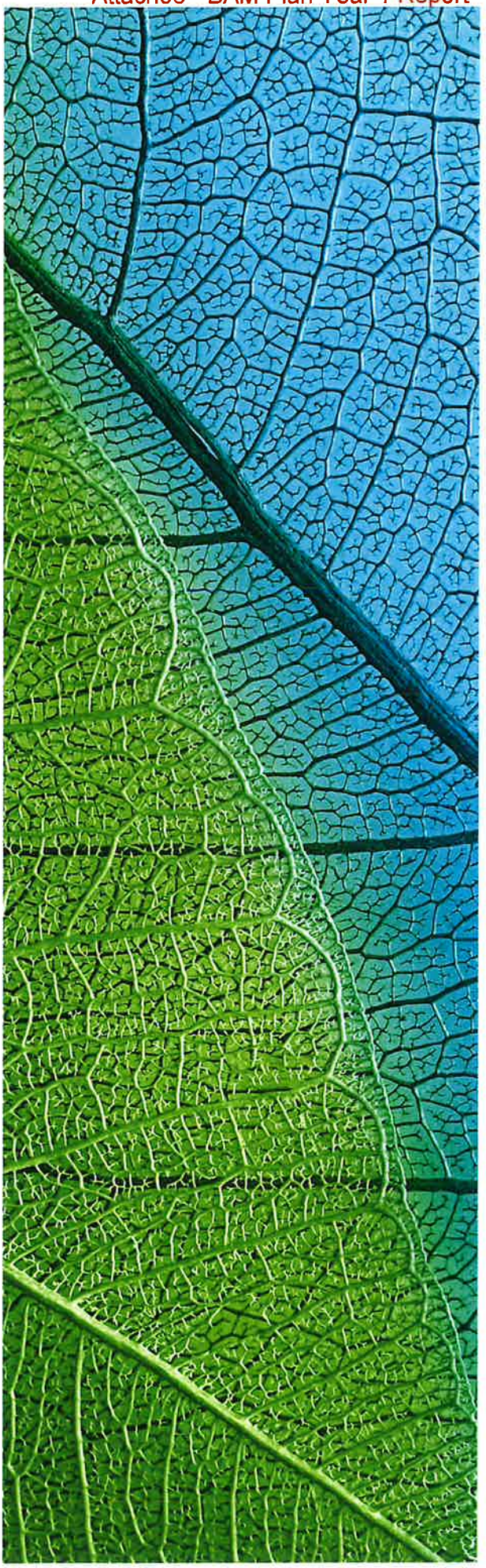

Salt Creek Wind Farm

Bat and Avifauna Management Plan – First Annual Report

BAM Plan Year 1 Report April 2020

MOYNE PLANNING SCHEME
THIS PLAN IS ENDORSED PURSUANT TO
PLANNING PERMIT No. **PL06/304.01**
SUBJECT TO THE CONDITIONS OF THE PERMIT AND
PROVISIONS OF THE MOYNE PLANNING SCHEME
Page 1 to 76 inclusive
Delegate: Date: 29/7/2020

Prepared for:
Salt Creek Wind Farm Pty Ltd

April 2020
Report No.15101 (17.3)

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1. Introduction

Salt Creek Wind Farm (SCWF) is located approximately 55 kilometres north of Warrnambool in Victoria's western district. The wind farm consists of 15 turbines with a maximum tip height of 150 meters, a switch yard and site office facility, interconnecting roads and associated infrastructure. The site itself is situated on approximately 750 hectares of grazing land. Scattered River Red Gum (*Eucalyptus camaldulensis*) trees exist on the western half of the site and several wind breaks consisting of young stands of planted Sugar Gum (*Eucalyptus cladocalyx*), Black Wattle (*Acacia mearnsii*) and various understory species occur on some paddock boundary fences. The majority of the site is cleared and supports only introduced pasture grasses.

The wind farm was granted planning approval by Moyne Shire Council of 8th June 2007 (Planning Permit No. PL06/304) subject to conditions, and was amended in February 2016 (PL06/304.01). Condition 33 of the planning permit stipulates the requirements of a Bat and Avifauna Management Plan (BAMP).

Jacobs (2017) developed a BAMP for SCWF which received approval from Moyne Shire and Department of Environment, Land, Water and Planning (DELWP) in 2017. Salt Creek Wind Farm Pty Ltd, a wholly owned subsidiary of Tilt Renewables Pty Ltd, (The Proponent) commissioned Nature Advisory Pty Ltd (formerly Brett Lane and Associates Pty Ltd) to implement the approved BAMP.

Nature Advisory has implemented elements of the BAMP since July 2018 as part of the approved monitoring program at SCWF including the following activities:

- Monthly carcass searches under all 15 turbines
- Scavenger trials to determine scavenging rates at the site
- Efficiency trials to assess the efficacy of searchers involved in the monitoring program.
- Brolga monitoring of wetlands:
    - Flocking site surveys - within five kilometres of the wind farm boundary; and
    - Breeding site surveys - within three kilometres of the wind farm boundary.
- Bat monitoring surveys.

This report covers the first 12 months of the SCWF BAMP implementation and is divided into the following sections:

Section 2: Aim of the BAMP monitoring program

Section 3: Determination of the monitoring period at dry, medium or wet

Section 4: Methods and results of the Brolga monitoring program

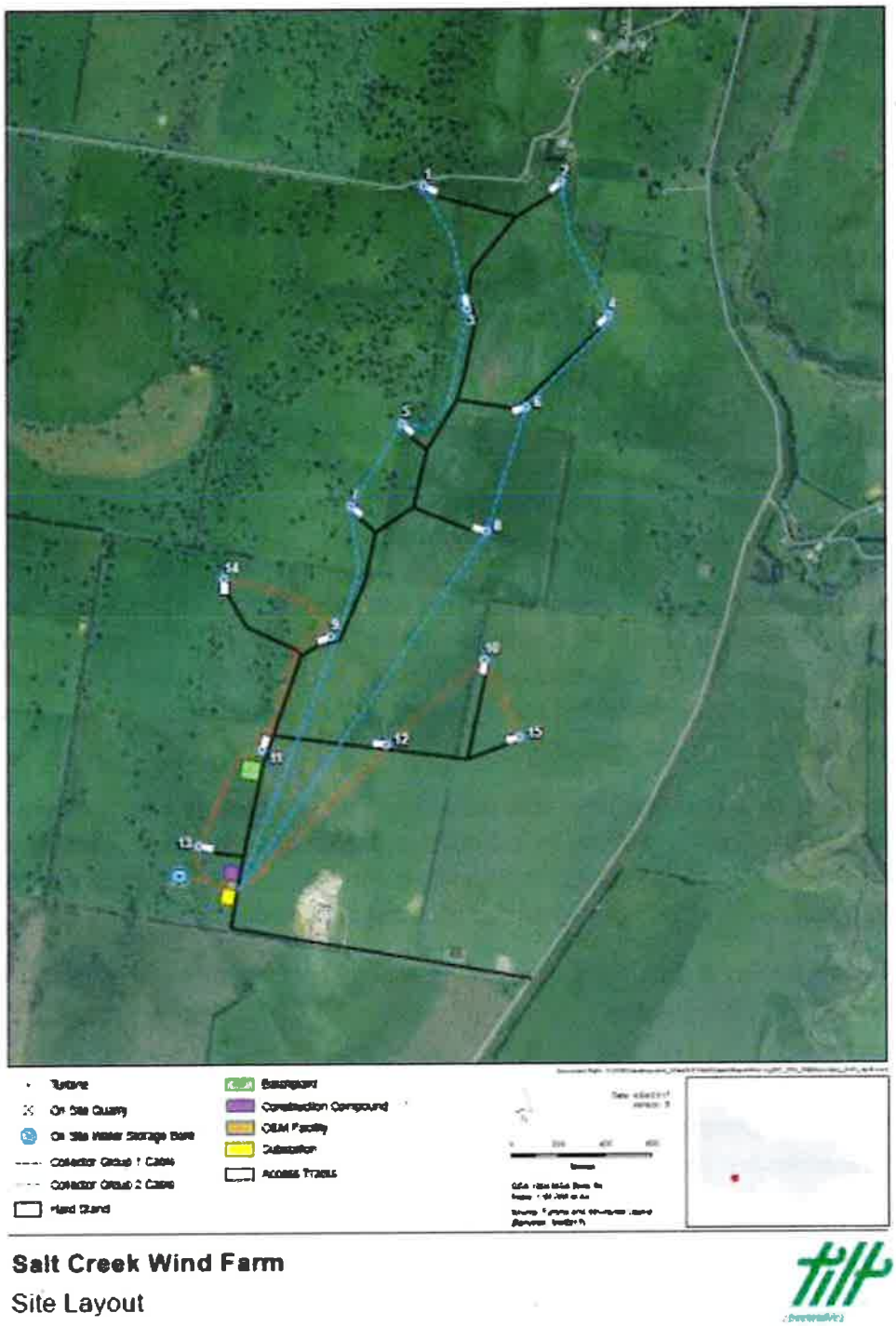
Section 5: Methods and results of the bat monitoring program

Section 6: Methods and results of the carcass monitoring program

Section 7: Discussion of the monitoring activities and further recommendations

This investigation was undertaken by a team from Nature Advisory Pty Ltd, comprising; Jackson Clerke (Zoologist), Beau Meney (Zoologist), Khalid Al-Dabbagh (Senior Zoologist), Peter Lansley (Senior Zoologist), Curtis Doughty (Senior Zoologist), Bernard O'Callaghan (Senior Ecologist and Project Manager) and Brett Lane (Principal Consultant).

