BODANGORA WIND FARM

BIRD AND BAT ADAPTIVE MANAGEMENT PROGRAM

Bodangora Wind Farm Pty. Ltd.

Approved 7 June 2017

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June 2017
Report No. 15124 (3.6)

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1. INTRODUCTION

The Bodangora Wind Farm (BODW1) project near Wellington in the Central West Slopes of New South Wales (NSW) received planning approval in August 2013 from the Minister for Planning and Infrastructure (Development Application MP10_0157). The wind farm is approximately two kilometres north-east of Bodangora, 20 kilometres north-east of Wellington and 40 kilometres south-east of Dubbo.

As a condition of approval, the proponent must prepare a 'Bird and Bat Adaptive Management Program' (BBAMP) for the wind farm, consistent with the requirements of condition of approval C6, presented below.

> *"Bird and Bat Monitoring*
>
> *06. Prior to the commencement of construction, the Proponent shall prepare and submit for the approval of the Secretary a Bird and Bat Adaptive Management Program, which takes into account bird and bat monitoring methods identified in the current editions of AusWEA Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia and Wind Farms and Birds: Interim Standards for Risk Assessment. The Program shall be prepared and implemented by a suitably qualified expert, approved by the Secretary. The Program shall incorporate monitoring, and a decision matrix that clearly sets out how the Proponent will respond to the outcomes of monitoring. It shall:*
>
> *(a) incorporate an ongoing role for the suitably qualified expert;*
>
> *(b) set out monitoring requirements in order to assess the impact of the Project on bird and bat populations, including details on survey locations, parameters to be measured, frequency of surveys and analyses and reporting. The monitoring program shall be capable of detecting any changes to the population of birds and/or bats that can reasonably be attributed to the operation of the Project, that is, data may be required to be collected prior to the commencement of construction;*
>
> *(c) incorporate a decision making framework that sets out specific actions and when they may be required to be implemented to reduce any impacts on bird and bat populations that have been identified as a result of the monitoring;*
>
> *(d) identify 'at risk' bird and bat groups, seasons, and/or areas within the Project site which may attract high levels of mortality and include monthly mortality assessments and periodic local population census' and bird utilisation surveys;*
>
> *(e) identify potential mitigation measures and implementation strategies in order to reduce impacts on birds and bats such as minimising the availability of raptor perches, swift carcass removal, pest control including rabbits, use of deterrents, and sector management including switching off*

turbines that are predicted to or have had an unacceptable impact on bird/bat mortality at certain times; and

(f) identify matters to be addressed in periodic reports in relation to the outcomes of monitoring, the application of the decision making framework, the mitigation measures identified, progress with the implementation of such measures, and their success.

The reports referred to under part (f) shall be submitted to the Secretary [of the Department of Planning and Environment (DPE)] *and* [Office of Environment and Heritage] *OEH on an annual basis for the first five years of operation and every two years thereafter (unless otherwise agreed to by the Secretary), and shall be prepared within two months of the end of the reporting period. The Secretary may, at the request of the Proponent at anytime, vary the reporting requirement or period by notice in writing to the Proponent.*

The Proponent is required to implement feasible and reasonable mitigation measures as identified under part (e) where the need for further action is identified through the Bird and Bat Adaptive Management Program, or as otherwise agreed with the Director General.

This BBAMP fulfils the requirements of this condition of approval.

1.1. BBAMP Objectives

The overall aim of this BBAMP is to provide *an overall strategy for managing and mitigating any significant bird and bat impacts arising from the operation of the BODW1.*

This is achieved by establishing monitoring and management procedures consistent with the methods outlined by the Australian Wind Energy Association's, Interim standards for bird risk assessment at wind farms (AusWEA 2005) and in the Clean Energy Council's Best Practice Guidelines (CEC 2013).

The specific objectives of this plan, derived from the conditions of approval, are detailed as follows:

- To implement a monitoring program capable of detecting any significant changes to the population of birds and/or bats that can reasonably be attributed to the operation of the project including pre- and post-construction presence;
- To detail a decision-making framework that outlines the specific actions to be taken and possible mitigation measures implemented to reduce any impacts on bird and bat populations that have been identified as a result of the monitoring, or in the event that an impact trigger[1] is detected;
- To detail specific monitoring for potentially 'at risk' bird groups, such as the Superb Parrot, Wedge-tailed Eagle and Grey-crowned Babbler , include monthly mortality assessments, periodic local population censuses and bird utilisation surveys;

[1] *Definition of 'impact trigger' and 'unacceptable impact' is detailed for threatened species in section 5.1.1 and for non-threatened species in section 5.2.1.*

- To detail specific and potential mitigation measures and related implementation strategies to reduce significant impacts on birds and bats; and
- To identify matters to be addressed in annual and biennial (after five years) reports in relation to the outcomes of monitoring, the application of the decision making framework, the need for mitigation measures, progress with implementation of such measures, and their success.

The strategy adopted to assist in detecting any impact triggers and/or unacceptable impacts are attributed to the operation of the wind farm includes:

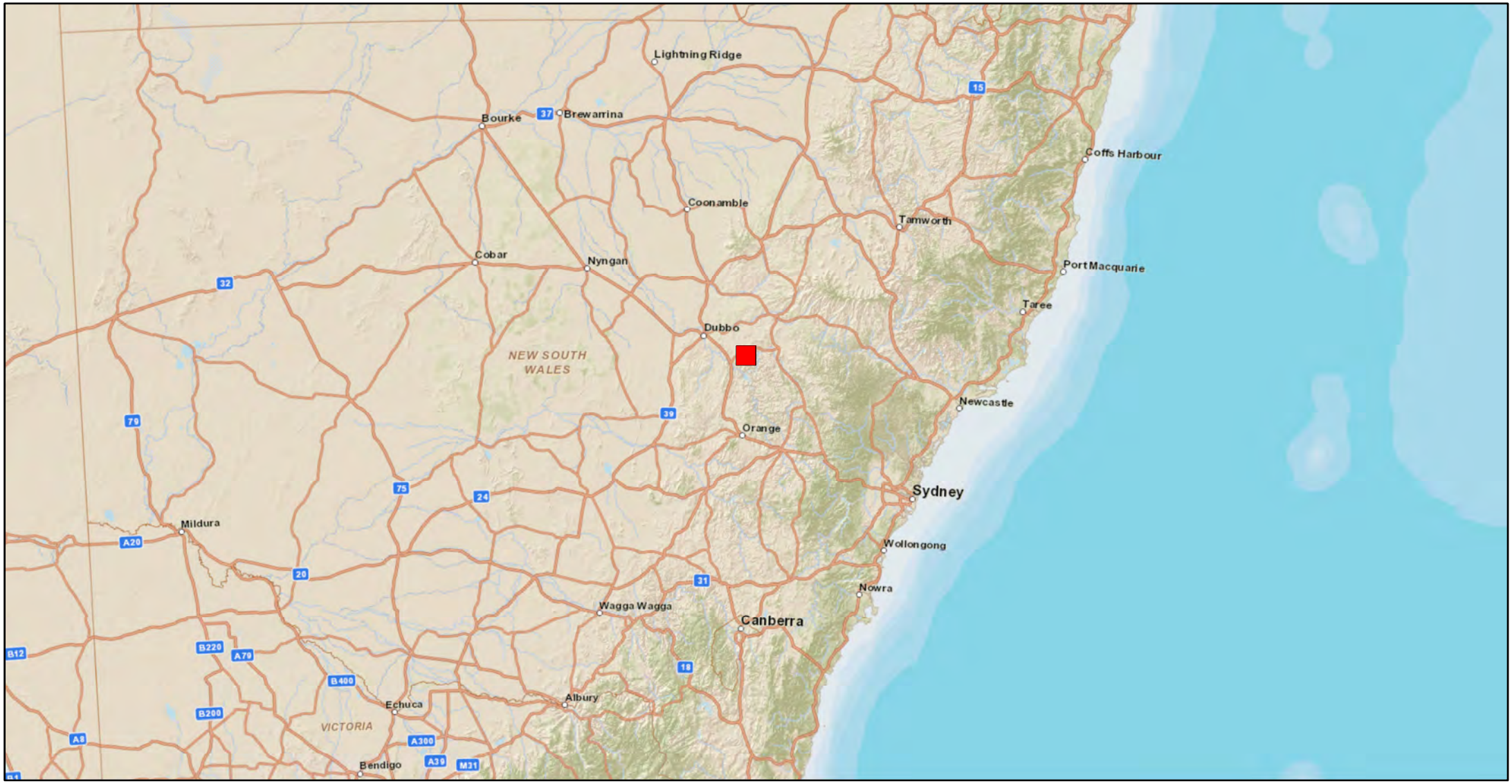
- Pre-construction monitoring surveys;
- Post-construction monitoring surveys, including carcass searches under turbines and woodland bird monitoring;
- Statistical analysis of the results of monitoring; and
- Reporting.

This management program is designed to utilise an adaptive management approach. Therefore, management measures can be amended in response to monitoring results to ensure more effective management and mitigation are implemented. If required, in order to ensure the efficacy of this adaptive management program, all activities will be undertaken subject to regular review and reporting by the suitably qualified expert with relevant experience who is approved by the Secretary of the DPE. Personnel undertaking the carcass searches will be adequately trained to undertake the assessments. The expert will also be in charge of data analysis, interpretation and reporting.

Note that the technical advice in this plan and the decision making framework is based on 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, BL&A have prepared approved plans and programs for Cullerin Range, Taralga, Capital and Woodlawn wind farms in NSW (BL&A 2011b&c, 2014a&b, 2015a&b), and for 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, 2011a, 2012a-d, 2013a-c).

The approach developed for monitoring impacts on birds and bats has been refined as these plans have been prepared and feedback received from regulators and decision-makers. This BBAMP has incorporated learning and experience from these plans, and as a result incorporates the latest approaches to monitoring wind farm impacts on birds and bats.

BL&A and Infigen have consulted with the OEH on the contents of this BBAMP including pre- and post-construction surveying requirements.



