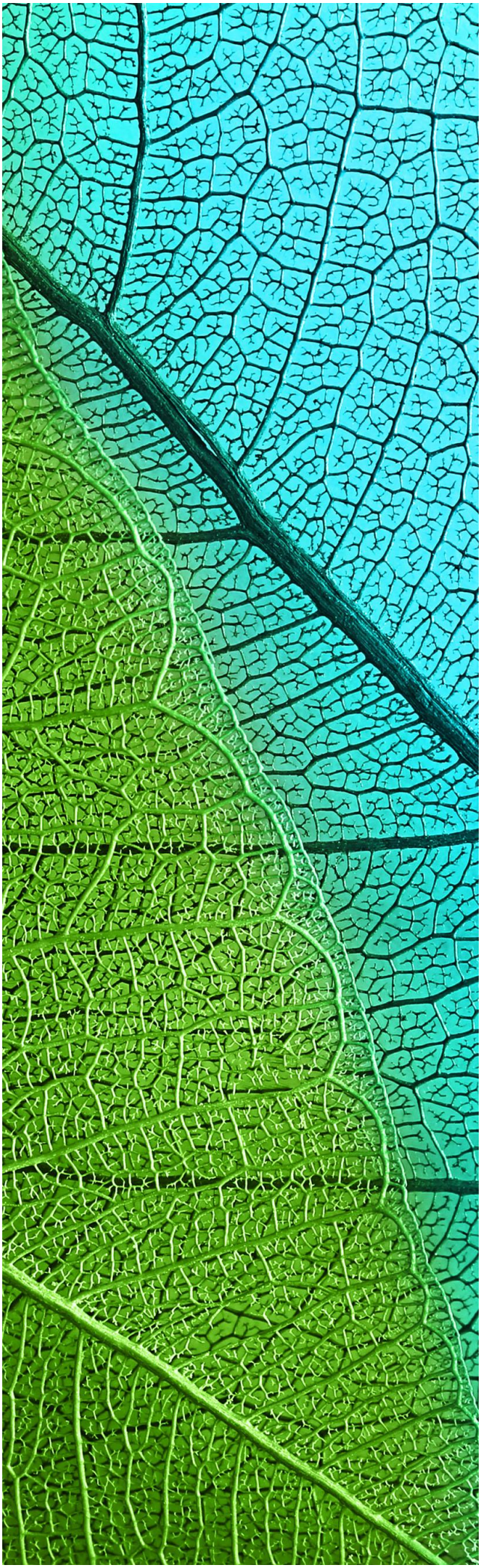

PLANNING and ENVIRONMENT ACT
MOYNE PLANNING SCHEME

PERMIT NO. 20060222-3
CONDITION 20
MODIFIED ENDORSED PLAN
Sheet 1 of 68

Signed: for
MINISTER FOR PLANNING
Date: 6 SEPTEMBER 2024

Ryan Corner Wind Farm

Bat and Avifauna Management Plan

Ryan Corner Development Pty Ltd

August 2024
Report No. 14144B (18.6)

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1. Introduction

Nature Advisory Pty Ltd (formerly Brett Lane and Associates Pty. Ltd. (BL&A)) and Symbolix Pty. Ltd. were engaged by Union Fenosa Wind Australia Pty. Ltd. (now Ryan Corner Development Pty Ltd) to develop a Bat and Avifauna Management Plan (hereafter BAMP) for the construction of a wind farm at Ryan Corner. The BAMP must accord with Condition 20 of the Ryan Corner Wind Farm Permit No. 20060222. This BAMP was prepared and submitted to the satisfaction of the Minister of Planning and was endorsed by the Department of Energy, Environment and Climate Action (DEECA, formerly DELWP) to form part of the original wind farm permit. This permit has since been amended twice (Permit No. 20060222-2, 9 March 2022 and Permit No. 20060222-3, 15 July 2024). As such, Ryan Corner Development Pty Ltd (the client) has engaged Nature Advisory to amend the Ryan Corner BAMP to accord with the most recent permit.

The site lies in south-western Victoria, approximately 15 kilometres north-west of Port Fairy and extends for about six kilometres along the western side of the Hamilton-Port Fairy Road. The wind farm area is approximately 3000 hectares. The wind farm includes a total of 52 4.2-megawatt wind turbines. The land is presently used for sheep and cattle grazing and has a long history of agricultural use and activity. The entire site is cleared grazing land with a limited number of small remnant areas of native vegetation (shrubland and grassland).

The Minister for Planning issued an amended planning permit for the construction of a Wind Farm (Moyne Planning Scheme, Permit No. 20060222-2). Under Condition 20 of this permit, a BAMP must be prepared. This condition states that:

20. *Prior to the project being deemed to be officially under operation ('Asset Ready for Full load operation') by AEMO,, a Bat and Avifauna Management Plan (BAMP) to the satisfaction of the Minister for Planning must be prepared in consultation with the DELWP Environmental Portfolio (now DEECA) and must be submitted to and approved by the Minister for Planning. When approved the plan will be indorsed and will then form part of the permit. The BAMP must include:*

    (a) a statement of the objectives and overall strategy for managing and mitigating any significant bird and bat strike arising from the wind energy facility operations;

    (b) a monitoring program of at least 2 years duration, either commencing upon the project being deemed to be officially under operation ('Asset Ready for Full load operation') by AEMO) or alternatively, such other time of commencement as is to the satisfaction of the Minister for Planning. The monitoring program must include surveys during the breeding and migratory seasons to ascertain:

        (i) the presence, behaviour and movements of any Brolga, especially breeding pairs in the vicinity of the wind energy facility;

        (ii) the presence, behaviour and movements of the Southern Bent-wing bat in the vicinity of the wind energy facility;

        (iii) the species, number, age and sex (if possible) and date of any bird or bat mortality arising from the wind energy facility operations;

        (iv) procedures for the reporting of any detected threatened bird or threatened bat mortality arising from the operation of the wind energy facility to DELWP Environmental Portfolio and the responsible authority within 7 days of becoming aware of any mortality;

(v) seasonal and yearly variation in the number of bird and bat mortalities arising from the operation of the wind energy facility;

(vi) whether bird and bat mortalities were at lit or unlit turbines;

(vii) the efficacy of searches for carcasses of birds and bats and information on the rate of removal of carcasses by scavengers, so that correction factors can be determined to enable calculations of the total number of mortalities;

(viii) procedures for regular removal of carcasses likely to attract raptors to areas near turbines; and

(ix) requirements for periodic reporting, within agreed timeframes, of the findings of the monitoring to the DELWP Environmental Portfolio, the responsible authority and the local community;

(c) recommendations in relation to a mortality rate for specified species which would trigger the requirement for responsive mitigation or offset measures to be undertaken by the proponent to the satisfaction of the Minister for Planning; and

(d) a strategy developed in consultation with DELWP Environmental Portfolio and to the satisfaction of the Minister for Planning to mitigate or offset any impacts in relation to the threatened or significantly affected native bird or bat species detected during monitoring. Measures to offset the impact may include management or improvement of habitat or breeding sites away from the wind energy facility in the region to improve breeding productivity, or other offsets to the satisfaction of the Minister for Planning."

21. Following the completion of the two-year monitoring program referred to in condition 20, a report must be prepared by the operator of the wind energy facility setting out the findings of the program and in particular assessing any cumulative impact of the wind energy facility on the defined bird and bat species, to the satisfaction of the Minister for Planning. The report should be generally in accordance with Windfarm collision risk for birds: Cumulative risks for threatened and migratory species, Department of Environment and Heritage (2006) and any general framework for cumulative impact studies if issued by the Minister for Planning at the end of the two-year monitoring program.

If, after consideration of this report, the Minister for Planning directs that further investigation of potential or actual impacts on birds and bats is to be undertaken, the extent and details of the further investigation must be prepared in consultation DELWP Environmental Portfolio and to the satisfaction of the Minister for Planning, and the investigation must be carried out to the satisfaction of the Minister for Planning.

This BAMP is based on a previous version of the BAMP developed in consultation with DEECA (formerly Department of Environment, Land, Water and Planning (DELWP)) over the last 10 years. Versions of the BAMP were provided to the then Department of Sustainability and Environment (DSE) (now DEECA) in 2012 and agreement reached on content. DEECA provided comments on the plan in 2019, which this current version of the BAMP addresses.

This BAMP details the objectives and strategies taken to meet the requirements of these approval conditions. Commissioning will be undertaken in stages. The actions of this BAMP will be triggered as each turbine chain is completed, rather than on completion of the entire wind farm. The implementation of the plan must be overseen by a qualified ecologist/ecological consultancy with a relevant tertiary degree or experience. This ecologist, employed by the wind farm operator, will be responsible for overseeing and implementing the BAMP according to the provisions stipulated in this document. This Plan is divided into three main parts: 1) Compliance; 2) DEECA-specified assessments; and 3) Compliance mitigation and summary. These parts are further subdivided into the following sections:

Compliance (see Section 8 for a compliance summary table)

Section 2 details the pre-construction bird and bat monitoring programs.

Section 3 specifies the routine reporting and review meetings.

Section 4 provides an outline of the aims and methodology of the post-construction utilisation surveys for the two species of concern.

Section 5 details the aims and methodology of the post-construction mortality surveys for the two species of concern.

DEECA-specified assessments

Section 6 outlines an intensive Southern Bent-wing Bat mortality survey program and details post-construction mortality estimation, prioritizing the two species of concern.

Compliance mitigation and summary

Section 7 discusses raptor risk-reduction measures and describes what is considered to be an ecologically significant impact. It also outlines a general procedure for implementing species-specific mitigation and offset measures.

Sections 8 and **9** provide a compliance summary and an approximate timeline of the work.

This plan was prepared by a team from Nature Advisory comprising Khalid Al-Dabbagh (Zoologist), Megan Price (Zoologist), Jackson Clerke (Zoologist), Sergio Nolazco Plasier (Zoologist) and Brett Lane (Principal Consultant), and Stuart Muir from Symbolix Pty Ltd (Statistician).

1.1. BAMP Objectives

The overall aim of this BAMP is:

> *"To confirm and ensure that operation of the Ryan Corner Wind Farm will not prejudice the survival of populations of bat and bird species of concern, including:*

- *Southern Bent-wing Bat;*
- *Brolga*; *and*
- *Any species of bat or bird listed on the Australian* Environment Protection and Biodiversity Conservation Act 1999*, the Victorian* Flora and Fauna Guarantee Act 1988, or the *Advisory List of Threatened Vertebrate Fauna in Victoria - 2013."*

The objectives will be achieved by establishing monitoring and management protocols, consistent with the methods provided in Australian Wind Energy Association (2005), adapted, where appropriate, based on more up-to-date knowledge.

- Measure the numbers of birds and bats, specifically in regard to the Brolga and Southern bent-wing Bat, affected by the operation of the Ryan Corner Wind Farm after operations commence (Section 5);
- Provide a context for measuring the impact of the Ryan Corner Wind Farm on the Brolga and any bird species of concern listed on state and Australian legislation (Section 4.1);
- Provide a context for measuring the impact of the Ryan Corner Wind Farm on the Southern Bent-wing Bat and any bat species of concern listed on state and Australian legislation (Section 4.2); and
- Establish protocols and procedures for identifying, reporting and mitigating any bird and bat impacts of the Ryan Corner Wind Farm, including any significant impacts (Section 7).

1.2. Site description

The site is north-west of Port Fairy (approx. centre 38° 17' S, 142° 7' E) and extends for about 6 kilometres along the western side of the Hamilton-Port Fairy Road. The wind farm site is approximately 3000 hectares, nearly triangular in shape, with the narrower end to the north. The wind farm would include a total of up to 52 4.2 megawatt V136 wind turbines with a hub height of 112 metres, rotor diameter of 136 metres, and a turbine blade tip height of 180 metres and a clearance from ground to blade of 44 metres (i.e. Rotor Swept Area between 44-180 m).

The land is presently used for sheep and cattle grazing and has a long history of agricultural use and activity. The entire site is cleared grazing land with a limited number of small remnant areas of native vegetation (shrubland and grassland). The site is regularly grazed by livestock.

The site comprises a combination of flat areas and low, undulating ridges of basalt rocks and is predominantly between 30 and 40 metres above sea level. The flat areas consist mainly of grazing paddocks covered with various exotic grasses and they are therefore highly disturbed. The ridges usually have extensive surface rock and are covered by exotic grasses and some native vegetation, particularly bracken.

The wind farm site is traversed by an unsealed road that runs from north to south (Riverside / Harris Road). This is fenced on both sides, isolating it from the paddocks and forming a small nature reserve. The road is open to the public but experiences very low traffic volumes. The fenced area contains patches of remnant native grassland and scattered Black Wattles. The roadside was the only area within the wind farm site where trees were observed, apart from scattered patches of planted pine trees used as windbreaks.

Wetlands on the wind farm site occur in depressions between the ridges. Most of these are temporary, shallow, freshwater marshes formed from surface water runoff, and are concentrated in the south-eastern section of the wind farm site. Two of these wetlands are particularly extensive. These include Island Swamp (southeast corner), the largest water body on the site when inundated. The other wetland is the semi-permanent Duck Hole wetland, situated just south of Island Swamp.

The layout of the turbines has been carefully designed in a way that avoids the wetland areas of the site. This design aims to minimise the collision rate of waterbirds at the site.

A review of Southern Bent-wing Bat roosting locations in south-west Victoria indicated that 14 caves were of significant value to the species (Table 1). Ten of the 14 caves reside within a 70 km radius of the site (the known SWBW dispersal range in one night; Bush *et al*. 2022, van Harten *et al*. 2022) and therefore bats from these caves may forage in the surrounding area of the wind farm but unlikely (in

large numbers) on the actual site due to very low vegetation cover and associated food resources. The low numbers of this species likely to utilise the site were confirmed in Anabat studies undertaken by Greg Richards & Associates Pty Ltd (2007), the results of which showed:

> *"The highest level of activity for any species averaged 2.2 calls per night and again indicates that the wind farm habitat is largely unsuitable for bats. In comparison, at the Blue Gum plantation* [northeast of the wind farm site]*, the average number of calls per night was more than 55. The average number of Southern Bentwing Bat calls per night was significantly lower at wind farm sites (0.5 – 1.1) compared with the better habitat at the Blue Gum plantation (8.9)."*

Table 1: Location and distance of Southern Bent-wing Bat roosting and maternity caves in relation to the Ryan Corner site (Table adapted from ACCIONA Energy (2009))

Region (ranked distance from site)	Location name	Coordinates		Approx. distance from site (km)	2009 status
		South	East		
Yambuk	Yambuk Cave	38°19	142°04	5	Still used as an important roost
Mt Eccles National Park	Un-named	38°04	141°55	30	Still used as an important roost
Grasmere	Grasmere Cave	38°16	142°32	35	Large numbers - high conservation value
Byaduk	Church Cave	37°55	142°00	40	A few bats, many at other times
Warrnambool	Starlight Cave	38°25	142°35	45	Now is the only maternity colony known from Victoria, one of only two maternity sites known for this species
Portland	Cashmore Cave	38°20	141°30	50	Indicated as roost cave by DEECA
Bats Ridge National Park	Tom-the-Cheap Cave	38°20	141°30	50	Usually lots of bats
Cape Volney	Panmure Cave	38°19	142°44	55	Large numbers - high conservation value
Portland	Cape Bridgewater Sea Cave	38°24	141°25	60	Still used as an important roost
Portland	Portland Maternity Cave	38°24	141°25	60	Indicated as roost cave by DEECA
Lower Glenelg National Park	Un-named (McLennan's Punt?)	38°00	141°10	90	Reasonable numbers
Porndon	Porndon Arch	38°18	143°17	100	Still used as an important roost
Cape Volney	Un-named	38°46	143°16	115	Still used as an important roost
Cape Patton	Un-named	38°42	143°50	150	Still used as an important roost
Lorne	Cumberland River Cave	38°45	144°00	170	Still used as an important roost

2. PRE-CONSTRUCTION MONITORING PROGRAM

2.1. Previous studies

Several investigations were undertaken between 2005 and 2007 to document the pre-construction usage of the wind farm site by birds and bats. Information gathered during these surveys has provided a baseline measure with which to compare the potential impacts of the wind farm after construction. These existing monitoring activities are described here.

Pre-construction monitoring activities included:

- Ryan Corner Wind Farm Ecological Assessment, Environmental Resources Management Australia (2006)
- Ryan Corner Wind Farm: Peer review of the ERM Ecological Assessment, BL&A, Report 6114 (1.0), July 2006
- Bird Utilisation surveys undertaken in spring (6–16 September 2006) and in summer (8–13 January 2007), at 8 on-site (impact) and 2 off-site (reference) survey points. A report by BL&A, Report No. 6114 (3.0), May 2007
- A Brolga Survey undertaken in September 2006. A report by BL&A, Report No. 6114 (3.0), May 2007
- Waterbirds survey undertaken in September 2006. A report by BL&A, Report No. 6114 (3.0), May 2007
- Ecology and conservation of the Southern Bent-wing Bat in relation to the Ryan Corner Wind Farm, Victoria. A report prepared by Greg Richards & Associates for Gamesa Energy, Australia Pty. Ltd., October 2006
- An Assessment of the bat fauna and patterns of regional migration in relation to the Ryan Corner Wind farm site, Victoria. A report prepared by Greg Richards & Associates for TME Australia Pty. Ltd., May 2007

The findings from these works are summarised below.

2.1.1. Ecological assessment

The initial ecological study was undertaken by Environmental Resource Management (ERM) Australia Pty. Ltd. for Gamesa Energy Australia/TMEA between July 2005 and June 2006.