Figure 1: Salt Creek Wind Farm locality



2. Objectives and Monitoring Activities

Condition 33 (PL 06/304) of the planning permit issued by the Shire of Moyne for the Salt Creek Wind Farm requirements are described below:

- *A statement of the objective of the BAMP*
- *A Brolga and Bat Utilisation Monitoring Program that:*
  - *Is consistent with the Draft Guidelines for Bat Survey in relation to Wind Farm Developments (ARI, 2007)*
  - *Must be implemented as soon as the use commences*
  - *Must run for a minimum of three years (but up to five years) in total*
  - *Must include provisions for assessment of the influence of wet and dry climatic conditions on the utilisation of the subject land by Brolga and bat populations. These provisions are to allow for the splitting of the monitoring program over non-sequential years so that results better reflect the long-term utilisation of the site by Brolgas and bats*
  - *The utilisation monitoring must occur in the first available 'dry', 'intermediate' or 'wet' year after the use commences. The determination of the year as 'dry', 'intermediate' or 'wet' must be endorsed by the responsible authority in consultation with the Department of Environment, Water, Land and Planning (DELWP) formerly known as the Department of Sustainability and Environment (DSE)*
  - *Provisions to assess the presence, behaviour and movements of any Brolga especially breeding pairs during their 'flocking' and 'breeding' behaviour periods, on the subject land and on land up to two kilometres away from any turbine (subject to third party approval being secured in writing by and at the sole cost of DELWP).*
- *A Bird and Bat Strike Monitoring Program to ascertain the species and numbers of any bird and bat strikes. The Program:*
  - *Must run for a minimum of three years in total*
  - *Must include a requirement for reporting any bird and bat strikes to DELWP within 7 days of the strike being detected*
  - *Must include the number of each species and preferably the age and sex of the birds and bats killed*
  - *Must include provisions that stipulate the timing and frequency of monitoring. This may include variations in timing and frequency of the monitoring so that it coincides with the behaviours and movements of specific species*
  - *Must, if installed, assess the occurrence of bird and bat strikes at turbines with aviation, obstacle, night time lighting versus those without*

- *Must include studies on the efficacy of searches for carcasses of birds and bats, and the rate of removal of carcasses by scavengers, so that firstly correction factors can be determined to enable calculations of the total number of mortalities and secondly so that a bat and bird strike monitoring program can be designed to give meaningful results. Studies should be undertaken during different seasons to determine seasonal variation in these factors*
- *The impact monitoring must occur in the first available 'dry', 'intermediate' or 'wet' year after the use commences. The determination of the year as 'dry', 'intermediate' or 'wet' must be endorsed by the responsible authority in consultation with the Department of Sustainability and Environment (DELWP).*

- *Provisions for review of the Brolga and Bat Monitoring Program at the end of the third year of monitoring to determine if species responses to the range of 'dry', 'intermediate' and 'wet' climatic conditions have been adequately addressed. Any further monitoring will be targeted at those species for which the strike rates show biologically significant impacts.*
- *A Mitigation and Management Strategy for any biologically significant impacts on Brolgas and bats arising from the wind energy facility operations. The strategy:*
  - *Must include mortality rates (as agreed with DELWP) for specific species which would trigger the requirement for responsive management and mitigation measures to be undertaken by the proponent*
  - *Must include measures to offset any significant impact. Significant impacts are to be pre-determined by agreement with DSE, the Responsible Authority and the permit holder. These measures may include, but are not limited to management or improvement of habitat or breeding sites away from the subject land to improve breeding productivity, or other offsets as may be agreed by DELWP.*
  - *May include procedures for regular removal of all types of carcasses (mammals, birds and reptiles) likely to attract biologically significant 'birds of prey' to areas near turbines if there is deemed to be a significant risk of impact with the wind turbine rotor blades.*
- *Regular Reporting Requirements. Reports of the findings of the Brolga and Bat Monitoring Program:*
  - *Must be documented by the Proponent within agreed timeframes*
  - *Must be made available to the public by the Proponent in electronic form via a website operated by the Proponent*
  - *Must be available to undertake studies on cumulative impacts which are referred to in Condition 34.*

The Bat and Avifauna Management Plan (BAMP) was prepared by Jacobs (2017) which received approval from Moyne Shire and DELWP in 2017. Salt Creek Wind Farm Pty Ltd (The Proponent) commissioned Nature Advisory Pty Ltd (formerly Brett Lane & Associates Pty Ltd) to implement the approved BAMP.

The BAMP aims to provide a strategy for managing and mitigating any significant bird and bat strikes arising from the wind energy facility operations. This is achieved by establishing monitoring and management procedures consistent with the methods outlined by the Australian Wind Energy Association (AusWEA 2005) and endorsed in the Clean Energy Council's Best Practice Guidelines (CEC 2018).

The objectives of this plan have been derived from the planning permit conditions and are specified in more detail below:

- To monitor the collision rate of birds and bats with the operating wind turbines, in particular:
  - Brolga (*Grus rubicunda*);
  - Southern Bent–wing Bat (SBWB) (*Miniopterus schreibersii bassanii*); and
  - Other species listed under the commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the state *Flora and Fauna Guarantee Act 1988* (FFG Act) and the Advisory list of Threatened Vertebrate Fauna in Victoria – DSE 2013 (the Advisory List).
- Detail information on the efficacy of searches for carcasses of birds and bats, and where practical, 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;
- To monitor the utilisation rates of SCWF by Brolga and SBWB and any impacts its operation may have on these species;
- Ascertain the occurrence of any seasonal and yearly variation, including for wet and dry climactic conditions, in the number of bird and bat strikes and Brolga and bat usage of the site, and whether further detailed investigations are to be undertaken in consultation with DELWP to the satisfaction of the Minister for Planning;
- To implement management, mitigation and/or offset measures, where required to respond to the impact of turbines on birds and bats;
- To report impacts of birds and bats within a public forum to allow for further studies into the cumulative impacts of wind farms on bird and bat populations; and
- Provide details of any responsive mitigation measures which may be implemented if the trigger mortality rate for a specified species is exceeded.

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

- Post-construction monitoring surveys, including carcass searches under operating turbines;
- Brolga and Bat monitoring;
- Analysis of the results from monitoring; and
- Reporting.

The BAMP is adaptive. Thus, management measures can be amended based on monitoring results to ensure a more effective implementation of the BAMP. Nature Advisory has implemented the monitoring program of the BAMP for SCWF during its first year of operation from July 2018 to June 2019.

3. Determination of the year as; dry, intermediate or wet

The SCWF BAMP states a requirement for the determination of a 'Dry', 'Intermediate' or 'Wet' year in order to address the requirements of conditions 33.b) iv) and 33.c) vii), in consultation with DELWP, to the satisfaction of Moyne Shire Council. The results of this standard, applied to the monitoring period covered in this plan, allow for additional analysis of the impacts the years rainfall may have had on monitoring results.

3.1. Methods

A weather protocol to determine each year as dry, intermediate or wet was developed and provided by DELWP using the following methods:

- Source Bureau of Meteorology (BOM) monthly rainfall data from 1979 – 2019 (Lake Bolac Post Office Station (BOM 2020));
- Calculate the 'total contributing rainfall' for each year between 1980 – 2019 by totalling the monthly rainfall from the preceding November to the end of the subject breeding seasons (the monitoring period, i.e. Year 1 = November 2017 – December 2018);
- Calculate the Mean and Standard Deviation of the total contributing rainfall 1980-2019 e.g. and
- Calculate the spread of data in a normal distribution and define Dry, Intermediate and Wet breeding seasons according to the Empirical Rule (68% of data falls within one Standard Deviation from the Mean, 95% fall within two standard deviations and 99.7% fall within three standard deviations):
    - Intermediate: One Standard Deviation of the Mean
    - Dry: Two/ Three Standard Deviations of the Mean (lower)
    - Wet: Two/ Three Standard Deviations of the Mean (upper)

3.2. Results

Appendix 1 contains monthly rainfall data, sourced from BOM (2020), where available.

Table 1 details the calculated Mean, Standard Deviation and as per the methods provided by DELWP described above and using the data contained in Appendix 1.

Table 1 This provides for the interpretation of a dry year, intermediate and wet.

The Mean was calculated to be 640mm and the Standard Deviation 112mm. Therefore; a monitoring period's rainfall within 528mm – 752mm is classed as an intermediate year, rainfall of <528mm is classed as a dry year and >752mm as wet.

The total rainfall for November 2017 to December 2018 was 508.6mm classing the year's rainfall as Dry.

Table 1: Classification of 12 monthly rainfall

1979-2019 Preceding November to December rainfall totals (mm)	
Mean	640
Standard Deviation	112
Year's rainfall classification	
Dry year	<528mm
Intermediate year	528-752mm
Wet year	>752mm

4. Brolga Utilisation Monitoring Program

The following section details post construction monitoring of Brolga in and around SCWF as outlined in the BAMP. The following surveys were undertaken:

- Flocking season surveys; and
- Breeding season surveys.

Figure 2 and Figure 3 show wetlands surveyed during the monitoring program.

4.1. Flocking season survey

Flocking season surveys were undertaken to determine any flocking activity occurring within a five-kilometre radius of the wind farm site. A flocking site must meet all of the following criteria described in the BAMP in Section 3.1.1. For a site to be considered a "flocking site" the BAMP states that the site must meet the following characteristics:

- More than one year of recording;
- More than 10 Brolga observed at the site;
- Brolga observed more than one month at the site;
- Site comprises deep freshwater marsh or permanent open water; and
- Be located within five-kilometre search area (of the wind farm).

Any identification of a flocking site would trigger further surveys, as per the BAMP.

4.1.1. Methodology

During the Brolga flocking season, dawn and dusk surveys were conducted at all accessible wetland sites within SCWF and a five-kilometre buffer to determine the presence or absence of Brolga, and if present; the size of any flocks encountered.

Any flights were monitored and recorded on a field map to see if the Brolga were at risk of collision with turbines by flying through the SCWF.

Surveys were carried out by a single observer using a vehicle over one to two days per month, from December 2018 to June 2019.

4.1.2. Results

A total of 18 wetlands were surveyed during the Brolga Flocking surveys (Figure 2). The following was noted during the survey:

- In December 2018 six of the wetlands surveyed held some water, namely wetlands numbered 1, 29205, 29214, 29226, 29243, and 30374;

- All wetlands were dry during January and February 2019. A number of wetlands were ruled out as unsuitable for flocking during these initial surveys, as they lacked water due to being drained or had been ploughed. These wetlands were not revisited; and
- During the other months of the survey (March 2019 onwards), some water was present in only in a small number of wetlands each month. Thus, the survey focused on those wetlands holding water during March to June namely wetlands numbered; 29150, 29182, 29214 and 30369. Appendix 2 contains detailed results of flocking season surveys and the status of the wetlands surveyed.

In summary, Brolga were found at only one wetland during the surveys of the flocking season. The brolga were recorded at wetland no. 30369, approximately 4.1 kilometres to the south of the wind farm boundary. Two birds were recorded at the wetland during each survey from March through to June 2019, i.e. on 29th March, 18th April, 24th May, and 19th June. This event does not meet the criteria for a flocking event as per the criteria outlined in Section 3.1.1 of the BAMP and summarised above in Section 4.1. There were no reports to DELWP of potential flocking sites as a site meeting the definition of a flocking site was not recorded within the five-kilometre search area.

4.2. Breeding Season

Breeding season surveys aimed to capture any nesting activity taking place on traditional or new breeding sites on wetlands within a three-kilometre radius of the wind farm site. The surveys were designed to meet the requirements of Section 3.1.2 of the BAMP.