Legend

Site location

0 0.75 1.5 3 Kilometers

N

Figure 1: Regional locality map

Project: Bodangora Wind Farm

Client: Infigen Energy

Project No. 15124	Date 1/03/2016	Created By: M. Ghasemi / C. Doughty

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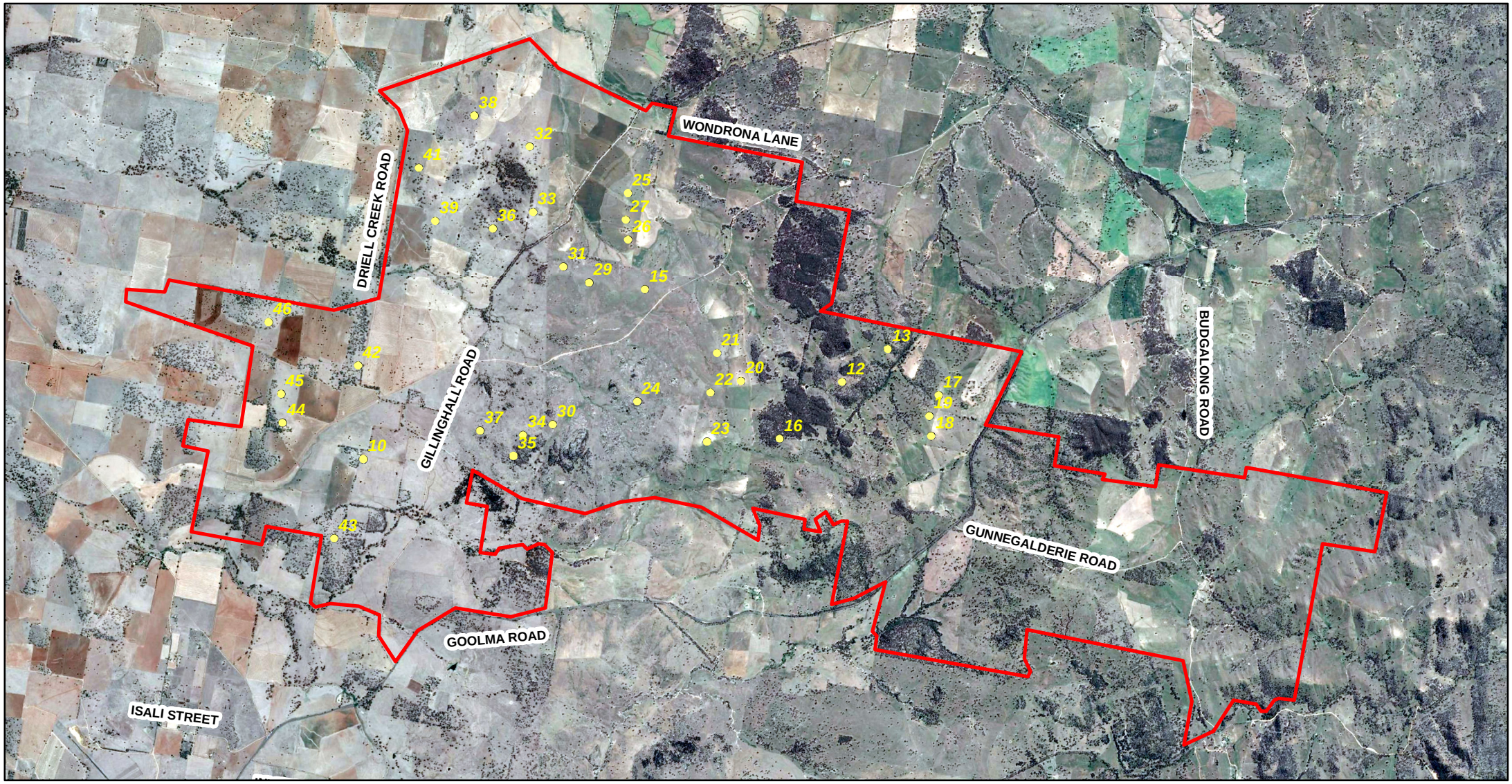

Legend

- Site boundary
- Turbines

0 0.75 1.5 3 Kilometers

N

Figure 2: Study area location

Project: Bodangora Wind Farm

Client: Infigen Energy

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1.2. Compliance summary

Table 1 details which sections of the BBAMP comply with each of the specific requirements outlined in the relevant Condition of Approval (C6) for the project. The conditions of approval have been abbreviated but their full and correct wording can be found in Section 1 above.

The consent condition for the BODW1 requires that this program be informed by AusWEA (2005), the Australian interim bird risk assessment standards for wind farms. The methods and reporting standards in this document have been adopted, with adaptation to reflect more recent technical development and regulator input.

Table 1: Sections within the BBAMP that respond to Condition of Approval C6 for Bodangora Wind Farm

Condition number	Abbreviated condition details	BBAMP Section/s
C6 (a)	*Incorporate an ongoing role for the suitably qualified expert.*	1.1, 3.4
C6 (b)	*Set out monitoring requirements in order to assess the impact of the project on bird and bat populations including details on survey locations, parameters to be measured, frequency of surveys and analyses and reporting.*	3
C6 (c)	*Incorporate a decision making framework that sets out specific actions and when they may be required to be implemented to reduce any impacts on bird and bat populations that have been identified as a result of the monitoring.*	5.1.2, 5.2.2
C6 (d)	*identify 'at risk' bird and bat groups….and include monthly mortality assessments and periodic local population censuses and bird utilisation surveys.*	2, 3
C6 (e)	*Identify potential mitigation measures and implementation strategies in order to reduce impacts on birds and bats…..*	3, 4 and 5
C6 (f)	*Identify matters to be addressed in periodic reports….*	3.6
C6	*Submit reports to the Secretary and OEH on an annual basis.*	3.6 and 5

1.3. Site Description

The project is located approximately two kilometres north-east of Bodangora, 20 kilometres north-east of Wellington and 40 kilometres south-east of Dubbo.

The majority of the project area comprises land used for agricultural purposes dominated by introduced pasture. Native vegetation ground cover is deficient, a typical characteristic of the NSW tablelands and western slopes (KMA 2011). The project site supports stands of woodland and scattered paddock trees, in addition to some areas of native vegetation along roadsides (KMA 2011). Canopy trees comprise White Box, Yellow Box and Blakely's Red Gum, which provide foraging, roosting and breeding resources for birds and tree-dwelling mammals. Farm Dams scattered across the site and low-lying flats and riparian zones along watercourses (primarily situated off the wind farm site), provide aquatic habitat (KMA 2011). The creeks on site are no permanent watercourses.

The BODW1 project will involve the construction and operation of a wind farm with up to 33 wind turbines each with a generating capacity of between 2.0 and 4.0 MW and a total installed capacity of up to 120 MW. The associated infrastructure will include access tracks, local road infrastructure upgrades, electrical connections between the turbines and a new substation, temporary and permanent meteorological masts, a gravel pit, a temporary concrete batching plant, an operations office and maintenance facility. The grid connection will be through a new substation connecting to the existing 132 kV transmission line between the Wellington substation and Beryl.

1.4. Pre-approval investigations of birds and bats at Bodangora Wind Farm

During the pre-approval and pre-construction phases of the development, investigations were undertaken that have informed this BBAMP. These have included:

- An Assessment of the Bat Fauna at the Proposed Bodangora Wind Farm, Via Wellington, NSW, was undertaken by Greg Richards and Associates Pty Ltd (2011).
- Initial flora and fauna assessment undertaken by Kevin Mills and Associates in July 2011. The results of the surveys are summarised in the report *Flora and Fauna Assessment – Bodangora Wind Farm, Shire of Wellington, New South Wales*. Report for Infigen Energy Pty. Ltd. Report No. 08/39 (KMA 2011).
- A targeted Superb Parrot survey for the proposed BODW1 was undertaken by BL&A (2015c). No Superb Parrots were observed in the focal survey areas of this assessment including where the Superb Parrot was previously recorded during the initial flora and fauna assessment (KMA 2011). It was considered that the likelihood of significant impact of the approved BODW1 layout on the Superb Parrot was negligible.

2. RISK ASSESSMENT FOR BODANGORA WIND FARM

2.1. Introduction to the Risk Assessment

BL&A undertook a risk assessment for a number of species and bird groups considered to be at potential risk of turbine blade strike or indirect disturbance at the approved Bodangora Wind Farm development. The objective of this risk assessment is to guide the development of the BBAMP through identifying potential risk of interaction between BODW1 and bats and avifauna species and/or groups.

To ascertain the species of concern that may occur on the BODW1, the following sources were used:

- The NSW Bionet Atlas Search tool (OEH 2015a): search area within the following co-ordinates, North: -32.29, West: 148.93, East: 149.21 and South: -32.53.
- The EPBC Act Protected Matters Search Tool (PMST) using a search region that included the proposed site and a 10km buffer (Department of the Environment 2015a).
- Flora and Fauna Assessment – Bodangora Wind Farm, Shire of Wellington, New South Wales (Kevin Mills and Associates 2011).
- Assessments of the Bat Fauna at the site (Richards 2011).
- Targeted Superb Parrot Survey – Bodangora Wind Farm (BL&A 2015c).
- Discussions and consultation with the OEH.

2.1.1. Species and groups of concern

From all the above sources, a list of species with the potential to occur on the BODW1 site was generated. Of these, a short-list of species of concern was then generated based on the likelihood of occurrence on the wind farm site itself given the habitat present. Species of concern are those that are listed on either the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the state *Threatened Species Conservation Act 1995* (TSC Act).

The original site assessments (KMA 2011) identified threatened and listed migratory species likely to occur on the site, some of which were detected during on-site fauna survey work. Although this has been taken into consideration, a number of additional species and groups, including non-threatened species/groups, have been identified through the current review that were not originally considered. The rationale for the inclusion of the short-listed species and groups can be found in Table 5. The short-listed species are listed below.

EPBC Act Listed threatened birds

- Superb Parrot (Vulnerable)
- Regent Honeyeater (Critically Endangered)
- Painted Honeyeater (Vulnerable)
- Swift Parrot (Endangered)

EPBC Act Listed Migratory Species

- Fork tailed Swift
- White-Throated Needletail
- Rainbow Bee-eater
- Satin Flycatcher

EPBC Act listed threatened bats

- Large-eared Pied Bat (Vulnerable)
- South-eastern Long-eared Bat (Vulnerable)
- Grey-headed Flying-fox (Vulnerable)

TSC Act listed threatened birds-

- Grey-crowned Babbler (Vulnerable)
- Hooded Robin (south-eastern form) (Vulnerable)
- Diamond Firetail (Vulnerable)
- Little Lorikeet (Vulnerable)
- Little Eagle (Vulnerable)
- Scarlet Robin (Vulnerable)
- Flame Robin (Vulnerable)
- Turquoise Parrot (Vulnerable)
- Varied Sittella (Vulnerable)
- Brown Treecreeper (eastern subspecies) (Vulnerable)
- Speckled Warbler (Vulnerable)
- Barking Owl (Vulnerable)
- White-fronted Chat (Vulnerable)
- Gang Gang Cockatoo (Vulnerable)

TSC Act listed threatened bats

- Yellow-bellied Sheathtail-bat (Vulnerable)
- Eastern Bent-wing Bat (Vulnerable)

2.2. Risk Assessment Process

The objective of the risk assessment is to guide the development of the Bird and Bat Adaptive Management Program (BBAMP) for the BODW1 by identifying those species or groups considered potentially at risk from either collision with turbines or disturbance by the operation of the wind farm. The outcomes of this risk assessment enable more targeted monitoring and management measures to be included in the BBAMP, focusing on species and groups identified at risk.

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, two

possible impact events were considered: birds or bats striking wind turbine blades; or birds or bats being deterred from using part of the wind farm due to disturbance. Risk was assessed 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 ISO31000 Risk Assessment Standard.

The assessment requires criteria to be developed for likelihood and consequence. These criteria are provided in Table 2 and Table 3. Table 4 shows the risk levels used and how they are determined from the assessed likelihood and consequence levels.

Table 2: 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 3: 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 4: 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*

This assessment was drafted by BL&A specialists and reviewed with Infigen. The draft Risk Assessment was provided to OEH in November 2015. A teleconference was held between OEH, Infigen and BL&A to review the risk assessment. Comments plus feedback from the OEH during these calls and written comments were incorporated into the current BBAMP.

2.3. Risk Assessment Results

Table 5 provides the results of the likelihood and consequence assessment based on the inputs from the aforementioned sources and includes the following information as part of the risk assessment process:

- Environmental value to be protected.
- Reasons for Inclusion.
- Threatened species status.
- Hazard or source event.
- Consequence and likelihood scores.
- Risk rating.
- Comments relating to risk rating scores.

The risk associated with wind turbine collision and indirect effects at the BODW1 for most birds and bats was rated as **negligible**. Those species with risks above negligible and / or those specifically identified as species of concern are described below.

No bat species of concern were identified and risks to threatened bat species are considered negligible.

The White-throated Needletail flies regularly at turbine height and flocks may pass over the BODW1 site during the summer months. Collisions have been recorded at wind farms elsewhere in NSW and Victoria between wind turbines and this species. The risk to this species from the BODW1 is considered as widespread and relatively numerous in eastern and south-eastern Australia. The overall risk is considered to be **low for risk of turbine strike and negligible for disturbance.**

Records of the Superb Parrot in the study area were from the western boundary of the proposed wind farm site. Turbines are proposed to be located in these areas. The Rotor Swept Area (RSA) height of the turbines is 20 – 150 metres above ground. The Superb Parrot spends the majority of its time feeding on the ground also feeds on branches on shrubs and trees. Since the Superb Parrot is unlikely to fly at RSA the majority of the time and is a seasonal migrant through the site it is less probable than not that the risk event could occur in any year. Thus, the overall risk to the species from the project is therefore rated as **negligible**.

Grey-crowned Babbler occurs in woodland habitat and was recorded in the study area. It is currently unknown whether the Grey-crowned Babbler may be affected by indirect impacts such as habitat displacement. Since the Grey-crowned Babbler is unlikely to fly at RSA the majority of the time, the risk to this species is therefore rated as **negligible**.