The first stage of the assessment comprised a desktop study in 2005, during which species and communities likely to occur in and near the wind farm were identified. Results were then corroborated following four field assessments, including targeted surveys. Fauna results are summarised below:

***Birds*:** A total of 54 bird species were recorded during the field assessments. Fifty were native and four were exotic. Eight identified species are regarded as rare or threatened within Victoria. Fixed point bird counts were undertaken near wetlands and in remnant vegetation, however the majority of census points were in pasture grass habitats (reflecting the relative amount of habitat types on the site).

Waterbirds primarily foraged in wetlands and rarely moved across the wind farm. Similarly, woodland bird activity was restricted to the woodlands. As such, these species groups were poorly represented during the census and species utilizing pasture grass habitat were dominant. In descending order, the five most common sighted species were Australian Raven, Australian Magpie, Common Starling, Willie Wagtail and Skylark.

No birds of prey were recorded during the fixed-point bird counts. The five following birds of prey were recorded incidentally: Swamp Harrier, Black-shouldered Kite, Nankeen Kestrel, Wedge-tailed Eagle and

Brown Falcon. Brown Falcon was regularly observed in the wind farm boundary, suggesting high numbers of this species foraging at the site. Wedge-tailed Eagle was recorded only once during the assessments, soaring significantly above turbine height, approximately two kilometres south-west of the wind farm.

No waterbird nests were observed in the wind farm boundary. Wetlands supported little emergent vegetation. Large numbers of White-faced Heron, Australian White Ibis, Straw-necked Ibis, Black Swan and Masked Lapwing were regularly observed at wetlands, with abundant numbers at Island Swamp and Duck Hole wetland. Other species recorded regularly included Royal Spoonbill, Yellow-billed Spoonbill, and one Eastern Great Egret.

A Brolga pair was regularly observed moving between the water bodies and surrounding grasslands in the south-eastern portion of the wind farm. Observed flights were low and were below turbine height (i.e. less than 30 metres above the ground).

Other threatened species which were infrequently observed at the site included Little Egret, Intermediate Egret, Glossy Ibis and Hardhead, all of which were identified in the vicinity of the ephemeral wetlands in the south-eastern portion of the wind farm boundary. Latham Snipes were identified in the northern parts of the wind farm and ducks, shelducks and teals were observed less frequently. However, habitats in the wind farm are likely to provide habitat for these species.

Mammals: The Red Fox, European Rabbit and Hare were observed throughout the wind farm. No evidence of any other ground-dwelling mammal was recorded. However, the site may provide habitat for ground-dwelling mammals not encountered during the assessment, due to the structural variability of the site associated with the basalt rocks, crevices and cracking soils (and in some areas vegetation cover). In particular, the site may contain habitat for the Fat-tailed Dunnart, a species listed as threatened on the DSE Advisory list.

Bats: Five species of bats were identified using the wind farm site, including Gould's Wattled Bat, Chocolate Wattled Bat, Southern Bent-wing Bat, Freetail Bat and Long-eared Bat sp. Bat records demonstrated that Large Forest Bat and Southern Forest Bat were also possibly utilizing the site although this could not be confirmed. The site predominantly does not support shrubs or trees, and is therefore not expected to support significant large bat populations.

Reptiles and Amphibians: Five species of frog and six reptiles were recorded during the field assessments. The stony ridges and scattered rocks contained a high abundance of indigenous herpetofauna. Frogs, including Striped Marsh Frog, Ewing's Tree Frog and Common Eastern Froglet, were regularly recorded under rocks in the vicinity of the ephemeral wetlands. Snakes and skinks were more widely recorded, with White's Skink, Lowland Copperhead and White-lipped Snake regularly recorded throughout the ridges and rocky knolls.

Other herpetofauna recorded in the wind farm boundary included Spotted Marsh Frog, and one Southern Smooth Froglet, located in a pasture immediately south of the Duck Hole wetland. It is likely that these frog species breed within the Duck Hole, the only permanent waterbody in the wind farm boundary. These species are likely to then disperse to other waterbodies over winter and spring. In some cases frogs may breed over this period, however, frogs are unlikely to persist in these areas of grazed pasture once the waterbodies dry out over summer.

Other reptiles found to occur on the site included Eastern Three-lined Skink, Grass Skink and Southern Grass Skink. These species are likely to occur throughout the site in areas containing scattered rocks, such as the ridges, knolls, low quality grassland, high quality grassland and stone walls. The Growling Grass Frog, Brown Toadlet and Southern Toadlet were not recorded in the wind farm boundary.

***Threatened Fauna*:** The desktop assessment revealed that 21 birds, six mammals, two fishes, three reptiles and three frogs classified as rare or threatened may occur on, or in the vicinity of the site. Of the 35 threatened species, 17 are listed under the EPBC Act and 20 are listed under Schedule 2 of the FFG Act. Eight of these species, all birds, were recorded on the site during the field assessments. Twenty-two of the 35 species identified have a 'moderate', 'high' or 'present' likelihood of occurrence on the site. These include: fourteen birds, two mammals, three reptiles, and three frogs (see original report for species names).

Orange-bellied Parrots are unlikely to occur at the site due to the absence or close proximity of suitable habitat.

The ecological assessment report discussed above was fully reviewed by BL&A (July 2006).

2.1.2. Bird utilisation surveys

Bird utilisation surveys were undertaken in accordance with the methods described below.

The field study involved fixed point censuses of birds. Eight impact site points and two reference site points were surveyed (Figure 1). At each point, a 15-minute count of all birds was undertaken, with all species identified and their flight height recorded within a 200-metre radius of the central point.

Flight height was recorded in three categories in relation to the formerly smaller turbines planned at the time the pre-construction surveys were conducted and reporting was finalised: below Rotor Swept Area (RSA height (<35m); at RSA height (35 – 120m); and above RSA height (>120m). Heights were estimated against nearby fence posts of known spacing.

Each point was surveyed ten times during varying periods of the day over a six-day survey period (covering all 10 sites). Two surveys were undertaken; first in spring 2006 and the second in summer 2007. In this way, some seasonal differences in bird activity and presence of species (due to migration) were accounted for in the data collection.

The results of the bird utilisation surveys are summarised below. Note that bird utilisation rates are not distance-corrected.

Spring 2006: Data from the survey showed that bird utilisation rate from the eight impact sites averaged 0.84 (0.60–1.00) birds per hectare per hour, and that on the reference sites averaged 0.58 (0.54–0.63).

A total of 42 species was observed at all heights during the bird survey. Of these, 11 species (*c.* 26%) were observed flying at RSA. The two most frequent species (totalling more than half of all observations) at this height were the European Skylark (introduced species) and ravens (mostly Little Raven). These were followed by Long-billed Corella and Australian Magpie. Together with the first two species, they accounted for more than 80 percent of all birds observed at RSA height. The remaining seven species accounted to between 1.3 – 3.8 percent of birds at RSA heights, and including four raptors; birds usually considered as more susceptible to collision with operating turbines.

Birds observed at RSA height accounted for 3.7 percent of all bird observations at the impact sites, with no birds observed flying above RSA height.

Five species of raptors were observed utilizing the wind farm site; there was noticeably more raptor activity at impact sites than at reference sites. The two most frequently observed raptors at the impact sites were Brown Falcon and Nankeen Kestrel. No Wedge-tailed Eagles were observed on the wind farm during the spring observations.

Nine species of waterbirds were recorded patchily during the survey. The most common species were White-faced Heron and Straw-necked Ibis. Most waterbirds occurred in very small numbers, with total number observed constituted 3.7 percent of all birds observed during the spring survey.

Summer 2007: Data from the survey showed that bird utilisation rate from the eight impact sites averaged 0.50 (0.38–0.72) birds per hectare per hour, and that on the reference sites averaged 0.74 (0.40–1.08).

A total of 24 species was observed at all heights during the bird survey. Of these, nine species (*c.* 37%) were observed flying at RSA. The two most frequent species (totalling more than 75 percent of all observations) at this height were the European Skylark (introduced species) and ravens (mostly Little Raven). These were followed by Straw-necked Ibis and Brown Songlark. Together with the first two species, they accounted for more than 90 percent of all birds observed at RSA height. The remaining five species were raptors and accounted for *c.* nine percent of birds at RSA heights; raptors are usually considered as more susceptible to collision with operating turbines.

Birds observed at RSA height accounted for 5.2 percent of all bird observations at the impact sites, with no birds observed flying above RSA height.

Five species of raptors were observed utilising the wind farm site; there was noticeably more raptor activity at impact sites than at reference sites. The two most frequently observed raptors at the impact sites were Brown Falcon and Wedge-tailed Eagle. It is likely that the wind farm area is part of the foraging range of one pair of eagles.

The waterbird abundance and diversity were very low during the summer bird utilisation survey. Only two species were recorded. The waterbirds formed only 0.7 percent of all individual records on the farm compared with 3.7 percent during the spring survey.

Comparisons between spring and summer surveys: Habitats for birds and other fauna on the Ryan Corner wind farm site are considered to be of low quality. The quality of the habitat deteriorated further during the summer with severe drought conditions and an extensive grass fire. Due to the severe drought all wetlands on the site were dry from October 2006 onwards.

Bird species richness and abundance in the summer survey were almost half those of the spring survey. A total of 42 species were recorded during the formal spring bird utilisation survey and 24 species during the formal summer survey. Species richness in summer was almost half that of spring. This difference was due to a lack in summer of common waterbirds, and some of the common farmland birds, such as cockatoos and corellas. The only addition to the bird list in summer is the Brown Songlark, a common summer visitor to most of south-eastern Australia's grasslands.

Bird abundance also declined in summer compared with spring; with almost half the numbers present in summer than in spring. Most of the common species, such as skylarks, ravens, goldfinches, and starlings declined significantly in numbers. On the other hand, resident birds, such as magpies, fairy-wrens and Willie Wagtails, did not show a pronounced decline in numbers.

The order of abundance of the most common species was almost the same in both surveys. The five most abundant species were exactly the same between seasons, while the next five most abundant species differed slightly.

The numbers of birds seen flying at RSA height was almost the same between the two seasonal surveys. However, observations suggested a higher proportion of birds flying at RSA height in summer than in spring. The two most abundant species were the same in both seasons.

The number of birds of prey seen flying at RSA height was similar between seasons. Four species were seen in spring and five species in summer. Their numbers were generally low (11% of RSA birds in spring

and 9% in summer). While the Wedge-tailed Eagle was not recorded during the formal counts in spring, it was recorded in summer. The birds seen in both seasons probably belong to one pair or family, for which the wind farm site forms part of a territory.

Waterbirds did not feature in the counts in summer, except for a small number of White-faced Herons found around water troughs, and Straw-necked Ibis found mostly flying across the wind farm site. More waterbirds were seen in spring before all the wetlands dried; however, their numbers were low compared with other wind farms in similar settings.

2.1.3. Brolga survey

A spring Brolga survey, which was designed to coincide with the breeding season, was undertaken during September 2007 and covered the wind farm site and a 20-kilometre radius from the wind farm.

Brolgas were found at three locations within the region. Eight individual Brolga records were obtained during the survey. Two of the records were considered to be the same individuals previously sighted from a nearby area. Six individual birds were therefore identified in the current survey of the region. No immature birds were observed during the breeding season survey.

A pair was observed foraging on the south-eastern side of the wind farm site in a paddock. They were disturbed and flew into the Duck Hole wetland, where they continued foraging. There have been previous records of Brolga breeding at this site. It was unclear where this pair was roosting.

The other two pairs were observed foraging in grasslands ten and 20 kilometres from the edge of the wind farm site. Both pairs were in the north-western section of the search area. One of the pairs was seen on two occasions in close proximately to each other on separate days at a site that was previously used for breeding. The other pair was sighted where there were no historical breeding records.

In summary, during the breeding season survey, three pairs of Brolga (6 birds) were recorded within the search area (20-kilometre radius of the Ryan Corner Wind Farm). None of these pairs was breeding.

2.1.4. Waterbird survey

The waterbird usage of wetlands and possible movement paths across the Ryan Corner Wind Farm site were surveyed over several days in September 2006.

As far as possible, all wetlands within a designated search area (20 kilometres) were visited and surveyed. Counts and observations were undertaken at wetlands that held water and populations of waterbirds at the time of the survey. The wetlands within the wind farm were visited on a daily basis. The larger wetlands in the search area were surveyed twice during the September survey. All waterbirds were identified and counted at each wetland visited.

Dawn and dusk surveys were undertaken within the wind farm site to determine any kind of movements across the wind farm. Notes were recorded of any other waterbird movements observed from the major wetlands from the surrounding search area.

The wind farm site supported very few waterbird numbers. The most abundant species was Straw-necked Ibis and White-faced Heron. The Straw-necked Ibis was seen in the largest numbers, although they were only seen during one evening survey. Waterbirds were considered to be resident at the time of the survey and were not observed flying to roosting sites away from the site.

Dawn and dusk surveys were made from different vantage points around the wind farm to record waterbird movements on two mornings and two evenings during September. Only two movements were observed. These findings indicate that most of the waterbirds from within the wind farm stayed in the area for much of the period of the survey, rather than commuting on a daily basis to other wetlands to forage or roost.

The lack of waterbirds on the site away from wetlands is consistent with findings of the bird utilisation surveys discussed above.

2.1.5. Bat investigations

Greg Richards and Associates Pty. Ltd. was commissioned to conduct two assessments of the bat fauna at the site of the Ryan Corner Wind Farm.

The first study involved a review of the ecology and conservation of the Southern Bent-wing Bat (*Miniopterus schreibersii bassanii*) in relation to the Ryan Corner Wind Farm project. The review discussed the ecology, taxonomy, biology, population and distribution and movement of the threatened bat in relation to the maternity and overwintering caves in south-west Victoria. The review also provided an assessment of the potential impacts and mitigation strategies to reduce risk to the threatened bat.

In addition, the review suggested a research program that identified some of this species' ecological patterns within the site and its environs. This information could then be used to determine whether impacts could occur to the local population. Should significant impacts be identified, mitigation measures would be identified. The research would be conducted in three stages to satisfy the following aims:

- Stage 1: Document distribution patterns within and away from the site and obtain information on bat flight height; Timing: November – December 2006;
- Stage 2: Establish whether the site is part of a migration path by monitoring the site and presence/absence at the maternity colony at Starlight Cave, Warrnambool and other caves used during winter; Timing: January – February 2007; and
- Stage 3: Review mitigation strategies that would be pertinent to the project per se would be reviewed in an individual report in collaboration with the client (Gamesa Energy Australia), once the site utilisation by the Southern Bent-wing Bat has been assessed and its migration pattern and timing has been estimated.

The second study included two phases: Phase 1 investigated the utilisation of the site by the local bat fauna, particularly targeting the Southern Bent-wing Bat, which is listed in the Victorian FFG Act and Australian EPBC Act. Phase 2 addressed issues that had been raised about the migration patterns of the Southern Bent-wing Bat at a regional scale, and in particular, whether or not this species was likely to move in abundant numbers across the site during its seasonal movements.

For the Phase 1 study in November 2006, automated bat call detectors that record the species-specific echolocation calls of free-flying bats were used at a series of five sampling points that were stratified across the habitats present on the wind farm site, and a sixth at a 43 hectare Blue Gum plantation just over the north-west boundary, which was selected so that a maximal species inventory could be obtained. A sampling point was also established on a meteorological tower where two automated detectors operated concurrently, one at ground level and the other at an approximate height of 40 metres.

For the Phase 2 study in 2007, six sampling points were installed at relevant locations to determine whether Southern Bent-wing Bats utilised the Ryan Corner wind farm site during their dispersal to wintering caves.

A total of 86,874 ultrasound files were recorded by the automated detectors during both phases of the study, a small proportion of which were identifiable bat calls. At least nine species were recorded during the assessment, including the Southern Bent-wing Bat.

The data from Phase 1 survey sites showed that bat fauna diversity and abundance was very low. The highest level of activity for any species averaged 2.2 calls per night. This suggests that the habitats

present in the wind farm boundary were limited. Conversely, the Blue Gum plantation, situated outside the wind farm boundary, provided habitat to bat species, indicated by the high level of activity with an overall average of 55 calls per night.

Similarly, the average number of Southern Bent-wing Bat calls recorded per night was significantly lower at wind farm sites (0.5 – 1.1) compared with the better habitat at the Blue Gum plantation (8.9).

Issues addressed in the Phase 2 (migration) study of the Southern Bent-wing Bat included:

a) Whether or not this species increase its utilisation of wind farms when it migrates between its breeding cave and over-wintering caves; and

b) When it migrates, does it leave the breeding cave *en masse* and fly in high numbers, or do individuals or groups pass through in low numbers.

The landscape-scale study commenced in late January 2007. During this period, bat calls were recorded over 70 nights at the only Victorian breeding site (Starlight Cave), a known wintering cave (Byaduk), a suspected "stopover" area at Mount Eccles National Park, two sites at the Ryan Corner wind farm and the Blue Gum plantation mentioned previously.

Almost 10,000 calls attributable to Southern Bent-wing Bats were recorded during the study, over a period of 333 detector nights, which equates to over 3000 hours of recording. The average number of calls recorded during the survey varied from 124.4 per night at Starlight Cave, 25.2 and 23.8 respectively at Byaduk Cave and the Blue Gum plantation outside the boundary of the Ryan Corner Wind Farm, to 1.2 and 0.6 per night at the two sites in the wind farm itself. In the good habitat (Manna Gum forest) at Mount Eccles National Park, there was an average of 7.4 calls per night.

Southern Bent-wing Bat activity at the Blue Gum plantation was high. In particular, activity rose when the bats were from Starlight Cave and commencing occupation of Byaduk Cave. Within the wind farm, activity also rose, though only marginally.

The pattern of dispersal was gradual, as opposed to the theory that Southern Bent-wing Bats may migrate in high numbers. Dispersal was over a much longer period than previously described (considered to be mid to late summer) and appeared to still be continuing when the study ended on April 9th 2007.