4.2.1. Methodology

The process of wetland survey was:

- Initial survey was complete to review that status of wetlands;
- Wetlands were identified where access was required. This was sent to DELWP and Moyne Shire and access was organised to survey these wetlands (mostly to the north of the SCWF);
- Monthly surveys were undertaken from July to December 2018 that included all accessible wetlands and known historical Brolga breeding sites at the SCWF and three-kilometre radius as outlined in Section 3.1.2 of the BAMP. The wetlands surveyed are outlined in Figure 3;
- The searches were undertaken during daytime by a trained and qualified zoologist; and
- Sites were travelled to by vehicle. The site surveys were undertaken by one zoologist on foot or by car using binoculars and a telescope from roadsides or directly accessing properties where possible.

4.2.2. Results

The number of wetlands surveyed that contained water (other than in drainage ditches) each month is presented in Table 2 below. Appendix 3 contains detailed results of the breeding season surveys.

Table 2: Wetland inundated during breeding surveys

Month surveyed 2018	No. of wetlands inundated	Brolga present?
July	3	No
August	10	No
September	10	Yes – at a single wetland (See below)
October	10	No
November	9	No
December	6	No

During the breeding season surveys, Brolga were recorded on only one occasion in September. They were recorded at wetland no. 29150 (at a distance of 3.25 km at its closest point, north-west of the closest turbine, Salt Creek WF WTG 1). There was no breeding activity recorded at this time. No other Brolga were recorded within 3 km at other times during the breeding season survey. There were no reports to DELWP of potential breeding sites as a breeding pair was not recorded.

The lack of breeding records in the 2018 season was considered to be unusual. A number of the wetlands surveyed within 3 km of the SCWF did not fill. It was also noted that there appeared to be much less rain than typical in the critical months of September and October 2018 (BoM 2019, see Appendix 1). It is plausible that the 2018 breeding season was too dry to sustain any Brolga breeding within 3 km of the SCWF.

4.3. Summary of brolga surveys

4.3.1. Flocking

There are no historic flocking records within five kilometres of the SCWF.

The surveys focussed on wetlands within five-kilometres of the SCWF. Two Brolgas were recorded within the search area (Wetland 30369) during four separate monthly flocking surveys. No Brolga activity that met the definition of flocking was recorded during the survey at any site.

4.3.2. Breeding

There were historical records of Brolga breeding within three-kilometres of the SCWF as shown on Figure 3. During the 2018 breeding season surveys there were:

- No Brolga breeding activity recorded within the three-kilometre survey radius;
- Only one record of a pair of Brolga at wetland 29150 that were not recorded during the monthly survey to undertake nest building towards a breeding attempt; and
- Rainfall records in Appendix 1 and wetland condition observations in Appendix 3 show a clear tendency towards a dry breeding season making it unfavourable for nesting.

It is therefore recommended to continue monitoring for Brolga as per the SCWF BAMP. No additional actions in relation to Brolga are considered necessary at this stage.

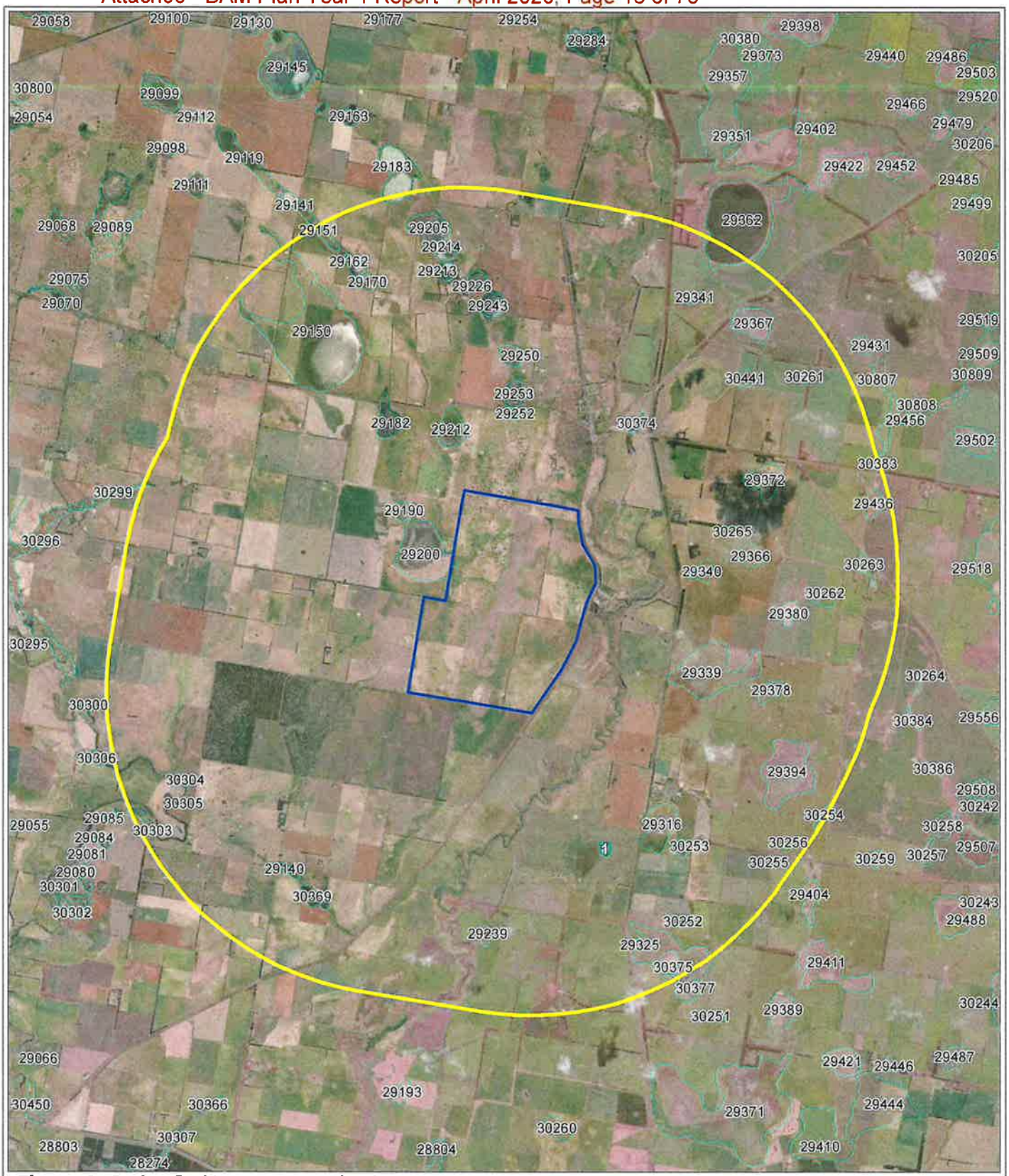


Figure 2: Brolga flocking survey wetlands

Project: Salt Creek Wind Farm **Client:** Tilt Renewables **Date:** 20/03/2020

SCWF boundary
Study area (5km buffer)
DELWP wetlands

N

Metres
0 1,200

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Figure 3: Brolga breeding survey wetlands

Project: Salt Creek Wind Farm **Client:** Tilt Renewables **Date:** 27/08/2019

- SCWF boundary
- Study area (3km buffer)
- ⊗ Historical past Brolga breeding records
- DELWP wetlands

N

Metres 0 800

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5. Bat Utilisation Surveys

Section 3.2 of the SCWF BAMP details the requirements for bat surveys. In summary, the BAMP states that the Anabats will be programmed to operate between sunset and sunrise over a six week period, over two periods, during early summer to early autumn (November – March) when bats are likely to be most active, as indicated through knowledge of a number of species seasonal cycles and results of the pre-construction survey. In accordance with the Arthur Rylah Institute (ARI) Guidelines, the two Anabats at each of the four sites will operate at the exact same time to allow direct comparison. The period of sampling will be scheduled during optimal weather conditions, which are relatively mild with no rain and preferably only light winds. The BAMP states that Anabats will be attached to Turbines 2, 5, 10 and 13.The above text as drawn from the BAMP indicates that a minimum of six weeks of recording over 2 periods is required to fill this requirement. In response to this requirement in the BAMP the following bat utilisation surveys were undertaken:

- Spring-Summer 2018 survey from late October to late December 2018, at the four turbine locations identified in the BAMP (Turbines 2, 5, 10 and 13); and
- Summer–Autumn 2019 survey from early February to mid-April 2019. Bat recordings were made from the same turbines and at same positions as those used during spring survey (Turbines 2, 5, 10 and 13).

These proposed periods are around 12 weeks – which is over 100% more than the requirement outlined in the BAM Plan. These surveys were designed to undertake detailed studies of the possible use of the wind farm by threatened bats, particularly the Southern Bent-wing Bat (SBWB), including their number of calls recorded, activity and distribution within the wind farm sites.

5.1. Methods

During the two seasonal surveys, automated bat detectors recorded the species-specific echolocation calls of free-flying bats at the four turbines identified at the SCWF. The SCWF BAMP identified four turbines (Turbines 2, 5, 10 and 13) to be surveyed.

The bat detectors were placed in the following locations:

- At ground level; and
- At nacelle height – approximately 85 metres above the ground.

Logistically it is not possible to place the bat recorders at heights of 50 metres on an operating wind turbine. This is not possible and risks entanglement of the recorder with the spinning rotor blade which could have severe consequences. Thus, a new approach to monitoring was utilised where the ultrasonic microphone was extended out the back of the nacelle at approximately 85 metres. The SongMeter was housed within the nacelle. DELWP confirmed two detectors being placed at a height of 85 metres rather than 50 metres is acceptable. The placement of the SongMeter was completed by a qualified wind farm technician.

While the BAMP specifies 'Anabats' this is noted as a generic way to refer to bat recorders. As DELWP have confirmed that 'Anabats' are considered interchangeable with 'SongMeters'.

The detectors used were new SongMeter 4 (SM4BAT ZC) (interchangeable with Anabat variety recorders outlined in the BAMP) with an external microphone. The SongMeters were programmed to commence operation approximately 30 minutes before dusk, and to cease approximately 30 minutes after dawn. Each SongMeter unit used a 64GB SDHC card that recorded bat echolocation calls, along with the date and time of each call.

Recordings were made concurrently at ground level (one metre) and at 85 metres above ground at nacelle height where the SongMeter microphones were mounted on top of the nacelle roof.

Calls from the units were downloaded and sent to Rob Gration (Australian Bat Specialist, Newport, Victoria) for identification. The files from the recording sites were viewed in Kaleidoscope software (Supplied by Wildlife Acoustics Inc., USA), which provides a sonogram display of frequency versus time. Call identification was based on a key developed by comparing the characteristics of bat calls within reference calls from known species recorded across Australia. Identification is largely based on changes to frequency patterns over time, especially as the characteristic frequency changes. Only those recordings that contained at least two definite and discrete calls were classified as bat calls. For most species, a call sequence of several seconds in duration is required before identification can be made confidently.