The Wedge-tailed Eagle is not a listed species but rather a species of concern to the OEH given it is considered as an iconic species and the occurrence of collisions involving the Wedge-tailed Eagle at wind farms across Australia. Low incidence rates of disturbance have been observed for this species (e.g.

successful breeding within 200 metres of operating turbines in NSW and Victoria (BL&A, unpubl. data)). Risks to this species arise therefore from potential collisions with turbines but not indirect disturbance. The risk to the Wedge-tailed Eagle was therefore considered to be likely to occur with an overall risk rating of **low**. Other raptor species were rated as **low** as they are less likely to consistently fly at and above RSA height, but have been recorded colliding with wind turbines although less often than eagles (BL&A unpubl. data) and are widespread and numerous in eastern and south-eastern Australia.

Table 5: Bird and Bat Risk Assessment – Bodangora Wind Farm

Value to be Protected	Reasons for Inclusion	Threatened species status	Hazard or Source Event	Likelihood of risk event	Consequence	Risk Rating	Comments
Birds							
Fork-tailed Swift *Apus pacificus*	Species or species habitat likely to occur within area	Listed Marine / Marine Migratory species EPBC Act	Collision with operating wind turbines	Unlikely	Negligible	Negligible	Fork-tailed Swift occurs throughout most of Australia in its non-breeding season, generally reaching south-eastern Australia by summer and early autumn, often following weather fronts. It flies at turbine height. Collision likely to be infrequent due to irregularity of occurrence. 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	
Satin Flycatcher *Myiagra cyanloleuca*	Species or species habitat likely to occur within area	Listed Migratory species EPBC Act	Collision with operating wind turbines	Unlikely	Negligible	Negligible	Occurs over a wide area of forests in Eastern Australia. Migrates across cleared ground between remnant treed vegetation. Numerous records in the wider region (BirdLife Australia 2015). Tends to move within treed habitats. Flight height on migration not known. Small numbers of individuals may migrate through the site and only a small proportion of these would collide with turbines. Small numbers that may be affected do not represent a significant proportion of the total population which occupies a large proportion of the forested country in south-eastern Australia (BirdLife Australia 2015) and likely numbers in the thousands.
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
White-Throated Needletail *Hirundapus caudacutus*	Suitable habitat occurs within area.	Listed Migratory / Marine species EPBC Act	Collision with operating wind turbines	Likely	Low	Low	Known to follow storm systems and fronts. Occasional mortality on other wind farms in its range and elsewhere. Typically fly at and above RSA height. Loss of a small number of individuals is concerning, but is not considered to be of population significance as the species is numerous in Australia (Department of the Environment 2015b). Current population estimates of population are not available and the number of Needletails recorded in eastern and south-eastern Australia may vary between years. . Tarburton (Australian Field Ornithology 31 (3) 2014) reports a 49% decline between the two national bird atlases and a 74% decline since the 1950's. IUCN listed overall as "Least Concern".
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Rainbow Bee-eater *Merops ornatus*	Species or species habitat likely to occur within area	Listed Migratory / Marine species EPBC Act	Collision with operating wind turbines	Unlikely	Negligible	Negligible	Usually in open or lightly timbered areas, often near water. Occur in partly cleared land such as farmland and in sand-dunes, both coastal and inland (Higgins 1999). This species usually flies below RSA height but is known to fly at height when migrating. It has not been recorded colliding with wind turbines in Australia.

Value to be Protected	Reasons for Inclusion	Threatened species status	Hazard or Source Event	Likelihood of risk event	Consequence	Risk Rating	Comments
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Brown Treecreeper *Climacteris picumnus*	Species or species habitat likely to occur within area	Vulnerable TSC Act	Collision with operating wind turbines	Rare	Negligible	Negligible	It occurs in woodlands dominated by eucalypts, especially Stringybarks or other rough-barked eucalypts, usually with open grassy understorey (Higgins *et al.* 2001). This species usually occurs in the lower canopy and does not fly at RSA height.
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Speckled Warbler *Chthonicola sagittata*	Species or species habitat likely to occur within area	Vulnerable TSC Act	Collision with operating wind turbines	Rare	Negligible	Negligible	It inhabits dry eucalypt forests and woodlands, especially those with box-ironbark eucalypt associations. It is also found in River Red Gum woodlands (Higgins and Peter 2002; Tzaros 2005). This woodland species does not fly at RSA height.
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Little Eagle *Hieraaetus morphnoides*	Species or species habitat likely to occur within area	Vulnerable TSC Act	Collision with operating wind turbines	Unlikely	Negligible	Negligible	The Little Eagle is distributed throughout the Australian mainland except the most densely forested parts of the Dividing Range (Marchant and Higgins 1993). Turbine strikes of this raptor species could occur, however the species has not been recorded at the Bodangora site, but has been recorded with 10-15 km of the property and may be occur occasionally on-site (pers comm. OEH 2015). 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). The species has not been recorded colliding with wind turbines and occurs in NSW at very low population densities so regular collision is unlikely.
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Varied Sittella *Daphoenositta chrysoptera*	Suitable habitat occurs within area.	Vulnerable TSC 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 the past several decades. (OEH 2015b). It inhabits eucalypt forests and woodlands flying at canopy level. Varied Sittellas forage in groups, flying into the tree canopy and working down the branches and the trunk, probing through the bark in search of insects (Pizzey & Knight 2003). This species would not fly at RSA height.
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	

Value to be Protected	Reasons for Inclusion	Threatened species status	Hazard or Source Event	Likelihood of risk event	Consequence	Risk Rating	Comments
Barking Owl *Ninox connivens*	Species or species habitat may occur within area, but species was not recorded	Vulnerable TSC Act	Collision with operating wind turbines	Unlikely	Negligible	Negligible	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend into closed forest and more open areas. Although common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW (OEH 2015b). The species has not been recorded from the wind farm site and habitats there are of low quality, reducing the likelihood of regular occurrence. It is therefore unlikely that the species would collide with turbines or be disturbed.
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Grey-crowned Babbler *Pomatostomus temporalis temporalis*	This species was recorded at the BODW1 (KM&A 2011, BL&A 2015)	Vulnerable TSC Act	Collision with operating wind turbines	Unlikely	Negligible	Negligible	Two family groups of Grey–crowned Babbler were observed within the wind farm boundary. It inhabits open forests and woodlands and requires an open shrub layer with sparse ground cover and fallen timber and leaf-litter (Higgins and Peter 2002). It is a ground dwelling bird that lives in communal family groups and nests in small terminal branches at the top or in the crowns of a wide variety of small trees, saplings and tall shrubs. This species generally confines itself to areas of wooded country and is unlikely to fly at RSA height. OEH requested this species be included in post-construction monitoring to test if indirect (i.e. disturbance) impacts occur.
			Indirect disturbance, including barrier effects	Unlikely	Low	Negligible	
Superb Parrot *Polytelis swainsonii*	This species was recorded at the Bodangora WF (KM&A 2011, BL&A 2015).	Vulnerable EPBC Act, TSC Act	Collision with operating wind turbines	Unlikely	Low	Negligible	The Superb Parrot occurs generally in woodlands. As a seasonal visitor, flights across the proposed wind farm would be limited to the migration and winter season. The likelihood of a collision is considered very low as the behaviour of the species indicates the species will typically fly below RSA height, although some flights may be at RSA height, particularly during migration (OEH, pers. comm. 2015).. There is therefore some potential for collision with wind turbines.
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Regent Honeyeater *Anthochaera phrygia*	Species or species habitat may occur within area, but was not recorded	Critically Endangered EPBC Act, TSC Act	Collision with operating wind turbines	Unlikely	Negligible	Negligible	The Regent Honeyeater 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). They are wide ranging, highly nomadic and occur in very low densities in the landscape so collision with wind turbines is unlikely.
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Painted Honeyeater *Grantiella picta*	Species or species habitat may occur within area, but was not recorded	Vulnerable EPBC Act, TSC Act	Collision with operating wind turbines	Unlikely	Negligible	Negligible	The Painted Honeyeater inhabits box-ironbark forests and woodlands and mainly feeds on the fruits of mistletoe so it is associated with mistletoe around the margins of open forests and woodlands (Higgins *et al.* 2001; Tzaros 2005). It has not been recorded in the study area and is unlikely to fly regularly at RSA height so collision is unlikely
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	

Value to be Protected	Reasons for Inclusion	Threatened species status	Hazard or Source Event	Likelihood of risk event	Consequence	Risk Rating	Comments
Swift Parrot *Lathamus discolor*	Species or species habitat may occur within area, but was not recorded	Endangered EPBC Act, TSC Act	Collision with operating wind turbines	Unlikely	Negligible	Negligible	The Swift Parrot may pass through the study area occasionally when migrating. Most of the tree species on the site are not the preferred sources of nectar for the Swift Parrot. A small number of preferred food trees were found in the central part of the site. However, the small number of these trees in the study area makes it unlikely that the species would spend much time in the area. For these reasons, collision or disturbance on a regular basis are unlikely.
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Diamond Firetail *Stagonopleura guttata*	Species or species habitat may occur within area, but was not recorded	Vulnerable TSC Act	Collision with operating wind turbines	Rare	Negligible	Negligible	This species is found in box-ironbark forests and woodlands, along watercourses and in farmland areas (Emison *et al.* 1987; Tzaros 2005). It has a low chance of occurrence on the wind farm site. It has been recorded regularly inhabiting farmland around wind turbines in southern NSW, where it has never been observed flying at RSA height (BL&A, unpubl. data).
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Flame Robin *Petroica phoenicea*	Species or species habitat may occur within area, but was not recorded	Vulnerable TSC Act	Collision with operating wind turbines	Rare	Negligible	Negligible	This robin is widespread on the tablelands and nearby, moving to lower altitudes in winter. Birds inhabit woodland and more open country in winter. It has been recorded regularly inhabiting farmland around wind turbines in southern NSW but is unlikely to fly regularly at RSA height so collision is unlikely.
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
White-fronted Chat *Epthianura albifrons*	Species or species habitat may occur within area, but was not recorded	Vulnerable TSC Act	Collision with operating wind turbines	Rare	Negligible	Negligible	The White-fronted Chat inhabits damp open habitats, particularly wetlands with saltmarsh areas bordered by open grasslands or lightly timbered land. The species is also observed in open grasslands and sometimes in low shrubs bordering wetlands. Inland, the White-fronted Chat is often observed in open grassy plains, saltlakes and saltpans that are along the margins of rivers and waterways. This species usually occurs in the lower canopy and would not fly at RSA height so collision is unlikely. It has been observed using farmland near operating wind turbines elsewhere without significant disturbance (BL&A, unpubl. data).
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Gang Gang Cockatoo *Callocephalon fimbriatum*	Species or species habitat may occur within wider region but was not recorded	Vulnerable TSC Act	Collision with operating wind turbines	Unlikely	Low	Negligible	The Gang Gang Cockatoo is widespread throughout Victoria and NSW, being generally reliant on eucalyptus assemblages that support a dense shrubby understorey (Ford, 1918; Howe 1924; Bridgewater 1932; Higgins 1999). Its preferred habitat is tall mountain forests and woodlands, particularly in heavily timbered, mature sclerophyll forests and woodlands. Wind farms in the Southern Tablelands of NSW that contain this habitat are usually located within the GGC's range. It has been recorded regularly inhabiting farmland around wind turbines in southern NSW where it has been observed flying at RSA height. The habitat present in the study area is sub-optimal for the species and the project lies at the western extremity of its range so regular occurrence and potential interaction with wind turbines is considered highly unlikely.
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	

