business days of confirmation.
- If the qualified expert cannot identify the carcass, then persons qualified to undertake DNA analysis to confirm species ID will be engaged to undertake identification.

The carcass will be handled according to standard procedures, as follows:

- The carcass will be removed from the site to avoid re-counting;
- The carcass will be handled by personnel wearing rubber gloves, packed into a plastic bag, then wrapped in a sheet of newspaper then in a second plastic bag;
- The carcass will be clearly labelled by including a copy of its completed carcass search data sheet in the second plastic bag to ensure that its origin can be traced at a later date, if required; and
- The double-bagged and wrapped carcass will be transferred to a freezer at the site office for storage so a second opinion on the species identity may be sought, if necessary, and for use in later scavenger and detectability trials.

The wind farm operator will obtain a permit from BCD under the *National Parks and Wildlife Act 1974* to handle and keep native wildlife (even dead wildlife) as part of the monitoring program as required.

4.4.3. Scavenger rates and trials

It will be important to ascertain the rate at which carcasses are removed by scavengers. This can be used to develop a 'correction factor' that informs the estimate of wind farm impacts on birds and bats (mortality rate). Scavengers can include ground-based animals, such as foxes and rats (more likely to detect carcasses by scent), as well as aerial scavengers such as birds of prey and ravens (more likely to detect them visually). The scavenger trial described below is designed to ascertain the scavenging rate, usually expressed as average carcass duration in the field.

An intact carcass will be defined as a carcass that does not appear to have been scavenged by a vertebrate scavenger. A partially eaten carcass will be any skeletal or flesh remains found. Feather spots will be defined by their presence and the absence of any other remains (a feather spot being a cluster of five or more feathers). Intact or partial carcasses and feather spots will all be recorded as a 'find'. However, the scavenger correction factor will not be applied to feather spots as these are most likely to represent the remains of carcasses after they have been scavenged.

Scavenger trials will be undertaken twice for the first year of operational phase monitoring. The objective of having two trials is to account for different vegetation conditions, so one will be held when the grass is long and one when the grass is short. The two periods for scavenger trials are shown in the Table 8, below.

Table 7: Timing for scavenger trials

Vegetation condition	Likely time period	Weather	Stocking
Short grass	Winter (January - August)	Cold weather	Heavy stock levels
Long grass	Late Spring (September - December)	Follow rain and higher temperatures	Light stock levels

After the scavenger trials conducted in the first year, the need and frequency of further scavenger and detectability trials will be reviewed and discussed with BCD.

Scavenger Trials

Scavenger Trials will be undertaken by a trained person (see Section 4.5) to determine the rate of loss by scavengers, and the nature of removal by scavengers (e.g. an early peak in scavenging a peak after carcasses have been in place for a period of time). The search area for scavenger trials will be 60m from the base of the turbine within the inner search zone and will be located under randomly selected operating turbines.

To identify potentially different scavenging rates, three categories of carcass will be used (Table 8). Based on current mortality estimation software requirements, every endeavour will be made to find all carcasses of each category. Improvements on this method would require an impractical and unlikely availability of required carcass numbers, and do not lead to a commensurate improvement in the statistical power of estimates. In addition, large birds (raptor size) may be substituted with data from previous grouped studies with approval from BCD.

Table 8: Number of replicates for each scavenger trial

Observer	Micro-bat	Medium sized birds	Large birds (large raptor size)
Observer 1	10	5	5
Observer 2	10	5	5

Twenty carcasses in total will be randomly placed under different turbines for each observer. The carcasses will be checked daily for the first five days, then every 48 hours for the following four days and then every three days until day 18 followed by every four days until they disappear or at the end of 30 days (see Table 9).

Table 9: Scavenger trial search timetable

Day
Day 1
Day 2
Day 3
Day 4
Day 5
Day 7
Day 9
Day 12
Day 15
Day 18
Day 22
Day 26
Day 30

Additional information on scavenger trials is provided below.

- The timing of searches is based on experience and regulatory approval at a number of other wind farms (BL&A unpublished records) where scavenger trials have been undertaken that show almost all carcasses have been scavenged within five to ten days.

More frequent monitoring than that proposed herein will not significantly affect consideration of scavenging and its impact on mortality estimates.

- A mix of small and medium to carcasses will be obtained for use in the scavenger trial. Where carcasses of the species of concern cannot be found, a similar-sized and coloured substitute will be used to reduce bias by visual predators.
- Latex gloves will be worn at all times while handling carcasses to minimise contact with human scent, which may alter predator responses around carrion and to minimise disease risk to the handler.
- At each trial site, one carcass (or more) will be placed randomly within the 60-metre search area. Carcasses will be thrown in the air and allowed to land on the ground to simulate at least some of the fall and allow for ruffling of fur or feathers.
- Carcasses used in the trial will have their coordinates recorded to ensure that they are not confused with an actual fatality found under a turbine during the trial searches.
- Notes will be taken on evidence remaining at sites where carcasses have been scavenged (e.g. scavenger scats, bones, feathers, animal parts and type of scavenging) if visible, such as tearing, pecking, complete removal of carcass, partial removal of carcass, bird or mammal predator evidence).
- Notes will be taken on the state of remaining carcasses in each search.

Conduct of two scavenger trials at seasonally different times is designed to account for occasional winter/spring increase in carrion use by some scavenger species. Previous studies have found that Red Foxes are reliant on rabbits and carrion in agricultural and forested areas (e.g. Brunner *et al*. 1975, Catling 1988, Molsher *et al.* 2000). Feral cats show little but uniform use of carrion throughout the year, whereas fox prey type is dependent on availability (Catling 1988). Catling (1988) found that foxes ate more carrion in winter/spring compared with summer/autumn, when they fed on adult rabbits. However, Molsher *et al*. (2000) found that there was no overall significant difference between seasons for carrion use. Seasonal differences only occurred in other prey types (not carrion), such as lambs, invertebrates and reptiles, as these are only available at certain times of the year.

Scavenger trials for large raptors will only be conducted once per year due to lack of availability of suitable carcasses for a technically sound trial. Experience from other wind farms indicates a low level of scavenging of these carcases and a high level of detectability that is consistent across the year (BL&A, unpubl. data).

The number of carcasses per animal and size category is based on obtaining a reasonable level of statistical confidence in the estimate of average carcass duration, as reflected in software requirements for current mortality estimation processes, whilst seeking to minimise the number of carcasses used, as they can be difficult to source. Large numbers of carcasses (e.g. on-site, road-kill) are difficult to obtain and it may be very complicated to find alternative sources (e.g. farmed and culled animals). It is also possible that large numbers of carcasses, more size categories and more replicates may attract more scavengers to the area. Previous studies (e.g. Molsher *et al*. 2000) have shown that fox prey use is related to availability and therefore more foxes may be attracted to the area if more carcasses are used, thereby biasing the resulting correction factor. In addition, raptors are potentially more susceptible to collision when preying on carrion beneath turbines. However, it is necessary to conduct these trials under turbines as some scavengers may alter their behaviour in response to the turbines. The final scavenger trial design is therefore a necessary compromise between high numbers

of trials and practicality whilst ensuring a statistically-valid trial design without altering either the behaviour of scavengers or the number of birds that may collide with turbines.

4.4.4. Detectability (Observer) trials

Detectability trials are conducted to test the rate at which the trained searchers detect carcasses under wind turbines. This enables a correction factor to be applied in calculating the rate at which turbines strike birds and bats.

Detectability trials will be supervised by a qualified ecologist 'carcass controller' and undertaken by searchers conducting the carcass monitoring program. The trial will be undertaken as a 'blind trial', that is; the searcher will not know that they are undertaking the detectability trial. To achieve this, the searcher will inform the supervising qualified ecologist 'carcass controller' which turbines they are planning to search each day during each search period. That way, the carcass controller will know where the searcher is going to be on a particular day. The carcass controller can then access the wind farm prior to the searcher and place the carcasses, as outlined below, without the searcher's knowledge.