For the purpose of the current surveys, the calls files with 45–55 kHz frequency were considered for the identification of the threatened species, namely the SBWB or its complex. Notwithstanding the frequency is slightly lower than expected, call identification is based on the pulse characteristics consistent with reference calls i.e. pulses (0.10-0.24) showing relatively long characteristic section that is not present in Little Forest Bat and Chocolate Wattled Bat calls. SBWB sonogram is shown in the Figure 4 below and positive identification was made by comparing it to a reference call recorded at Panmure Cave, Victoria.

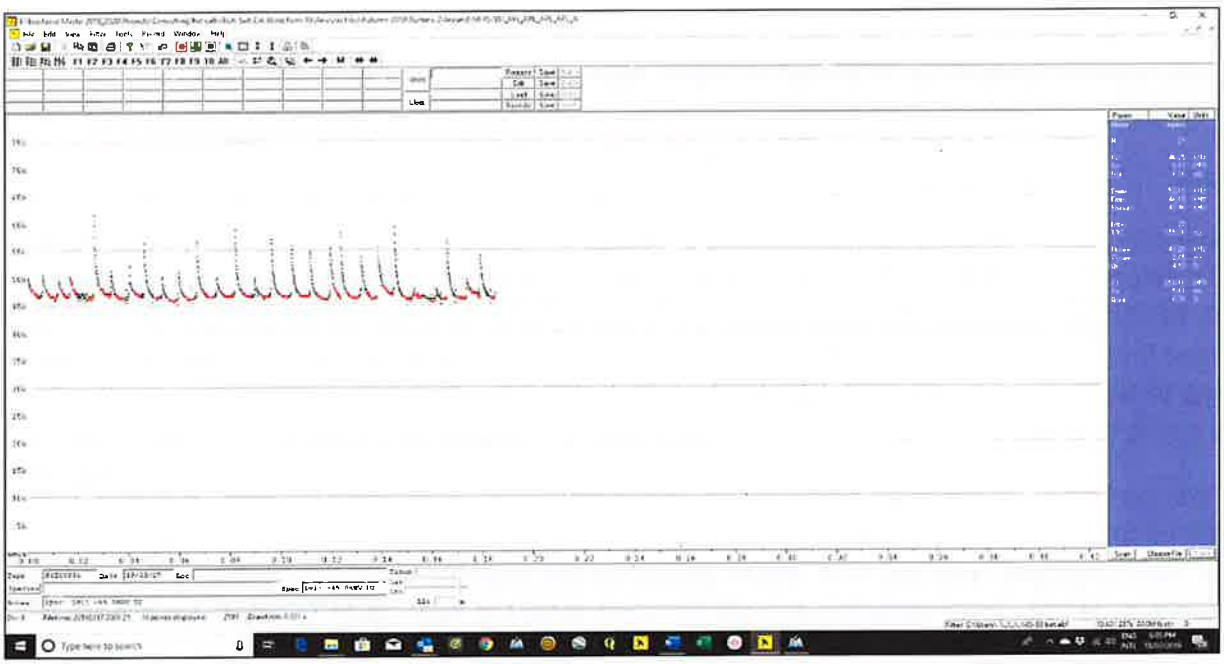

Figure 4: A representative call of Southern Bent-wing Bat recorded at Salt Creek WF.

5.1.1. Limitations

The identification of echolocation calls from microbats in south-eastern Australia is facilitated by the fact that many calls are species-specific. Calls that could not be identified definitively were allocated to species complexes.

A further limitation in the use of this technique is that it is not possible to census bat numbers. For example, 10 calls of a particular species may be recorded but it is not known if this represents 10 individuals of that species or one individual of that species flying past the bat recorder 10 times. Therefore, it is not possible to determine utilisation rates, only activity levels.

Occasionally recording devices such as those used in the survey experience technical difficulties, which are not uncommon. As a result, short periods of time may not be recorded and total hours of recordings vary between the different recorders. Weather conditions including severe storms during the recording period may at time interfere with the recording process.

The bat detectors used during this survey sample a limited airspace to a distance of approximately 20–30 metres.

The recording of calls by extending a microphone from the nacelle has not been often undertaken in Victoria. There may be limitations with this method due to noise of the nacelle moving or other technical issues. These are discussed more in the results section below.

Finally, bat activity levels may vary in response to weather variables such as air temperature, relative humidity, barometric pressure, wind speed, direction & gusts, rain and moonlight. Typically, bats are found to be less active during the following circumstances (G. Richards; pers. comm.):

- During periods of full moon, and when the moon is high in the sky;
- At higher wind speeds a decrease in activity may be observed at wind speeds over 10 metres per second (recognising recordings at higher wind speed may be attenuated); and
- During moderate to heavy rainfall.

5.1.2. Timing of the Surveys

The timing (dates) and the number of hours of recording during the two seasonal surveys at SCWF are summarised in Table 3. This period covered the peak migration periods of the SBWB discussed with DELWP as outlined in the email on the 5 December 2018. The two survey periods would as to extend from October to November and February to March. The BAMP stated the monitoring should begin in November however was adjusted to include October which is considered to coincide with the spring migration.

As per the BAMP, a total of six weeks of concurrent recording, between ground and at height, was required to be undertaken during each survey period. Songmeters were left in place to record once they were deployed until the next search period by the zoologists and the next servicing of the turbines at height. Thus, recording periods for some locations were up to 95 days (i.e. the SCWF engineering technicians retrieved the recorders at height during servicing). However, each period covered at minimum of 7 weeks of simultaneous recording at the ground level and nacelle height from the 1st of November to 20th December 2018 for Spring-Summer and 21st February to 11th April

2019 for Summer-Autumn. Comparisons were made between these concurrent recordings where possible, but any other recording of note outside this were also included.

Overall, bat recording during the Spring–Summer survey included over 591 detector-nights (7044 bat–hours) from the four pairs of SongMeter recorders. Each pair recorded concurrently at one of the four selected turbines (T2, T5, T10, T13) from two sub-sites; on ground and at 85 metres above ground from a SongMeter mounted on the roof of the turbine Nacelle.

The recorders at ground level were placed by Nature Advisory technical staff. The recorders at height were placed by technicians from SCWF as permits to operate at height are required to work at the top of the wind turbine.

During Summer–Autumn survey, Bat call recording totalled 466 detector-nights (4872 bat–hours) from the same number and arrangement of SongMeter as the Spring survey.

The number of recording nights is detailed in Table 3 below. Most SongMeter 4s operated effectively. There was an equipment failure for turbine 2 at height in the Summer-Autumn survey where the recorder only recorded for 31 nights. Overall, monitoring was in excess of the 6 weeks per period required in the BAMP.

Table 3: Timing of the two seasonal surveys at Salt Creek Wind Farm

Turbine & position		Spring-summer 2018 survey			Summer-Autumn 2019 survey		
		Recording dates		No nights	Recording dates		No. nights
T2	Ground	26/10/2018	18/12/2018	53	21/02/2019	11/04/2019	49
	Nacelle	3/11/2018	3/02/2019	92	4/02/2019	7/03/2019	31
T5	Ground	26/10/2018	19/12/2018	54	21/02/2019	11/04/2019	49
	Nacelle.	4/11/2019	4/02/2019	92	4/02/2019	8/04/2019	63
T10	Ground	26/10/2018	20/12/2018	55	21/02/2019	11/04/2019	49
	Nacelle	1/11/2018	4/02/2019	95	4/02/2019	12/04/2019	67
T13	Ground	26/10/2018	20/12/2018	55	21/02/2019	11/04/2019	49
	Nacelle	1/11/2018	4/02/2019	95	4/02/2019	14/04/2019	69
Total nights of recording				**591**			**426**

5.2. Results of the survey

The following section details the bats recorded on-site and threatened species recorded, their related status and activity at the wind farm. The detailed analysis focused on the SBWB as it is highlighted as a species of concern in the BAMP. Other common species have not been included in the analysis.

The identification of echolocation calls from microbats in Australia is facilitated by the fact that many calls are species-specific; however, not all species can be consistently or reliably identified using this technique. The identification of SBWB calls using ultrasonic bat detectors is difficult and often key salient call characters may not feature prominently in all recordings. This leaves open the possibility that the call may belong to one of the Little Forest Bat or the Chocolate Wattled Bat. Calls that could not be positively identified were allocated to the category Southern Bent-wing Bat/Little Forest Bat/Chocolate Wattled Bat species complex.

Several other common bat species were also recorded across the wind farm. These species included the Chocolate Wattle Bat, Gould's Wattled Bat, Little Forest Bat, Forest bat complex (*Vespadelus darlingtoni, V. regulus, V. vulturnus*) and the Long-eared Bats (*Nyctophilus geoffroyi, N. gouldi*).

5.2.1. Bat activity

Bat activity at SCWF compares well with other wind farms in similar settings (BL&A; unpublished reports), with most activity originating from common and widespread species with threatened species constituting only a very small section of the bat fauna.

Table 4 provides a summary of the bat species recorded at ground level and at height.

Table 4: Summary of species recorded with call frequency between 45-55 Khz

Season	Turbine	Position	SBWB calls *	Sp. Complex - SBWB **	Chocolate Wattled Bat	Forest bat Species Complex ***	Long-eared species #
spring	T2	gr.			y	y	
		nac			y	y	
	T5	gr.			y	y	
		nac			y	y	
	T10	gr.			y	y	Y
		nac					
	T13	gr.				y	
		nac					
Autumn	T2	gr.	y	y	y	y	
		nac			y		
	T5	gr.			y	y	y
		nac				y	
	T10	gr.	y	y	y	y	
		nac					
	T13	gr.	y	y	y	y	y
		nac			Y		

Notes: see Appendix 5 for more detail on the analysis.

* Confirmed SBWB calls

** SBWB Species complex -*Miniopterus schreibersii bassanii | Chalinolobus morio / Vespadelus vulturnus*

*** Forest bat species complex includes - *Vespadelus darlingtoni / V. Regulus / V. vulturnus*

\# Long eared species include *Nyctophilus geoffroyi / N. gouldii*

It is noted that most of the species were recorded at ground level. While the Chocolate Wattled Bat was recorded at height at three of the turbines and Forest Bat species recorded at height at two of the turbines. The Little Forest Bat and the Long-eared Bats were recorded only at ground level.

The White-striped Freetail Bat (WSFB) with its call frequency between 10-18kHz was very common at the nacelle height in autumn and spring. In summary, of the 18,432 nacelle files recorded in autumn and spring, 11,076 were in the 10-18khz filter range which belongs to WSFB and some

noise. Only 1,148 were in the 20-44Khz i.e. bats other than WSFB frequency range and SBWB frequency range as outlined in the Table 4 and some noise files. The presence of this bat species on-site was also confirmed in the carcass searches (see Section 6.2.3. below).