The number of calls recorded in the wind farm when Byaduk Cave was occupied in greatest numbers did not increase sharply. This suggests that Southern Bent-wing Bats favour woodland habitats over open pasture, which is the dominant habitat in the wind farm. Therefore, impacts on this species from the operation of the wind farm are unlikely to be significant

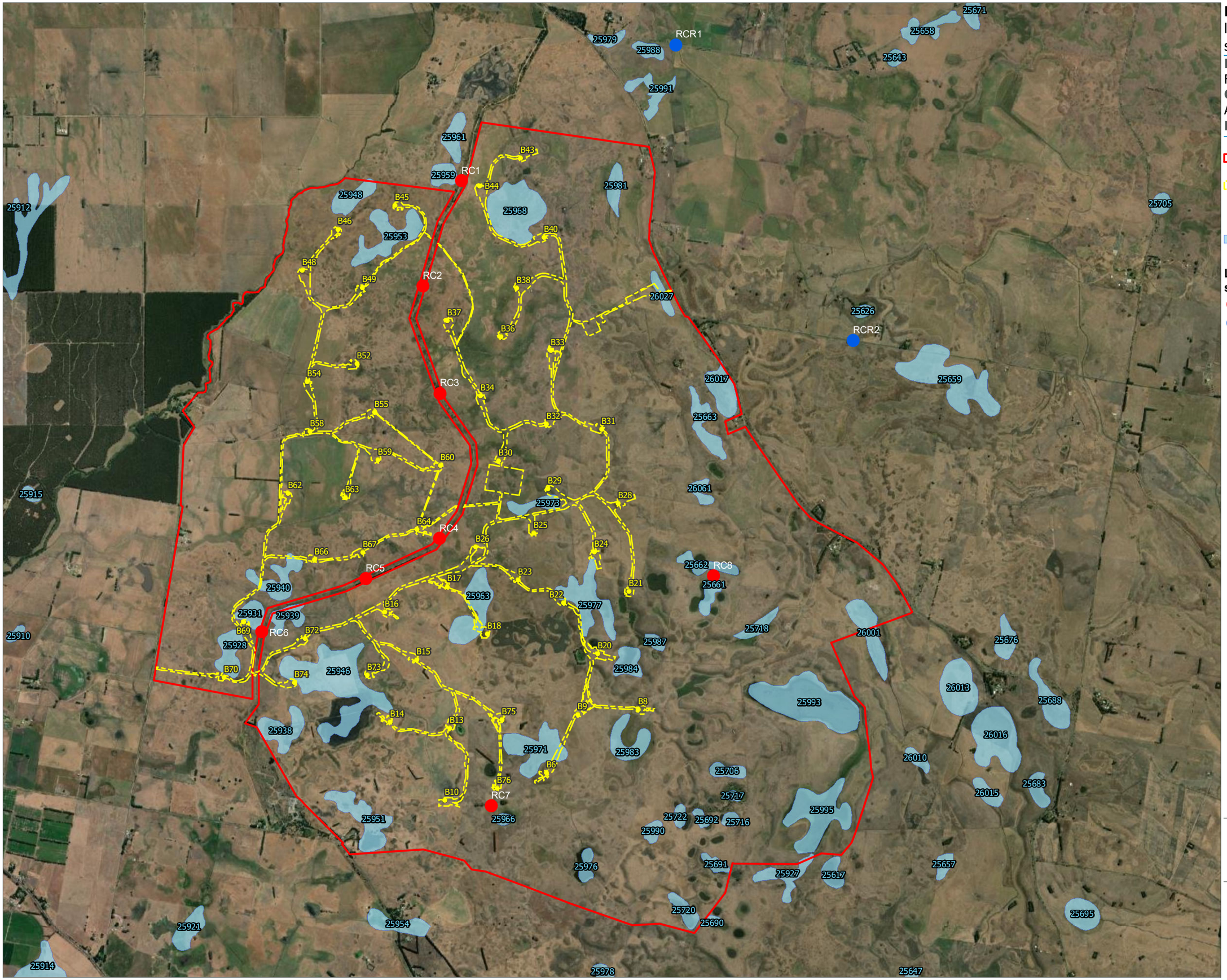

Figure 1: Approximate location of bird utilisation survey points

Project: Ryan Corner Wind Farm
Client: Global Power Generation Australia
Date: 11/06/2021

- Ryan Corner WF boundary
- Development footprint
- Proposed turbine locations
- DELWP wetlands -not identified as breeding wetland

Location of bird utilisation survey points

- Inside WF boundary
- Outside WF boundary

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3. ROUTINE REPORTING, REVIEW MEETINGS, DATA ACQUISITION AND PERSONNEL

3.1. Routine reporting and review meetings

This section of the plan outlines the reporting arrangements for the BAMP. Specific reporting guidelines may also be discussed in their respective sections (e.g., Brolga reports in that section), and therefore further clarification should be sought in those sections if sufficient detail is not provided below. Review meetings may be required after reports are submitted and therefore the actual date of these meetings will be determined in the future.

Brolga activity reports will be prepared in January (for the preceding breeding season) and July (flocking season) each year, summarising the findings from the targeted Brolga investigations. The aim of the report is to understand Brolga population, movements and habitat usage within the vicinity of the wind farm and whether the wind farm is having a significant impact on any of these aspects. This will further inform risks to the species and the requirement for adaptive management of the wind farm and further mitigation measures that may be required. This will include but not be limited to information on:

- The results of monitoring of Brolga occurrence in wetlands on the wind farm and within the area of concern around it;
- The results of any behavioural monitoring of breeding or flocking birds;
- The results of any home range mapping;
- Identification of any risk behaviour that may put birds at risk of colliding with turbines (defined based on observed movement directions, flight speeds and heights, and distances from turbines);
- An assessment of the likely risk to breeding or flocking Brolgas from the wind farm; and
- Discussion of feasible mitigation measures, if required.

A **first-year report** will be prepared after twelve months of monitoring. The purpose of the report is to present the results from the first year of monitoring, identifying any significant impacts arising from the operation of the wind farm that may require mitigation, and reviewing the monitoring methods and recommending refinements, if necessary, for the second year. Matters to be addressed in the first report include but will not be limited to:

- Summary of post-construction survey and carcass search results, including scavenger and searcher efficiency trials, total survey days and comparison of lit and unlit sites (if applicable);
- Changes to, and final protocol of, the experimental methodology, for example, alterations to duration and frequency and areas sampled;
- Mortality estimates for birds and bats in size classes and for specific species where possible, analysed by a suitably qualified statistician, and detected numbers for all other species recorded during the carcass searches;
- A summary of observations of any threatened species monitoring, including the results of the targeted Brolga and Southern Bent-wing Bat monitoring, including comparisons with pre-construction findings, and a summary of any significant impacts according to the protocol later in this section of the plan;
- Once available, this report will be presented to a review meeting with the Regional Manager, Barwon South West Region, DEECA (or their delegate) and the Responsible Authority. The results of the carcass searches (including the scavenger and observer efficiency trials) will be reviewed and refinements to the monitoring program will be agreed;

- The first-year report will be presented to DEECA and the Responsible Authority within two months of completion of 12 months of mortality monitoring. Reports will be supplied in both digital and hard copy.

The **two-year report** will comprehensively outline *two years* of monitoring and provide a conclusion on the impacts of avifauna and provide recommendations for mitigation measures and additional monitoring requirements, and will include the following:

- Detailed survey methods (including list of observers, dates and times of observations);
- Results of the Brolga breeding and flocking surveys;
- Results of the bat survey in general and of the threatened Southern Bent-wing Bat in particular;
- Comparisons with the findings of the pre-construction surveys in relation to Southern Bent-wing Bat and Brolga;
- Mortality estimates for birds and bats in size classes and for specific species where possible, analysed by a suitably qualified statistician, and detected numbers for all species recorded during the carcass searches;
- Any other mortality recorded on site but not during designated carcass searches (i.e., incidental records by site personnel, etc.);
- A discussion of the results, including:
    - Whether indirect impacts on bird use of the site are of significance at a regional, state or national level, or if listed species were affected;
    - Whether the level of mortality was ecologically significant or affected listed species of birds (including the Brolga) or bats;
    - Any differences between years that may have arisen due to wet and dry conditions;
    - Whether continuation of the monitoring program after two years is warranted and, if so, in what form;
    - Any discernible differences in collision rates between lit and unlit turbines, where relevant; and
    - Any recommendations for reducing mortality, if necessary.

If a significant impact on birds or bats is detected before scheduled reporting is due then Ryan Corner Development Pty. Ltd. DEECA and the Responsible Authority via email: pea.energyproject@delwp.vic.gov.au.

Following completion of the two years of monitoring, results will be reviewed by DEECA and the Responsible Authority to determine whether further monitoring and reporting is required.

3.2. Data acquisition/submission and personnel involved

This section of the plan outlines the acquisition/submission of data and personnel involved in the field work, report writing and background research for the BAMP. Data for all work conducted for the BAMP will be available to DEECA and other relevant authorities in both electronic and hard-copy format. Electronic submission of relevant data will coincide with the reports however, it must be understood that some data will be in a very raw format and mid-collection. The submission of the data does not replace the summary of information and data outlined in the individual reports but is in addition to and is in accordance with DEECA requests. This data acquisition and submission applies to all following sections and therefore unless otherwise stated the procedure for inclusion of data follows the above guidelines.

Any data or report submissions to DEECA should be made through email atpea.energyproject@delwp.vic.gov.au.

All personnel who have worked in the field and office to contribute to this management plan thus far are experienced and qualified ecologists or statisticians (i.e., min. Bachelor degree with Honours, many with PhD). Qualifications and training of all personnel involved are readily available. Training is very thorough and involves background theoretical training, knowledge of policies and other administrative matters (e.g., OHSE) and technical/field training (e.g. equipment, species identification).

Ecologists assigned to conducting carcass searches will be degree qualified and should have experience with carcass searches in Australia, including the identification of the Southern Bent-wing Bat and Brolga. If unqualified personnel are involved in carcass searches this will be stated within the relevant section of this plan, and training to these individuals will be given by such qualified personnel outlined above.

Unqualified individuals who have been adequately trained in the methods outlined in Section 5 may only be used in carcass searches, only qualified and experienced ecologists may be used in any other monitoring activities.

All carcass monitoring search tracks recorded via GPS (Section 5.1.3) will be provided in shapefile with annual reports.

4. Post construction utilisation survey program

This section of the plan describes the objectives and methods of the post construction utilisation surveys to be undertaken once operations commence at Ryan Corner Wind Farm. The main objectives are to:

1. Determine the population and activity of Brolgas based on the occurrence of breeding and flocking, and activity patterns of Southern Bent-wing Bat on and around the wind farm site, with reference to the regional known population sizes and activity/movements of individuals. The latest estimated regional population of Brolgas (March 2024, SW Australia) is 836 individuals (SWIFFT Database www.swifft.net.au; viewed on 13/6/24). For SBWB no regional population estimates are available but counts and bat call activity data from the closest roosting/maternity caves will be used as a reference (e.g., 17,233–18,000 individuals in Starlight Cave 45km from RCWF; TSSC 2021). Updated population numbers will be used—along with additional sources—by the time annual reports are in preparation, if available.
2. Determine if either of these two species of concern has altered their activity or population numbers have changed post construction.

Each of the two species of concern has different survey requirements and therefore there is a section dedicated to firstly, the Brolga and secondly, the Southern Bent-wing Bat. All personnel involved in Brolga and Bat utilisation surveys will be trained and qualified ecologists with strong field experience. Qualifications and training details will be available, on request, by any interested party.

4.1. Brolga risk assessment surveys

The aim of the Brolga risk assessment surveys is to document the occurrence of breeding and flocking Brolgas on and near the wind farm site to ascertain if any urgent mitigation or offset measures are required. In particular, the surveys will aim to ascertain the likelihood of regular occurrence of Brolga in areas where they may collide with wind turbines. The closest flocking site is located around Penshurst, approximately 40 km northeast of the project site (DELWP 2020). As there are no known Brolga flocking sites within five kilometres and wetlands in the area are ephemeral and as such there is no need to undertake Brolga flocking surveys as Brolga are not present in the area during the flocking season (January – June). The Brolga breeding season is from July – December and this is the time when surveys will be undertaken. A search for records from the Victorian Biodiversity Atlas (VBA; DELWP 2024) showed a total of eight breeding sightings between 1984 and 2021 in a c.10 km radius, ranging from 3.5 to 10 km from the edge of the wind farm site.

The Brolga risk assessment survey will commence during the first month the wind farm becomes operational (defined as being the first chain of turbines is operational) if during the breeding season. If the wind farm becomes operational outside the breeding season it will commence in the following July and will cover two breeding seasons over two years in accordance with condition 20.b)(i) Brolga surveys will be conducted for a minimum of two years at which point their continuation will be assessed by the Minister for Planning, based on the results presented in the final monitoring report. The methodology for any continuation of sampling must be developed in consultation with DEECA.

The surveys will involve a targeted breeding season survey within the wind farm site and out to a minimum 3.2 kilometres from the wind farm boundary.

The DEECA (South West Region) will be immediately notified by email, pea.energyproject@delwp.vic.gov.au within three business days of the surveys completion if Brolga are observed during the targeted surveys. If one or more Brolgas is detected on the wind farm site during operation, this will be *immediately* (within three business days) reported to the relevant authorities, together with sighting details, such as behaviour, foraging behaviour and use of the site, where relevant.

Brolga surveys will be undertaken by a suitably qualified ecologist.

4.1.1. Breeding season Brolga monitoring

The breeding season monitoring program (July to December inclusive) will be undertaken monthly and include the components described below:

Wetland assessment:

- All DEECA listed wetlands within 3.2 kilometres of the wind farm site will be assessed (Figure 2) subject to private land access arrangements (trespassing is illegal), for Brolga breeding suitability. Access to wetlands on private land will be sought and the use of drones discussed, however if access is denied the potential viability of wetland's potential to form habitat may remain unknown. Satellite imagery or viewing from public roads using telescopes will be attempted but detailed assessment may be impossible beyond this. This will be noted as a limitation and taken into consideration in annual reporting when reviewing the results of the monitoring program. Wetlands not suitable will be ruled out from further surveys. Any wetlands observed or noted from aerial photography that are not included in the DEECA wetland layer will be mapped and assessed accordingly;
- An assessment of wetlands for their potential to be used as breeding sites by Brolga on and within 3.2 kilometres of the wind farm site will preferably be done after winter-spring rainfall (August–September) had been sufficient to fill wetlands and promote the growth of aquatic vegetation; and
- DEECA wetland mapping will be reviewed to identify potential Brolga breeding habitats within the survey area. This will allow for unsuitable wetlands to be ruled out of the survey regime.

  Suitable breeding wetlands may meet one of the following criteria (DSE 2011):

  - Isolated temporary wetlands that can hold water continuously, for at least four months, throughout the Brolga breeding season (July to November); or
  - Group(s) of temporary wetlands that can hold water continuously, for at least three months, throughout the Brolga breeding season (July to November); or
  - Permanent wetlands that have a record of Brolga breeding.

  Unsuitable wetlands may meet one or more of the following criteria (DSE 2011):

  - Permanently drained; and/or,
  - Planted with trees.

Potential breeding sites:

- All potential breeding sites identified through the wetland assessment will be surveyed by observers on foot or from a vehicle (to avoid disturbance), where feasible (i.e., accessibility permitting) while remaining beyond brolga flight initiation distance (FID: distance that a bird will flee an oncoming predator), estimated to about 200 metres, to avoid interrupting normal behaviour;
- Observers will use binoculars and telescopes to obtain sufficient data quality. Sites will be surveyed as comprehensively as possible (i.e., roaming surveys AusWEA 2005) due to the wide dispersal of individual Brolgas in a given area;
- Sites will include all wetlands on and within 3.2 kilometres of the wind farm site and paddocks surrounding these wetlands;
- These sites will be surveyed fortnightly from July to December; and
- Any nest building, courtship behaviour and other reproductive activities will be noted. These behaviours are quite obvious and do not require close inspection to verify.

Detailed behavioural observations:

- Where confirmed breeding is identified at any wetland on the wind farm site or within 3.2 kilometres of a turbine, more detailed observations will be triggered. If breeding activity is recorded, this triggers the requirement to complete a two-day monitoring event on a fortnightly basis until the end of breeding (i.e., fledging or failure);
- The behaviour of individual Brolgas found breeding in the search area will be recorded and information collected on active movement, that is; if they take flight, are in flight or are travelling on foot between areas (i.e., not foraging, resting, vigilant). The start and finish times of all observations will be recorded;
- Variables to be recorded will include distance (m) and direction (bearing) travelled (i.e. absolute and in relation to turbines, plotted on a map), flight height (m), number of Brolgas and their origin and destination, as well as the habitat at the destination (e.g. wetland, pasture, cropland);
- If possible, the number of juveniles and/or adults within the group will be noted, otherwise the number of individuals will be estimated and recorded; and
- Other information that will be recorded will include location (GPS), weather and condition and water level of the breeding wetland. The aim will be to provide an overall picture of the individuals' home range around a breeding site over the course of the breeding season.

Analysis and assessment:

- Flight information (e.g., distance, bearing) will be plotted on maps to determine whether any Brolgas regularly use flight paths close to the turbines (this will aid in identifying any collision risk);
- General location and wetland quality information will provide information for home range mapping;
- As Brolgas have high site fidelity (i.e., return to favourite breeding sites frequently), a daily maximum population estimate can be calculated (also mean, standard error and range) for the area of concern; and
- Breeding sites and movement data can provide information regarding possible disturbance to Brolgas.