The most efficient use of time is to conduct the detectability trials concurrently with the scavenger trials during the first day of placing the carcasses. As humans are reliant on visual cues to determine carcass location, the two visibility categories of low and high grass cover will be compared (as described in section 4.4.4).

To account for observer variability in detecting carcasses, only personnel who have carried out monthly searches at BWF will be involved in the detectability trials. Detection efficiency (percentage of carcasses detected) will then be incorporated into later analyses that derive mortality estimates. The number of carcasses to be employed in each trial is detailed in Table 10 and explained below. The carcass controller (a person not involved in monthly carcass searches) will throw each carcass into the air and allow it to land on the ground to simulate at least some of the fall and the potential ruffling of fur and feathers. The carcass controller will note the placement of carcasses (via GPS) and is free to decide where and how many are deployed under each turbine, however all bats should be located within the inner, 60 metre search zone.

Table 10: Number of replicates per season for detectability trials, given two factors of size and visibility

Season	Micro-bat	Medium sized birds	Large birds (large raptor size)
Long grass / vegetated	10	5	5
Short grass	10	5	5

Analysis indicates that there is a large confidence interval on the estimate of searcher efficiency, even for a high number of trials (plus or minus ten percent even with 50 replicates). This means that only relatively large seasonal changes in detection (~20 - 30% or more) will be resolvable from normal background variation. Sampling will be undertaken during the two periods that represent the greatest change in vegetation cover (therefore visibility), using a number of carcasses that is logistically manageable and aligned with the number and timing of scavenger trials. Statistical confidence analysis indicates that this will result in a

reasonably precise detectability estimate after one year, and optimal precision after two, although as second year of trials is not currently planned.

Any substitute carcasses for these trials will be of both similar size, colour and form to the species being represented or species of concern (i.e. brown mice rather than birds should be substituted for bats as birds do not have the same body shape, colour and appearance).

If sufficient carcasses cannot be obtained, then stuffed, realistic-looking artificial substitutes may be used. As humans are entirely visual searchers, it is not essential to use real carcasses as long as the substitutes appear similar once on the ground. It is considered to be more time efficient and cost effective to undertake scavenger and detectability (observer) trials concurrently.

4.4.5. Incidental Carcass Protocol

Personnel at the Biala Wind Farm may from time to time find carcasses within the wind farm site during day-to-day operations and maintenance activities. In this case, the carcass will be handled according to the carcass detection protocol outlined in section 4.4.2. All wind farm personnel will be made aware of this carcass handling protocol as part of their HS&E training and induction. If the find is made within five days prior to a scheduled carcass search, the carcass will be left *in situ* but photographed and its position recorded (GPS). A carcass search data sheet (Appendix 2) will be completed for each incidental carcass found (whether removed or not).

This incidental carcass protocol is valid or the life of the wind farm project.

4.4.6. Analysis of results and mortality estimation

The results of the carcass searches will be analysed in order to provide information on:

- The species, number, age and sex (if possible) of birds and bats being struck by the turbines;
- Separate estimated annual mortality rates for all birds and all bats (and for particular species, if required) including an estimate of the number of carcasses per turbine per year; and
- Any detected spatial or temporal variation in the number of bird and bat strikes.

The search results will be detailed in the first annual report and the detailed analysis and estimates in the second annual report. The latter will identify if further detailed investigations or mitigation measures are required.

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 the full analysis and estimate will be provided in the second annual report, together with recommendations on the scope of future monitoring, if required.

All data will be analysed to provide the average estimated mortality of birds and bats, their standard error (variability) and ranges for the BWF. The mortality rate of each species (if estimates for individual species are possible) and size class detected will be calculated after two years. If possible, the standard error and range of these estimates will be reported. Note that it may not be possible practically to provide this due to the likely low number of carcasses

detected. Where this is an issue, it will be reported. Mortality estimates will also take into consideration the actual operational time of the turbines (obtained from the project operator).

The estimated mortality rate will be generated by modelling the scavenger losses and results of the human detectability trials, and using sampling inference to account for the periods between turbine searches. The data from the scavenger and detectability trials will be analysed using relevant techniques based on Generalised Linear Modelling (GLM) and (censored) Survival Analysis. Censored measurements are only partially known, such as the exact time of mortality or the exact time to scavenge loss (see, for example, Kaplan & Meier (1958)). In addition to providing mortality estimates, this analysis will determine if any of the factors (i.e. size class or habitat stratification of turbine sites) are significant, where possible.

4.5. Personnel Involved

This section of the plan outlines the personnel involved and any training required for the field work and report writing necessary for this BBAMP. All personnel implementing this Plan will be trained thoroughly, including background theoretical training, knowledge of policies and other administrative matters (e.g. OH&S) and technical and field methods. BWF will ensure that it engages suitably qualified and trained people to supervise and implement the monitoring program.

Nature Advisory has been approved by DPE as suitably experienced and qualified ecologists in relation to the implementation of this BBAMP. A suitably qualified ecologist with experience in supervising wind farm bird and bat monitoring programs will oversee in detail and be leading site implementation of the program, including the carcass searches, searcher efficiency trials and scavenger trials. Any person undertaking searches will be trained and supervised by the approved ecologist familiar with the techniques. The searcher will receive training from the qualified ecologist in the following areas:

- Turbine searches, including transect spacing in inner and outer zones, number and location of turbines to search and transect search methods;
- Equipment usage, such as GPS;
- Data recording;
- Carcass storage; and
- Species identification.

The qualified ecologist will supervise the initial carcass search to ensure that field methods are being undertaken correctly and undertake an audit in the first three months to ensure that methods are being implemented correctly. The qualified ecologist will also be responsible for identifying any recorded carcasses from photographs or from specimens transferred to the freezer on site after searches.

The first searcher efficiency trial will be initiated and set up by the ecologist, who will also train a separate person (the 'carcass controller') to run searcher efficiency trials. Training will include:

- Correct preparation and handling of trial carcasses;
- Correct methods for the random placement of trial carcasses within a randomly selected sub-set of the search areas; and
- The need to place trial carcasses without the searcher knowing they are being placed.

If for some reason the searcher is unable to undertake the monthly searches as planned (due to illness etc) a back-up person will be identified in advance. If a back-up person is required to undertake searches, they will also be trained and supervised by a qualified ecologist and will participate in searcher efficiency trials.

The scavenger trials will be set up by the approved qualified ecologist, with searches being undertaken by the trained searcher.

Analysis of mortality data will be undertaken by the approved qualified ecologist with support from a statistician.

Annual reports and all investigations resulting from an impact trigger (see section 6) will be prepared by the approved qualified ecologist and subject to an internal peer review process.

4.6. Injured Bird and Bat Protocol

All on-site staff and monitoring personnel will be advised of the correct procedure for assisting injured wildlife. Wind farm personnel who find injured wildlife will be required to report the find to the wind farm site manager, who will be required to place the animal immediately into a dark place (e.g. box or cloth bag, if safe to do so) for transfer to the nearest wildlife carer or veterinarian.

Contact details of local veterinary staff and wildlife carers are provided below to ensure that if injured wildlife are found and cannot readily be released back to the wild, they are treated accordingly and in a timely manner.

- Crookwell Veterinary Hospital, 220 Goulburn St, Crookwell NSW 2583, Phone: (02) 4832 1977
- WIRES, 02 6778 4994 or 1300 094 737.

This Injured Bird and Bat Protocol is valid for the operational life of the wind farm.