The Gould's Wattled Bat has a call frequency of around 30 KHz. This species was recorded frequently both at ground level and nacelle level. The presence of this bat species on-site was also confirmed in the carcass searches (see Section 6.2.3. below).

5.2.2. Southern Bent-winged Bat activity

For the current survey, detailed call analysis focussed on the threatened SBWB and the species complex in which it is a member. The threatened Yellow-bellied Sheathtail Bat was not recorded at SCWF during these surveys.

The threatened bat, namely **Southern Bent-wing Bat** (*Miniopterus schreibersii bassanii*) was recorded during the two seasonal surveys as outlined in Table 5. In addition, one species complex was recorded which included the bat species Chocolate Wattle Bat, Little Forest Bat and SBWB (*Chalinolobus morio, Vespadelus vulturnus, M.s. bassanii*). The assignation of a call to the complex indicates that the call was not able to be distinguished on call characteristics as to whether it belonged to any of these three species. This species complex includes the threatened SBWB as one of its members Table 5.

The level of occurrence of the threatened SBWB can be inferred from the frequency of its calls recorded at ground level and at height at the selected four turbines where recording took place. Table 5 provides the details of the two seasonal records including, number of calls of SBWB and the species complex, position (height), number of days of actual records and number of total days of recordings.

The results of the survey as outlined in Table 5 indicate:

- Spring-summer 2018:
    - No SBWB recorded at ground level or at height;
- Summer-autumn 2019:
    - Five SBWB calls were recorded from three of the four locations at ground level; and
    - No SBWB calls recorded from the four recorders at height during summer-autumn survey,
    - The five SBWB calls were recorded on five separate nights (one call per night) out of a total of 230 recording nights at ground level (2.2 % of all ground level recording nights) of operation;
    - Fourteen calls of the SBWB species complex were recorded during Summer–Autumn survey and from the same three turbines where the positively identified SBWB calls were recorded Table 5.

The height distribution of the threatened bats was studied by placing the SongMeter microphones at two different heights; on ground and a microphone extending from the rear of the turbine nacelle, approximately 85 metres above ground. The following is noted:

- All SBWBs recorded and all species complex calls that may contain the SBWB were recorded at ground level; and
- There were no SBWB and complex calls recorded at 85 metres height above the ground.

Overall, the number of calls of confirmed SBWB were very low with five confirmed calls. If all SBWB calls are combined with the calls from species complex containing the SBWB the total number would be 19 calls during the Summer–Autumn survey (0.05 call per night) over 426 recording nights.

Table 5: Results of the two seasonal recordings of the calls of threatened bats at Salt Creek WF.

Season	Turbine	Position	SBWB calls	Sp. Complex*	Tot. nights of recording (1,017 night)
Spring–Summer 2018	T2	Ground	0	0	53
		Nacelle	0	0	92
	T5	Ground	0	0	54
		Nacelle	0	0	92
	T10	Ground	0	0	55
		Nacelle	0	0	95
	T13	Ground	0	0	55
		Nacelle	0	0	95
Summer–Autumn 2019	T2	Ground	2	3	49
		Nacelle	0	0	31
	T5	Ground	0	0	49
		Nacelle	0	0	63
	T10	Ground	1	7	49
		Nacelle	0	0	67
	T13	Ground	2	4	49
		Nacelle	0	0	69
Total calls			**5 (5)****	**14 (12)**	

Notes: * The Species complex includes the Chocolate Wattle Bat, Little Forest Bat and Southern Bent–wing Bat (*Chalinolobus morio, Vespadelus vulturnus, M.s. bassanii*) as its members.
** Numbers between two brackets indicate number of actual nights when calls were recorded.

An analysis of the dates of the recording of the SBWB is presented in Table 6 below.

The following is noted from an analysis of the calls of the SBWB and the SBWB Species complex:

- The five calls attributed to the SBWB all occurred on different nights and all calls were single calls only;
- The 14 calls attributed to the SBWB Complex were recorded in February and March 2019;
- Ten of the calls attributed to the SBWB Complex were single calls; on two nights (25 February and 23 March) there were two calls recorded; and

- It is difficult to draw a significant pattern of calls from the low levels of calls over the survey period.

Table 6: Dates of recording SBWB at SCWF

Turbine	Number of SBWB calls	Dates of SBWB calls	Number of Sp. Complex	Dates of Sp. Complex (SBWB Complex)
T2	2	17/3/19, 23/3/19,	3	24/02/2019, 22/3/19, 28/3/19
T10	1	22/3/19,	7	25/2/19 (2 calls), 28/2/19, 3/3/19, 22/3/19, 23/3/19 (2 calls)
T13	2	19/3/19 11/4/19	4	9/3/19, 22/3/19, 1/4/19, 11/4/19

5.2.3. Status of the Southern Bent-wing Bat

The SBWB is listed as Critically Endangered under the EPBC Act, protected under the FFG act and listed as Endangered on the Advisory List of threatened vertebrates in Victoria (DSE 2013).

The SBWB occurs in south-western Victoria. Its local distribution is largely determined by the availability of caves, mine shafts or tunnels suitable as roosting sites. This bat roosts in caves during the day, dispersing over a range of habitats at night. Its feeding areas tend to be associated with major drainage systems. In Victoria, they usually forage over forested areas but also occur widely in lower densities on the sparsely-treed Volcanic Plain (Menkhorst 1995).

In spring and summer, the SBWB congregates in "maternity caves" where the females give birth to, and raise their young. In autumn and winter, after the young are weaned, these bats disperse over south-west Victoria and into eastern South Australia. Small numbers of this species have been found roosting during the day in inland and coastal cliff caves, as well as disused mine shafts (Duncan *et al.* 1999; Menkhorst 1995).

The nearest maternity cave of the SBWB to the SCWF is the Starlight Cave near Warrnambool (Vic.), approximately 60 kilometres to the south of SCWF. In 2007, it was estimated that approximately 10,000 adult and 4,000 young bats occupied the Starlight Cave (Greg Richards, Pers. Comm.). Bats recorded at the wind farm site most probably breed in the Starlight Cave in Warrnambool. The winter roosting caves of this species includes Byaduk, Mt Eccles, Grassmere and elsewhere in the region.

The SBWB is understood to congregate at the maternity cave as early as August, and by the end of October almost all the regional population of the bat may be at the maternity cave. Breeding takes place in the Starlight Cave in December (DOEE 2019). The SBWB remains at the maternity cave and start dispersing in late January and February with the dispersal continuing through to April.

5.3.Summary of bat studies

The activity of the threatened species of bats at SCWF compares well with other wind farm sites in similar, largely agricultural settings (BL&A; unpub. data).

In summary, a number of bats typical of SW Victoria were recorded at the site. These included the Chocolate Wattle Bat, Little Forest Bat, Forest bat complex (*V. darlingtoni, V. regulus, V. vulturnus*) and the Long-eared Bats (*Nyctophilus geoffroyi, N. gouldi*). The White-striped Freetail Bat was recorded at nacelle height together with the Chocolate Wattle Bat and the Forest bat complex.

One species of threatened bat, namely, the SBWB was recorded utilising the wind farm site. In addition, one species complex was also recorded including the complex that included the threatened SBWB (Chocolate Wattled Bat / Little Forest Bat / Southern Bent-wing Bat).

There was a total of only five confirmed calls recorded for the SBWB, recorded at three of the four turbine sites. The number of actual calls over the actual detected nights was 1 call per night over 5 separate nights over the 1,017 recording nights.

Calls from the species complex containing the SBWB were infrequent. There were 14 calls from three of the four turbine sites recorded over the Summer–Autumn survey (426 detector nights). They were not recorded during the spring survey (591 detector nights).

In summary in relation to the SBWB,

- An occasional SBWB may pass through the site at or above ground level;
- There is no evidence of SBWB flights at rotor swept area heights;
- There is no evidence of usage other than occasional usage of the sites surveyed for SBWB; and
- There is no evidence of migration (en-masse) across the site.

6. Bird and Bat Strike Monitoring Program

The bird and bat strike monitoring program is undertaken to record the impact of the SCWF on birds and bats and develop an estimate of the number of bird and bat fatalities attributable to the operation of turbines at SCWF. The bird and bat strike monitoring program involved the following elements:

- Carcass searches under all turbines at the wind farm on a monthly basis;
- Scavenger trials to determine the rate at which carcass are removed; and
- Efficiency trials to determine the efficacy of searchers undertaking the carcass searches.

A team of qualified and experienced ecologists from Nature Advisory Pty Ltd have undertaken the first 12 months of monitoring at SCWF.

6.1. Methodology

6.1.1. Carcass search program

Carcass searches were undertaken at all 15 turbines at SCWF, once a month, over a period of three days from July 2018 to June 2019 inclusive.

The BAMP describes a 132-metre search radius that was searched at each turbine by searching two zones; the inner zone and the outer. The inner zone consisted of a radius within the search zone of 77 metres and was searched in four metre transects. The outer covered the remaining area out to 132 metres and was searched in 10 metre transects.

Initially, two ecologists from Nature Advisory searched the turbines in tandem, one searching the outer zone and the other searching the inner simultaneously. The surveys were undertaken from July 2018 until March 2019. From April to June 2019 a scent detection dog was used to conduct the searches. The scent detection dog is being encouraged for use in Victoria by the DELWP to undertake detection of carcasses as it is considered to be more efficient in the detection of carcasses and featherspots, in particular the smaller bat carcasses in some cases. A modification of the BAMP has been approved by the Responsible Authority for the continued use of scent dogs as an alternative to human searches for the ongoing implementation of the BAMP.

Since April 2019 a scent detection dog has been used to search the entire radius at each turbine under the command of an experienced and qualified ecologist with specialist training to handle the detection dog. The dog searches the area in transects of approximately 20 metres depending on wind strength. The radius will reduce in unfavourable conditions, which for example include days of no wind.

For both methods, transects were recorded using handheld GPS and GPS dog collar, and the details of each search including; time, date, weather conditions, person/s involved recorded on data sheets. If a carcass was located then species, location, photos, substrate/vegetation and distance to turbine were also recorded.

Any carcass found within the 132-metre radius was deemed to have been caused by turbine strike. Carcasses found during formal survey searches is included as a 'formal find'. Carcasses found outside a formal search or outside the radius, for example; by wind farm staff, is included as an incidental find.

An additional search was undertaken during April 2019 as a result of a significant impact trigger. The results of this search are included in the overall results as incidental finds.

6.1.2. Scavenger trials

The average duration of carcasses in the field prior to being removed by scavengers contributes to an essential correction factor required for the calculation of bird and bat mortality rates at wind farms.