4.1.2. Brolga reporting

At the completion of each breeding season survey, a report will be prepared and submitted to DEECA and the Minister for Planning analysing the data gathered and describing the behaviour of flocking and breeding Brolgas and the range of their movements in relation to operating wind turbines. This report will provide a review of Brolga behaviour, including breeding and flocking activities, habitat use and home range mapping in the immediate and adjacent area and will outline whether there are any gaps in the knowledge or in the survey methodology (i.e., possibly warranting an increase in the duration or frequency of surveys). The prepared report must be submitted within one month of completion of the surveys.

Figure 2: Brolga breeding wetlands within 5km radius of Ryan Corner Wind Farm

Project: Ryan Corner Wind Farm
Client: Global Power Generation Australia
Date: 11/06/2021

- Ryan Corner WF boundary
- Turbines
- Development footprint
- Ryan Corner WF buffer - 3200m
- Ryan Corner WF buffer - 5000m
- Breeding record accuracy buffer - 900m

VBA Brolga breeding records

- Breeding site
- Flocking site
- DELWP wetlands -not identified as breeding wetland

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4.2. Southern Bent-wing Bat risk assessment surveys

A bat survey, with emphasis on the Southern Bent-wing Bat will be undertaken at Ryan Corner Wind Farm site after wind farm operations commence. The timing of the surveys is designed to coincide with periods when the Southern Bent-wing Bat is likely to be present and utilising the wind farm site. The aim of the survey is to gain a better understanding of the species usage of the site, particularly in regard to flight heights and activity levels around operational turbines. This will inform further risk assessment on the species and determine the need for any adaptive mitigation measures required after operations have commenced. Surveys will be conducted for a minimum of two years at which point the Minister for Planning will determine if further surveys are required. Such timing includes two individual seven-week survey periods as follows:

- Late summer survey (February to March inclusive) to coincide with the period of increased inter-cave movement from the maternity caves to non-maternity caves; and
- Spring survey (October to November inclusive) to coincide with increased foraging activity of bats with warming conditions and increased inter-cave movements as the bats return to the maternity caves to breed.

4.2.1. Methodology

Survey periods will cover two seven-week surveys during the key periods outlined above when Southern Bent-wing Bats are most actively moving across the landscape between non-maternity and maternity caves. Ultrasonic bat records (e.g., Wildlife Acoustics Song Meter) will be deployed to cover all habitat stratification present within the wind farm (i.e., in or adjacent pasture, waterbodies, woodland).

Bat detectors will be deployed to simultaneously record bat calls at height and at ground level. In order to achieve this, paired bat detectors will be installed (i) at ground-level at the base of operating turbines (or in adjacent habitat) and (ii) at nacelle height. Nacelle height installation must be undertaken by qualified turbine technicians, with the bat detector microphone installed outside (on the underside) of the nacelle pointing down and away from the blades. Nature Advisory will instruct the qualified turbine technician in the appropriate placement and operation of the bat detectors prior to installation to ensure consistent and accurate data collection. This methodology has been successfully implemented in targeted bat detector surveys conducted at operational turbines at Salt Creek Wind Farm in Victoria (Nature Advisory unpublished data).

This methodology —paired bat detectors installed at ground level and at nacelle height— will be employed at five turbines in representative habitat of the wind farm; totalling 10 bat detector units.

4.2.2. Analysis and assessment

Echolocation calls recorded during the bat detector surveys will be used to investigate the presence and relative activity of all bat species listed under the FFG Act and EPBC Act, as well as non-listed species that are known to collide with operational turbines (e.g., White-striped Free-tailed Bat). During the call analysis, a particular focus will be placed on the Southern Bent-wing Bat. Calls produced by common, widespread bat species may be filtered out during the data analysis process.

The information from each bat detector provides information on the locations across the study area where activity is occurring (e.g., calls produced by a certain species are only recorded from one location at any one time, or at multiple locations across different nights). However, the actual number of individual bats of any species moving through the site cannot be calculated, because multiple calls could be produced by one individual bat passing by a single detector multiple times, or by multiple individuals passing the detector once.

Echolocation call data will be sent to a qualified and experienced expert for analysis.

4.2.3. Reporting

Southern Bent-wing Bat survey results will be incorporated in the annual mortality monitoring report. Methods of call analysis and the assessor must be included in the reporting. Bat detector survey data will be provided to DEECA within eight weeks of conclusion of seasonal surveys, and survey results will be incorporated in the annual mortality monitoring report. Methods used for call analysis and the expert conducting the analyses must be included in the reporting. All Southern Bent-wing Bat calls must include time of recording and include example call sequences. Weather conditions during the survey periods must also be documented.

Results will be prepared at the end of both the first and second year of monitoring. Results will be peer reviewed in consultation with DEECA. As per DEECA's instructions, reporting will include the number of calls identified per species per night at each site, number and percentage of calls that were unidentifiable, number and percentage of calls that were identified to species complex level, reference calls used, and reporting of any significant timing patterns of calls throughout the night. identified to Southern Bent-wing Bat species complex level (i.e., calls may have been produced by either Southern Bent-wing Bat or other species with similar call characteristics, namely Little Forest Bat, Southern Forest Bat, Large Forest Bat, Chocolate Wattled Bat), reference calls used, and reporting of any significant timing in the pattern of when calls are recorded throughout the night. This information may provide useful background that informs mitigation measures, if required.

5. POST CONSTRUCTION MORTALITY DETECTION PROGRAM

This section of the plan describes the objectives and methods of the post construction mortality detection program to be undertaken once operations commence at Ryan Corner Wind Farm. The program will be conducted for a minimum of two years at which point their continuation will be assessed by the Minister for Planning, based on the results presented in the final monitoring report. The methodology for any continuation of sampling must be developed in consultation with DEECA. This program aims to comply with conditions of the planning permit.

5.1. Mortality detection

The purpose of detecting mortality is to determine the actual impact of the wind farm on the regional avifauna (e.g., number of deaths per year). Mortality is defined as any dead bird or bat detected beneath a wind turbine. 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. It is assumed that any dead bird or bat detected beneath a turbine and within the "search zone" has died as a result of collision or interaction with a turbine.

The fatality monitoring also aims to detect patterns (e.g., peak times) as a basis for determining significant impacts and informing adaptive mitigation. In addition, there are only two species of concern, Brolga and Southern Bent-wing Bat. Therefore, the search protocol has been limited to these two species and although other carcasses/species will be recorded, these species have not been considered while designing the protocol.

To provide accurate mortality rates it is essential that the program is scientifically and statistically robust. Multiple factors can affect mortality rates and therefore if they are not controlled for within the methodology, they will be incorporated into later statistical modelling as covariables or random factors. A scavenged carcass may increase the variability in mortality rates and thus carcasses will be assessed for possible scavenging and rates will be estimated from experimental trials. In case humans are used for carcass searches at any point during the monitoring in replacement of dogs, it is acknowledged that human detectability of carcasses is also a potential confounding variable and protocols have been developed to control or incorporate this error. Before all searching begins the turbines selected for searching will be surveyed for existing carcasses. If carcasses are found, they may be retained for use in later scavenger/detectability trials.

The following sections outline:

- **Trained personnel:** The minimum requirements for person/s involved in conducting post-construction monitoring;
- **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:** definition of detectability and the experimental trial methodology;
- **Analysis:** general outline of how the data will be analysed.

5.1.1. Trained personnel

Personnel involved in implementing the post construction mortality detection program must either be an experienced and suitably qualified ecologist or be adequately trained by a suitably qualified ecologist according to the methods outlined in the following sections.

If personnel are to be trained, then training must be provided by a qualified ecologist experienced in implementing mortality monitoring at other wind farms. Searchers would be trained in the methods below and supervised on site for the first month of searches to the satisfaction of the attending ecologist.

The qualified ecologist will conduct an audit of trained searches after three months of monitoring to ensure a professional standard. If searches or results are unsatisfactory then retraining may be required or training of new personnel.

The ecologist will be retained to identify or verify the species of all bird and bat carcasses found by trained searches remotely or on site if required to ensure correct identification.

Only a qualified ecologist will conduct scavenger and efficiency trials (Section 5.1.5 & 5.1.6). That person will have a degree qualification and considerable and relevant experience in bird or bat work.

Relevant reporting on the mortality monitoring program will be undertaken by a qualified ecologist.

The qualifications and training records of all personnel involved in monitoring will be provided to DEECA prior to the commencement of monitoring.

Any scent detection dog and dog handler will be trained by an experienced trainer.

5.1.2. Turbine selection

The target population are the turbines themselves and the sample population will be one-third of the entire turbine number (19 out of 52 turbines). It is the turbines that proxy for the wind farm, and not the search area nor the carcass detections.

Turbines are selected at random and all turbines have an equal chance of being selected. However, adjustments were made by substituting some turbines with nearby ones to avoid accessibility constraints. The spatial distribution of these turbines is even across the area, with no visual evidence of clustering (Appendix 1). Preselected turbines may be subject to change upon the first site survey if onsite conditions at a preselected turbine are considered unsafe to survey the majority of the search radius. Once turbines have been selected, these will not be changed.

The sampling size has been determined based on what a feasible and practical approach will provide the most accurate mortality rate given high variability observed on other wind farms. Each turbine that is selected for the searches will have the following meta-information recorded:

- location (easting northing),
- location in chain,
- curvature of chain,
- distance to nearest neighbour,
- identification of nearest neighbour,
- local vegetation,
- distance to any relevant ecological interface.

5.1.3. Search protocol

The search area beneath each turbine has been determined to best detect Brolga and Southern Bent-wing Bat carcasses based on the turbine dimensions (Hull & Muir 2010).

Based on the Hull and Muir (2010) model, 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 or Brolga) may be found a little further out, but 95% are within 115 metres of the turbine.

Given this evidence, inner and outer circular search zones have been designated. The inner zone will cover a radius of 60 metres from the base of the turbine to target the detection of carcasses of bats and small to medium and large sized birds. The outer zone will comprise the zone between the 60-metre and 120-metre radius circles. Although they are still recorded in the inner zone, the outer zone will ensure the adequate detection of carcasses of medium to larger sized birds, which can fall further away from turbines.

Scent detection dog team protocol

It is recommended that searches be undertaken by a scent detection dog team. Paula *et al*. (2011) found that dogs trained to find bird and bat carcasses under turbines were far more accurate when compared with humans in controlled trials (92% vs 9%) while Mathews et. al. (2013) found that dogs found up to 53% more bats on the ground when compared with humans, and completed surveys over the same area in 25% less time.

Turbines will be searched once a month out to 120 metres; however, no inner and outer zone designation is required for scent dog method.

A scent dog does not 'look' for carcasses but finds them via scent. Therefore, it does not need to cover as much ground as if it were looking with its eyes but only needs to cover enough ground to encounter all possible 'scent cones' within the search area. The scent cone is the area downwind of the target, in this case a carcass, in which the scent will drift with the wind. So, if the wind is strong; the scent will drift further but in a narrower scent cone, and if the wind is light; the scent cone will be wider but will not drift as far. In the case of strong wind, then transects will need to be narrow to ensure scent cone areas will be encountered. Transects of approximately 20 metres wide will be adequate to cover an area in moderate wind conditions. This could be reduced to 10-15 metres in strong wind (Figure 3).

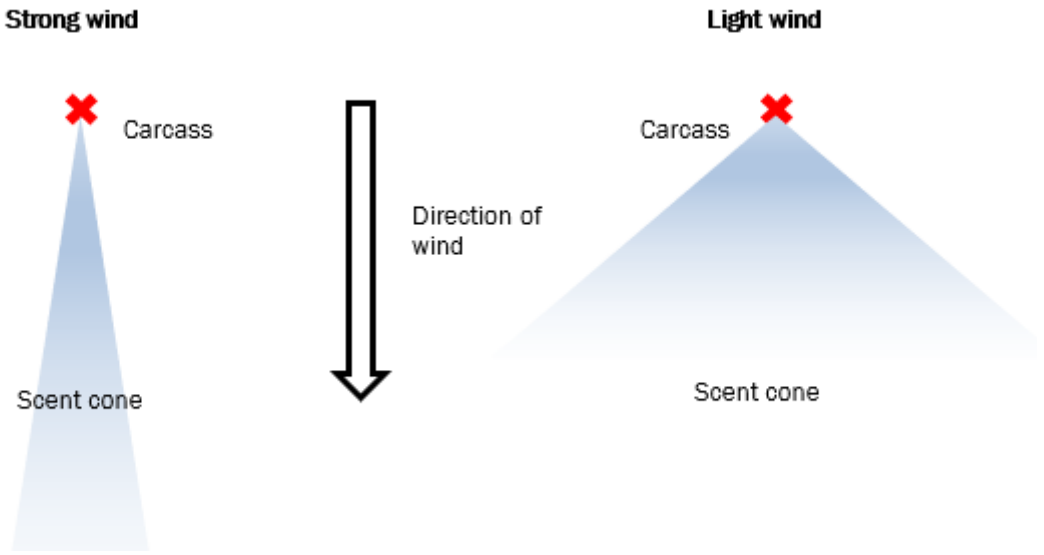


Figure 3: Visual representation of 'scent cones'

The handler will start down wind of the turbine and walk into the wind allowing the dog to freely zig zag across the searcher's transects, using commands to control how far the dog moves to each side of the transect (i.e., 20 metres). Then repeat this at a slower pace when walking the return transect that would be with the wind. The searcher does not need to reach the edge of the radius upwind of the area as any carcass scent there would drift down into the transects.

All search transects conducted (by human and/or scent dog) will be recorded via GPS and tracks to be made available on request and submitted to DEECA as required.

Search regime

All turbines will be searched out to 120 metres once per month. The order of turbines searched will be randomized between searches.

To ensure accurate detection of bats in particular, a secondary 'pulse' search will be undertaken every month of the monitoring program. A recent study of Southern Bent-wing Bat ecology found that, although the species' activity is reduced in the winter months, significant activity is still detected in winter, including intercave movements, suggesting some level of foraging activity continues throughout the year (van Harten *et al*. 2022). After the initial 12-month pulse search period, the requirement for another 12 months of pulse searches will be reviewed in the first annual report depending on the species and numbers of bats being found as mortalities.

Pulse searches entail searching the 'inner zone' (out to 60 metres) again two to three days after the initial search. This ensures bats are unlikely to be missed and can also provide insight into the frequency of bats flying into turbines.

Search methods will follow those outlined above.

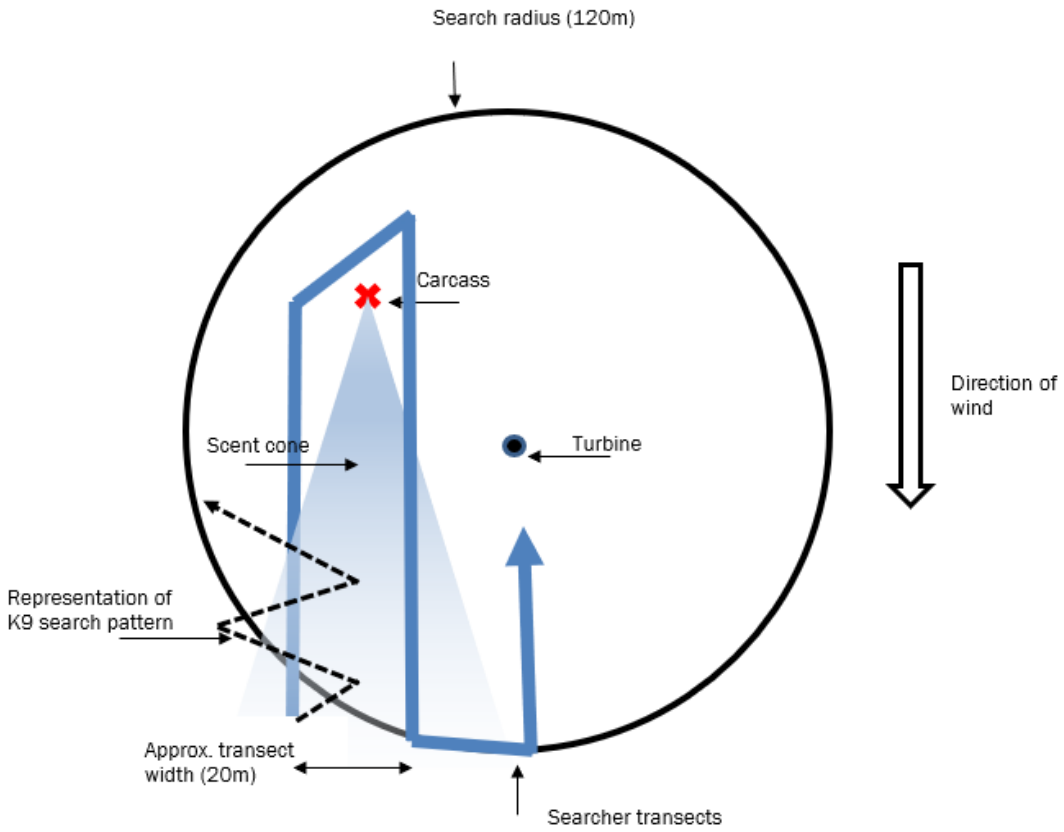


Figure 4: Scent detection dog search pattern

5.1.4. Carcass detection protocol

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

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

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

- The carcass will be removed from the site to avoid re-counting;
- The carcass will be handled by personnel wearing rubber gloves, packed into a plastic bag, then wrapped in a sheet of newspaper then in a second plastic bag;

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

DEECA, South-West Region, will be provided with a copy of the completed carcass search data-sheet for all recorded carcasses of threatened species within three days. It will be necessary for the wind farm operator to obtain from DEECA a permit under the state *Wildlife Act 1975* 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.

5.1.5. Scavenger rates and trials

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

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

Scavenger trials will be undertaken twice per year for the first two years of operational phase monitoring. The objective of having two trials per year is to account for different seasonal vegetation conditions, so one will be held when the grass is long and one when the grass is short. The two periods for scavenger trials are shown in Table 2 below.