Value to be Protected	Reasons for Inclusion	Threatened species status	Hazard or Source Event	Likelihood of risk event	Consequence	Risk Rating	Comments
Little Lorikeet	Species or species habitat may occur within wider region but was not recorded	Vulnerable	Collision with operating wind turbines	Unlikely	Low	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 2015b). Little Lorikeet are at risk of colliding with turbines given their fast flight, sometimes 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, ensures they would only occasionally be likely to collide with or be disturbed by wind turbines.
Glossopsitta pusilla		TSC Act	Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Scarlet Robin *Petroica multicolor*	Species or species habitat may occur within area, but was not recorded	Vulnerable	Collision with operating wind turbines	Rare	Negligible	Negligible	The Scarlet Robin lives in open forests and woodlands in Australia. During winter, it visits more open habitats such as grasslands in farmland, urban parks and gardens. Flight height studies at nearby wind farms indicate that Scarlet Robin flies at heights of 20 metres or less (BL&A unpubl. data). This is below RSA height so collision with wind turbines is highly uinlikely.
		TSC Act	Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Turquoise Parrot *Neophema pulchella*	Species or species habitat may occur within area, but was not recorded	Vulnerable	Collision with operating wind turbines	Unlikely	Low	Negligible	This species occurs in eucalypt woodlands and open forests, with ground cover of grasses and sometimes a low understorey of shrubs (Higgins 1999). This species flies fast and at a range of heights, depending on activity and may be susceptible to colliding with turbines. It was not recorded at the Bodangora site but has been recorded once to the north of Wellington (KM&A 2011). It is unlikely that this species occurs regularly on the wind farm site so interactions with wind turbines are unlikely.
		TSC Act	Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Hooded Robin (south-eastern form) *Melanodryas cucullata*	Suitable habitat occurs within area.	Vulnerable	Collision with operating wind turbines	Rare	Negligible	Negligible	The Hooded Robin occurs mostly in open Grey Box, White Box, Yellow Box, Yellow Gum and Ironbark woodlands with pockets of saplings or taller shrubs, an open shrubby understorey, sparse grasses and patches of bare ground and leaf-litter, with scattered fallen timber (Higgins and Peter 2002; Tzaros 2005). It generally confines itself to areas of wooded country and does not fly at RSA height.
		TSC Act	Indirect disturbance, including barrier effects	Rare	Negligible	Negligible	
Wedge-tailed Eagle *Aquila audax*	This species was recorded at the BODW1 (KM&A 2011, BL&A 2015).	N/A	Collision with operating wind turbines	Almost Certain	Low	Low	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 New South Wales and it is the most commonly struck raptor at wind farms in Australia (BL&A, unpubl. data). Disturbance is not an issue, with the eagle breeding successfully as close as 200 metres from operating wind turbines in NSW and Victoria (BL&A, unpubl. data).
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Other raptor species	This species was recorded at the BODW1	N/A	Collision with operating wind turbines	Likely	Low	Low	Turbine strikes by commonly occurring raptors, such as Brown Falcon and Nankeen Kestrel have occurred irregularly at other wind farms in south-eastern Australia (BL&A, unpubl. data). The widespread and common status of these

Value to be Protected	Reasons for Inclusion	Threatened species status	Hazard or Source Event	Likelihood of risk event	Consequence	Risk Rating	Comments
	(KM&A 2011, BL&A 2015).		Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	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 and Victoria (BL&A, unpubl. data).
Waterbirds	Waterbirds were recorded at the BODW1 (KM&A 2011, BL&A 2015).	N/A	Collision with operating wind turbines	Unlikely	Low	Negligible	Waterbird habitats on the Bodangora site 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 move across farmland frequently (BL&A, unpubl. data).
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Bats							
Grey-headed Flying Fox *Pteropus poliocephalus*	Species or species habitat may occur within area, but species was not recorded	Vulnerable EPBC Act	Collision with operating wind turbines	Rare	Negligible	Negligible	This flying-fox inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Churchill 1998). The Grey-headed Flying-fox was not observed during surveys within the study area. Their wide distribution and episodic occurrence in the area coinciding with eucalypt flowering events, which are sporadic, ensures they would be likely to collide very occasionally with turbines with no consequence for their wider population.
			Indirect disturbance, including barrier effects	Rare	Negligible	Negligible	
Large-eared Pied Bat *Chalinolobus dwyeri*	Species or species habitat may occur within area, but species was not recorded	Vulnerable EPBC Act	Collision with operating wind turbines	Unlikely	Negligible	Negligible	This species forages in tall open forests and the edges of rainforest. It roosts in caves, mine shafts and similar structures (Churchill 1998). It is unlikely to occur in the study area and interactions with wind turbines are therefore considered unlikely.
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
South-eastern Long-eared Bat *Nyctophilus corbeni*	Species or species habitat may occur within area, but species was not recorded	Vulnerable EPBC Act	Collision with operating wind turbines	Unlikely	Negligible	Negligible	This bat species occurs in dry woodland and shrubland communities in semi-arid regions (Menkhorst 1995). It is unlikely to occur in the region, so impacts from the wind farm are not considered likely.
			Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	

Value to be Protected	Reasons for Inclusion	Threatened species status	Hazard or Source Event	Likelihood of risk event	Consequence	Risk Rating	Comments
Yellow-bellied Sheathtail-bat	Suitable habitat occurs within area. Recorded in low numbers at Bogandora WF site	Vulnerable	Collision with operating wind turbines	Unlikely	Low	Negligible	The Yellow-bellied Sheathtail-bat was only recorded at the three creek sites, very irregularly, involving a few calls each night. It would be considered to be very rare in the project area however may move through the area occasionally. Viable populations may move through the area. Predicted to occur to the south and east of the wind farm. Its occurrence at the wind farm site makes collision with wind turbines likely at some stage in the project life but the population consequences are considered low.
Saccolaimus flaviventris	(Richards 2008)	TSC Act	Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	
Large Bent-wing Bat	Species or species habitat may occur within area, but species was not recorded	Vulnerable	Collision with operating wind turbines	Unlikely	Low	Negligible	The Large Bent-wing Bat was recorded infrequently in previous surveys in relation to the gold mining operation at Cadia (approximately 20 km south of Orange, approximately 120 km south of Wellington). Although not recorded at the Bodangora WF, it may occasionally occur in the wider region, therefore there is potential for turbine strike during the life of the BODW1 project. The population consequences of such an infrequent occurrence are unlikely to be significant.
Miniopterus schreibersii		TSC Act	Indirect disturbance, including barrier effects	Unlikely	Negligible	Negligible	

2.4. Conclusions from the Risk Assessment for Bodangora Wind Farm

The surveys of the BODW1 to date, combined with the knowledge generated at operating wind farms elsewhere in Australia (BL&A unpubl. data), indicate that collision rates of birds and bats at wind farms are typically very low. This risk assessment indicates that no significant population-wide impacts are anticipated for the species of concern assessed.

The key species and groups identified in the risk assessment, and during discussions with the OEH, to be addressed in the BBAMP are:

- Raptors are known to be vulnerable to collision with operating wind turbines. A number of raptor species have been recorded at the wind farm site during surveys. No threatened raptor species is considered to be at risk from the wind farm, although the Little Eagle was recorded within 10-15 kilometres of the project site, however is yet to be recorded on the site. The BBAMP will propose that raptor mortality be monitored through the regular process of post-construction carcass searches;
- The Wedge-tailed Eagle is the most exposed to collision risk due to its common habit of soaring and circling at height while foraging. There were two records of this species recorded on the site in July 2011 (KM&A 2011) indicating the wind farm may be part of the territory of a pair. The mainland sub-species of the Wedge-tailed Eagle is common and widespread (Barrett *et al.* 2003), and it is not a threatened species. The BBAMP proposes Wedge-tail Eagle mortality be monitored through the regular process of post-construction carcass searches. In addition, incidental observations of Wedge-tailed Eagles will be undertaken and recorded during carcass searches;
- 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 and is unlikely to be locally common. Its conservation status is listed as secure both at a state and Commonwealth level, although it is a listed migratory species at the Commonwealth level. The BBAMP proposes White-throated Needletail mortality be monitored through the regular process of post-construction carcass searches;
- The Superb Parrot is a threatened woodland bird species, listed as Vulnerable on both the EPBC Act and the TSC Act threatened species lists. The proposed wind farm site is located within the seasonal migratory range of the Superb Parrot and it has previously been observed on the site. The Superb Parrot is not known to breed on the wind farm site, therefore the proposed development will not have a significant impact on breeding habitat or its breeding cycle. However, it may occasionally pass through the area on migration. It is considered that the risk of the BODW1 to the Superb Parrot is negligible. However, the BBAMP proposes Superb Parrot mortality be monitored through the regular process of post-construction carcass searches. In addition, two seasonal searches will be conducted in August-September and in summer (December-January) autumn to identify migration through the site. Incidental observations of Superb Parrot will be undertaken and recorded during carcass searches;
- Grey Crowned Babbler is listed as vulnerable on the TSC Act and was recorded at the wind farm site. This species generally confines itself to areas of wooded country and is highly unlikely to fly at RSA height. OEH seek to understand any potential indirect impact from displacement through barrier effects. Notwithstanding this, the Grey Crowned Babbler is assessed as being at negligible risk from the project. The BBAMP will propose that the Grey Crowned Babbler be monitored through observations of breeding nest

collected as incidental observations during the regular post-construction carcass searches;

Many of the TSC Act listed species screened in this risk assessment are not at risk from the Bodangora WF. Woodland birds and many bats don't often fly at RSA height and therefore do not regularly encounter turbines.

This risk assessment indicates that a small proportion of the species and groups of concern (two groups out of 23 birds / bird groups) have more than a negligible risk of being affected by collision with operating turbines once the wind farm is constructed.

3. POST CONSTRUCTION SURVEYS

A range of approaches will be utilised post-construction to meet the requirements of the relevant condition of approval (C6).

A carcass search program will be implemented for two years to detect birds and bats that collide fatally with wind turbines and to estimate annually the numbers of birds and bats affected by the wind farm (see section 3.2), where statistically reliable. In addition, any survey requirements triggered by one of the triggers included below may initiate further surveys. The final methodology for post-construction surveys is outlined within this BBAMP.

Table 1 (in Section 1) summarises the key requirements of the consent condition.

Post-construction carcass searches will commence on start-up and commissioning of all turbines at Bodangora WF.

Post-construction searches are expected to be carried out for two years following construction, with a review of all monitoring data undertaken at this time. Preliminary results and recommendations will be provided on any changes in the monitoring regime following the first year of data collection. The second annual report will include a detailed evaluation of this program.

3.1. Bird Surveys

3.1.1. Monitoring 'at risk' groups

The key "at risk" groups have been identified through the risk assessment (see section 2) and discussions with OEH. The groups highlighted for monitoring were:

- Woodland birds – two species, Superb Parrot and Grey-crowed Babblers;
- Birds of Prey (Raptors) – the risk assessment considered raptors at moderate (Wedge-tailed Eagle) and low (others) risk; and
- White-throated Needletail a migratory species that demonstrates a flight behaviour that puts it a risk with collision with turbines.

Grey-crowned Babbler

The Grey-crowned Babbler is considered vulnerable on the TSC Act (DEC 2005). This species utilises woodland within the proposed wind farm boundary and was recorded from two locations within the wind farm. One location was away from turbines and associated wind farm infrastructure. The other was located along the ridge near the location of proposed turbine 9 in a White Cypress Pine woodland habitat on a granite outcrop.

A range of possible factors are known to influence the local distribution of the Grey–crowned Babbler. These include the seasonality (wet and dry years), habitat removal, invasive bird species, food sources, and disturbance. There is no known published information on the impacts that wind turbines have on the Grey-crowned Babbler.

Given that the home range of the Grey–crowned Babbler varies hugely form 1–50 hectares if the home range of the babblers in the impact zone is greater than 10 hectares it is highly unlikely that the turbines will impact on the local population. It is not known whether there may be some sort of indirect impact in the form of disturbance to the Grey–crowned Babbler in the construction phase and / or the operational phase.

Given the sedentary and resident nature of this species, it is proposed that monitoring will focus on detection of any change in the home range of the group of Grey-crowned Babblers at turbine 9 pre- and post- construction (operational phase).

Prior to construction surveys will be undertaken, at least 12 individual surveys over any number of days, with up to two surveys per day to determine the presence of the Grey–crowned Babbler in the area. This survey will:

- Record all Babblers within 500 metres of T9;
- Include a count of the number of birds observed and their location; and
- Nests will be mapped.