The methods outlined in the BAMP involved 10 carcasses of two size classes; microbat, large bird (i.e. Brolga), totalling 20 carcasses a season placed under turbines resulting in 80 carcasses being placed under the turbines over the year. The number of carcasses proposed for the trial was considered to be logistically difficult to source every season and also to be likely to attract and support scavenging species, such as Red Fox (an introduced pest), thereby increasing scavenger activity on the site.

Therefore, alternative methods were proposed for the scavenging trial in a letter to DELWP dated 5th September 2018 which proposed modifications of the scavenger and detectability trials as follows:

The trials are to be conducted during each season in the first year of monitoring. Trials should be completed in January, April, July (substituted for June 2019) and October. The trials will be undertaken in accordance with the following process:

- *Carcasses will be randomly placed within the carcass search area of the selected turbines;*
- *Carcasses will be of native species, or surrogates;*
- *At least ten (minimum of five of each size class), and a maximum of up to 20 carcasses (10 per size class) of interest will be used each season providing a statistically useful number as outlined below:*
    - *Medium-large birds or substitutes – at least five per trial; and*
    - *Microbats or substitutes – at least five per trial*
- *In relation to Brolga, the use of brolga substitutes (i.e. turkey) is not recommended as it is likely to increase the attractiveness of the site to introduced predators, i.e. foxes.*

Additionally, methods for monitoring carcasses for the scavenging trial proposed that each carcass be checked every day for 10 days, then every third thereafter. This was not considered efficient, as the wind farm is unmanned, and this approach does not provide for any understanding of the types of scavengers taking the carcasses. Therefore, it was agreed with DELWP that carcasses be monitored via motion triggered camera which would record any scavenging event in the field, eliminating the need to check the carcasses physically. Thus, the following methodology was adopted:

- At each randomly placed carcass, a Moultrie® M-40i camera was attached to a star picket approximately three metres away to record any movement around the carcass;

- Cameras were collected after 30 days and photos stored on SD cards reviewed. If the carcass was still present after this time it was discarded; and
- Cameras were checked regularly to ensure the carcass remained in the camera's vision.

Scavenger trials using this methodology were undertaken during each season during the first year of operation monitoring and were conducted independently of the efficiency trials. Please see Table 11 which details the placements dates for all carcasses where a successful scavenging event was recorded and when this event was recorded (see limitations below for the unsuccessful trials).

Thus, the deployment of carcasses and substitutes for the successful scavenger trials included

- Spring – 6 med/large birds and 4 small carcasses representing bats;
- Summer – 9 med/large birds and 2 small carcasses representing bats;
- Autumn – 6 med/large birds and 4 small carcasses representing bats;
- Winter – 4 large birds and 5 small carcasses representing bats.

Limitations

Every effort was made to source the appropriate number of carcasses for each season, or a suitable proxy. Overall, an additional 21 carcasses or carcass proxies were deployed as part of the scavenging trial on top of what is listed above. Unfortunately these deployments did not provide usable data due to limitations including; SD cards becoming corrupted and not storing data, cameras not recording even after being correctly set up (these were replaced by the manufacturer), cameras not recording the actual scavenging event for unknown reasons and incorrect camera deployment by field staff.

Using motion detecting cameras to monitor scavenging events is a relatively new method for wind farm monitoring programs. The above listed problems are being resolved with experience and improved equipment but unfortunately could not be overcome during this monitoring program. Additional carcasses could not be found in time for additional deployments and monitoring (a total of 60 carcass were deployed overall). As such; the deviation from the above listed numbers is solely due to equipment failure and lack of additional carcasses.

To clarify the impact of these issues on the overall mortality rate Symbolix, the project's statisticians were consulted. They advised that the proposed BAM Plan approach of 10 carcasses per season is not enough replicates to obtain seasonal mortality estimates for the analysis. However, the total number of carcasses used for the trails was adequate to obtain an annual scavenger rate.

Data for all scavenger trial carcasses used in provided in Appendix 8.

6.1.3. Searcher efficiency trials

A letter dated 5 September 2018 was provided to DELWP to propose modifications of the searcher efficiency trials. The detectability trials sought to be in line with this letter. The changed proposed are outlined below:

3.3.3 Searcher efficiency trials

The objective of searcher efficiency trials is to determine the percentage of bat and avifauna carcasses detected by searches, to allow bird and bat strike counts to be adjusted for searcher bias.

- *Searcher efficiency trials will be conducted in the first year of monitoring; with the searcher to be unaware of the trial dates;*
- *Searcher efficiency trials should be completed in the middle of each season in January, April, July and October;*
- *Carcasses will be of native species, where available; otherwise, surrogate non-native species will be used. Trial carcasses will include both medium-large birds and small bat carcasses which are expected at the site;*
- *To ensure trials provide statistically robust results for species of interest carcasses used are to approximate the following:*

Target species	***Substitute***	***Target number (full year)***	***Notes***
Brolga (Grus rubicunda) -	*Turkey carcass*	*8*	*Not recommended, but if required by the regulator*
Southern Bent Wing Bat (Miniopterus schreibersii bassanii)	*Black mouse*	*20*	
Medium to Large Birds	*Common Myna*	*20*	*Will include representatives of carcasses recorded*
Other species listed under the EPBC Act and FFG Act - Advisory List	*Unknown as these species have not been impacted*		

Efficiency trials were conducted using available carcasses and also substitutes. A target number of 60 was achieved, however 20 of each size class were not able to be sourced and only three medium sized carcasses were deployed (see Table 12).

The following was undertaken during the searcher efficiency trials:

- Trials were undertaken in the middle of each season February, May, July and October;

- Carcasses were placed by an observer not involved in the searches at SCWF prior to the regular searchers arriving on site. Searchers were not aware that trials were being undertaken, i.e. a blind trial;
- Two–three carcasses were placed at random within the search radius underneath selected turbines;
- Carcasses were marked with GPS so they could be relocated;
- The searchers would conduct the usual search methodology under seven turbines (the reasonable maximum possible a day for 132 metre radius) and record and collect any carcasses found;
- The observer would contact the searcher after they have completed their search to determine which of the placed carcasses they had found. Any carcasses found which had not been placed as part of the trial would be recorded as usual; and
- The observer efficiency was calculated as the percentage of carcasses found of those placed.

6.2. Results

The number of formal searches under turbines for the monitoring period totalled 180. The total area under each turbine searched is approximately 54.7 square kilometres equalling 821 square kilometres searched each month.

The vegetation condition of the site did not change unexpectedly over the year. The site consists primarily of grazing paddocks with scattered trees. There is no other vegetation in the search areas apart from two wind breaks which hold acacia and Sugar Gum with some tussock understorey. The pasture grass is grazed throughout the year and becomes longer during and after winter through into spring, then shortens and dies off during and after the dry period of summer through autumn. The vegetation condition is therefore generalised as followed: Winter: medium length grass (5-10cm), Spring: long grass (10-15cm), Summer: medium grass (5-10cm), Autumn: short (0-5cm).

No turbines at SCWF are lit and as such; no comparison between unlit and lit turbines can be undertaken.

Pest control was undertaken in June 2019 which consisted of fox shooting and rabbit warren ripping. Pindone has was also deployed as a rabbit control method by the land manager in March and in May 2019.

A carrion removal program has also been undertaken as part of general farming activities on the property in which dead sheep and lambs are removed from near turbines whenever they are located. Between 15 and 20 animals have been removed and disposed of since official operations began.

6.2.1. Carcass search program

The results from carcass searches between July 2018 and June 2019 at SCWF are summarised below in Table 7. Results are split into carcasses found during formal searches and those found incidentally. Incidental finds are classified as any carcass that was discovered under a turbine by wind farm personnel or the farmer outside of formal monthly monitoring periods or when Nature Advisory were on site outside these formal monitoring periods. Formal results included a total of 46 carcasses over 12 months and 11 found incidentally. The majority of incidental carcasses were recorded in April

2019 during an additional search of all turbines at the SCWF in response to an impact trigger (See section 6.3.).

Table 7: Carcass search result summary for first year of monitoring

Search type	Season	Month	Bird	Bat	Feather spot	Total
Formal	Winter	July	2	-	-	2
		August	1	-	-	1
	Spring	September	3	1	-	4
		October	4	-	1	5
		November	-	-	-	0
	Summer	December	1	1	-	2
		January	2	2	1	5
		February	1	8	-	9
	Autumn	March	1	5	2	8
		April	-	3	1	4
		May	2	2	-	4
	Winter	June	1	1	-	2
Formal totals			**18**	**23**	**5**	**46**
Incidental	Winter	July	1	-	-	1
		August	-	-	-	0
	Spring	September	-	-	-	0
		October	-	-	-	0
		November	-	-	-	0
	Summer	December	-	-	-	0
		January	-	-	-	0
		February	-	1	-	1
	Autumn	March	-	-	-	0
		April	2	7	-	9
		May	-	-	-	0
	Winter	June	-	-	-	0
Incidental totals			**3**	**8**	**0**	**11**

The results from the formal carcass searches are displayed graphically in Figure 5. This shows that there was a spike in bat fatalities during February. Bird fatalities were steady throughout the year.

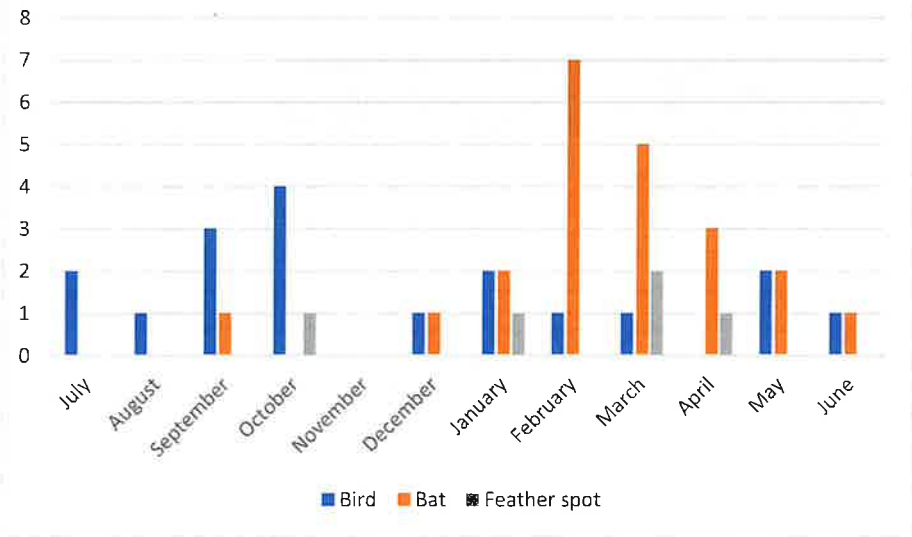

Figure 5: Year 1 formal search results

The raw data for all carcass finds, including incidental finds, during the first year's monitoring is available in Appendix 6. This table also provide information weather conditions during each search period.