4.7. Reporting and Review Meetings

4.7.1. Annual reporting

In accordance with Project Approval Schedule 3, Condition 21, reports will be submitted to the Secretary and BCD on an annual basis. An annual report will be prepared within three months of the completion of the first year of operation phase monitoring. This annual report will focus on presenting the results of the mortality searches, any management measures implemented and recommending refinements to monitoring activities, if required. The second annual report will present the first full analysis of data collected and will be presented within three months of the end of the second year of monitoring. Annual reports will be published on the project website.

Matters to be addressed in this full report include, but will not be limited to:

- A brief description of the management prescriptions implemented and identification of any modifications made to the original management practices;
- The survey methods (including list of observers, dates and times of observations);
- Results of carcass searches and incidental carcass observations;
- Estimates of bird and bat mortality rates (per turbine per year) based on statistical analysis;

- Seasonal and annual variation in the number and composition of bird and bat strikes, where detectable;
- Any other mortality recorded on site but not during designated carcass searches (i.e. incidental records by site personnel);
- Identification of any unacceptable impacts or impact triggers, and application of the notification framework and relevant adaptive management measures;
- A summary of livestock carcass removal for the purposes of predator reduction;
- Details of any landowner feral animal control programs and their timing;
- A discussion of the results, including:
    - Bird risk reduction measures;
    - Any further recommendations for reducing mortality, if necessary;
    - Whether the level of mortality was unacceptable for affected listed ('at risk') species of birds or bats;
    - Usage of the wind farm area by species of concern at more than negligible risk and factors influencing this (ie. climatic, geographical and infrastructure);
    - Analysis of the effectiveness of the notification framework; and
    - Recommendations about further monitoring.

4.7.2. Strike notification protocol

Strike notifications will be delivered to the Biodiversity and Conservation Division (BCD) in a monthly report to be completed after each carcass search period during the implementation of this BBAMP.

An impact trigger will be reported within 21 days of its occurrence to BCD.

Impact trigger notification reports will include:

- the number of strikes detected;
- expert advice identifying the impacted species;
- Biodiversity Conservation (BC) Act listed species impacted or, if identification is uncertain, the BC Act listed species most closely related/likely to have been impacted;
- the circumstances of detection (GPS location, turbine, when/how detected, incidental/formal monitoring?);
- the approximate time of the strike, or the likely period during which the strike occurred, and reasons for the estimated time/period;
- the species and timing of all previous detections at that turbine (irrespective of listed species impacted), and at that wind farm for the impacted listed species;
- operational, seasonal, land management and environmental/meteorological circumstances that may have contributed to the strike;
- in the event of a threatened species impact trigger, indicate what measures have been implemented, or are proposed, to reduce the risk of further impacts to that species. The justification for implemented/proposed measures, and timing and responsibilities must be provided; and

- based on the circumstances of the detection and the implemented/proposed mitigation measures, modifications to the monitoring program that will be implemented to improve the likelihood of detecting impacts to that listed species.

5. MITIGATION MEASURES TO REDUCE RISK

Mitigation involves the prevention, avoidance and/or reduction of the risk of an impact trigger occurring or continuing to occur. An '*impact trigger*' is defined in section 6 as a threshold of impact on birds or bats that triggers an investigation and/or management response. This section outlines such measures and addresses condition of approval 21 (b).

Sections 5.1 to 5.3 outline mitigation measure that will be implemented as standard practice for the life of the wind farm. Section 5.4 outlines interim mitigation measure that will be implemented immediately in the event of an '*impact trigger*' occurring. Species specific mitigation measures must also be implemented in the event of a trigger, however these must be based on further investigation into the species' behaviour. Such investigation may determine that species specific mitigation is not warranted (see Section 6.3).

The overall objective of mitigation measures is to ensure that the operation of BWF does not lead to significant impacts on threatened or non-threatened birds and bats. Any future novel or new mitigation measures that are identified to be of potential benefit for birds and bats at the BWF should be incorporated into the plan as part of adaptive management, in consultation with the BCD.

5.1. Carcass (carrion) removal program and stock forage control

Land-use and stock management below and around turbines can influence the presence and behaviour of native birds on site. Examples that could elevate bird collision rates include:

- Grain feeding can attract parrots and cockatoos; and
- Carrion and rabbits can attract raptors.

This section proposes possible mitigation measures to address these matters.

A moderate risk to Wedge-tailed Eagle has been identified for BWF. The eagle and other raptors forage for carrion (and the fresh or decaying flesh of a dead animal) and also on small mammals and rabbits. In order to reduce the risk of raptors colliding with turbines, a regular carrion removal program will be implemented during operations, to reduce the attractiveness of the site to raptors and therefore reduce the potential for fatal collisions by this group of birds. This program will focus on an area of a minimum of 200 metres around turbines, where safe, feasible and practical. The procedures below will be adopted.

- A designated suitable person will be appointed (such as a wind farm employee or landowner) to perform the function of Carrion Removal Coordinator who will ensure the activities described below.
    - Monthly inspections of each turbine at the wind farm site to search for any stock, introduced or native mammal and bird carcasses (to be recorded as incidental finds) that may attract raptors (e.g. kangaroos, pigs, goats, foxes, rabbits, dead stock). This search will be undertaken via vehicle and visual checks in addition to using binoculars to look for larger carcasses within 200 metres of each turbine.
    - Additional, opportunistic observations by operators during normal inspections and work routines and by landowners as they travel around their properties provides further opportunity to identify and report carcasses of stock or feral animals so that timely collection can be undertaken to remove them. Observations will be reported to the Carrion Removal Coordinator. This can be addressed by operator and

landowner protocols within the operational phase environmental management plan and associated procedures.

- Any carcasses and/or remains found that are within 200 metres of turbines, will be collected and disposed of as soon as possible, in a manner that will avoid attracting raptors close to turbines.
- Consult with the landowner or wind farm manager in relation to the appropriate disposal of collected carrion, to be located at least 200 metres away from the closest turbine.
- Wind energy facility maintenance staff and landowners will be required to notify the Carrion Removal Coordinator immediately following identification of carrion on site in between monthly searches.
- Carcass occurrence and removal will be recorded in a "management log book" maintained by BWF asset manager or delegated representative.

- During lambing season (usually late autumn / winter) young lambs are susceptible to death. Therefore, lambing will be restricted in paddocks at least 200 metres away from turbines to reduce the risk that raptors (Wedge-tailed Eagles in particular) are attracted close to the turbines.
- In order to reduce collision risks to birds, where practical and with landowner agreement, the practice of grain feeding of stock within 200 metres of turbines should be minimised as it could attract parrots, cockatoos or other birds to turbines, increasing collision risk.
- Any feral animal control on the wind farm site should involve the timely removal and appropriate disposal of resulting carcasses (see Biodiversity Management Plan).
- An annual summary of carcass removal, based on the 'management log' will be provided in the annual monitoring reports.

The implementation of carrion removal program is on an on-going basis.

5.2. Lighting on turbines and buildings

It has long been known that sources of artificial light attract birds, as evidenced by night-migrating birds in North America and Europe. Lighting is probably the most important factor under human control that affects mortality rates of birds and bats colliding with all structures (Longcore, *et al*. 2008). Most bird mortality at communication towers for example, occurs in poor weather with low cloud in autumn and spring, i.e. during migration periods (Longcore, *et al*. 2008).