This will gather base line data and be able to compare results once the turbines are constructed and operational.

Post–construction, one survey will be undertaken each month over one year to determine the presence of Grey Crowned Babblers. This will be completed using the same methodology as the pre-construction survey.

If the Grey–crowned Babbler is deterred by the turbines then they would prefer to nest at sites further away from turbines. This could easily be picked up from the above methodology. However, it will not exclude the possibly that the Grey–crowned Babbler is relocating for reasons other than operation of the wind turbines.

Targeted Superb Parrot Survey

Although no Superb Parrots were detected during the targeted survey (BL&A 2015), it is considered likely to occur in and surrounding the project site as evidenced from the initial bird utilisation surveys and other records. The main risks to Superb Parrot are:

- Potential woodland habitat loss; and
- Collision with operating turbines.

It is very important that migrations, if they occur at the BODW1 are understood, thus it is recommended that targeted Superb Parrot surveys are conducted during the migration and dispersal seasons. Peak migration period is thought to be from late August to early September when they may occur in larger numbers migrating through the study area to breeding grounds to the south. The species is believed to disperse from the breeding grounds to forage and move through the wind farm area during late December to mid-February. These surveys will build upon information already obtained from pre-approval surveys undertaken by BL&A (mid-October 2014) and KMA (mid-July 2011), which confirmed limited numbers of Superb Parrots on both occasions. These surveys were undertaken when Superb Parrots were unlikely to occur in the region in large numbers.

The proposed focus of the Superb Parrot survey is to generate information on all recorded Superb Parrots movements through the region, and to assist in the identification of “risk” behaviour that the parrots may exhibit. “Risk” behaviour is defined for the purpose of tis BBAMP as consistent observations of ten or more flights per day of flocks of ten or more birds between turbines at a height that would result in levels of collision of potential consequence for the regional and wider population of the species.

An initial one year of monitoring is proposed for the Superb Parrot to include the following:

- Summer – Autumn Migration (1 February to 30 April)
    - Fortnightly surveys of five sites on ridgeline vantage points within the wind farm for a period of one hour during daylight hours; If no sightings are recorded in that one hour period, the survey at that site is complete until the next fortnight, and move onto the next site.
    - If greater than 20 sightings are recorded within the one hour period at any of the five sites, a focussed investigation to be launched within 3 days with the survey to continue daily for four further days at all five sites (it may take some time to mobilise observers); thereafter no further survey would be required that season.
    - All Superb parrots observed from the full visible range of each site location be recorded together with flight height estimates.
- Spring Migration (1 September and 30 October)
    - Weekly surveys of five sites on ridgeline vantage points within the wind farm for a period of one hour during daylight hours; If no sightings are recorded in that one hour period, the survey at that site is complete until the next week, and move onto the next site.
    - If greater than 20 sightings are recorded within the one hour period at any of the five sites, a focussed investigation to be launched within 3 days with the survey to continue daily for four further days at all five sites (it may take some time to mobilise observers); thereafter no further survey would be required that season
    - All Superb parrots observed from the full visible range of each site location should and flight height estimates be recorded.

The surveys will be undertaken by:

- *Regular monitoring:* A local ecologist with confirmed experience in bird observations will be contracted to undertake the regular monitoring searches for the Superb parrot. This local ecologist will be tested on bird ID by experienced observers.
- *Focussed investigation:* A experienced professional ecologist will undertake the focussed investigation. The experienced ecologist has at least 3 years of professional field experience to conduct specialist surveys using a defined protocol including recording flight heights.

Thus, construction for BODW1 to begin in early 2017, the following surveys are proposed:

- Spring migration in 2017 (September-October 2017); and
- Summer – Autumn Migration 2018 (1 February to 30 April 2018)

Surveys will be subject to Work Health and Safety requirements as it will be during the construction of the wind farm.

A report will be written on the result of these surveys. These will be reviewed. The results will guide the need for additional surveys of a similar nature in keeping with the adaptive nature of this BBAMP. Further studies will be discussed with the OEH if required after reviewing results of the first year.

Birds of Prey (Raptors)

After operations commence, monthly monitoring of eagle flight movements and breeding activity is required for twelve months to determine whether operating turbines affect the behaviour of eagles. This will inform the level of risk of the local population to possible impacts from the Bodangora wind farm. This raptor monitoring can be incorporated into the monthly carcass searches program.

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 4 below.

Migratory Species

White-throated Needletail typically flies at and above RSA flight, particularly during migration. Monthly mortality detection surveys will monitor their presence and any impacts likely to occur from the BODW1 (see section 3.3).

3.2. Mortality Detection

The purpose of detecting mortality is to determine the actual impact of the proposed wind farm on birds and bats, coming into contact with blades, by attempting to estimate the annual number of birds and bats that collide fatally with turbines. Ongoing monitoring of turbine mortality at operating wind farms typically serves to:

- provide data that can inform adaptive management of the collision risk (i.e. patterns of mortality related to seasonal changes or local conditions); and
- detect mortality of threatened and non-threatened bird and bat species, which can trigger species-specific mitigation strategies.

Mortality rates will be estimated for all bird species combined, and all bat species combined if sufficient data is available. If threatened species are found underneath a turbine, the mortality rate for that particular threatened species will also be estimated, if possible. Mortality is defined as any bird or bat carcass detected in the defined search area under wind turbines. Detection can be either during the formal carcass searches (designed to generate an estimate) or at other times (incidental observation, outside the formal search times or from wind farm operational staff).

Collision by birds and bats with wind turbines will be monitored through a rigorous carcass-search program for a minimum period of two years after operations commence. The requirements of further mortality monitoring will be analysed in the second annual report. Monitoring will commence as close as practicable to immediately after final turbine commissioning.

It is 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. 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).

The search protocol has been designed to optimally detect key species of interest and also 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 on all bird and bat mortality is collected.

To derive accurate mortality rates, it is essential that the program is scientifically and statistically robust. A number of factors, such as scavenging and 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 3.3.4). Human detectability of carcasses is also a potential confounding variable and protocols have been developed to control for this (section 3.3.5) and incorporate this factor into final mortality estimates.

The interpretation of carcass search results, including the design of the search program, scavenger trials and detectability trials (see below) are determined by statistical considerations. The practical considerations that have informed the design of the trials below are listed below.

- Very few carcasses are found under wind turbines in Australia compared with Northern Hemisphere wind farms (i.e. less than half the number in the Northern Hemisphere based on BL&A unpublished data from monitoring ten south eastern Australian 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. 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.
- It is known that detectability will be easier in short grass in the dry time of the year compared to in longer grass in the wet time of the year.

Similar methods to those proposed in this BBAMP have been included in a number of other approved bird and bat monitoring programs in New South Wales and Victoria (see section 1.1 for examples). The techniques described here are based on the small number of programs already implemented (e.g. Hull *et al*. 2013, BL&A unpubl. data from ten wind farm projects), knowledge of experimental design, sound statistical analysis and recent feedback from regulatory authorities.

Mortality detection is proposed to be carried out for two years. After two years of mortality monitoring, a detailed report will be prepared reviewing the mortality detection program detailing the results.

The following sections outline:

- **Turbine selection:** how the wind turbines will be selected for a search
- **Search protocol:** the size of area beneath turbines to be searched and how this will be done
- **Scavenger rates and trials:** definition of scavenging and how experimental trials will be conducted
- **Detectability and trials:** definition of detectability and the experimental trial methodology
- **Analysis and mortality estimation:** general outline of how the data will be analysed to gain estimates of bird and bat mortality.

3.2.1. Turbine Selection

Turbines will be selected based on the following rules of thumb:

- Each turbine within a stratum has an equal chance of being selected for the searches (randomly selected by random number generation table);
- No stratum can have less than three turbines; and
- Once the turbines have been selected, the selection will not change.

In the past, the random selection has been changed each month but this compromises the precision of the mortality estimate. Stratification of sampling is the most appropriate way in which to monitor turbines considered *a priori* to be a higher risk to birds and bats. In the case of Bodangora, a minimum of eight turbines from the wooded areas (considered likely to support higher bat activity levels) and eight from the open areas will be searched.

The results from each stratum will be analysed separately to establish if there are differences in estimated mortality between them. They will then be combined for a whole-of-wind-farm mortality estimate using appropriate statistical methods for stratified estimates with constant selection probabilities within strata.

To ensure a valid dataset for statistical analysis, the mortality detection search will be based on 16 turbines (representing almost half the turbines). Of the 16 turbines, each will be searched to 100 metres, and a pulse survey conducted within 2-3 days with a search to 60 metres. Section 3.3.2 below details the rationale behind each search zone.

The number of turbines searched has been determined based on what will provide the most accurate mortality rate given the high variability in detected carcasses shown on other wind farms, and that humans will have search limits (e.g. work, health and safety considerations). Each turbine that is selected for the searches will have the following recorded:

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

Additional searches

It is also noted that OEH requested "selection of turbines to be included in the carcass search program should be revised periodically to ensure that all turbines are sampled for at least 12 months during their first 2 years of operation" (letter from OEH 24th March 2017), i.e. 100% of turbines searches for at least 12 months (50% of the 24 month monitoring). This is to ensure all turbines on the site are searched to allow identification of any turbines with higher mortality rates. This will provide information to feed into the review of BBAMP implementation after two years of operation and guide future monitoring and mitigation measures.

As the proposed turbine search selection is based on a statistical design protocol to generate whole of wind farm mortality estimates as well as stratified results, the methodology is fixed, i.e. in the first 2 years of monitoring 50% of turbines will be searched each month for 24 months

However, to meet OEHs request, the other 50% of the turbines not included as the selected turbines will be searched once a month for at least 12 months during their first 2 years of operation in a pattern where turbines selection is revised periodically.

In total, this level of effort is beyond the level requested by OEH, and it will allow for a comparison of the average mortality rate at various turbines which may be related to landscape characteristics.

3.2.2. Search protocol

The search area beneath each turbine has been determined to best detect bats and medium to large bird carcasses (as targeted from the risk assessment), 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 the evidence, two circular search zones have been designated, the inner core zone and the outer zone. The inner core 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 at six metres across this circle (Figure 3).

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 are spaced at 12 metres and carried out from the edge of the inner zone out to a total of 100 metres radius from the turbine (see Figure 3). 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.

Of the 16 turbines all will be searched up to 100 metres, with a following pulse search (within 2-3 days) out to 60 metres. The selected turbines will be searched monthly and the order of turbines searched will be randomised, however the same turbines will be searched each month.

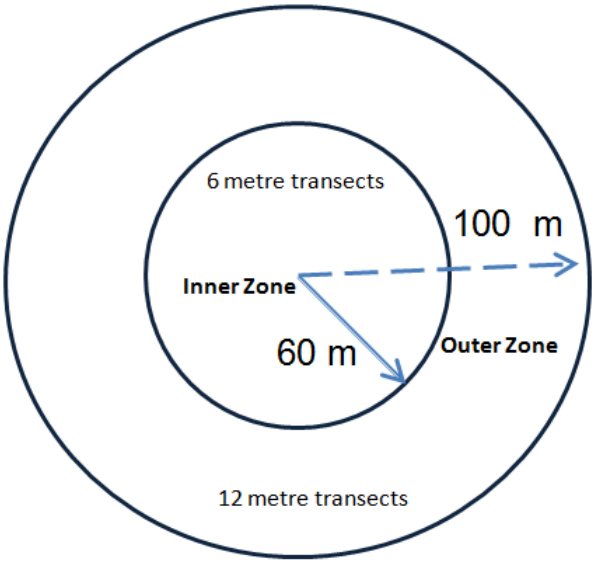


Figure 3: Carcass search zone underneath the turbines

Carcass detection protocol

If a carcass is detected (a 'find') the following variables will be recorded in the carcass search data sheet (see Appendix 1):

- GPS position, distance in metres and compass bearing of the carcass from 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; and
- Weather (including recent extreme weather events, if any), visibility, maintenance to the turbine and any other factors that may affect carcass discovery.