The number of mortalities, including incidental finds, that occurred at each turbine is described in Table 8 below. The highest mortalities occurred at Turbine 1 located at the northern end of the wind farm in a large patch of scattered River Red Gum (RRG). The next highest numbers occurred at Turbines 7 and 9 with seven mortalities each, including two incidentals at both, were also located relatively close to RRG trees. The remaining turbines had between two and five mortalities, except Turbines 11 and 13 which had no mortalities detected.

Table 8: Mortalities by turbine

	Formal carcasses		Incidental carcasses		
Turbine number	Birds	Bats	Birds	Bats	Total Carcasses
1	3	4	2	-	**9**
2	2	1	-	1	**4**
3	1	4	-	-	**5**
4	2	-	-	-	**2**
5	-	2	-	2	**4**
6	3	1	-	-	**4**
7	3	2	-	2	**7**
8	1	1	-	-	**2**
9	3	2	1	1	**7**
10	2	2	-	1	**5**
11	-	-	-	-	**0**
12	1	1	-	-	**2**
13	-	-	-	-	**0**
14	1	1	-	1	**3**
15	1	2	-	-	**3**
Totals	**23**	**23**	**3**	**8**	**57**

6.2.2. Bird results

During the first year of carcass searches, a total of 23 bird mortalities were detected during formal searches. This included 18 carcasses and five feather spots (Table 9). An additional three records were incidental finds.

Figure 5 shows the highest number of bird mortalities were detected during October 2018, during Spring, where five mortalities were detected. The next highest was September 2018, and January and March 2019 which held three mortalities each. The remaining months held either one or two mortalities. November 2018 had no mortalities detected.

In terms of seasonal variation:

- Spring - eight mortalities;
- Summer- five mortalities;
- Autumn- six mortalities; and
- Winter- four mortalities.

Table 9 show species diversity from mortalities across the wind farm. A total of 11 species of bird were identified, including three introduced species. Australian Magpie was the most commonly detected mortality across the wind farm with 10 formal records. All other species held either one or two records.

All bird species detected were common and widespread species, typical of farmland environments in Victoria. No threatened or listed species of bird were detected as mortalities during searches.

Table 9: Year 1 bird species mortality at SCWF

Species	Scientific name	Formal records	Incidental records	Feather spots	Totals
Australian Magpie	*Cracticus tibicen*	6	1	4	**11**
Brown Falcon	*Falco berigora*	2	-	-	**2**
Common Starling*	*Sturnus vulgaris*	2	-	-	**2**
European Skylark*	*Alauda arvensis*	2	-	-	**2**
Nankeen Kestrel	*Falco cenchroides*	1	1	-	**2**
Welcome Swallow	*Hirundo neoxena*	2	-	-	**2**
Australasian Pipit	*Anthus novaeseelandiae*	1	-	-	**1**
Eastern Barn Owl	*Tyto javanica*	1	-	-	**1**
Galah	*Eolophus roseicapilla*	-	-	1	**1**
European Goldfinch*	*Carduelis carduelis*	-	1	-	**1**
Stubble Quail	*Coturnix pectoralis*	1	-	-	**1**
Totals		**18**	**3**	**5**	**26**

Notes: * = Introduced species.

6.2.3. Bat results

Thirty-one mortalities were detected at SCWF during the first year of monitoring. Twenty-three bat carcasses were found during formal carcass searches and eight carcasses were recorded incidentally outside the formal carcass searches (Table 10).

During the formal carcass searches the highest number of mortalities of bats detected was in February 2019 with seven carcasses followed by March with five, then April with three. January and May 2019 both recorded two mortalities, on either side of the three aforementioned highest mortality months, and December 2018 and June 2019 held one mortality (Figure 5). The period from July to November 2018 detected no mortalities except September, in which one bat mortality was detected. The carcass in September 2018 was a Grey–headed Flying–Fox (see Section 6.3). Microbats and flying–foxes exhibit different behaviours in that microbats will typically not be active during colder months and enter a state of torpor, while flying–fox are active throughout the year and will migrate to suitable climates when required.

Seasonally, summer through to autumn held the highest bat mortalities, whereas winter through to the end of spring recorded very few.

Table 10 shows species diversity from bat mortalities. A total of five species were identified in addition to one carcass that could not be identified, as there were not sufficient remains to do so (a part of a wing detected by the scent dog). White-striped Freetail Bat was the most commonly detected species with eight carcasses recorded formally and four incidentally, followed by Gould's Wattled Bat with eight formal carcasses and two incidentals. These species are usually the most detected bat species in south-eastern Australia during mortality searches (Nature Advisory, unpub. data). They remain common and widespread across south–eastern Australia however, and SCWF is

unlikely to impact on the population measurably. Chocolate Wattled Bat and Southern Forest Bat were also detected during carcass searches.

One listed bat species was detected during carcass searches; Grey-headed Flying–Fox (*Pteropus poliocephalus*) (GHFF) listed as Vulnerable under the EPBC Act. Four mortalities of this species were detected at SCWF during the first year of monitoring, three during formal carcass searches and one carcass recorded as an incidental find. This recording of the carcass of the GHFF triggered an impact response which is discussed further below.

Other bat species detected during carcass searches were common and widespread species, typical of farmland environments in Victoria. There were no carcasses of threatened or endangered microbats species recorded during the searches or recorded incidentally.

Table 10: Year 1 bat species mortality at SCWF

Common name	Scientific Name	Carcass records	Incidental records	Totals
White-striped Freetail Bat	*Tadarida australis*	8	4	12
Gould's Wattled Bat	*Chalinolobus gouldii*	8	2	10
Grey Headed Flying Fox	*Pteropus poliocephalus*	3	1	4
Chocolate Wattled Bat	*Chalinolobus morio*	3	-	3
Southern Forest Bat	*Vespadelus regulus*	-	1	1
Unknown bat sp.	*N/A*	1	-	1
Totals		**23**	**8**	**31**

6.2.4. Scavenger trial

Scavenger trial data collected to date is displayed in Table 11. Best efforts were made each season to deploy as many carcasses as were available using the methods described in section 6.1.2. There were limitations in the numbers of sufficient quality bat carcass for the trials on a number of occasions substitutes were required.

In each season, two size classes of carcass and substitutes were deployed; bat or bat substitute and medium-large bird. Substitutes used are described in Table 11. In Spring ten carcasses were deployed, eleven in Summer, ten in Autumn and nine in Winter.

Due to limitations in field deployment of cameras, the scavenger rates will be refined for the appropriate size classes for each season using data averaged across the year combined with knowledge of scavenging rates from other wind farms. The scavenger trials from future monitoring should also focus on collecting useful data with various carcass size classes across the year that reflect the actual mortality at the wind farm.

The scavenger rate is the average number of days until the carcass is removed by scavengers. The average scavenging rate in spring was 7.2 days; in summer 3.9 days; in autumn 6.2 days and in winter 3.5 days. Summer has the fastest scavenging rate which may indicate higher scavenging activity during the warmest months. Spring averages were skewed by two carcasses which were not taken; however, all other carcasses were taken in three days or less.

Analysis was also done on carcass size classes overall and across seasons. Overall, in total bats and substitutes persisted on average for two days in the field, while medium to large birds and substitutes persisted for 7.5 days. During spring bats persisted for 1.5 days and medium-large birds 11 days; in Summer bats were scavenged in two days and medium-large birds in 4.3 days; in Autumn; bats scavenged on an average of 2.5 days and medium-large birds 8.7 and in winter bats averaged 5.6 days and medium to large birds 1 day.

Scavengers observed on camera consisted of typical farmland environment scavengers such as; Little Raven, Australian Magpie, Wedge-tailed Eagle and Red Fox.

Photo 1 - Little raven scavenging carcass

Photo 2 - Red fox scavenging carcass

Overall the scavenging rate varied between the seasons. It was also influenced by the types of carcasses and substitutes provided. Carcasses of dead birds and bats collected during carcass searches are often not highly suitable for use in the scavenger trials as they may be old, dehydrated and in poor quality. As outlined in the limitation section above there were issues with equipment failure which limited the results.

Winter had the highest scavenging rate, indicating that scavengers are most active during that period. This coincides with when the weather was coolest and grass was of long length. Scavenging rates were typically several days longer for medium to large birds and substitutes over bats and substitutes. The most common scavenger for bats and bat substitutes was the Little Raven and for medium to large birds and bird substitutes was the Red Fox.

For the statistical analysis of mortality, Symbolix, the project's statisticians were consulted on the proposed approach in the Salt Creek Bam Plan. They advised that the proposed BAM Plan approach of 10 carcasses per season is not enough replicates to obtain seasonal mortality estimates for the analysis. However, the total number of carcasses used for the trials was adequate to obtain an annual scavenger rate.

Table 11: Scavenger trial results to date

Season	Placement Date	Turbine	Species	Carcass size	Days in the field	Scavenger
Spring	24/10/2018	9	Brown Falcon	Large	30	Not scavenged
Spring	24/10/2018	4	Australian Magpie	Medium	30	Not scavenged
Spring	22/11/2018	2	Common Myna	Medium	1	Unknown
Spring	22/11/2018	6	House mouse	Bat sub.	1	Little Raven
Spring	22/11/2018	5	House mouse	Bat sub.	1	Little Raven
Spring	22/11/2018	5	Common Myna	Medium	1	Unknown
Spring	22/11/2018	5	House mouse	Bat sub.	1	Australian Magpie
Spring	22/11/2018	5	Common Myna	Medium	1	Unknown
Spring	22/11/2018	10	Common Myna	Medium	3	Unknown
Spring	22/11/2018	13	House mouse	Bat sub.	3	Australian Magpie
Total average days in field					**7.2**	
Summer	19/12/2018	2	Common Myna	Medium	5	Red Fox
Summer	19/12/2018	4	Common Myna	Medium	13	Unknown
Summer	19/12/2018	4	Common Myna	Medium	3	Unknown
Summer	19/12/2018	6	Common Myna	Medium	2	Red Fox
Summer	19/12/2018	6	Common Myna	Medium	2	Red Fox
Summer	19/12/2018	8	Common Myna	Medium	1	Australian Magpie
Summer	21/02/2019	12	Brown Falcon	Large	3	Red Fox
Summer	21/02/2019	10	White-striped Freetail Bat	Bat	3	Unknown
Summer	21/02/2019	9	Peregrine Falcon	Medium	5	unknown
Summer	21/02/2019	11	Gould's Wattled Bat	Bat	1	Australian Magpie
Summer	21/02/2019	11	Nankeen Kestrel	Medium	5	Red Fox