Table 2: Timing for scavenger trials

Vegetation condition	Likely time period	Weather	Stocking
Short grass	Winter (July)	Cold weather	Heavy stock levels
Long grass	Late Spring (November)	Follow rain and higher temperatures	Light stock levels

Scavenger Trials

Scavenger Trials will be undertaken by a trained person (Section 5.1.1) to determine the rate of loss by scavengers, and the nature of removal by scavengers (e.g., an early peak in scavenging a peak after carcasses have been in place for a period of time). The search area for scavenger trials will be 120m from the base of the turbine under the turbines selected for carcass monitoring. Large birds can fall anywhere within the 120-metre radius and therefore, birds will be placed anywhere within the search radius. Bats on the other hand, typically only fall out to about 60 metres and will therefore only be placed within the 60-metre radius (Section 5.1.3).

To identify potentially different scavenging rates, three categories of carcass will be used (Table 3). Based on current mortality estimation software requirements, every endeavour will be made to find all carcasses of each category. Improvements on this method would require an impractical and unlikely availability of required carcass numbers, and do not lead to a commensurate improvement in the statistical power of estimates. See Appendix 3, Symbolix letter 17 November 2020.

Brolga equivalent carcasses have not been provided as a category of carcass for scavenger trial purposes for several valid reasons. Firstly, it is unknown what would constitute a viable substitute carcass for such a large bird. For example, Wedge-tailed Eagles on average are not scavenged at all, instead decomposing in situ, whereas other large birds (i.e., a Raven or Falcon) might be scavenged quite quickly, so it is unclear if either would be appropriate. Next, it is not permitted to source uncleaned poultry (i.e., plucked, gutted etc) in Victoria, and cleaned poultry is not a statistically viable substitute for deceased birds (Symbolix 2020).

As such, it is proposed that the category 'Large Birds' in general be used instead. Symbolix letter (Appendix 3) supports this approach.

Table 3: Number of replicates for each scavenger trial

Vegetation condition	Micro-bat	Medium sized birds	Large birds (large raptor size)
Short grass	10	10	10
Long grass	10	10	10

Thirty carcasses in total will be randomly placed under different selected turbines for each season. This can be done by generating random numbers in Microsoft Excel. For example, a number 0 and 30 can represent how many steps a person takes around the base of the turbine, starting at the turbine entrance, and then another number between 0 and 120 can represent how many metres the person then walks away from the turbine. Thus, providing a random location within the search radius.

Scavenger trials will be undertaken via motion sensor camera traps. Cameras can be mounted on vegetation, nearby objects such as fence posts, or mounted on steel pickets away from farm tracks or areas likely to be ploughed during farming activities. Carcasses will be placed three to five metres from the camera and the camera set to record any images of scavengers removing the prey. This will ensure greater accuracy in determining how long a carcass remains in the field. Additionally, it will remove the added bias issue of humans constantly checking carcasses, which may deter scavengers such as foxes which are naturally cautious of humans. This will also incidentally provide additional information on what scavengers are taking the carcasses.

Additional information on scavenger trials is provided below.

- A mix of small and medium to large 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 60-metre search area. Carcasses will be thrown in the air and allowed to land on the ground to simulate at least some of the fall and allow for ruffling of fur or feathers.

- Carcasses used in the trial will have their coordinates recorded to ensure that they are not confused with an actual fatality found under a turbine during the trial searches.
- Notes will be taken on evidence remaining at sites where carcasses have been scavenged (e.g. scavenger scats, bones, feathers, animal parts and type of scavenging) if visible, such as tearing, pecking, complete removal of carcass, partial removal of carcass, bird or mammal predator evidence).
- Notes will be taken on the state of remaining carcasses in each search.

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

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

The number of carcasses per animal and size category is based on obtaining a reasonable level of statistical confidence in the estimate of average carcass duration, as reflected in software requirements for current mortality estimation processes, whilst seeking to minimise the number of carcasses used, as they can be difficult to source. Large numbers of carcasses (e.g., on-site, road-kill) are difficult to obtain and it may be very complicated to find alternative sources (e.g. farmed and culled animals). It is also possible that large numbers of carcasses, more size categories and more replicates may attract more scavengers to the area. Previous studies (e.g., Molsher *et al*. 2000) have shown that fox prey use is related to availability and therefore more foxes may be attracted to the area if more carcasses are used, thereby biasing the resulting correction factor. In addition, raptors are potentially more susceptible to collision when preying on carrion beneath turbines. However, it is necessary to conduct these trials under turbines as some scavengers may alter their behaviour in response to the turbines. The final scavenger trial design is therefore a necessary compromise between high numbers of trials and practicality whilst ensuring a statistically-valid trial design without altering either the behaviour of scavengers or the number of birds that may collide with turbines.

5.1.6. Detectability trials

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

To account for observer variability in detecting carcasses, only personnel who have carried out monthly searches at Ryan Corner Wind Farm will be involved in the detectability trials. Detection efficiency (percentage of carcasses detected) will then be incorporated into later analyses that derive mortality estimates. The number of carcasses to be employed in each trial is detailed in Table 4 and explained below. The carcass controller (a person not involved in monthly carcass searches) will throw each carcass into the air and allow it to land on the ground to simulate at least some of the fall and the potential ruffling of fur and feathers. The carcass controller will note the placement of carcasses (via

GPS) and is free to decide where and how many are deployed under each turbine, however all bats should be located within the inner, 60 metre search zone.

Table 4: Number of replicates per season for detectability trials, given two factors of size and visibility

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

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

Ecologists will notify DEECA, five days prior of the actual timeline of all experimental trials (scavenger and detectability) so that DEECA have the opportunity to observe the trials.

The review provided by Symbolix (Appendix 3) considered a previous BAMP version which has since been superseded, in which the number of microbats proposed for trials was 20. The review outlines that 10 carcasses per size class is the minimum amount required for a statistically sound correction factor in regard to scavenger rates. As such, this number is proposed in the current BAMP version for both correction factors.

5.1.7. Analysis and data limitations

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

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

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

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

All data will be analysed to provide the average estimated mortality of birds and bats, their standard error (variability) and ranges for the Ryan Corner Wind Farm. The mortality rate of each species (if estimates for individual species are possible) and size class detected will be calculated after two years. If possible, the standard error and range of these estimates will be reported. Note that it may not be possible practically to provide this due to the likely low number of carcasses detected. Where this is an issue, it will be reported. Mortality estimates will also take into consideration the actual operational time of the turbines (obtained from the project operator).

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

5.2. Incidental Carcass Protocol

Personnel operating the Ryan Corner Wind Farm may from time to time find carcasses within the wind farm site. In this case, the person concerned will respond in the way described below.

- The site manager will immediately be informed and, for each carcass, will arrange that it:
  - GPS position recorded;
  - Have the distance and compass bearing of the carcass from the wind turbine tower based measured and recorded;
  - Be removed from the site to avoid re-counting;
  - Be handled by trained personnel wearing rubber gloves, packed into a plastic bag, wrapped in newspaper, then put into a second plastic bag; and
  - Be transferred to a freezer at the site office for storage so the carcass or partial remains will be identified by a suitably qualified and experienced ecologist and used in observer efficiency and scavenger trials, if suitable.
  - If the find is made within five days prior to a scheduled carcass search, the carcass will be left *in situ* but photographed and position recorded (GPS).

A carcass search data sheet (Appendix 2) will be completed for each incidental carcass found. All bird and bat carcasses (not used for experimental trials) found beneath turbines during searches and incidental finds will be retained (frozen) for at least 12 months and offered to DEECA or as per wildlife permit permissions. Any unclaimed carcasses will be offered to DEECA prior to disposal.

5.3. Injured Bird and Bat Protocol

All onsite staff and monitoring personnel will be advised of the correct procedure for assisting injured wildlife. All ecologists are very familiar with the correct and ethical treatment of injured wildlife and are often able to provide necessary care to aid in quick release (e.g., dehydration, shock). Contact details of local veterinary staff and wildlife carers will be provided 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.

Wind farm personnel who find injured wildlife will be required to report the find to the wind farm site manager, who will require a trained person to place the animal immediately into a dark place (e.g. box or cloth bag) for transfer to the nearest veterinarian (list to be maintained at the wind farm office).

6. POST CONSTRUCTION INTENSIVE MONITORING AND MORTALITY ESTIMATES PROGRAM

The following section outlines targeted monitoring for priority species as requested by DEECA, in addition to Planning Permit requirements.

6.1. Intensive Southern Bent-wing Bat monitoring program

This section outlines a protocol for targeted carcass searches for the Southern Bent-wing Bat as per instructions from DEECA and Dr Lindy Lumsden (DECCA's Arthur Rylah Research Institute). The data collected from this program cannot be incorporated with the above mortality surveys or mortality estimates as it can only provide information about the particular turbines selected for the program and for the two intense survey periods. Additionally, the data cannot be generalized to the entire farm or any other wind farms.

The intensive monitoring periods will be from February to March (inclusive) and again in October to November (inclusive). The surveys can be run in conjunction with the above mortality surveys and if a turbine is selected for both purposes the data can be replicated and used for both. Dr Lumsden has requested that 17 of the turbines be selected within the Ryan Corner Wind Farm site. These will be located on the western side of the wind farm, given their proximity to the nearest forested area and the Shaw River. Turbines will include B45, 46, 48, 49, 52, 54, 55, 58, 59, 60, 62, 63, 64, 66, 67, 69 & 70.

The intensive monitoring will only survey the 60-metre inner search zone with four-meter transect spacings, as per the pulse searches, as this encompasses the impact detection zone of microbats (Arnett et al 2005, Hull and Muir 2010). These searches will be undertaken weekly (four searches a month) for seven weeks during each period respectively and can incorporate the initial standard monthly search and pulse search.

The intensive survey will follow search protocols outlined in Section255.1.3.

The data will be available to DEECA and Dr Lumsden in hard-copy or electronic form and the information incorporated as a separate data appendix in the annual reports.

6.2. Mortality estimation

A priority specified by DEECA, is to report modern, statistically robust mortality projections for the entire site. It is acknowledged that this is a current and dynamic aspect of research and that the outcomes from such programs may be equally dynamic and so offer little potential for compliance monitoring at this stage.

Due to the rapidly advancing techniques, the adherence to meta-data collections (data about the underlying data) is paramount, as are correct, statistically valid selection processes. There are two species of concern, and mortality estimates are targeted to these species.

To be a statistically robust estimate, all protocols must be unbiased and controlled. If these conditions are met, then the results could be potentially generalised to other sites within Victoria and any information gained may be applicable (possibly with some caveats that can be determined from the process itself) to other developments.

Current mortality estimates require the following:

- Sampling protocol (to enable generality and scaling up to site-wide estimate): Section 5.1.2 & 5.1.3;
- Modelling protocol (to account for losses): Section 5.1 & 5.1.2 and statistical modelling; and

- Search protocol (to collect the raw data in a consistent fashion compatible with the two protocols above): Section 5.1.3.

The projected mortality rate will be generated through modeling the scavenger losses and detectability, and using sampling inference to account for the selection and stratification. Currently, the most appropriate model is that of Huso (2010).

It is unnecessary for the purposes of the BAMP to detail the analysis process, which should be flexible and respond to specifics of the data collected. However, the basic premise of these approaches is to calculate the expected counts of carcasses, accounting for modeled losses (both scavenger and detection) and to account for sampling fraction, stratification and density proportioned areas to produce an estimate of "arrivals"," or true mortality.

Due to the intensive data load required, this will be done for the two species of interest (if possible) and those other species detected (i.e., carcasses) that fall into the large bird and micro-bat categories. Finally, as the analysis process needs to be flexible and respond to the data collected, we are unable to predict the format of the results (e.g., estimated fatality/turbine/year).

7. IMPACT TRIGGERS, MITIGATION AND OFF-SETS

Mitigating and offsetting significant impacts on birds and bats is an important requirement of the planning permit and one of the key aims of this Bat and Avifauna Management Plan.

Planning permit condition 20 (d) called for a procedure for managing and mitigating any significant impacts from bird and bat strikes. It is also proposed to report these, if and when they occurred, to DEECA within the appropriate timeframe at the email address: pea.energyproject@delwp.vic.gov.au.

7.1. Raptor risk reduction measures

The planning permit condition calls for carcass removal to reduce the attractiveness of the site to birds of prey and, therefore reduce the chances of fatal collisions by this group of birds. A procedure for carrion removal is provided below.

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

- Weekly inspections of the entire wind farm site by onsite personnel will be undertaken to search for any stock, introduced or native mammal and bird carcasses that may attract raptors (e.g., kangaroos, foxes, rabbits) within 250 metres of turbines;
- Any incidental finds of birds and bats will follow the *Incidental Carcass Protocol* (depending on carcass location);
- Any carcasses and/or remains found will be immediately (within hours) collected and quickly disposed of in a manner that will avoid attracting raptors close to turbines (e.g. burying them in a designated location, burning provided correct permits/laws are met). All disposal efforts will be carried out far from turbines;
- Carcass occurrence and removal will be recorded in a "management log book" maintained by Ryan Corner Development Pty. Ltd.;
- Rates at which carrion are found will be reviewed, in consultation with DEECA, after three months of wind farm operations commencing to ascertain if the carrion removal schedule needs to be refined; and
- An annual summary of carcass removal, based on the 'management log' will be provided in the first year and final year monitoring program reports to the Regional Manager, South West region, DEECA, and the Responsible Authority.
- The need for continuation of the carcass removal program will be assessed after two years of operation. In general, the criteria for continuation will be based on the frequency of carcass finds. For example, if carcass frequency is particularly low (e.g. one or two per quarter) outside of turbine search zones (i.e., not beneath) the intense program may be discontinued or reduced considerably subject to agreement fromDEECA.
- Rabbit control will be considered in the event of high numbers of Wedge-tailed Eagle strikes. This will limit the prey availability of this species. This can include, baiting, shooting and warren ripping.

7.2. Definition of impact trigger

An impact trigger is where there is evidence of death or injury to native birds and/or bats by collision or other interaction (e.g., barotrauma) with turbines. A significant impact on native birds and/or bats, for the purposes of non-scheduled reporting is defined as circumstances where:

- In any two successive monthly carcass searches, a total of four or more native bird or bat carcasses (or parts thereof) of non-threatened species (excluding introduced species) are found at the same turbine; and/or
- A threatened bird/bat species (or recognisable parts thereof) listed under the EPBC Act, FFG Act or Advisory List of Threatened Vertebrate Fauna in Victoria – 2013, is found dead or injured within the wind farm site during any mortality search or incidentally by wind farm personnel.

All on-site wind farm staff will be familiarised with the identifying features of a Brolga (e.g., posted photos and descriptions) and with protocols for immediate reporting of such incidences. Reporting arrangements for significant impacts are described in the next section of this plan.

7.3. Mitigating significant and general impacts

Mitigation involves the prevention, avoidance and/or reduction of the risk of a significant impact. Generally, the aim is to take actions in advance to avoid a significant impact. The following provides a framework for assessing and mitigating significant bird and bat impacts of the Ryan Corner Wind Farm. The relationship between these activities is shown in Figure 6. The activities include:

- Immediate reporting (two business days) of an impact trigger to wind farm management and to the Regional Manager, South-West Region, DEECA (via email) followed by discussions of requirements and aims of investigations;
- An Investigation within 10 business days by an appropriately qualified ecologist of the occurrence on site of the affected bird or bat species to identify the particular risk behaviours that could lead to collisions. This must include consultation with a relevant species ecology expert and DEECA. A site field assessment of suitable habitat on and near the site should be undertaken, unless not relevant (i.e., some aerial species which would not utilise habitat on or near site). An investigation is necessary to determine the actual cause of death/injury (in the unlikely event that the animal was, for example, shot). The very rapid investigation will assess the most effective mitigation and will ensure that the mitigation is implemented correctly and quickly (within 10 days), subject to a clear understanding of the cause of the impact trigger. This process will involve a meeting between the ecologist concerned, the wind farm operator, and DEECA to discuss species-specific requirements;
- Responsive mitigation and if this is not possible, offsetting measures will be implemented; however mitigation (and also offsetting) cannot replace the loss of one individual of a species of concern; and
- The investigation and following activities will also focus on the evaluation of likelihood of further occurrences and impacts and may indicate a requirement for further targeted surveying.

The intent is for mitigation requirements to be resolved within four weeks of the investigation.

Additional general mitigation measures must be implemented from the commencement of operations at the wind farm and include:

- Farmers would be requested to not spread grain supplement feed for stock within 250 metres of turbines. This attracts foraging birds which may collide with the above turbines. This agreement should be established ahead of operations commencing.
- Any lighting of turbines in general must be baffled as to limit attracting insects at night, which in turn will attract bats.

Subject to an assessment of the level of risk of impacts of significance continuing, mitigation will be implemented, in consultation with DEECA, which may include but not be limited to:

- Habitat assessment, modification, vegetation planting/removal;
- Changes in land use practices (including stock management) near turbines;
- No or reduced cropping/sowing around or near turbines;
- Bird deterrence;
- Increasing turbine and powerline conspicuousness by rotor patterns, marking and/or audible signals/echolocation;
- Changes to lighting of turbines; and/or
- Temporary turbine shutdown for high risk periods/locations;
- Technology activated temporary shutdown (e.g., sensors detect approaching individuals of the species of concern, subject to validation).

An impact trigger of a Southern Bent-wing Bat will result in the implementation of an appropriate mitigation method in consultation with DEECA (Figure 5). As an immediate precautionary action, low wind-speed curtailment (i.e., increasing turbine cut-in speed) will be applied to any turbine associated with a mortality event. Low wind-speed curtailment has been shown to be an effective approach to mitigate bat mortality at wind farms around the world (Arnett *et al*. 2016, Wellig *et al*. 2018, Whitby *et al*. 2021, Lloyd *et al*. 2023), including Australia (Bennett *et al*. 2022). In case of an additional mortality event occurring at a same turbine where low wind-speed curtailment has already been implemented, an increase in cut-in speed will be applied. This hierarchical and precautionary approach of immediate response was developed by Nature Advisory following feedback from DEECA to address specific triggers actions for Southern Bent-wing Bat, and is detailed in Section 7.4.