It is postulated that bright lights may temporarily blind birds, particularly those accustomed to flying at night or in low light conditions causing them to fly toward the light source and collide with the lit structure (Gauthreaux and Belser 2006). Birds may be prone to saturation of their retinas, causing temporary blindness when subjected to bright light (Beier 2006) and mortality of both birds and bats can result from collisions with lit structures. Bats are also attracted to the increased numbers of insects that may congregate near bright light sources. Birds can also become disoriented or 'trapped' in the field of light beyond which they cannot see (Longcore *et al.* 2008). Measures to reduce the impact of lighting include using low pressure sodium or mercury lamps with UV filters to reduce brightness. The colour of lighting may also be important. Some studies have found that red lights resulted in a lower mortality than white lights (Longcore *et al*. 2008), but more recent research on oil rigs at sea suggests

that blue or green lights may result in lower mortality than red or white lights (American Bird Conservancy 2014).

For the above reasons, external lighting (apart from aviation hazard lighting) will be baffled and directed to avoid excessive light spillage and security lighting will be baffled to direct it towards the area requiring lighting and not skyward. This will assist in meeting the bat deterrence requirements of Consent Schedule 3, Condition 4.

5.3. Raptor perch removal

Where observations by ecologists during the implementation of this plan or wind farm personnel during routine operations identify a structure or tree used regularly for perching by birds of prey within 300 metres of wind turbines, consideration will be given to removing this perch to reduce the level of bird activity near wind turbines. This decision will be made on the final advice of the ecologist supervising the implementation of this BBAMP.

5.4. Interim mitigation measures

This section outlines mitigation measures to implemented as soon as possible after an *'impact trigger'* has occurred. These measures aim to lower the immediate risk to species impacted by turbine operation while further investigations into species specific mitigation measure are undertaken. It is important to understand that mitigation measures will not be applicable to lowering risk for all species. The below suggested measures should be implemented as appropriate to the species impacted, and their appropriateness concluded in consultation with BCD.

5.4.1. Reduce foraging opportunities

Efforts to remove species specific food sources around turbines or on the wind farm itself could be undertaken to reduce attractiveness of the area to the threatened species in question. For example; implementing a culling of the introduced species; Starlings, may reduce foraging opportunities for certain threatened Raptor species that prey on them.

Foraging opportunities could also be reduced by removing non-native vegetation that provide a food source. This would be very species specific and difficult to implement for native species, but is worth exploring. Removal of native vegetation is not recommended.

5.4.2. Pest control

Implementing pest control, particularly for European rabbit, may further reduce prey species and scavenging opportunities for some threatened species. Reducing fox numbers may also reduce scavenging of carcasses during mortality searches, potentially increasing detectability or species colliding with turbines.

Wedge-tailed Eagle has been identified as being at moderate risk from the wind farm. In the event of a WTE strike, an integrated rabbit control program (to reduce site attractiveness to Wedge-tailed Eagles) will be implemented.

Methods to control rabbits include borrow destruction, poisoning and shooting. Any rabbit control program will require cooperation with the landowners.

5.4.3. Additional turbine monitoring

Turbines that have struck threatened species, and those within two kilometres will be subject to additional carcass searches, initially within a week of an impact trigger then fortnightly until six weeks after the trigger. This will identify if an ongoing impact to threatened species or species of concern is occurring. Where the species is a long-lasting species, rarely scavenged (e.g. Wedge-tailed Eagle), it will not be necessary to increase the frequency of searching (this species' carcass persists for over a month).

6. IMPACT TRIGGERS AND NOTIFICATION FRAMEWORK

This section identifies the circumstances that will result in notification, further investigation and additional mitigation for both threatened and non-threatened birds and bats ('impact triggers'). If an impact trigger is met, there must be an investigation into the cause of the impact, and whether the event was likely to be a one-off occurrence or occur regularly.

By way of definition, an **impact trigger** may be an unacceptable impact in itself or may lead to an unacceptable impact if it continues. The purpose of defining an impact trigger is that it results in a more detailed investigation of the project's impact on the species concerned, enabling an early response to a possible ongoing situation that may lead to an unacceptable impact.

Note that the approach developed in this section is based on that approved for numerous bird and bat monitoring programs for wind farms in both New South Wales and Victoria, and up to date feedback from regulators on the implementation of approved plans (see section 1.1 for details).

Ultimately, the wind farm owner or their appointed representative will be responsible for implementation of this BBAMP and the notification that goes with it, with technical support provided by the approved expert.

6.1. Threatened Species

6.1.1. Definition of Impact Trigger and Unacceptable Impact

Generally, an impact trigger is where there is evidence of death or injury to birds and/or bats by collision or other interaction with turbines. Under this program, the circumstances that define an impact trigger and unacceptable impact for threatened birds and/or bats are detailed below.

Impact Trigger for Threatened Species occurs if a threatened bird or bat species (or recognisable parts thereof) listed under the Commonwealth EPBC Act or NSW BC Act is found dead or injured under or close to a wind turbine during any mortality search or incidentally by wind farm personnel.

Definition of Unacceptable Impact on Threatened Species:

- Where population numbers are known and reported by BCD for the period concerned, an unacceptable impact is any impact that is likely to affect the viability of the population of the species in the bioregion; OR
- Where population numbers are not known, an unacceptable impact is more than three carcasses found of one threatened species over a two-month period.

6.1.2. Notification Framework and Reporting

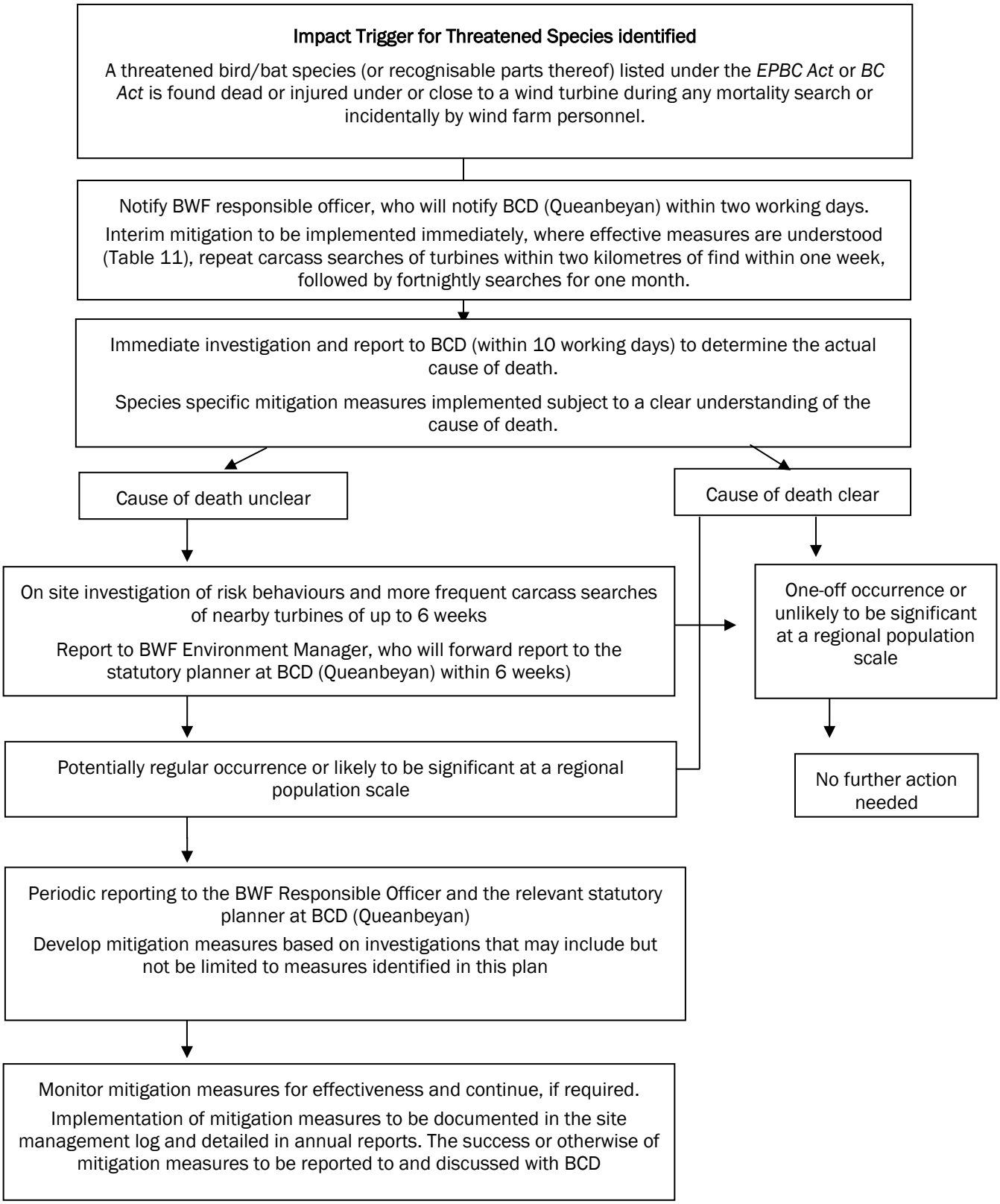
If a threatened species impact trigger occurs, interim mitigation measures and further investigation will immediately be commenced, and the notification framework outlined below and in Figure 4 will be followed. This process will result in increased carcass search frequency for all turbines within two kilometres of the strike (see below) and the implementation of species-specific mitigation measures aimed at reducing collision risk, unless the investigation finds this to be unnecessary. This section complies with Schedule 3, Condition 21 of the project approval.