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, wrapped in newspaper, put into a second plastic bag;
- The carcass will be clearly labelled to ensure that its origin can be traced at a later date, if required; and
- The 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 scavenger and/or detectability trials.

It will be necessary for the wind farm operator to obtain a permit from OEH under the NSW *National Parks and Wildlife Act 1974* to handle and keep native wildlife (even dead wildlife) as part of the monitoring program. An application for this permit will be submitted in a timely manner to ensure approval has been obtained prior to commissioning of the turbines.

3.2.3. Intense carcass searches

Intense carcass searches may be undertaken should an appropriate trigger require it, such as a threatened species found dead or injured beneath a turbine. The need for further intense carcass searches will be discussed with OEH as part of the trigger reporting process (see Figures 4 and 5), and a decision on implementation will be informed by the results of the routine searches and investigations required in response to impact triggers (see later). Intense searches are expected to be targeted at the particular species that triggered a required response.

3.2.4. 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' for the estimate of the numbers of birds and bats affected by the wind farm. Scavengers can include ground-dwelling 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. 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 (a cluster of five or more feathers) and the absence of any remains. 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 carcasses that have already been scavenged.

Scavenger trials will be undertaken twice per year for the first year of post-construction monitoring. The objective of having two trials is to account for different vegetation conditions: one will be held when the grass is long; and one when the grass is short. Based on experience, grass is expected to be longest in late spring (most probably November), following rainfall and rising temperatures. Grass is expected to be short during the colder months of winter (July), or when stock have been grazing an area.

After this, the need and frequency of further scavenger trials will be reviewed with OEH.

Scavenger Trials

Scavenger Trials will be undertaken by a trained person (defined in section 3.4) to determine the probability and nature of scavenger loss and removal (e.g. an early peak in scavenging, or scavenging that peaks after carcasses have been in place for a period of time). The search area for scavenger trials will be the same as in the search protocol (above) and will be located under operating turbines, selected based on the methodology outlined in section 3.3.1.

To determine potentially different scavenging rates on birds and bats, three size categories of carcass will be used. Different scavengers are active at different times of day and this will be accounted for by placing carcasses out during the early morning and late afternoon. This will reduce the potential for bias in the search intervals. Based on current mortality estimation software requirements, every endeavour will be made to find ten carcasses of each size category (Table 6). Improvements on this 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.

Table 6: Number of replicates for each scavenger trial

Time	Micro-bat	Small-medium birds	Medium to very large birds
Early Morning	10	10	10

The trials will be conducted at ten randomly-selected turbine sites of the 16 used for monthly mortality searches (see section 3.3.1). The first five carcasses of each size category (ten carcasses in total) will be randomly placed under different turbines in the morning. Each of the carcasses will be checked twice- daily for the first two days, daily for another three days, then every second day for the next six days and then every three days until they disappear or at 30 days (Table 7).

Table 7: Scavenger trial search timetable

Day
Day 1 - afternoon
Day 2 - morning
Day 2 - afternoon
Day 3 - morning
Day 3 - afternoon
Day 4
Day 5
Day 7
Day 9
Day 12
Day 15
Day 18
Day 21
Day 24:
Day 27
Day 30

Additional procedures for scavenger trials are provided below.

- The timing of searches is based on experience and regulatory approval at a number of other wind farms (BL&A unpublished records). Almost all carcasses have been scavenged within five to ten days. More frequent monitoring than that proposed herein will not significantly affect the estimate of carcass duration and its impact on mortality estimates.
- A mix of small and medium to very large bird and bat carcasses (if available) 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 inner 70 metre search zone, depending on the search protocol for that turbine. 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 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. 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 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.

The number of carcasses per 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. 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. 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.

3.2.5. Detectability trials

As outlined above, all searches will be supervised by a qualified ecologist and undertaken by trained ecologists or personnel trained by the ecologist (see Section 3.4).

Detectability trials will be undertaken to assess the probability that a searcher will detect an existing carcass, given the prescribed mortality search protocol detailed for monthly carcass searches in section 3.3.2 (i.e. searching along the six metre and 12 metre transects). The most efficient use of time is therefore to conduct the detectability trials concurrently with the scavenger trials.

To account for observer variability in detecting carcasses, all personnel who have carried out monthly searchers at BODW1 (likely maximum two) 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 10 and methods explained in the above section 3.3.4. The carcass controller (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 feathers. The carcass controller will note the placement of carcasses (via GPS), however all carcasses should be located within the inner, 60 metre search zone. Training of searchers

and carcass controllers, and who will manage the scavenger and detectability trials is detailed in section 3.4.

Confidence analysis shows 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.

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).

3.2.6. Incidental Carcass or feather-spot Protocol

Personnel at the BODW1 may find carcasses of birds and bats or feather spots within the wind farm site during normal day-to-day operation and maintenance activities. A carcass means actual remains of individuals (e.g. body, wings, skeleton). A feather-spot means a clump of feathers (minimum four feathers). Feather spots may be evidence of dead birds that have been scavenged.

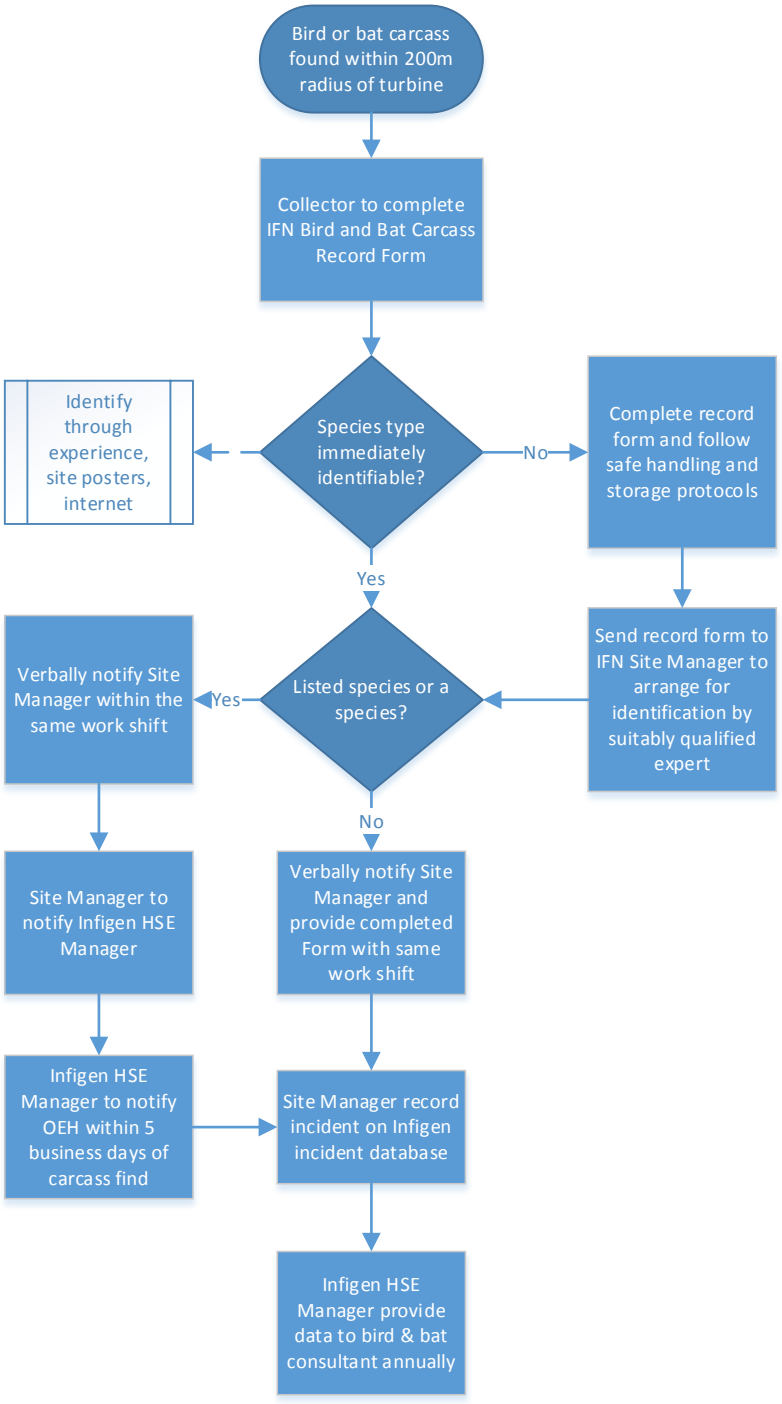
All bird and bat carcasses and feather-spots found will be handled in the manner described below.

1. Photograph the carcass where it is found and record all details on the Infigen Bird and Bat Carcass Record Form before moving the carcass.
2. Wearing gloves, remove or mark the carcass once details have been recorded to avoid recounting. The carcass must be stored on site in the dedicated freezer so that the species can be preserved until it is identified.
3. Inform the Infigen Site Manager and provide a copy of the record form before the end of the same working shift.
4. Infigen Site Manager to record finding on the Infigen incident management system and where required, notify the appropriate authorities within the required timeframes and in consultation with the Infigen HSE Manager.
5. The local veterinary will be contacted in the first instance, and / or wildlife assistance such as WIRES (1300 094 737) will be contacted and informed of any injured wildlife.

All wind farm personnel will be made aware of this carcass detection protocol as part of their Health, Safety and Environment training and induction. Each carcass found will be photographed, collected and placed in the on-site freezer. A carcass search data sheet (Appendix 1) will be completed for each incidental carcass found.

Infigen staff will follow the process below in the management of bird and bat carcass or feather spot.

Infigen Bird and Bat Carcass Find – Collection and Reporting Process



Last updated by A. McCormack 07/01/2016

Figure 4: Process for Infigen's management of incidental carcass or feathers pot

3.2.7. Analysis of results and mortality estimation

The results of the mortality monitoring surveys 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.
- Any seasonal or yearly variation in the number of bird and bat strikes.

The results will be detailed in annual reports (Section 3.6) and will provide a basis for identifying if further detailed investigations or mitigation measures are required.

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

All data will be analysed to provide the average estimated mortality of birds and bats, their standard error (variability) and ranges for the Bodangora wind farm. The seasonal and annual mortality of each species (if estimates of individual species are possible) and size class detected will be calculated. If possible, the standard error and range of these estimates will be reported

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 selection and stratification of turbines. 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.

It is difficult to provide the actual format (e.g. fatalities/turbine/year) of the results, in this current BBAMP, as it is subject to the results of the experimental trials and the variability of the data. As the results cannot be predicted (no pilot studies are available), results will be reported in a way that gives as much information as possible but with an accurate interpretation of the data. As stated above, it will be possible to provide the number, average (with attendant standard error) and other basic statistics of recorded fatalities per study population for the sampling time/effort. All species carcass data will be analysed and presented, where possible, with species-specific information.

3.3. 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 working on this Plan will be trained thoroughly, including background theoretical training, knowledge of policies and other administrative matters (e.g. work, health and safety) and technical and field training methods. Infigen will ensure that it engages suitably qualified and trained people to supervise and implement the monitoring program in accordance with project approval.

A suitably experienced and qualified ecologist will oversee in detail and be involved in the implementation of the program, including the carcass searches, searcher efficiency trials, scavenger trials. Any person undertaking searches will be trained and supervised by a qualified ecologist who is familiar with the techniques. The searcher will receive training from the qualified ecologist in the following areas:

- Turbine searches i.e. transect spacing, number of turbines to search and transect search methods
- Equipment usage i.e. GPS
- Data recording
- 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.

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) the field searches will be extended at the end of the nominated search period to make up for the missed searches. If any additional personnel are 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 qualified ecologist, with searches being undertaken by the trained searcher.

Analysis of mortality data will be undertaken by a qualified statistician or ecologist. Annual reports and all investigations as a result of an impact trigger being detected will be prepared and carried out by a qualified ecologist.

3.4. 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 veterinarian. Alternatively, if the vet is not available, a wildlife carer will be contacted.

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.

- Wellington Veterinary Hospital, 780 Mudgee Road, Wellington, (02) 6845 2872

- NSW Wildlife Information, Rescue and Education Service Inc (WIRES) - Dubbo 1300 556 686

This protocol is valid for the operational life of the wind farm.