Up-to-date information on mortalities of Southern Bent-winged Bats at four operational wind farms in Victoria was provided to Nature Advisory during discussions with DTP and DEECA (held on 12th of October 2023). All of these wind farms have a minimum Rotor Swept Area (RSA) that is lower than the minimum RSA of Ryan Corner Wind Farm (i.e., 44 metres). Unpublished analyses of carcass search results from operational wind farms carried out by Nature Advisory shows that mortality of bats decreases with increasing height of the lower minimum RSA. It is also known that there are fewer records of Southern Bent-wing Bat calls recorded when bat detectors are placed at RSA heights. Thus, it is anticipated that the potential impact on the Southern Bent-winged Bat is likely to be relatively low based on the average lower minimum RSA heights from previous wind farms in which mortalities have been recorded. The minimum RSA of these wind farms in comparison with the minimum RSA of the Ryan Corner WF is detailed as follows.

- Macarthur Wind Farm – min RSA of 23 meters (21 meters lower than Ryan Corner WF);
- Cape Nelson North Wind Farm – min RSA of 33.5 meters (10.5 meters lower than Ryan Corner WF);
- Salt Creek Wind Farm – min RSA of 24 meters (20 metres lower than Ryan Corner WF); and
- Dundonnell Wind Farm – min RSA of 39 meters (5 meters lower than Ryan Corner WF)

Depending on the outcomes of the investigations (see Figure 5), further mitigation actions could include increasing cut-in speed or shutdowns during periods of higher bat activity, if required. Additionally, should three mortalities be identified at separate turbines within the duration of this plan, Ryan Corner Development Pty. Ltd. will commit to consult with DEECA to review the BAMP. The purpose of these consultations will be to reassess the BAMP and explore the testing of alternative mitigation measures,

such as acoustic deterrents, including consultation on the implementation and empirical assessment of the effectiveness of any proposed mitigation program.

Immediate mitigation (e.g., above techniques) may be required if Brolgas are significantly impacted and will be implemented under the supervision of a qualified ecologist in consultation with DEECA and in a prompt manner (Figure 5). Significant impacts may be one-off or cluster events and therefore the mitigation procedure should follow steps outlined in Figure 5. It is difficult to anticipate how a significant impact may arise and therefore what mitigation would be required. However, if a significant impact is detected, the cause may be evident immediately (e.g., particular land-use practice) in which case immediate mitigation must be implemented, as described. Where a solution is not immediately evident, it will be the subject of investigation and subsequent response.

A significant impact (as defined in Section 7) will represent an 'incident' within the Ryan Corner Development Pty. Ltd. EH&S system and the appropriate internal incident reporting procedures will be used. This will be followed within two business days by reporting as described in Figure 5 to DEECA. Additionally, all actions will be developed and implemented in consultation with and agreement from DEECA.

7.4. Impact triggers for Southern Bent-wing Bat

Background

The Southern Bent-wing Bat (SBWB) is listed as "critically engendered" in Victoria under the FFG Act and Federally under the EPBC Act (TSSC 2021). The SBWB is small (~15 g), insectivorous bat that roosts in a network of ~70 roost caves located across a restricted distribution (19,452 km^2) from southwestern Victoria to southeastern South Australia (DELWP 2020). SBWBs gather in late spring and early summer at maternity caves to give birth and raise their young, and then disperse in autumn to use non-breeding caves throughout the cooler parts of the year (Churchill 2008). The three known maternity caves are located near Naracoorte in South Australia, Warrnambool and Portland in Victoria (Southern Bent-wing Bat National Recovery Team 2022).

Mortality has been documented at three monitored wind farms in SW Victoria and it is summarised in Table 5. These mortalities do not represent actual numbers of collisions since current monitoring programs detect only a small and uncertain percentage of bird and bat mortalities at wind farms, especially where collisions are infrequent for certain species (Moloney *et al*. 2019).

Table 5: Mortality of Southern Bent-wing Bat at wind farms in Victoria (known till January 2024)

Wind Farm	Completed	No of turbines	Hub (m)	Min RSA (m)	Blade (m)	Mortality (raw numbers)	Notes
Cape Nelson North/Sir William Grant wind farm	2015	23	80	=80-46.5= 33.5	46.5	6	This wind farm is adjacent to a known roosting cave for SBWB
Macarthur WF	2013 (mortality recorded 2014-2015	140	85	23	56	2	Drawn for the annual reports n monitoring
Wind farm east of Starlight Cave	(mortality recorded in autumn 2020)			24		1	Information provided by pers comm
TOTAL						**9**	

Impact Trigger Level 1

A single or a number of Southern Bent-winged Bats are recorded dead within 60 metres of a turbine within a single event (for the purposes of the trigger this may be over a search period of up to five days (the length of the search period)

Actions in response to Impact Trigger Level 1

In the event of each individual SWBW mortality identified:

- Additional carcass searches to determine extent of the *impact*
  - Search all turbines within 1 km of the turbine where each carcass was recorded, that have not already been searched on the same day, to a radius of 60 metres from the base of the turbine.
  - If a subsequent carcass is recorded during that search, all turbines within 1 km of that find, that have not already been searched on the same day, will be searched to a radius of 60 metres.
  - The findings of the searches will be recorded and reported upon as detailed below.
- Adaptive mitigations - Assignment of risk
  - Any turbine where a carcass of the SBWS is recorded will be labelled as a "high risk" turbine.
  - The assignment of "high risk will be for a period of two years from the date of assigning "high risk".
  - If there are no further mortalities at the turbine for two years the risk will be re-assigned to "low" risk.
- High risk turbines
  - Any "high risk" turbine will be included in all subsequent turbine searches for two years from the date of assigning "high-risk".
  - Any turbine assessed as high risk will be operated with a "nighttime low wind speed cut-in of 4.5 metres / second" for the period of November– May, from dusk to dawn.
  - Will be included in the intensive monitoring program of the BAMP.
- Incident Investigation
  - Upon the morality event, an investigation will commence with five days and the report submitted to the Responsible Authority within 28 days.
  - The investigation will seek to assess any relevant attributes associated with the SBWB mortality/event.
  - The report will identify factors including:
    - Date and time of mortality,
    - Identify, if possible, wind direction and speed when bat was struck,
    - Weather conditions,
    - Description of the season,
    - Location of mortality in relation to habitat, vegetation and water sources,
    - Proximity of nearest known SBWB roost caves, and
    - Analysis of any other mortality on the site.
  - Overall, the report will compile all relevant information and provide report on:
    - Conclusions of investigation in regard to risk to SBWB and likelihood of occurrence on site,
    - Recommendations for future actions to mitigate impacts on the SBWB, and
    - Options for other mitigation including deterrents.

Impact Trigger Level 2

A single or a number of Southern Bent-winged Bats are recorded dead within 100 metres of a turbine within a single event (for the purposes of the trigger this may be over a search period of up to five days (the length of the search period) of a turbine assigned as "high risk" under Trigger 1.

Actions for Impact Trigger Level 2

- **Additional carcass searches to determine extent of the impact**
  - Search all turbines within 1 km of the turbine where each carcass was recorded, that have not already been searched on the same day, to a radius of 60 metres from the base of the turbine.
  - If a subsequent carcass is recorded during that search, all turbines within 1 km of that find, that have not already been searched on the same day, will be searched to a radius of 60 metres.
  - The findings of the searches will be recorded and reported upon as detailed below.
- **Adaptive mitigations - Assignment of risk**
  - Any turbine where a carcass of the SBWS is recorded will be labelled as a "high risk – Trigger 2" turbine.
  - The assignment of "high risk will be for a period of two years from the date of assigning "high risk- T2".
  - If there are no further mortalities at the turbine for two years the risk will be re-assigned to "low risk" risk.
- **High risk turbines - T2**
  - Any "high risk-T2" turbine will be included in all subsequent turbine searches for two years from the date of assigning "high-risk-T2".
  - Any turbine assessed as high risk will be operated with a "nighttime low wind speed cut-in of 4.5 metres / second + 1.5 m/s (an increase low wind cut in speed of 1.5 m/s in additional to the Trigger 1)" for the period of November–May, from dusk to dawn.
  - Will be included in the intensive monitoring program of the BAMP.
- **Incident Investigation**
  - Upon the morality event, an investigation will commence with five days and the report submitted to the Responsible Authority within 28 days.
  - The investigation will seek to assess any relevant attributes associated with the SBWB mortality/event.
  - The report will identify factors including:
    - Date and time of mortality,
    - Identify, if possible, wind direction and speed when bat was struck,
    - Weather conditions,
    - Description of the season,
    - Location of mortality in relation to habitat, vegetation and water sources,
    - Proximity of nearest known SBWB roost caves, and
    - Analysis of any other mortality on the site.
  - Overall, the report will compile all relevant information and provide report on:
    - Conclusions of investigation in regard to risk to SBWB and likelihood of occurrence on site,
    - Recommendations for future actions to mitigate impacts on the SBWB, and
    - Options for other mitigation including deterrents.

Impact Trigger Level 3

Where a third strike has been recorded of Southern Bent-winged Bats within 100 metres of a turbine within a single event (for the purposes of the trigger this may be over a search period of up to five days (the length of the search period), RCWF will revisit the efficacy of this plan in consultation with DEECA.

Actions for Impact Trigger Level 3

- Additional carcass searches to determine extent of the impact
  - Search all turbines within 1 km of the turbine where each carcass was recorded, that have not already been searched on the same day, to a radius of 60 metres from the base of the turbine.
  - If a subsequent carcass is recorded during that search, all turbines within 1 km of that find, that have not already been searched on the same day, will be searched to a radius of 60 metres.
  - The findings of the searches will be recorded and reported upon as detailed below.
- Adaptive mitigations - Assignment of risk
  - Once there has been a third strike, any turbine where a carcass of the SBWS is recorded will be labelled as a "high risk – Trigger 3" turbine.
  - Any turbine within 600 metres of the turbine where Tigger Level 3 was recorded will have turbines operating with a 4.5 m/s cut in speed for the period of November–May, from dusk to dawn, and continued to be applied while the T3 impact turbine is considered as "high risk" (see Table 6 for a description of proximity).
  - The assignment of "high risk will be for the period of time RCWF revisits the efficacy of the plan with DEECA, or period of two years from the date of assigning "high risk-T3"(whichever date is shorter).
  - If there are no further mortalities at the turbine for two years, the risk will be re-assigned to "low" risk.
- High risk turbines – T3
  - Any "high risk-T3" turbine will be included in all subsequent turbine searches for two years from the date of assigning "high-risk-T3".
  - Any turbine assessed as high risk will be operated with a night time low wind speed cut-in of 6.0 m/ for the period of November – May.
  - Will be included in the intensive monitoring program as detailed in Section 6.1 of the BAM Plan.
- Incident Investigation
  - Upon the morality event, an investigation will commence with five days and the report submitted to the Responsible Authority within 28 days.
  - The investigation will seek to assess any relevant attributes associated with the SBWB mortality/event.
  - The report will identify factors including:
    - Date and time of mortality,
    - Identify, if possible, wind direction and speed when bat was struck,
    - Weather conditions,
    - Description of the season,
    - Location of mortality in relation to habitat, vegetation and water sources,
    - Proximity of nearest known SBWB roost caves, and
    - Analysis of any other mortality on the site.
  - Overall the report will compile all relevant information and provide report on:

- Conclusions of investigation in regards to risk to SBWB and likelihood of occurrence on site,
- Recommendations for future actions to mitigate impacts on the SBWB, and
- Options for other mitigation including deterrents.

- Overall, these turbines will continue to implement cut-in speed for the durations indicated above or may be reduced in future consultation with DEECA in a review and amendment of the plan.

Table 6: Turbines within 600 metres of each individual turbine (See Appendix 1)

Collision with	600m. - Affected WTGs
WTG06	09, 75, 76
WTG08	09, 20
WTG09	06, 08, 20
WTG10	76
WTG13	14, 75, 76
WTG14	13, 15, 73
WTG15	14, 16, 73
WTG16	15, 17, 67, 73
WTG17	16, 18, 23, 26, 64
WTG18	17, 23
WTG20	08, 09, 21, 22
WTG21	20, 22, 24
WTG22	20, 21, 23, 24
WTG23	17, 18, 22, 25, 26
WTG24	21, 22, 25, 28
WTG25	23, 24, 26, 29
WTG26	17, 23, 25, 64
WTG28	24, 29
WTG29	25, 28, 30, 32
WTG30	29, 32, 34, 60
WTG31	32
WTG32	29, 30, 31, 34
WTG33	36, 38
WTG34	30, 32, 36
WTG36	33, 34, 37, 38
WTG37	36
WTG38	33, 36, 40
WTG40	38
WTG43	44
WTG44	43
WTG45	46
WTG46	45, 48, 49
WTG48	46, 49
WTG49	46, 48
WTG52	54, 55
WTG54	52, 58
WTG55	52, 58, 59
WTG58	54, 55, 62
WTG59	55, 60, 63
WTG60	30, 59, 64
WTG62	58, 63, 66
WTG63	59, 62, 66, 67
WTG64	17, 26, 60, 67
WTG66	62, 63, 67
WTG67	16, 63, 64, 66
WTG69	70, 72
WTG70	69, 74
WTG72	69, 73, 74
WTG73	14, 15, 16, 72
WTG74	70, 72
WTG75	06, 13, 76
WTG76	06, 10, 13, 75

7.5. Offsetting significant impacts

It is difficult to predict what form a significant impact might take and what species it may involve and hence, the type of offsetting which may be required. Potential offset options for the two species of concern would be markedly different. A few possible offsets include:

- Habitat/wetland rehabilitation (Brolga);
- Roosting and maternity cave rehabilitation (bat);
- Increasing food availability away from wind farm site (Brolga);
- Increasing diurnal structure conspicuousness, rotor patterns (Brolga);
- Using acoustics to deter bats and other nocturnal fauna at night (bats);
- Implementation of trials using new technological mitigation measures, in collaboration with universities or other research institutions; and
- Allocation of funding towards research and conservation of impacted species.

In the event of the first Trigger Level 1, the project will allocate an anticipated $50,000 (AUD) toward a Southern Bent-wing Bat offset research fund or the National Southern Bent-wing Bat recovery program. This amount is a one-off payment and will be made within three months of the first reported impact trigger. Evidence of this contribution will be provided to the Department of Transport and Planning (DTP) and DEECA. Additional offset options will be researched and discussed with DEECA as required.

A generalised framework is described below to ensure that if significant impacts cannot be completely mitigated, then off-setting arrangements can be discussed and agreed with the relevant authorities.

Arrangements for agreeing on offsetting measures are summarised below.

- Should a significant impact not be mitigated through on-site management then offsetting off-site would be triggered.
- A meeting would be organised between Ryan Corner Development Pty. Ltd. and the relevant authorities and government (e.g., DEECA) experts to discuss and agree offset options.
- Offsetting would be commensurate with the level of impact (to be determined after the investigations undertaken as part of the mitigation protocol; Section 7.3).
- Offsets must be initiated within 12 months of the detection of a significant impact and continued for as long as a significant impact continues that cannot be mitigated through on-site management. Offsets will be monitored and evaluated for their effectiveness and any alterations will be made accordingly to achieve the desired outcomes (in consultation with the relevant authorities).

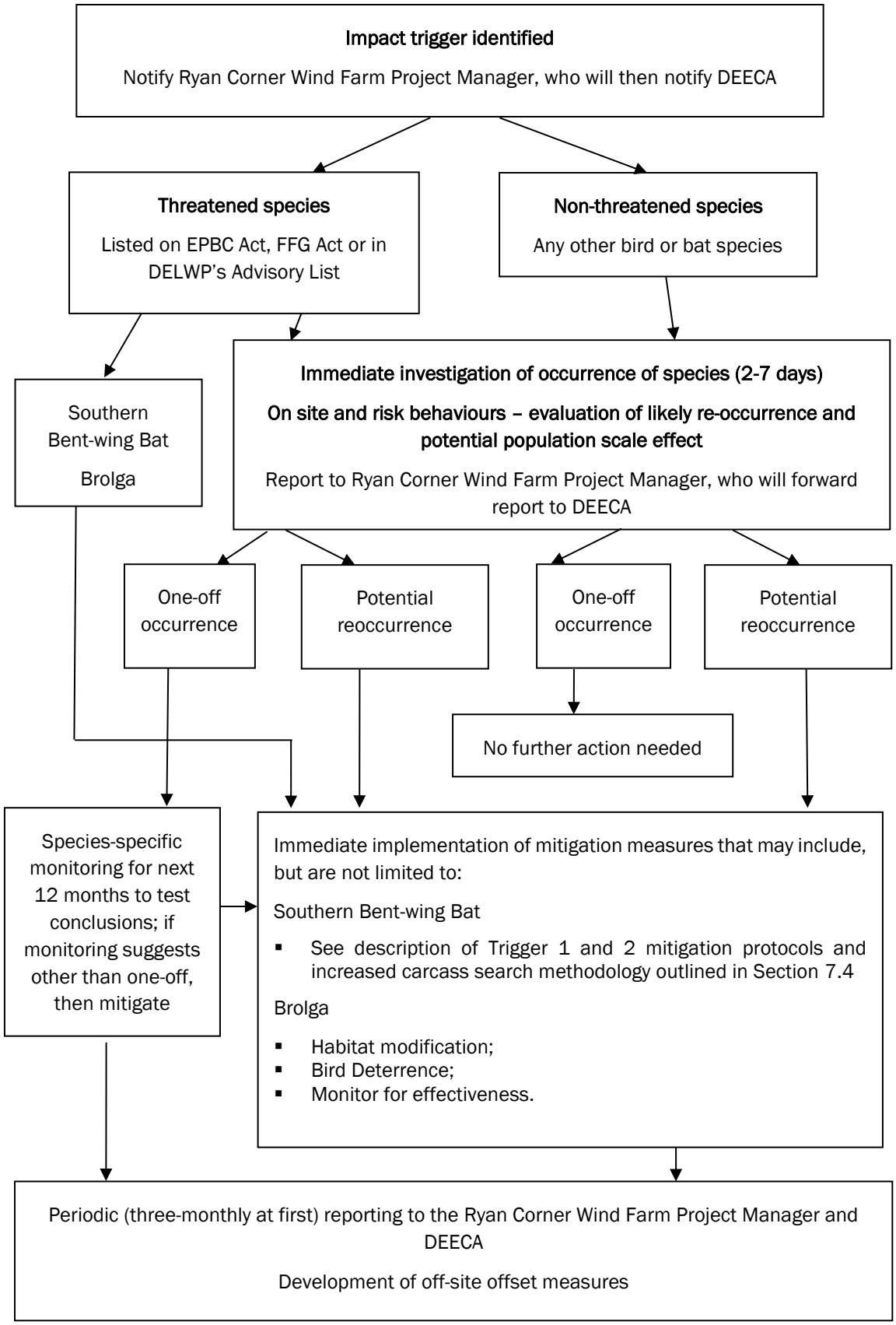
In the case of the Brolga, the regional framework for impact assessment established by DEECA provides an excellent basis for agreeing offset measures (DSE 2011). This framework is based on a Population Viability Assessment (PVA) that can model the dynamics of population impacts of wind farm effects, as well as the population impacts of mitigation and offsetting.