- Immediate reporting of the occurrence of an impact trigger to BWF's responsible manager, who will report it to the relevant statutory planner at BCD (Queanbeyan) within two business days of it being recorded. A feasible and effective interim mitigation measure, listed in (but not limited to) Table 11 4.5, will be implemented immediately to reduce immediate risk to the threatened species. This must be appropriate to the species in question and implemented in consultation with BCD.
- Repeated searches of the turbine and nearby turbines (within two kilometres) within a week, followed by fortnightly searches for another month (a total of four searches, including the original search that detected the impact trigger, in six weeks).
- Immediate investigation (to be completed within 10 days) by an appropriately qualified ecologist to determine, if possible, the circumstances that lead to the death or injury. If the cause of death is considered to be due to turbine collision, an investigation will be undertaken to identify any particular risk behaviours that could have led to the collision and the likelihood of further occurrences will be evaluated together with the findings from the first additional carcass search.
- Further investigation in the same period (within 10 days of the impact trigger) will aim to provide a clear understanding of whether ongoing impacts are likely, informed by on-site investigations of the occurrence of the species on the wind farm site and any risk behaviour it is displaying. This will identify the most effective species-specific mitigation measures to be implemented, with such mitigation to be implemented immediately its feasibility and effectiveness is confirmed in this 10-day period.
- If, following this investigation, the fatality is deemed to be a one-off occurrence or highly unlikely to re-occur, further action is not considered necessary. This decision will be made in consultation with BCD and will be determined based on available evidence and using a precautionary approach. Note that the successful execution of this requirement relies upon BCD providing timely and definitive input to this process.
- If the cause of the impact trigger is not clear, further on-site investigation of risk behaviours and evaluation of likely re-occurrence will be required over the following weeks, coupled with continued carcass searches. If these further investigations suggest that the impact trigger or triggers are unlikely to re-occur due to changes in site conditions, and species behaviour and presence, or the implementation of effective mitigation measures, no further action would be necessary. This decision will be determined in consultation with BCD, based on the results of the required investigations.
- If the onsite investigation suggests that the impact trigger may indicate the potential for an on-going impact, species-specific monitoring and on-going mitigation would be required. During species-specific monitoring and mitigation, periodic reports will be provided by BWF to BCD.
- Responsive mitigation measures will be developed and, as agreed with relevant agencies, implemented in a timely manner. Examples of mitigation measures may include but are not limited to those outlined in Sections 5 and 6.3.

Any evaluation of impacts and decisions regarding mitigation measures and further investigations required will be undertaken in consultation with BCD. Any required investigation, and recommended management and supplementary mitigation measures will be documented in the project management log and detailed in annual reports, as detailed in Table 12. This log will be available for inspection by BCD or on the request of the Secretary DPE.

It is recommended that the DPE approved specialist for implementation of the BBAMP be responsible for advising BWF on the implementation of this notification framework and, with the wind farm manager, for discussions with BCD and DPE.

Figure 4: Notification framework for identifying and mitigating impacts on threatened species



6.2. Non-threatened Species

6.2.1. Definition of Impact Trigger and Unacceptable Impact

The circumstances that define an impact trigger and significant impact for non-threatened birds and/or bats under this Management Plan are detailed below. Note native species not listed as protected in the local government area, are not considered of conservation significance and therefore are not subject to adaptive management or this impact trigger. These species are Sulphur-crested Cockatoos, galahs, magpies, crows, ravens, pipits and introduced bird species. All other native bird and bat species are subject to adaptive mitigation arising from this impact trigger.

Impact Trigger for Non-threatened Species: The trigger is defined as a total of four or more bird or bat carcasses, or parts thereof, of the same species in two successive searches at the same or adjacent turbine(s) of a non-threatened species (excluding species mentioned above).

Where population numbers are known and reported by BCD or where habitat extent is known, the **definition of an unacceptable impact** on non-threatened species is any impact that is likely to reduce the viability of the population of the affected species in the bioregion.

Note that although the impact trigger does not include ravens, magpies, Sulphur-crested Cockatoos, corellas, pipits and introduced species, detected mortalities for these species will still be reported as part of the annual reporting process.

6.2.2. Notification Framework

In the event that an impact trigger for non-threatened species is detected the following steps will be followed:

- BCD (Queanbeyan) will be **notified** of the impact trigger within seven days of recording the event.
- An **evaluation** of impacts to the non-threatened species' bioregional population will be undertaken.
- A **report** on the investigation will be delivered to the relevant statutory personnel at BCD (Queanbeyan) within three weeks.