3.5. Routine Reporting and Review Meetings

Reports will be submitted to the Secretary and OEH as per the project approval conditions.

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

- A description of the BBAMP activities undertaken during the reporting year;
- A summary of search methodologies and searches undertaken;
- Details and results of the carcass searches;
- Observations from the Superb Parrot surveys;
- Observations from the Babbler monitoring; and
- Any identified impact triggers and / or recommended updates to the BBAMP risk assessment.
- Any recommended changes to survey effort based on the results of the surveys.

At the end of the second year of post-construction monitoring, an overall assessment will be made of all the data obtained during the first two years of BBAMP implementation, details of the management practices implemented, as well as recommended adjustments. The results of the review and its implications will be discussed with OEH.

Annual reports prepared for years beyond the first two years will include the results of any monitoring activities undertaken for that year and a discussion regarding any impact triggers or unacceptable impacts identified, mitigation measures implemented and application of the decision making framework. As this management plan is adaptive, further refinements to the program will be included in periodic reports following the second year of post-construction monitoring and will be based on the outcomes of monitoring surveys and report any impacts.

OEH has requested that additional carcass monitoring is undertaken at least once every 10 years. It is proposed that the need for future monitoring is reviewed on the basis of the first two years of monitoring and longer-term monitoring is based on evidence.

4. MITIGATION MEASURES TO REDUCE RISK

Mitigation involves the prevention, avoidance and/or reduction of the risk of an impact trigger (defined in section 5 as a threshold of impact on birds or bats that triggers an investigation and/or management response) occurring or continuing to occur. While the wind farm is considered to present negligible to low risk to bird and bat species, proactive mitigation measures shall be implemented to prevent bird and bat collision with wind turbines and to addresses project approval conditions.

The overall objective of mitigation measures is to ensure that the BODW1 does not lead to unacceptable impacts on threatened or non-threatened birds and bats. Section 5.3 outlines mitigation measures that are specific to hypothetical impacts, if they were to occur.

Below are ongoing mitigation measures to be implemented as required.

4.1. Carrion removal

Regular carrion removal from within 200 metres of turbines will be implemented to assist in reducing the attractiveness of the site to raptors and therefore reduce the chances of fatal collisions by this group of birds. Carrion is defined as the dead and decaying flesh of an animal that often serves as a food source for animals.

To provide for the regular removal of carcasses likely to attract raptors to areas near turbines the procedures below will be adopted.

- Designate a suitable person (such as a wind farm employee or landowner) who will undertake the following activities:
    1. Site personnel shall notify the Site Manager immediately of any identified carrion within 200 metres of an operating turbine.
    2. The Site Manager is responsible for notifying the landowner so that any carcasses and/or remains found that are within 200 metres of turbines, can be collected and disposed of as soon as possible, in a manner that will avoid attracting raptors close to turbines.
    3. The Site Manager shall continue to consult with landowners in relation to the appropriate disposal of collected carrion, to be located at least 200 metres away from the closest turbine, whilst still leaving the carrion available as a food source so as to not reduce the habitat quality for raptors.
    4. Carcass occurrence and removal will be recorded by the Site Manager.
- During lambing season (usually late autumn / early winter) young lambs are susceptible to death. Therefore, the Site Manager will consult with required landowners to request that they restrict lambing in paddocks at least 200 metres away from turbines.
- If a large number of rabbit carcasses are incidentally observed during pre- or post-construction monitoring surveys, it may be necessary to conduct an integrated rabbit control program within 200 metres of turbines. Methods to control rabbits include borrow destruction, poisoning and shooting (DPI 2014). Any rabbit control program will require agreement from the landowner.
- An annual summary of carcass removal, based on records will be provided in the annual monitoring reports.

4.2. Grain feeding

Grain feeding, trails and spillage from grain trucks, can attract cockatoos and parrots. Therefore, the Site Manager shall communicate and consult with landowners as required in relation to stop grain feeding practices within 250m of operating wind turbines if it is deemed necessary in reducing the likelihood of the Superb Parrot colliding with turbines.

5. IMPACT TRIGGERS AND DECISION-MAKING 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 a regular event.

The impact trigger may be an unacceptable impact in itself, or may lead to an unacceptable impact.

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

5.1. Threatened Species

5.1.1. 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: A threatened bird/bat species (or recognisable parts thereof) listed under the EPBC Act or TSC Act is found dead or injured under or close to a wind turbine during any mortality search or incidentally by wind farm personnel. The fatality shall be able to be attributed to the wind farm operations.

5.1.2. Decision Making Framework

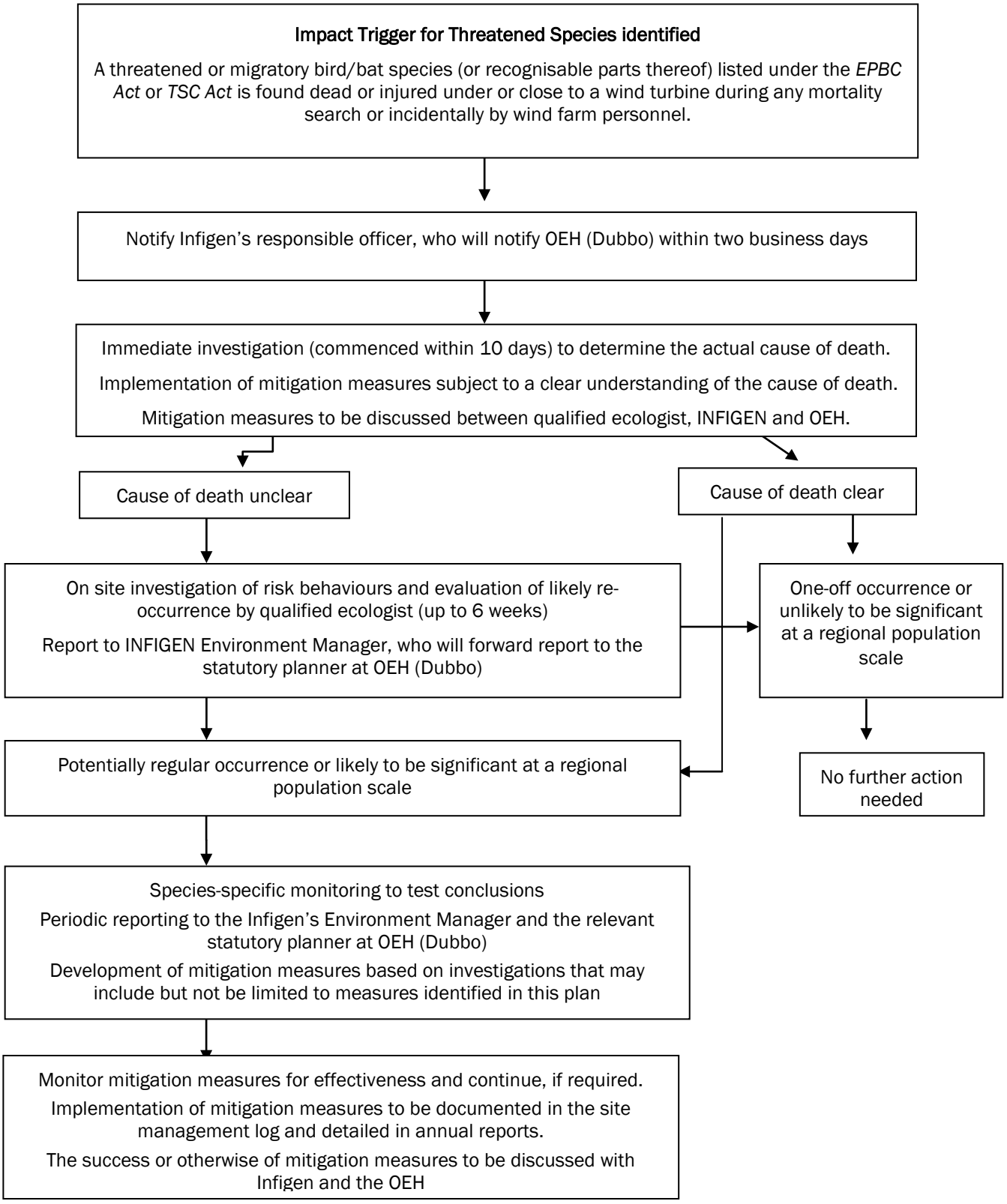
If a threatened species impact trigger occurs, further investigation will immediately be triggered and the decision making framework outlined below and in Figure 5 will be followed. This section complies with Condition C6 of the conditions of approval.

- Immediate reporting of the occurrence of an impact trigger to Infigen's responsible officer, who will report it to the relevant statutory planner at OEH (Dubbo) within two business days of it being recorded.
- Immediate investigation (to be commenced within 10 business days) by an appropriately qualified ecologist to determine the cause of death or injury (in the unlikely event that the animal was, for example, shot). 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 an evaluation of the likelihood of further occurrences. The impact trigger may be one-off or cluster events.
- The investigation will assess the most effective mitigation, in consultation with Infigen, and will ensure that the mitigation is implemented correctly and quickly, if possible, subject to a clear understanding of the cause of the impact.
- If the cause of the fatality is deemed to be a one-off occurrence or the ongoing risk is unlikely to be significant at a population scale, further action is not considered necessary. This decision will be made in consultation with OEH and will be determined based on available evidence and using a precautionary approach

- If the cause of the impact trigger is not clear, further onsite investigation of risk behaviours and evaluation of likely re-occurrence may be required over the following weeks (up to six weeks). If these investigations suggest that the impact trigger was a one-off event or the ongoing risk is unlikely to be significant at a population scale, no further action would be necessary. This decision will be determined in consultation with OEH, based on available evidence and using a precautionary approach.
- If the onsite investigation suggests that the impact trigger may be a regular occurrence, species-specific monitoring may be required as agreed with OEH. During the monitoring period, periodic reports will be provided to Infigen and OEH.
- Responsive mitigation measures will be developed and implemented as needed, in consultation with Infigen, and in a timely manner. Examples of mitigation measures may include but are not limited to those outlined in sections 4 and 5.3.

Any evaluation of impacts and decisions regarding mitigation measures and further investigations required will be undertaken in consultation with Infigen and the OEH. Any required investigation, and recommended management and supplementary mitigation measures, will be documented in the site management log and detailed in annual reports. Documentation and records will be available upon request by OEH or the Secretary.

Figure 5: Decision making framework for identifying and mitigating impact triggers for threatened species



5.2. Non-threatened Species

5.2.1. 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 BBAMP is detailed below. Note that impacts on common farmland birds, including magpies, ravens, White Cockatoos, corellas and introduced bird species are not considered of conservation significance and are therefore not subject to adaptive mitigation or this impact trigger.

Impact Trigger for Non-threatened Species: In any two successive monthly carcass searches, two or more bird or bat carcasses (or parts thereof) of a non-threatened species, other than ravens, magpies, White Cockatoos, corellas, and introduced species, are found at the same turbine (i.e. a total of four or more carcasses of the same species in two successive searches at the same turbine).

Where population numbers are known and reported by OEH for the period concerned, the definition of an unacceptable impact on non-threatened species is any impact that is likely to:

- lead to a greater than 50% reduction in the immediate population (i.e. local population, where known) that utilises the wind farm over a five year period; AND
- act in an ongoing way to reduce the wider, regional population (where known) by more than 30% over a five year period; OR
- reduce the total species' population (where known) by more than 10% over a five year period.

Where population numbers are not known, the definition of an unacceptable impact on non-threatened species is

- More than four carcasses of one non-threatened species (including raptor species, magpies, ravens, and introduced species) are found during both formal and incidental carcass searches in a two month period.

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

5.2.2. Decision Making Framework

In the event that an impact trigger for non-threatened species is detected, an evaluation of impacts to the non-threatened species will be undertaken. OEH (Dubbo) will be notified of the impact trigger within seven days of recording the event. An appropriate scale to consider population effects of the impact trigger will be agreed between OEH and the proponent on a case-by-case basis with consideration given to the species in question.