Impacts on Brolga from the operation of Ryan Corner Wind Farm must be net zero. If impacts are detected (i.e., one Brolga mortality), mitigation measures must be put in place in consultation with DEECA to ensure that this impact can be offset, including a management plan which stipulates for objectives, timeframes, actions (such as those suggested above), monitoring and regular reporting, with provisions for amendments and adaptation where necessary.

A similar approach will be considered for Southern Bent-wing Bat. As this species is known to be present at the Ryan Corner Wind Farm site, it is considered that any mortality cannot be defined as a “once off” when considered over the life of the wind farm. Upon a trigger occurring, immediate mitigation measures are required to be developed and implemented in consultation with DEECA to mitigate

impacts to the species. Mitigation measures such as turbine curtailment and ultrasonic acoustic deterrents will also be considered in addition to the suggestion above, in areas where turbines have been identified as having a heightened risk of collisions or where impact triggers have been met. However, these measures would also require further investigation in consultation with DEECA to provide the most effective implementation. Suitable curtailment protocol to increase the cut-in speed at which turbines operate during higher risk periods has been effectively used to mitigate microbat mortality (Bennett *et al*. 2022). It is noted that the Bennett *et al*. (2022) study found that approximately 80% of all bat strikes occurred during January to April.

Figure 5: Operational procedure for investigating impact triggers



8. COMPLIANCE SUMMARY

The following Table 7 indicates the sections of the Bat and Avifauna Management Plan that comply with the specific conditions outlined in the Planning Permit (no. 20060222-2). The conditions of the permit have been abbreviated but their full and correct wording can be found in the introduction.

Table 7: Sections within the BAMP that comply with the conditions of the Planning Permit for Ryan Corner Wind Farm

Condition number	Abbreviated condition details	BAMP Section/s
20a	Statement of aims and strategies for managing and mitigating significant bird and bat strike	4, 7
20b (i)	Presence, behaviour and movement of Brolga, especially breeding pairs	4.1
20b (ii)	Presence and activity of Southern Bent-wing Bats in the vicinity	4.2
20b (iii)	Species and number of bird and bat strikes	5
20b (iv)	Procedures for reporting of threatened bird/bat mortalities to the DEECA within 7 days	5, 7
20b (v)	Seasonal and yearly variation in the number of bird/bat strikes	5
20b (vi)	Bird/bat strikes at lit or unlit turbines	5
20b (vii)	Efficacy of searches for carcasses and *where practicable*, information on scavenger rates, so that the total number of mortalities can be corrected for	5
20b (viii)	Procedures for regular removal of carcasses likely to attract raptors	7.1
20b (ix)	Periodic reporting, within agreed timeframes, of monitoring to DEECA and the local community	3.1
20c	Recommendations in relation to a mortality rate which would trigger mitigation measures to be undertaken to the satisfaction of the Minister for Planning	7
20d	Strategy to offset impacts detected during monitoring to the satisfaction of the Minister for Planning	7
21	Reporting and reviewing procedures, where the Minister for Planning will then determine whether further investigations are to be undertaken	3.1

9. TIMEFRAMES AND RESPONSIBLE PERSONEL

This table outlines a general and approximate timeline for the post-construction monitoring surveys and reporting (Table 8).

Table 8: Approximate timeline for surveys and reporting after commissioning of turbines on the Ryan Corner Wind Farm.

Process	Details	Start	Finish	Report timing	Responsible party
Implementation of this BAMP	Oversee the full and complete implementation of all post construction monitoring activities according to the provisions outlined in this document	Commencement of turbine operation	24 months post operation	As per relevant monitoring activity below	The wind farm operator will appoint a qualified ecologist/ ecological consultancy
Preventive mitigation measures (Section 7.1)	Implementation of mitigation measures as detailed in Section 7.1 through maintenance of a log book.	Commencement of turbine operation	Ongoing as required	Part of annual reports	Wind Farm Operator
Mitigation response as outlined in this plan	Implementation of mitigation responses as agreed with the regulator based on, and informed by, agreed studies that demonstrate effectiveness of mitigation measures	Ongoing as required	Ongoing as required	As agreed with regulator	Wind Farm Operator
Brolga breeding surveys and reporting	The first monthly breeding surveys will commence on the first day of July after turbines are operational. The second will commence the following year. Brolga activity reports will be prepared in January (for the preceding breeding season) summarising the findings from the targeted Brolga investigations.	July	December January	One month after completion of surveys	Qualified ecologist
Brolga flocking surveys and reporting	The first monthly flocking surveys will commence on the first day of December after turbines are operational. The second will commence the following year.	December	June	One month after completion of surveys	Qualified ecologist

	Brolga activity reports will be prepared in July (flocking season) each year, summarising the findings from the targeted Brolga investigations.		July		
Southern Bent-wing Bat surveys	Surveys will begin in whichever month (Feb/Oct) follows turbine operation	February	March	Incorporated into annual reports	Qualified ecologist
		October	November		
Mortality surveys	Approximately one-third of turbines surveyed within one week per month every month for two years			Incorporated into annual reports	Qualified ecologist or specially trained searcher
Scavenger trials	Experimental trial designed to determine scavenging rate	Post-operation of turbines	-	Incorporated into annual reports	Qualified ecologist
Detectability trials	Experimental trial designed to determine detectability rate	Post slab laying	Operation of turbines	Incorporated into annual reports	Qualified ecologist
Targeted Southern Bent-wing Bat mortality surveys	Migratory intensive surveying (two periods included on right): 17 turbines to be determined by Dr Lumsden. Each turbine core area searched twice (within two days) per month	February	March	Incorporated into annual reports	Qualified ecologist or specially trained searcher
		October	November		
First year report	Comprehensive report of surveying methods and results (given mid-collection). Possible review of methodology. Discussion may include recommendations			Two months after 12 months of surveying	Qualified ecologist
Second year report	Comprehensive report of 24 months of surveying methods and results. Discussion will include (but not limited to) any significant impacts that may influence review proceedings.			Two months after 24 months of surveying	Qualified ecologist
Incidental reports	Any significant impacts outlined in section 7 may require immediate (email within three business days reporting) (and action) to DEECA and relevant authorities.			2-7 days of impact	Qualified ecologist

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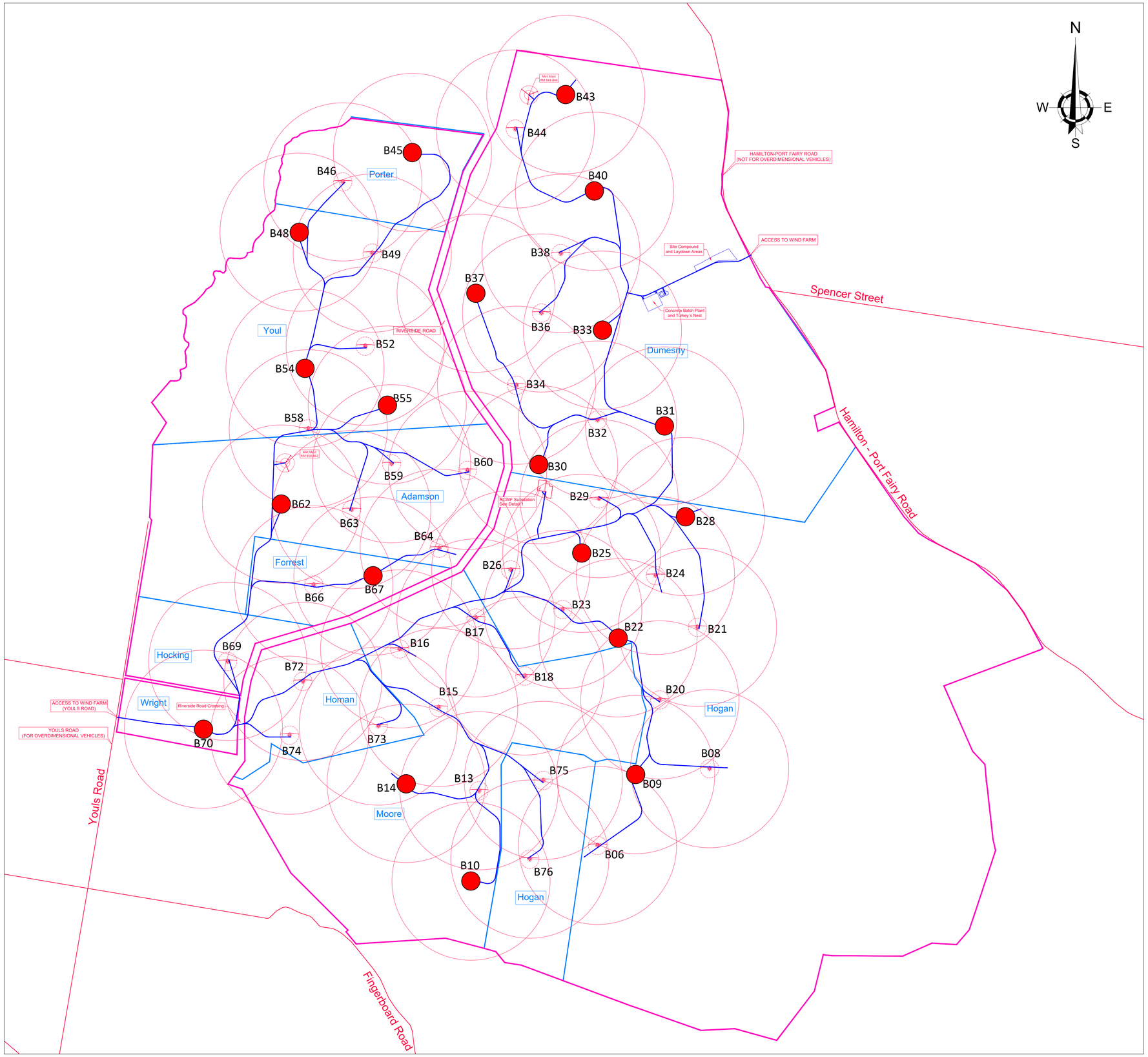
11. GLOSSARY

Bias (statistical)	there are several forms of bias that can be introduced to scientific studies, namely, selector bias, in which the replicates (turbines) are chosen where their probability of selection is not equal
Confounding variable	a variable that may influence the data to such an extent that it would alter outcomes; it is crucial to control its effects in design or analysis
Corvid	a species belonging to the Corvidae family; e.g., ravens, crows
Covariable	a variable that may influence the data, that is not relevant to the objectives of the investigation but which must be controlled for in design or analysis
Detectability	the probability that a searcher will detect an existing carcass
Ephemeral	lasting for short periods; the river does not flow for most of the year
Factor	a categorical independent variable; categories of interesting levels, e.g. a factor may be size and its levels are small, medium and large
GPS	Global Positioning Satellite
Power analysis	a statistical procedure to determine the number of required subjects (replicates) in a study to show a significant difference at a predetermined level of significance and size of effect
Raptor	a bird of prey; e.g. eagles, falcons and owls
Replicates	the number of subjects in a study or per level, the number cannot be too few as you cannot make any definite conclusions
Searcher	an ecologist that will search for carcasses in the mortality programs
Significant difference	a statistical term referring to a difference between two or more variables or groups; it is based on the assumption that the two or more variables are the same and therefore if you find there is a pre-determined level of difference you can accept they are statistically different. This is a very simple definition, for more information, there are many online dictionaries
Significant impact	generally a reduction in the number of individuals in a population; a more refined definition is impossible here as they are species-specific
Species of concern	the Brolga and the Southern Bent-wing Bat
Sample/study population	as it is impossible to gather information from an entire population (i.e., like sampling all human height >6 billion people), this is reduced to a sample of the entire population and as long as assumptions and random sampling (etc.) are adhered to conclusions can be made about the study population and related to the entire population
Variable	a parameter that varies, there are different types of variables, but generally it is a parameter you are interested in (also called the dependent or response variable: as it responds to a factor or independent variable)
Variation	many values calculate an average, therefore the actual data varies; the variation is a general term to refer to the calculated variation of the data (also sometimes called error, but error is also a more complex phenomenon)

Appendix 1: Layout with radius of 600 metres around each turbine and selected turbines for carcass searches



TURBINE ID.	GDA94 - MGA Zone 54 Coordinates (m.)		TURBINE ID.	GDA94 - MGA Zone 54 Coordinates (m.)	
	Eastings (X)	Northings (Y)		Eastings (X)	Northings (Y)
B6	598877	5759061	B38	598599	5763549
B8	599727	5759643	B40	598854	5764021
B9	599166	5759598	B43	598636	5764754
B10	597917	5758790	B44	598253	5764493
B13	597978	5759475	B45	597473	5764315
B14	597425	5759531	B46	596945	5764092
B15	597672	5760108	B48	596613	5763711
B16	597376	5760551	B49	597168	5763552
B17	597955	5760786	B52	597115	5762847
B18	598326	5760346	B54	596658	5762679
B20	599349	5760165	B55	597282	5762400
B21	599635	5760715	B58	596683	5762220
B22	599032	5760635	B59	597315	5761955
B23	598613	5760850	B60	597891	5761905
B24	599316	5761108	B62	596480	5761649
B25	598757	5761276	B63	597013	5761607
B26	598219	5761151	B64	597676	5761315
B28	599542	5761555	B66	596725	5761036
B29	598888	5761690	B67	597173	5761103
B30	598430	5761948	B69	597072	5760456
B31	599385	5762242	B70	595888	5759942
B32	598877	5762286	B72	596642	5760305
B33	598914	5762968	B73	597214	5759966
B34	598263	5762550	B74	596541	5759897
B36	598452	5763098	B75	598465	5759554
B37	597956	5763248	B76	598363	5758957

POINT ID	GDA94 - MGA Zone 54 Coordinates (m.)	
	Eastings (X)	Northings (Y)
Ryan Corner WF Substation - Fence Setout		
F1	598433.0447	5761833.8340
F2	598490.2903	5761824.5098
F7	598420.1837	5761754.8745
P1	598487.2540	5761805.7593
P2	598513.4093	5761801.4992
P3	598510.9797	5761786.6919
P4	598537.1350	5761782.4317
P5	598529.7400	5761737.0300
P6	598477.4294	5761745.5503
P7	598522.5058	5761692.6153
P8	598486.4805	5761698.4831
P9	598482.0054	5761708.3306
Met Mast		
RM B58-B62	596508.00	5761962.00
RM B43-B44	598357.00	5764752.00

SUBSTATION LOCATION - DETAIL 1
SCALE 1/2000

LEGEND

- WIND FARM BOUNDARY
- WIND FARM ROAD
- PLOT - LANDOWNERS
- WIND TURBINE & HARDSTAND AREA
- MET MAST
- CARCASS MONITORING

GPG
OPEN DRAWING EDITION
COPY FOR: COMMENTS
Date: 29/04/2024

NOTES

1. CAD file and external reference files are in GDA94 - MGA zone 54 Coordinate System.
2. Dimensions in meters

Ed.	Date	Designed	Pr. Eng.	Revised	Approved	Issued For
1		SAM	SAM	DHJM	BMJ	INFORMATION

Ryan Corner Development Pty Ltd

PROJECT:

RYAN CORNER WIND FARM

DRAWING TITLE:

WIND FARM GENERAL LAYOUT
600 m. radius influence from wind turbines

SCALE: INDICATED

CUST. CODE:

GPG CODE: 31405I00nnn

SHEET . NEXT

GPG Naturgy Group

IT 05993.ES-TI-FO.09-EN

DINA1

Appendix 2: Carcass data-sheet; to be used for any carcass searches, scavenger and detectability trials and incidental finds

RYAN CORNER WIND FARM – MORTALITY MONITORING PROGRAM: CARCASS DATA-SHEET*					
Details above the heavy line will be collected for each site searched. All details below the line are required if a carcass is found.					
Collector:		**Date:**	**Start Time:**	**Finish Time:**	
Turbine identifier (incl. lit/unlit):					
Vegetation	**Description (inc. vege type):**				
	Ave. height:	**Density:** Very Dense / **Dense** / Moderate / Sparse / Very Sparse			
Temperature:		**Wind direction/speed:**	**Humidity:**		
Search purpose (e.g. scavenger trial):		**If scheduled search; search completed: Yes / No**			
Onsite works in last 5 days:					
Weather conditions in last 5 days:					
Comments:					
Carcass details	**Time:**	**Coordinates:**	**Substrate:**		
Distance from Tower(m):		**Bearing from Tower (deg):**			
Species common name: **Scientific name:**			**Sex/age?:**		
Photo Taken**	Yes / No				
Carcass condition:					
Signs of injury:					
How old is carcass estimated to be	<24 hrs	1-3 days	> 3 days	Other:	
Other Notes: (incl. presence of stock)					

Please note: detailed information about each turbine (e.g. distance from water bodies) will be collected once; therefore the "turbine identifier" refers back to the information stored.