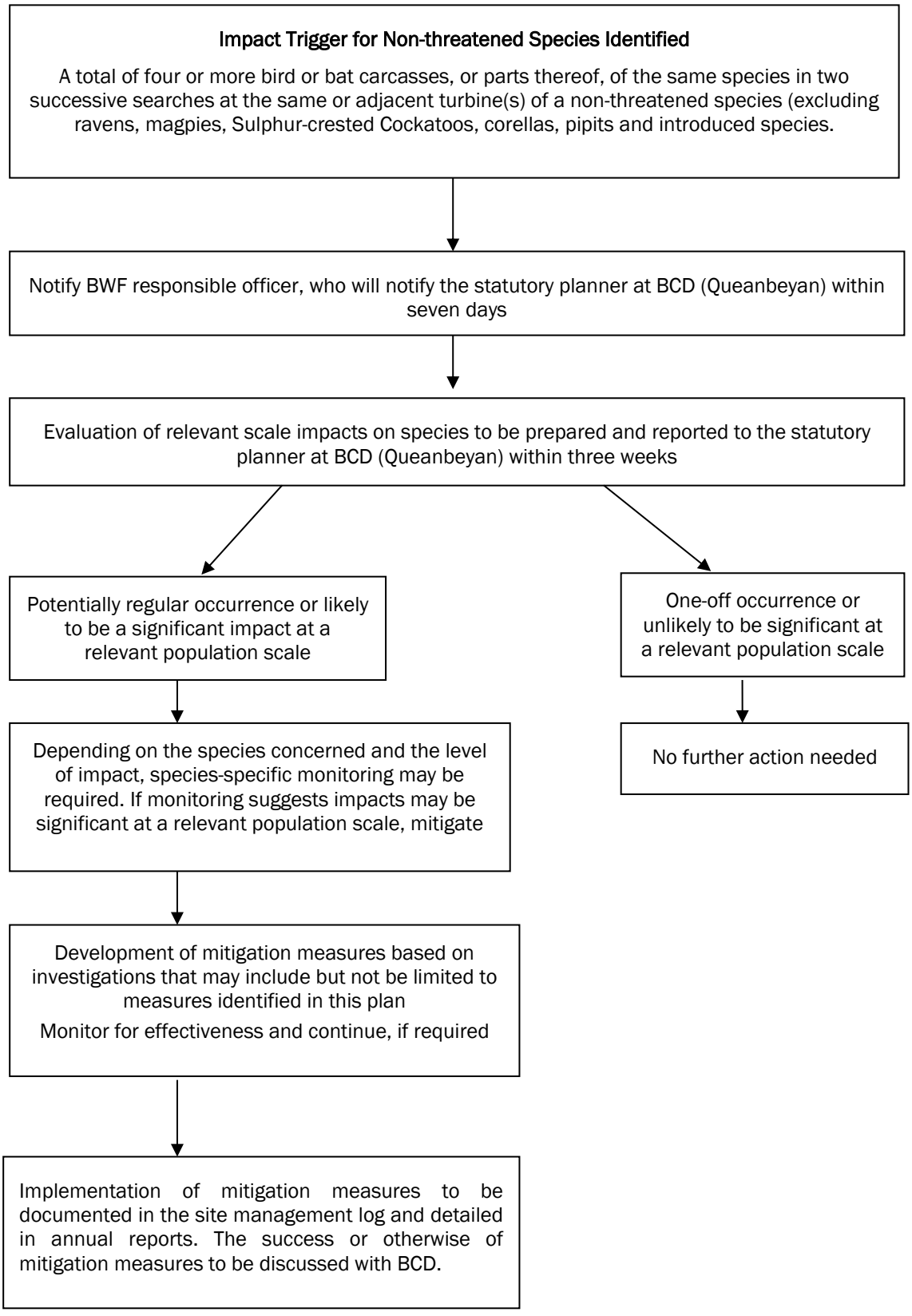
If the evaluation indicates that the event was a one-off occurrence or is unlikely to be an unacceptable impact at a bioregional population scale for the species in question, no further action will be necessary (as outlined in Figure 4).

If the event is deemed to be a potentially regular occurrence or likely to lead to an unacceptable impact on the species in question, species-specific monitoring may be required (Figure 4). If further monitoring confirms that impacts are likely to lead to an unacceptable impact on the species, mitigation measures will be required. Potential mitigation measures are outlined in Table 11, however specific mitigation measures will be determined based on the species involved and the outcome of investigations.

Any evaluation of impacts and decisions regarding mitigation measures and further investigations required will be undertaken in consultation with BCD. Any required investigation, and recommended management and supplementary mitigation measures,

will be documented in the site management logs and detailed in annual reports. This log will be available for inspection by BCD or on the request of the Secretary DPE.

Figure 5: Notification framework for identifying and mitigating impacts on non-threatened species



6.3. Species-specific mitigation measures

Species-specific mitigation will be targeted to the particular species impacted and therefore must be based on research and investigation into what will be effective, feasible and warranted. The purpose of species specific mitigation measures will be to stop a demonstrated ongoing impact from continuing to occur at a scale that leads to an unacceptable impact. Specific mitigation measures will be implemented depending on the nature, cause and significance of any impact recorded and in response to the results of investigations of the event and of the species concerned on the wind farm site.

Although it is unknown what species-specific mitigation measures will be required in response to a particular situation, some hypothetical examples are provided in Table 11 below. These are examples of potential issues not considered to date but describe useful and tested responses from other wind farms in addressing the issues. Should these be implemented as a management response at BWF the response of birds and bats to these measures will be monitored, recorded and reported to BCD in line with the notification procedure in Figure 4.

The purpose of investigations will be to identify clearly the most feasible and effective mitigation measures.

6.4. Specific management objectives, activities, timing and performance criteria

Table 12 summarises specific commitments to management objectives, activities and timing for the implementation of mitigation measures.

Table 11: Species specific mitigation measures in the event of repeated impact triggers occurring

Hypothetical cause of impact	Mitigation Measure[2]	Likelihood of impact continuing following mitigation	Time to implementation
Migration of threatened migratory bats through the wind farm footprint leading to regular collision and mortality indicated by carcass search results	Investigation of Electromagnetic bat deterrent systems on turbines that are regularly leading to such collisions.	Low	Implement after repeated impact triggers over the six week trigger investigation period (see Figure 4).
Foraging habits in response to site condition leading to more than expected collisions of threatened bird species	Investigation of early warning systems to prevent collision.	Low	Implement after repeated impact triggers occurring within six weeks of the first trigger event.
Foraging source identified that attracts threatened species and "at risk" species close to turbines	Consider the use of acoustics (ie. loud music/irregular noise) to discourage birds from foraging in this location where such noise would not impact neighbours	Low	Implement as soon as possible.
	Encourage species into alternative areas away from turbines, where available, through the use of social attraction techniques offsite (decoys and audio playback systems) and supplementary feeding		Implement according to agreed plan (see Figure 4)
Farming practice attracts threatened species to risky areas (e.g. grain feeding of stock)	Investigate whether farming practice is a contributing factor and if so, subject to landowner agreement, relocate practices further from turbines to reduce risk	Low	Immediately
Wind/rain/fog causing low visibility	If low visibility at the site is identified as an issue, carcass searches may be repeated during periods of low visibility to measure mortality rates.	Low	Immediately low visibility is identified as the cause of repeated impacts on threatened species.
Attraction to lights on the wind farm site	Except where otherwise required by CASA, avoid high intensity lighting within the wind farm site (e.g. use of light hoods) or switch off lighting temporarily while species is on or near the wind farm site. Additional measures include: • Synchronise any flashing lights, • Use red rather than white or yellow lights, • Remove lights, where practicable, and/or • All other lights switched off except when needed for service work	Low	If lights can be switched off, this should occur immediately. Alternative measures should be implemented as soon as practicable after recording the impact trigger.
Attraction to small dams on site	Subject to landowner agreement, fill in dam and provide alternative stock watering arrangements	Low	Implement as soon as possible after recording the impact trigger if the dam is the cause of the problem.
Nest site close to turbine	Discourage nesting close to turbines in following breeding seasons	Low	Prior to breeding season.
Perching/foraging close to turbines	Minimise perching opportunities near turbines	Low	Implement according to agreed plan

[2] Note that the mitigation measures in this table are examples of what may be possible. Ultimately, the chosen mitigation measure will be identified as part of the impact-trigger investigations shown in Figures 5 and 6, and may not include any of these examples if they are not relevant.