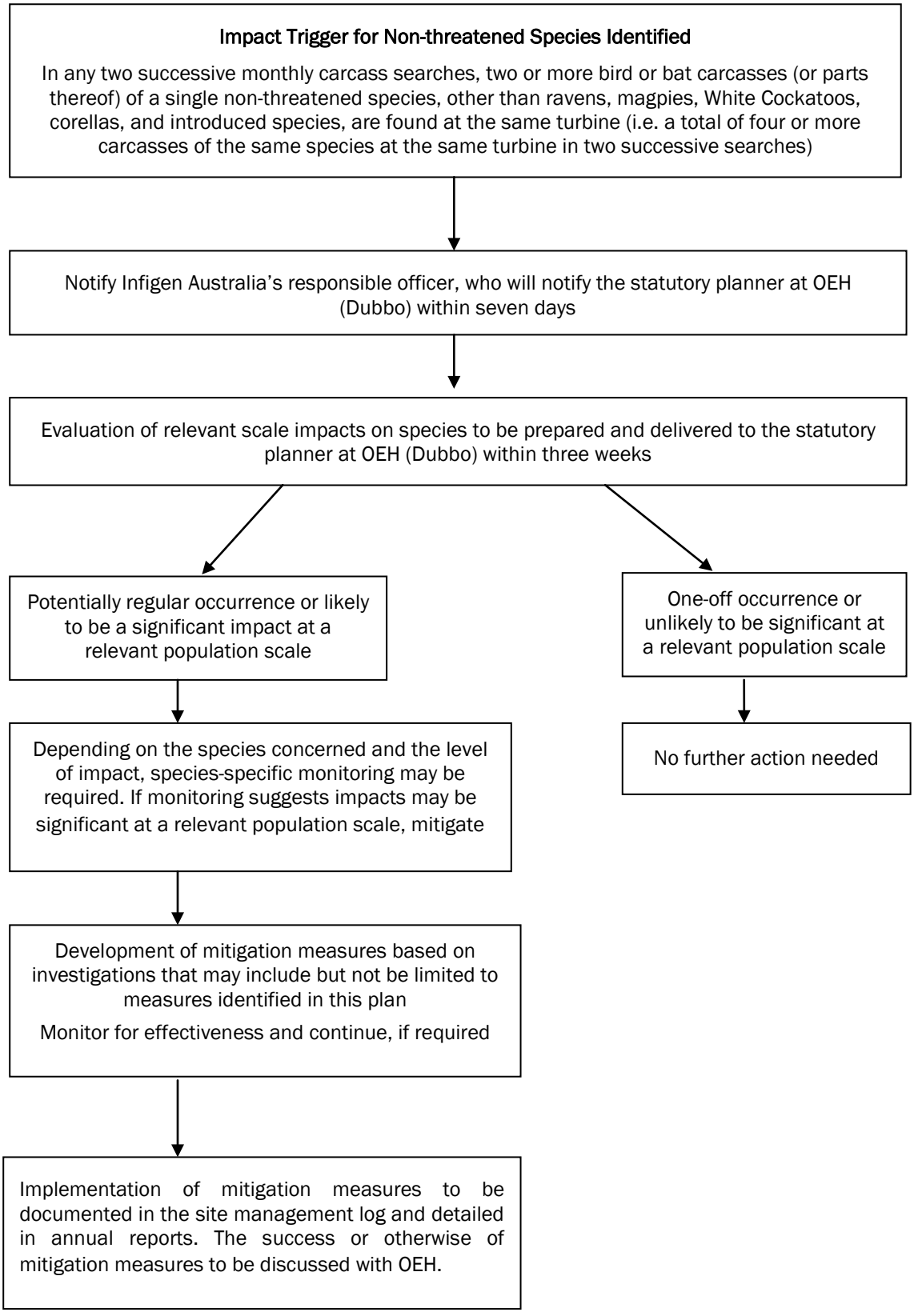
A report on the investigation will be delivered to the relevant statutory personnel at OEH (Dubbo) within three weeks. If the evaluation indicates that the event was a one-off occurrence or is unlikely to be an unacceptable impact at a relevant population scale for the species in question, no further action will be necessary (as outlined in Figure 6).

If the event is deemed to be a potentially regular occurrence or likely to lead to an unacceptable impact to the species in question, species-specific monitoring may be

required (Figure 6). 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 section 5.3, 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 agreement from Infigen and the OEH. 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 OEH or on the request of the Secretary.

Figure 6: Decision making framework for identifying and mitigating impact triggers for non-threatened species



5.3. Supplementary Mitigation Measures

Supplementary mitigation measures will be implemented in consultation with Infigen and the OEH in the event that an impact trigger occurs. The purpose of supplementary mitigation measures will be to prevent the impact from continuing to occur. Specific mitigation measures will be implemented depending on the nature, cause and significance of any impact recorded and in response to the results of targeted investigations of the event and of the species concerned on the wind farm site.

It is difficult at this stage to know what the cause of an unacceptable impact trigger will be, therefore possible examples of impacts and potential mitigation measures specific to the impact trigger, and the time taken to implement these measures, are detailed in Table 8. Note that in implementing mitigation measures, a suite of measures that may or may not include those in Table 8 would need to be implemented, depending on the circumstances.

Although it is unknown what supplementary mitigation measures may be required in response to a particular situation, some hypothetical examples are provide in Table 8 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.

The purpose of investigations will clearly be to identify the most relevant and effective mitigation measures that are 'fit for purpose'.

In the event that turbine shutdown is considered necessary by OEH, a species management strategy for the particular affected species will be prepared with OEH that sets out:

- The nature of the ongoing unacceptable impacts, including the level of risk to the species' regional and overall populations, where known;
- The findings of detailed investigations undertaken in response to the impact trigger, focussing on the species' use of the immediate area around affected turbines;
- Clear scope for on-going monitoring to identify triggers for turbine shut-down;
- Agreed triggers for turbine shutdown and restart; and
- Reporting and consultation arrangements.

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

Table 9 summarises specific management objectives, activities, timing and performance criteria for the implementation of this plan. It can be used for the purpose of monitoring and reporting process of the implementation of this plan.

Table 8: Supplementary mitigation measures in the event of an unacceptable impact trigger occurring

Hypothetical cause of impact	Possible Mitigation Measure[2]	Likelihood of impact continuing following mitigation	Time to implementation
Foraging source identified that attracts threatened species to impact areas	Use acoustics (i.e. loud music/irregular noise) to discourage birds from foraging in this location	Low	Implement as soon as possible and no later than two days after recording the impact.
	Encourage species into alternative areas outside of the wind farm boundary, where available, through the use of social attraction techniques offsite (decoys and audio playback systems)		
	Investigate and, if considered appropriate, remove foraging habitat from the wind farm site		Before removal of foraging habitat is undertaken, alternative mitigation measures should prove to be ineffective in reducing collision risk to acceptable levels.
Farming practice attracts threatened species to risky areas (e.g. grain feeding of stock)	Discuss and consult with the appropriate landowner about halting farming practice and removing attraction	Low	Immediately
Wind/rain/fog causing low visibility	Where visibility is identified as an issue, carcass searches will be suspended during periods of increased visibility. Temporary shutdown of those turbines found to cause the problem may be necessary during periods of extreme low visibility – to be implemented only in the event that threatened species are experiencing unacceptable impacts.	Low	Immediately
Attraction to lights on the wind farm site	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. Alternative measures include: • Synchronise any flashing lights, • Use red rather than white or yellow lights, or • Remove lights	Low	There are no high intensity lighting on or near wind turbines.
Attraction to small dams on site	Discuss and consult with the appropriate landowner about filling in dam and providing\e alternative stock watering arrangements	Low	Implement within ten days of recording the impact trigger, if possible.

[2] Note that the mitigation measures in this table are examples of what may be possible.

Table 9: Specific management objectives, activities, timing and performance criteria

Management objectives	Management activities and controls	Timing	Performance criteria for measuring success of methods	Completed (yes/no)
Baseline surveys	Obtaining Grey-crowned babbler survey data	Pre--operation	• Pre-operational surveys completed	
	Obtaining Superb Parrot survey data		• Pre-operational surveys completed	
Baseline surveys	Obtaining Grey-crowned babbler survey data	Post-construction	• Post-operational surveys completed and reported upon	
	Obtaining Superb Parrot survey data		• As per agreed with OEH	
Mortality monitoring	Sixteen turbines to be surveyed each month to 100 metres. The same turbines will be searched each month for at least two years (and remaining 50% of turbines searched at least for 12 months in 24 months)	Post-construction – monthly for two years	• Post-construction mortality surveys undertaken monthly at 16 turbines for at least one year • Remaining 50% of turbines searched at least for 12 months in 24 months	
	Calculating annual mortality of birds and bats per turbine based on post-operational repetition of monitoring activities. Annual mortality estimates should be made after the second year of monitoring and should include correction factors from scavenger and detector efficiency trials	Post-construction – at the end of the second year of mortality monitoring	• Scavenger and detector efficiency trials undertaken • Estimates of mortality for birds and bats made after two years of monitoring	
Annual Reports	Annual Reports to be submitted annually for the first five years and every two years thereafter unless otherwise agreed by the Secretary.	Post-construction – every year for the first five years and every two years thereafter	• Annual reports for the first five years and every two years thereafter delivered within two 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 decision-making framework and recommendations for the following year	
Mitigation measures to reduce risk	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 • Increase frequency of stock and kangaroo carcass removal and disposal if required	
	Restrict lambing to paddocks at least 200m from turbines in consultation with the relevant landowner		• No increase in raptor mortality during lambing season	
	Stock will not be fed grain underneath turbines within 250 metres of wind turbines in consultation with the relevant landowner		• No increase in bird mortality due to grain underneath turbines; no impact to Superb Parrot	
Mitigation measures to reduce risk	Pest control program - Implement rabbit control if the carrion removal program suggests rabbit carcasses are an issue in consultation with relevant landowner	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 construction	• Protection of offset site if relevant t	
	Minimising external lighting. If required, aviation safety lighting should use low intensity, LED, red flashing lights on nacelles			

Management objectives	Management activities and controls	Timing	Performance criteria for measuring success of methods	Completed (yes/no)
	Baffle 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			

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Appendix 1: Carcass and featherspot Record Form

Please fill out details in this form for each bird/bat carcass found. Injured wildlife must be transported to the nearest veterinary and or / wildlife rescue and care.

Term	Definition
Recordable Bird / bat carcass	Birds or bats found on the ground within 200m radius of a wind turbine generator.
Feather spots	Cluster of feathers (minimum 10 feathers or two primary feathers).
Intact	Carcass that is completely intact is not badly decomposed and shows little or no sign of being predated or scavenged.
Scavenged	An entire carcass showing signs of being fed upon by a predator or scavenger or a dismembered carcass in one location.
Injured	Bird or bat found to be alive but injured.

Recordable bird or bat carcass details (If you do not know or are unsure of an answer write "unknown")	
Carcass identified by (name):	
Form completed by (name):	
Wind farm name:	
Date & time:	
Weather conditions in preceding 24 hours: (including wind speed and direction and any unusual weather conditions in last 48 hours. If a waterbird, note the level of water in surrounding water bodies).	
Turbine number:	
Distance (m) and bearing (deg) of carcass from turbine	
Species identification *(type of bird / bat)*	
Description of carcass: Intact, Feather-spot, Scavenged or injured (and any other observations, including description of the injuries)	
How old and what sex is the carcass estimated to be?	
If remains found, indicate type *(body, wings, skeleton, feather spots)*	
Additional comments	
Photos taken of carcass where it is found *(attach photos on page 2)*	Yes ☐ No ☐

Photos

Take the photograph with the carcass in situ with a ruler (or other item at hand) next to it to allow measurements to be made.

Take a photo of:

- Photo of the carcass / feather spot as found in relation to the turbine
- Photo of top and bottom sides of carcass
- Photo of spread wing

Post find actions

Verbally notify the Infigen Site Manager and provide a copy of this report to them within the same shift as the carcass has been found (or the next business day if a weekend or public holiday).