Post Find Actions:

1. Place carcass in sealable plastic bag then wrap it in newspaper and take to freezer at site office.
2. A copy of this completed form will be sent to the Regional Director, South West Region, Department of Sustainability and Environment, within three days of the date of the carcass find.
3. One form should be completed for each carcass found
4. **Please attach photo to this form

Appendix 3: Symbolix Letter November 2020

symbolix

making your data work harder

To: Jackson Clerke
Nature Advisory
Via email

Ref #: BLARCAH20201117a
Date: 24 November 2020
CC:

Re: Ryan Corner Wind Farm - Mortality Program Review

To whom it may concern:

Thank you for requesting our review of the proposed Post Construction Mortality Detection Program at Ryan Corner Wind Farm, in south-western Victoria. This letter outlines the scope of the review, our appraisal of the study, and final comments.

Scope of works

We were engaged by Nature Advisory, on behalf of Global Power Generation Australia Pty Ltd, to:

- Review the proposed design of the Post Construction Mortality Detection Program (including carcass searches, scavenger loss and searcher efficiency trials) for Ryan Corner Wind Farm, VIC.
- Prepare a letter of advice regarding the efficacy of the proposed design, referencing statistical adequacy.
- Comment on the intensive Southern Bent-wing Bat survey program
- Comment on the use of brolga carcass equivalents in the scavenger trials

In reviewing the documentation, we refer specifically to the following documents:

- Ryan Corner Wind Farm Bat and Avifauna Management Plan (Brett Lane & Associates 2018) (hereafter *BAM Plan*)
- We specifically refer to:
  - Section 5.1 *Mortality detection* and subsections;
  - Section 6.1 *Intensive Southern Bent-wing Bat monitoring program*

  - Other sections only as relevant to the sections under review.

- "Ryan Corner BAM Plan DELWP comments.docx" - word document from DELWP to Nature Advisory (undated)

Appraisal of the mortality study program

What are the required objectives for the Mortality Program?

Under condition 20 of the permit for the wind farm, the BAM Plan's Mortality Program must deliver:

- *a monitoring program of at least 2 years duration, either commencing upon the commissioning of the last turbine of the first stage of the approved development and use (if any) or alternatively, such other time of commencement as is to the satisfaction of the Minister for Planning. The monitoring program must include surveys during the breeding and migratory seasons to ascertain:*
  - [. . .]
  - *seasonal and yearly variation in the number of bird and bat mortalities arising from the operation of the wind energy facility;*
  - *the efficacy of searches for carcasses of birds and bats and information on the rate of removal of carcasses by scavengers, so that correction factors can be determined to enable calculations of the total number of mortalities;*

In addition, targeted carcass searches for the Southern Bent-wing Bat are required as per requested from DELWP and Dr Lindy Lumsden (ARI).

In the BAM Plan the response to this requirement is to propose:

- A structured survey program designed to estimate the total mortality of birds and bats (and species/size groups if sufficient carcasses found).
- An intensive survey program at specific times of year and turbines, targeting the Southern Bent-wing bats

This letter will assess the design based on current understanding of best practice for estimating mortality from carcass search programs.

Appraisal of the design

We briefly assess the design of the various component surveys designed to quantify searcher efficiency, scavenger rate, and mortality for the main component of the mortality survey design.

Statistical adequacy - searcher efficiency

We refer to Section 5.1.5 *Detectability trials* of the BAM Plan.

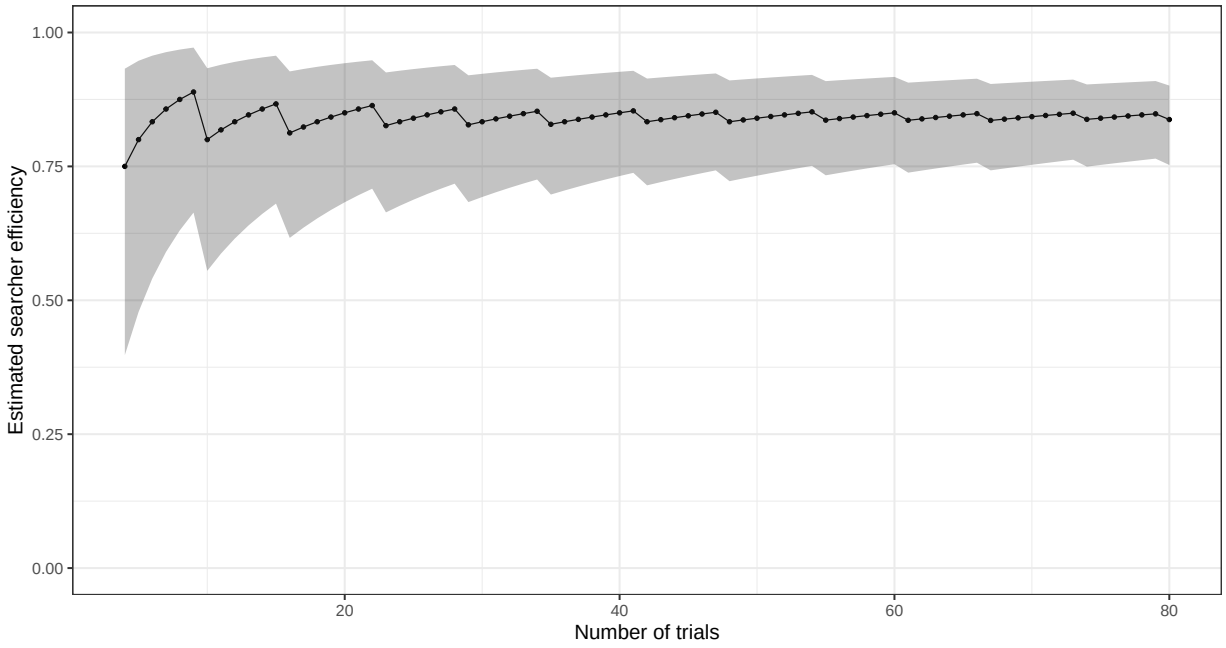


Figure 1: Estimated searcher efficiency (proportion of carcasses found) with 95% confidence bound for a given number of trials. Assumes an overall efficiency of 84.3%.

The above chart (Figure 1) has been calculated (Clopper 1934) as a scenario to highlight the issues with detectability trials. We have assumed that the "true" observer efficiency is 84.3%.

The coarse black line shows us the estimated efficiency, given a field trial of known sample size, and some number of detections. The 95% confidence window is shown by the grey shaded area. The jaggedness of all curves is a known effect, due to the nature of a dichotomous variable (i.e. "I found it/I did not find it").

There is little precision gain for adding more than 15-20 replicates for a given species class.

The number of replicates (20 microbats/small bird equivalents per year, 10 medium birds per year, and 10 large birds per year) proposed is statistically reasonable for the searcher efficiency, and will give appropriate confidence intervals for input into mortality estimation.

Statistical adequacy - scavenger rate trials

We refer to Section 5.1.4 *Scavenger rates and trials* of the BAM Plan.

We measure time to (scavenger) loss with on-ground trials and analysis using standard survival study methods ((Kaplan and Meier 1958), (Terry M. Therneau and Patricia M. Grambsch 2000)). Although cameras will be used at Ryan Corner, we still support survival methods to account for any unknown loss times (e.g. carcasses still in place at end of trial).

If we assume an exponential loss function for carcasses, the relative standard error (RSE) is a simple function of the number of carcasses lost: RSE $= 1/\sqrt{n}$. As Figure 2 shows, the precision is not vastly improved by increasing the numbers of trials.

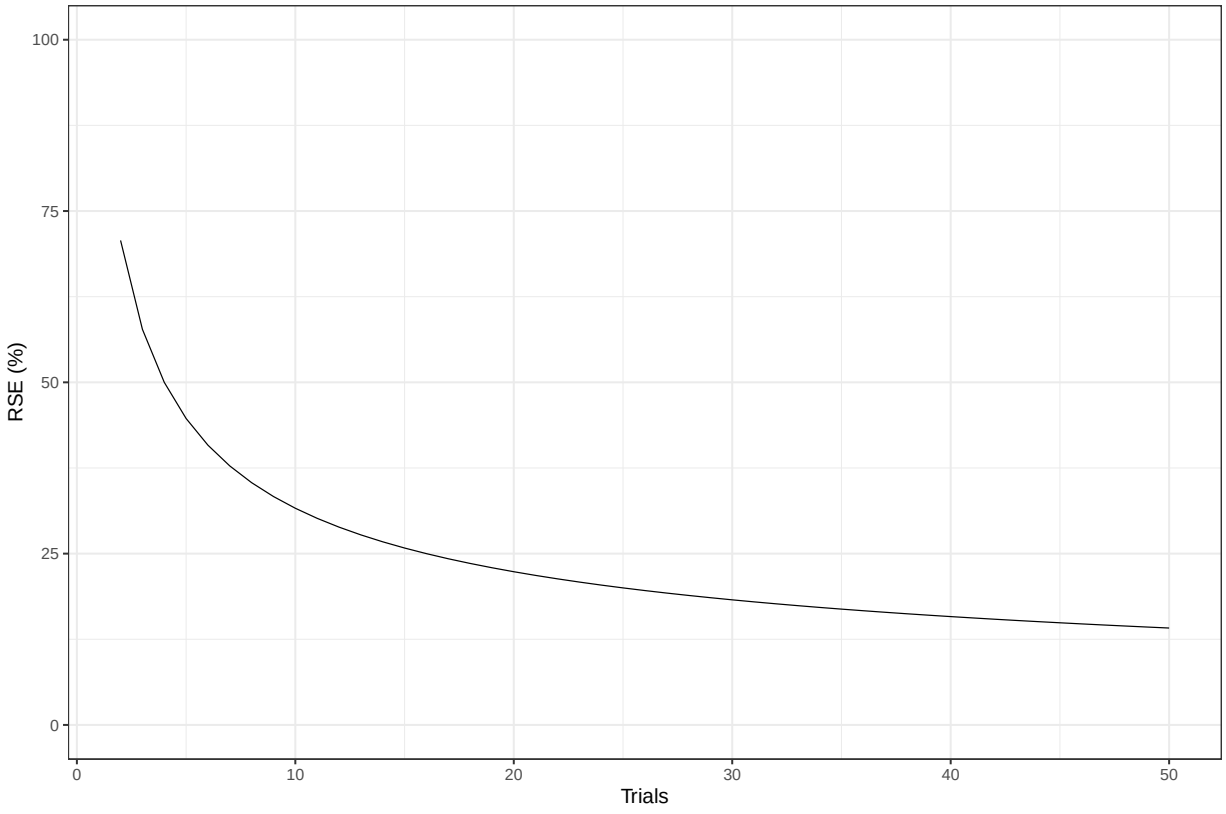


Figure 2: Relative standard error of scavenger rate as a function of carcasses lost

We would recommend 10 replicates per species class as a minimum. **The survey design proposed exceeds this, and therefore we conclude it is statistically sound.**

Statistical adequacy - carcass searches

We refer to Section 5.1.2 *Turbine selection* and 5.1.3 *Search protocol* of the BAM Plan.

The proposed carcass surveys will sample one-third of the turbines minimum (19 of 56). There

is no strict statistical rule for the right number of turbines sampled. It is more important to ensure the turbines are selected at random (assuming all turbines are accessible). This is the only way to enable an unbiased estimate of mortality. The survey will run for a minimum of two years, and has at least one survey per month, capturing seasonal variation on-site.

We also recommend the same turbines are searched each month. Having a consistent minimum time between searches minimises the variability in estimating the change a carcass has been lost to scavenge since the last survey.

The survey (as proposed in the BAM Plan) complies with these suggestions, and is statistically sound.

The proposed search areas (60m inner zone, and 120m outer zone) will capture 95% of the fall zone for bats and 95% of the fall zone for birds, according the models implemented from (Hull and Muir 2010).

Selection and timings

The three component surveys above are based on a single geographical site stratum. The land cover on the site is characterised as cleared grazing land with a limited number of small remnant areas of native vegetation (BAM Plan Section 1 *Introduction*). The choice of a single stratum is reasonable in this case.

Selecting turbines at random for the carcass search sample will ensure a unbiased sample of the turbines This is required to achieve a unbiased estimate of site mortality.

The searcher efficiency and scavenger rate trials will be timed to occur at times of the year that represent low vegetation load versus high vegetation load. This is a reasonable compromise between running multiple trials throughout the year, but still sampling the range of conditions that impact detection/scavenge activity.

Appraisal of the intensive bat survey

We refer to Section 6.1 *Intensive Southern Bent-wing Bat monitoring program* of the BAM Plan.

It has been requested by DELWP and Dr Lindy Lumsden (ARI) that intensive carcass searches for the Southern Bent-wing Bat are undertaken in Feb-Mar, and Oct-Nov. There are 17 selected turbines for this program, which are located to the west of the farm, and in proximity to nearby forest and river habitat. These turbines will be searched weekly in the 60m inner zone during the intensive survey period, using standard search protocols.

We discuss this separately to the general mortality study appraisal, as this is non-standard survey procedure.

The selection of turbines and timing of surveys for this program is non-random. Therefore, the

any analyses on this subset of turbines cannot be generalised to the whole of the farm, other Victorian sites, or other time periods. The data cannot be combined with the general mortality data.

As standard search protocols are used, an estimate of total Southern Bent-wing bat mortality can be obtained for the selected turbines and time periods only, using searcher efficiency and scavenger rate results from the general trials.

To summarise:

The DELWLP proposed change (Nature Advisory, n.d.) from monthly pulsed surveys to weekly surveys does not weaken the survey design, and is a statistically valid change. We caution that this data cannot be used to determine mortality for the period for the whole site (as the turbines are not statistically sampled but chosen in a biased way, based on assumption of higher risk). If a mortality estimate is carried out on these data, it is only applicable to the turbines and date ranges of the weekly surveys.

Comment on brolga equivalents in the scavenger and detectability trials

We note the recent request from DELWP to amend the scavenger and detectability trials to include 10 brolga equivalent carcasses.

It's not possible or ethical to source brolga carcasses for this trial and (we understand from conversations with Nature Advisory Ecologists) large birds like turkeys would have to be purchased live and culled by the field crews.

It's outside the scope of our professional training to quantify the ethical and OH&S implications of this request; suffice to say that we will not certify a design that requires ecologists to undertake animal slaughter without full ethics clearance and a very strong research justification. Contributing inputs to a statistical model for the purpose of furthering our research knowledge of the cumulative impacts of wind farms is not a strong enough justification, in our professional view as statisticians and environmental practitioners.

What are the implications if brolga-equivalent carcasses are not sourced?

- Mortality estimates can use scavenger / detectability rates determined from the large bird or general bird cohort in the proposed trials.
  - We do not know for certain the scavenge rate or searcher efficiency for brolgas. We do know that another roughly brolga-sized large bird, the Wedge-tailed Eagle, has a very long time to carcass loss (Stark 2020). Other birds / large birds in general (e.g. raven sized) do not have as long time to carcass loss as the WTE. We also know that birds (in general) have a high rate of detection in Victoria.
  - This suggests that using general bird / large bird rates as a proxy for brolga would

result in an underestimate of time to scavenge and a corresponding **overestimate** of mortality for brolga species. That is, we would tend to predict more brolga mortalities than then the actual. This is manageable with clear communication of the analysis assumptions when analysis is done.

- The Operational Procedures in the plan require immediate investigation upon **detection** of any threatened species, including Brolga.
  - As there is already a management plan based on actual counts of carcasses the role of the mortality estimation for brolgas is one of knowledge gathering rather than direct management or compliance. That is, the mortality estimates are useful for determining inputs for any future landscape scale cumulative research DELWP wishes to conduct.

With these considerations in mind we do not support the requirements to include brolga proxies in the study.

Final remarks

The survey program represents standard statistical best practice for estimating mortality at a wind farm, and satisfies the condition of the permit. It is consistent with other sites in Victoria, which enables future combined analysis. The pulse survey protocol over summer/autumn accounts for the shorter scavenge times expected for bat species.

The weekly carcass searches during October-November and February-March will use the same field protocols as the main survey. The data from these surveys will *"be available to DELWP and Dr Lumsden in hard-copy or electronic form and the information incorporated as a separate data appendix in the annual report"* (Brett Lane & Associates 2018). It is appropriate to treat this as a separate survey - the biased selection of turbines precludes its inclusion in an estimate of total site mortality.

The scavenger and detectability trials as proposed represent current best practice for these adjunct surveys. We do not support for the inclusion of brolga proxies in addition to the carcass sizes proposed. The statistical benefit does not outweigh the potential OH&S and ethical issues involved with sourcing carcasses of that size.

Regards,

Dr Elizabeth Stark MEIANZ

Managing Director - Symbolix Pty Ltd;

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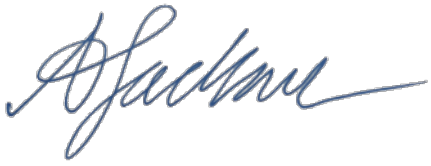

Alex Jackson

Consulting Analyst - Symbolix Pty Ltd;

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