Table 12: Specific management objectives (including relevant consent condition from Schedule 3), activities, timing and performance criteria

Management objectives	Management activities and controls	Timing	Performance criteria for measuring success of methods	Completed (yes/no)
Baseline surveys 21 (a)	Obtaining pre-construction baseline bird and bat utilisation data	Pre-construction • Bird survey complete • Bat survey complete	• Bird utilisation surveys (point count and transect surveys) undertaken as described in this BBAMP – 2017/2018 • Bat utilisation surveys undertaken as described in this BBAMP • Raptor surveys undertaken as described in this BBAMP (2018)	
	Obtaining operational phase bird and bat mortality data	Operational phase	• As per results of the mortality monitoring in this BBAMP.	
Mortality monitoring 21 (c) and (e)	All turbines to be searched each month to a radius of 120 metres in accordance with the inner- and outer zone search protocol for a period of 24 months, following which the need for further surveys will be reviewed based on the results of the first two years of monitoring.	Operational phase monthly until end of 24 months	• Operational phase mortality surveys undertaken monthly at least 18 turbines for two years, with a review after the first years to determine if a change in the methodology is required. • Where an impact trigger occurs, carcass-searching to be stepped up to the frequency detailed in Section 6.1.2.	
	Calculating annual mortality of birds and bats per turbine based on operational phase repetition of monitoring activities. Mortality estimates should include correction factors from scavenger and detector efficiency trials.	Operational phase at the end of the first two years of mortality monitoring	• Scavenger and detector efficiency trials undertaken • Estimates of mortality for birds and bats made after full year of monitoring	
Annual Reports 21 (e)	Preparation of Annual Reports to be submitted to Secretary and BCD for the first two years after the completion of a year's monitoring activities.	Operational phase– after years one and two.	• Annual reports for the first two years delivered within three months of completion of yearly monitoring. • Annual reports to include (but not be limited to) results of monitoring surveys for that year, any impact triggers or unacceptable impacts identified, mitigation measures implemented, application of the notification framework and recommendations for the following year. • Further annual reports upon agreement	
Mitigation measures to reduce risk 21 (b) and (d)	Carrion removal program - stock and kangaroo carcasses will be removed from within 200 metres of wind turbines on a monthly basis and disposed of.	During operation	• Carcasses removed • Activity recorded in management log book • Increase frequency of stock and kangaroo carcass removal and disposal if required • All mitigation actions recorded in a project site management log.	
	Restrict lambing to paddocks at least 200m from turbines.		• No increase in raptor mortality during lambing season	
	Stock will not be fed grain underneath turbines		• No increase in bird mortality due to grain underneath turbines	
Mitigation measures to reduce risk 21 (b) and (d)	Pest control program - Implement rabbit control if the carrion removal program suggests rabbit carcasses are an issue, subject to landowner agreement	During operation	• Monitor effectiveness of rabbit control and, where bird mortality is clearly related to rabbit numbers, increase the effectiveness of rabbit control	
	Habitat improvement or protection to encourage animals to use habitats away from turbines.	During operation	Protection of offset site located in woodland habitat.	
	Minimising external lighting. There are only low levels of lighting on the wind farm during operation.		If mortality at turbines near light sources significantly exceeds that of activity at unlit turbines, type and duration of lighting will need to be reviewed, subject to security and OH&S limitations.	
	Remove permanent lights on buildings and sub-stations to avoid light spillage and visibility from above.			
	Baffle security lighting to avoid light spillage and visibility from above, consistent with the requirements of consent schedule 3, condition 4.			
	Use of deterrents – Where required, overhead powerlines should have marker balls and/or flags where they cross waterways		No incidental records of bird mortality from power line collision around waterways.	

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Appendix 1: Threatened Bird and Bat Species likelihood of occurrence at the Biala Wind Farm

Common Name	Scientific Name	TSC	EPBC	Habitat	Number of records	Likelihood of occurrence
Australian Painted Snipe	*Rostratula australis*	E	CE	Generally inhabits shallow terrestrial freshwater wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or sometimes tea-tree (*Melaleuca*). Sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber.	0	No suitable habitat on site - **unlikely to occur.**
Barking Owl	*Ninox connivens connivens*	V		Eucalyptus dominated forests and woodlands, commonly near water-bodies, such as streams and rivers, and requires hollow trees for nesting and trees with dense foliage for roosting (Higgins 1999).	0	Suitable habitat on site - **potential to occur.**
Black Falcon	*Falco subniger*	V		Mostly occurs in the western plains and in the drier lowland parts of NSW; widespread but sparse across northern and eastern mainland Australia (Marchant and Higgins 1993; Menkhorst et al. 2017).	1	Habitat marginal - some open cleared farmland but usually prefers more extensive lowland plains further west. **Potential to occur.**
Black-faced Monarch	*Monarcha melanopsis*		M (Bonn)	Rainforests, eucalypt woodlands, coastal scrub and damp gullies (Higgins et al. 2006).	0	No suitable habitat on site - **unlikely to occur.**
Blue-billed Duck	*Oxyura australis*	V		Deep freshwater wetlands with dense vegetation while breeding; some birds disperse to more open wetlands outside breeding season (OEH 2017a).	1	Suitable farm dams exist; **recorded on site.**
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V		Woodlands dominated by eucalyptus, especially Stringybarks or other rough-barked eucalypts usually with open grassy understorey (Higgins et al. 2001)	2	Suitable dry woodland and forest habitat on site. **Recorded on site.**
Diamond Firetail	*Stagonopleura guttata*	V		Found in woodlands, dry open forests and lightly timbered farmland where it feeds on native grasses (Higgins et al. 2006). Regularly found in farmland around wind turbines in southern NSW (BL&A unpublished data).	10	Suitable dry woodland and forest habitat on site. **Recorded on site.**
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V*		Dry open sclerophyll forests and woodlands, usually dominated by eucalypts. Often found on the edges or in clearings of forest and woodland and sometimes recorded in shrubland and heathland and other various modified landscapes (Higgins *et al* 2006).	3	Suitable dry woodland and forest habitat on site - **likely to occur.**
Flame Robin	*Petroica phoenicea*	V		Breeds in forests in south-eastern Australia, usually in the hills or high-country. Migrates in autumn to lower altitudes and more open habitat such as farmlands, plains and some urban areas (Higgins and Peter 2002).	4	Suitable habitat on site - **potential to occur.**
Fork-tailed Swift	*Apus pacificus*		M (CAMBA, JAMBA, ROKAMBA)	The species can occur in wet sclerophyll forest but mainly prefers open forest or plains. It is almost exclusively aerial and feeds up to hundreds on metres above the ground, but can feed among open forest canopy. The species breeds internationally and seldom roosts in trees and is unlikely to be impacted by the development (Higgins et al 2006).	0	Suitable habitat on site - **potential to occur.**

Common Name	Scientific Name	TSC	EPBC	Habitat	Number of records	Likelihood of occurrence
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V		Occurs in forest along the coast and ranges from the Hunter Valley of NSW to south-west Victoria; moves to lower altitudes in autumn-winter (Higgins 1999).	4	Suitable habitat on site - **potential to occur.**
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V		The species is dependent on Sheoak (*Allocasuarina spp.)*; prefer woodlands dominated with allocasuarina or open eucalypt forests with middle stratum of allocasuarina (Higgins 1999).	0	No suitable habitat on site - **unlikely to occur.**
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V		Occur mostly in lightly timbered habitats such as dry woodlands with an open shrubby understorey, sparse grasses and patches of bare ground and leaf-litter, with scattered dead and fallen timber for foraging perches (Higgins and Peter 2002).	1	Suitable dry woodland and forest habitat on site. **Potential to occur.**
Latham's Snipe	*Gallinago hardwickii*		M (CAMBA, JAMBA, ROKAMBA)	Latham's Snipe breeds mostly in Japan and migrates to Australia during late August to March. While in Australia it occupies wetlands and roosts in nearby dense vegetation during the day. It may occur in very small patches of habitat such as alpine bogs and roadside ditches (Higgins and Davies 1996).	0	Little or no suitable habitat on site. Some birds may pass through the Biala WF area stopping at vegetated farm dams but **unlikely to occur.**
Little Eagle	*Hieraaetus morphnoides*	V		Over wooded and forested lands and open country of Aust. Range extending into arid zone. Most abundant in open forest and woodland.	8	Suitable habitat on site - **potential to occur.**
Little Lorikeet	*Glossopsitta pusilla*	V		Mainly dry, open sclerophyll forests and woodlands, usually dominated by Eucalyptus. Often near waterbodies such as creeks, lakes and swamps.	2	Suitable dry woodland and forest habitat on site. **Recorded on site.**
Painted Honeyeater	*Grantiella picta*	V	V	Inhabits box-ironbark forests and woodlands and mainly feeds on the fruits of mistletoe. Strongly associated with mistletoe around the margins of open forests and woodlands. Occurs at few localities. Uncommon breeding migrant from further north, arriving in October and leaving in February. (Higgins et al. 2001).	0	Suitable habitat on site - **potential to occur.**
Powerful Owl	*Ninox strenua*	V		Open and tall wet sclerophyll forests with sheltered gullies and old growth forest with dense understorey. They are also found in dry forests with box and ironbark eucalypts and River Red Gum. Large old trees with hollows are required by this species for nesting. In Victoria, the Powerful Owl is widespread, having been recorded from most of the state. However, throughout its range it is uncommon and occurs in low densities. (Higgins 1999; Soderquist et al. 2002).	6	Suitable habitat on site - **Recorded on site.**
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	Inhabits dry box-ironbark eucalypt forests near rivers and creeks on inland slopes of the Great Dividing Range. It could also occur in small remnant patches or in mature trees in farmland or partly cleared agricultural land (Higgins et al. 2001).	1	Suitable habitat on site - **potential to occur.**
Rufous Fantail	*Rhipidura rufifrons*		M (Bonn)	Primarily found in dense, moist habitats. Less often present in dry sclerophyll forests and woodlands (Higgins et al. 2006).	0	No suitable habitat - **unlikely to occur.**
Satin Flycatcher	*Myiagra cyanoleuca*		M (Bonn)	Tall forests and woodlands in wetter habitats but not in rainforest (Higgins et al. 2006).	0	No suitable habitat - **unlikely to occur.**

Common Name	Scientific Name	TSC	EPBC	Habitat	Number of records	Likelihood of occurrence
Scarlet Robin	*Petroica boodang*	V		Eucalypt woodlands forest with open understorey (Higgins and Peter 2002).	21	Suitable open woodland and forest habitat on site. **Recorded on site.**
Speckled Warbler	*Chthonicola sagittata*	V		Inhabits dry eucalypt forests and woodlands, especially those with box-ironbark eucalypt associations. It is also found in River Red Gum woodlands. The species is uncommon; populations have declined since the 1980s. (Higgins and Peter 2002; Tzaros 2005).	2	Suitable habitat on site. **Potential to occur.**
Spotted Harrier	*Circus assimilis*	V		It prefers open woodlands that do not obstruct low flight, and natural and exotic grasslands in arid and semi arid areas (Higgins & Davies 1996).	0	Suitable habitat on site. **Potential to occur.**
Superb Parrot	*Polytelis swainsonii*			Occupies open riverine and box-gum woodlands of the inland slopes and southern Riverina of New South Wales and north-central Victoria. Breeding occurs in large eucalypts with hollows in the Riverina and south-west slopes regions; a proportion of the population moves north in autumn-winter (Higgins 1999; OEH 2017b).	1	Open woodland habitat exists on site but considered suboptimal. **Recorded on site; likely to occur.**
Swift Parrot	*Lathamus discolor*	E	CE	In NSW it is a non-breeding autumn-winter visitor from its breeding grounds in Tasmania. Prefers a narrow range of eucalypts including Boxes, Ironbarks, Blakely's Red-gum, Swamp Mahogany, Blackbutt, Red Bloodwood and Spotted Gum (Higgins 1999; OEH 2017b). It spends winter mostly inland of the Great Dividing Range but some years reaches the coast (Higgins 1999; Kennedy and Tzaros 2005).	0	Suitable habitat on site - **potential to occur.**
Varied Sittella	*Daphoenositta chrysoptera*	V		Eucalypt woodland and forest with a shrubby and/or grassy understorey (Higgins and Peter 2002).	18	Suitable habitat on site - **Recorded on site.**
White-fronted Chat	*Epthianura albifrons*	V		Open grasslands low shrublands, and wetland vegetation including saltmarshes (Higgins et al. 2006).	14	Suitable habitat on site. **Recorded on site.**
White-throated Needletail	*Hirundapus caudacutus*		M (CAMBA, JAMBA, ROCAMBA)	Aerial, over all habitats, but probably more over wooded areas, including open forest and rainforest. Often over heathland and less often above treeless areas such as grassland and swamps or farmland (Higgins 1999).	0	Suitable habitat on site - **potential to occur.**
Yellow Wagtail	*Motacilla flava*		M (CAMBA, JAMBA, ROCAMBA)	Extremely uncommon migrant. Few sightings in Victoria. Mostly occurs in well-watered open grasslands on the fringes of wetlands. Roosts in mangroves and other dense vegetation (DotE 2015).	0	No suitable habitat - unlikely to occur.
Eastern Bentwing Bat	*Miniopterus schreibersii oceanensis*	V		Roosts in caves and similar artificial structures such as mineshafts and road culverts. Disperses over a range of habitats at night and may feed at considerable height (Churchill 2008).	19	Suitable habitat on site. **Recorded on site.**
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V		Sclerophyll forests from the Great Dividing Range to the coast, prefer wet habitats where trees are greater than 20 metres high (Churchill 2008).	8	Suitable habitat on site. **Recorded on site.**

Common Name	Scientific Name	TSC	EPBC	Habitat	Number of records	Likelihood of occurrence
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	Brisbane, Newcastle, Sydney and Melbourne are occupied continuously. Elsewhere, during spring, they are uncommon south of Nowra and widespread in other areas of their range. Roosts in aggregations of various sizes on exposed branches. Roost sites are typically located near water, such as lakes, rivers or the coast. Roost vegetation includes rainforest patches, stands of Melaleuca, mangroves and riparian vegetation, but colonies also use highly modified vegetation in urban and suburban.	0	No breeding sites in the study area - **unlikely to occur.**
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*	V		Known to occur from urban, agricultural semi-arid and tall wet forest habitats (Menkhorst 1995). Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country (OEH 2017a).	1	Suitable habitat on site. **Recorded on site (BL&A 2018).**

Notes: BC = threatened species status under the BC Act: CE = critically endangered; E = endangered; V = vulnerable; * = Preliminary Determination by the NSW Scientific Committee; **EPBC**= threatened species status under EPBC Act: CE = critically endangered; E = endangered; V = vulnerable; M = listed migratory taxa; Bonn = Bonn Convention - Convention on the Conservation of Migratory Species of Wild; CAMBA - China- Australia Migratory Birds Agreement; JAMBA - Japan-Australia Migratory Birds Agreement; ROKAMBA - Republic of Korea Australia Migratory Birds Agreement.

Appendix 2: Carcass Search Data Sheet

BIALA WIND FARM - BIRD AND BAT MORTALITY MONITORING PROGRAM CARCASS SEARCH DATA-SHEET*				
Please fill out all details above the heavy line for each site searched All details below the line are required if a carcass is found **Do not move a carcass until the details below have been completed**				
Biala WF				
Date:				
Start Time:				
Finish Time:				
Turbine Number:				
Wind direction and strength in preceding 24 hours:				
Any unusual weather conditions in last 48 hours?				
Distance of Carcass from Tower(m):				
Bearing of Carcass from Tower (deg):				
Preliminary Species Identification:				
Photo Taken**	Yes / No			
Signs of injury:				
How old is carcass estimated to be (tick category):	<24 hrs	1-3 days	> 3 days	Other
Other Notes **(ie. sex/age of bird, substrate and vegetation at site of find):**				
Post Find Actions: 1. Place carcass in sealable plastic bag then wrap it in newspaper then in a second plastic bag with a copy of this data-sheet and take to freezer at site office.				
* One form should be completed for each carcass found				
** Please attach photo to this form				