Season	Placement Date	Turbine	Species	Carcass size	Days in the field	Scavenger
Total average days in field					**3.9**	
Autumn	17/04/2019	3	White-striped Freetail Bat	Bat	1	Little Raven
Autumn	17/04/2019	6	White-striped Freetail Bat	Bat	1	Little Raven
Autumn	17/04/2019	14	Long-billed Corella	Medium	1	Wedge-tailed Eagle
Autumn	17/04/2019	14	White-striped Freetail Bat	Bat	3	Red Fox
Autumn	17/04/2019	13	Chicken	Large sub.	2	Inconclusive
Autumn	23/05/2019	12	Gould's Wattled Bat	Bat	5	Red Fox
Autumn	23/05/2019	11	Chicken	Large sub.	2	Little Raven
Autumn	23/05/2019	10	Chicken	Large sub.	10	Unknown
Autumn	23/05/2019	9	Grey-headed Flying-Fox	Large	30	Little Raven
Autumn	23/05/2019	8	Grey-headed Flying-Fox	large	7	Red Fox
Total average days in field					**6.2**	
Winter	20/06/2019	9	Chicken	Large sub.	1	Red Fox
Winter	20/06/2019	8	Chicken	Large sub.	1	unknown
Winter	20/06/2019	12	White-striped Freetail Bat	Bat	1	unknown
Winter	20/06/2019	9	Chicken	Large sub.	1	Red Fox
Winter	20/06/2019	8	White-striped Freetail Bat	Bat	1	Little Raven
Winter	20/06/2019	12	White-striped Freetail Bat	Bat	9	Australian Magpie
Winter	20/06/2019	13	Chicken	Large sub.	1	Australian Magpie
Winter	20/06/2019	13	White-striped Freetail Bat	Bat	3	Little Raven
Winter	20/06/2019	10	White-striped Freetail Bat	Bat	14	Red Fox
Total average days in field					**3.5**	

6.2.5. Searcher efficiency trials

Results for searcher efficiency trials are shown in Table 12. The maximum number of carcasses available were used each season which ranged between 15 to 17 per trial and carcasses were classed as one of two classes, as used in scavenger trials.

Searcher efficiency rates varied between the seasons. During spring the searcher efficiency rate was the lowest at 43.7%. This coincides with when the grass is longest (up to 30 cm) and carcasses, in particular small bats, very difficult to detect. Summer detection rates were 80%. These two trials were undertaken by two searchers working in tandem. Autumn rates were 88.3% and Winter 76.5 for which trials were undertaken by scent detection dog. It is noted that there was marked improvement in detectability when using the scent dog.

During Spring 14.3% bats were detected and 66.6% of birds. For Summer; 75% of bats and 77.8% of birds were detected. In Autumn; 80% of bats and 100% of birds were detected, and in Winter

60% of bats and 83.3% of birds. Overall, pooled data indicates that 52% of bats were detected and 81% of birds. This comparison involves two different methods and searchers.

Overall; detectability was lowest in Spring coinciding when the grass length was it its longest when grass can be up to 30 cm or more. However, this result is likely to improve when using scent detection dog during this same season in year two of monitoring, as the dog relies almost entirely on scent so the presence of high vegetation should have little impact. Scent detection dog efficiency depends on weather conditions such as temperature and wind strength. On average; bat detectability was significantly lower than medium-large birds due to their small size and the challenges of recording bats that are obscured by long grass.

Table 12: Searcher efficiency rates

Turbine	Searchers	Carcass	Class	Detected
25th October 2018 - Spring (long grass)				
5	Searcher 1 &2	Mouse/bat	Bat	No
6	Searcher 1 &2	Mouse/bat	Bat	No
7	Searcher 1 &2	Mouse/bat	Bat	No
8	Searcher 1 &2	Mouse/bat	Bat	No
9	Searcher 1 &2	Mouse/bat	Bat	No
11	Searcher 1 &2	Mouse/bat	Bat	No
14	Searcher 1 &2	Welcome Swallow	Small	Yes
4	Searcher 1 &2	Common Myna	Small	No
4	Searcher 1 &2	Australian Magpie	Large	Yes
5	Searcher 1 &2	Common Myna	Small	No
6	Searcher 1 &2	Common Myna	Small	Yes
7	Searcher 1 &2	Common Myna	Small	Yes
8	Searcher 1 &2	Australian Magpie	Large	Yes
9	Searcher 1 &2	Brown Falcon	Large	Yes
11	Searcher 1 &2	Common Myna	Small	No
14	Searcher 1 &2	Common Myna	Small	Yes
Detectability				**43.7%**
21st February 2019 - Summer (medium grass)				
9	Searcher 1 &2	Gould's Wattled Bat	Bat	Yes
10	Searcher 1 &2	White-striped Freetail Bat	Bat	Yes
13	Searcher 1 &2	White-striped Freetail Bat	Bat	Yes
14	Searcher 1 &2	White-striped Freetail Bat	Bat	No
9	Searcher 1 &2	Peregrine Falcon	Medium	Yes
9	Searcher 1 &2	Common Myna	Small	Yes
10	Searcher 1 &2	Blue-winged Parrot	Small	Yes
10	Searcher 1 &2	Common Myna	Small	*Scavenged
11	Searcher 1 &2	Nankeen Kestrel	Medium	No
11	Searcher 1 &2	Gould's Wattled Bat	Bat	Yes
12	Searcher 1 &2	Australian Wood Duck	Large	Yes

Turbine	Searchers	Carcass	Class	Detected
12	Searcher 1 &2	Blue-winged Parrot	Small	Yes
13	Searcher 1 &2	Common Myna	Small	No
14	Searcher 1 &2	Common Myna	Small	Yes
15	Searcher 1 &2	Australian Magpie	Large	Yes
15	Searcher 1 &2	Common Myna	Small	Yes
Detectability				**80.0%**
23rd May 2019 - Autumn (short grass)				
9	Searcher 1 & dog	Gould's Wattled Bat	Bat	No
11	Searcher 1 & dog	Gould's Wattled Bat	Bat	Yes
12	Searcher 1 & dog	Gould's Wattled Bat	Bat	Yes
13	Searcher 1 & dog	White-striped Freetail Bat	Bat	Yes
15	Searcher 1 & dog	White-striped Freetail Bat	Bat	Yes
8	Searcher 1 & dog	Spotted Dove	Medium	Yes
8	Searcher 1 & dog	Chicken	Large	Yes
8	Searcher 1 & dog	Grey-headed Flying-Fox	Large	Yes
9	Searcher 1 & dog	Grey-headed Flying-Fox	Large	Yes
9	Searcher 1 & dog	Australian Magpie	Large	Yes
10	Searcher 1 & dog	Chicken	Large	Yes
10	Searcher 1 & dog	Australian Magpie	Large	Yes
11	Searcher 1 & dog	Chicken	Large	Yes
12	Searcher 1 & dog	Common Myna	Small	No
12	Searcher 1 & dog	Grey-headed Flying-Fox	Large	Yes
13	Searcher 1 & dog	Raven	Large	Yes
15	Searcher 1 & dog	Chicken	Large	Yes
Detectability				**88.3%**
20th June 2019 - Winter (medium grass)				
7	Searcher 1 & dog	White-striped Freetail Bat	Bat	Yes
8	Searcher 1 & dog	White-striped Freetail Bat	Bat	No
11	Searcher 1 & dog	White-striped Freetail Bat	Bat	Yes
12	Searcher 1 & dog	White-striped Freetail Bat	Bat	Yes
13	Searcher 1 & dog	White-striped Freetail Bat	Bat	No
7	Searcher 1 & dog	Chicken	Large	Yes
7	Searcher 1 & dog	Common Myna	Small	No
8	Searcher 1 & dog	Common Myna	Small	Yes
10	Searcher 1 & dog	Grey-headed Flying-Fox	Medium-large	Yes
10	Searcher 1 & dog	Chicken	Large	Yes
11	Searcher 1 & dog	Grey-headed Flying-Fox	Large	Yes
12	Searcher 1 & dog	Common Myna	Small	Yes
12	Searcher 1 & dog	Chicken	Large	No
13	Searcher 1 & dog	Chicken	Large	Yes
13	Searcher 1 & dog	Common Myna	Small	Yes

Turbine	Searchers	Carcass	Class	Detected
15	Searcher 1 & dog	Grey-headed Flying-Fox	Large	Yes
15	Searcher 1 & dog	Common Myna	Small	Yes
Detectability				76.5%

Notes: * = carcass was scavenged before it could be located and was therefore discounted.

6.3.Impact triggers

The identification of the carcass of a Grey-headed Flying–Fox (GHFF) in September 2018 triggered an investigation as outlined in the BAMP. These investigations are detailed in a report on the Grey–headed Flying–Fox (BL&A 2019) and are summarised with the specific actions and next steps below.

On 25th September 2018, a GHFF as found dead during formal surveys under Turbine 5 at the SCWF. This species is listed as Vulnerable under the EPBC Act. This event triggered the response required under section 4.2 of the BAMP.

The initial incident was reported to DELWP and Moyne Shire Council on 26th September 2018, as required by the BAM Plan. The trigger response was to undertake a more detailed investigation of the fatality. On Monday 1st October 2018 a proposed initial investigation method responding to the trigger impact were provided to Moyne Shire and DELWP. Subsequently, feedback was obtained from Council on 1st October 2018 and DELWP on 2nd October 2018.

This initial investigation in October 2018 identified that it was unlikely that GHFF were travelling from the nearest permanent camp, located in Warrnambool almost 60 kilometres to the south of SCWF. It considered whether a temporary camp might be located nearby but found that the local foraging habitat available to the species (e.g. Sugar Gum, River Red-gum), including in Cobra Killuc Wildlife Reserve, were not flowering and so there would be little food available in the region. No GHFF were observed in or around the wind farm during the initial survey undertaken in Warrnambool and in and around the SCWF.

However, five months later, during the monthly February 2019 carcass search two GHFFs carcasses were recorded. One carcass was recorded on the 20th February 2019 under Turbine 3 and the second carcass on the 21st February under Turbine 10. One additional GHFF carcass was recorded by wind farm staff, recorded as incidental carcass on the 22nd February under Turbine 14. These impacts again triggered a second investigation as required by the BAM Plan.

These second set of incidents were reported to DELWP and Moyne Shire Council as required by the plan. On the 26th of February 2019 a proposed methodology for additional investigation was developed in consultation with Flying-Fox expert, Dr. Rodney van der Ree from Melbourne University, and provided to the Moyne Shire and DELWP for review.

The second investigation in February 2019 found additional information to increase the understanding of the GHFF. These finding included:

- Planted Sugar Gums in the local region was experiencing a mass flowering event and was providing foraging habitat for the GHFF as well as birds and other species. At least 41 individuals were recorded foraging in Cobra Killuc Wildlife Reserve, 3 km to the south west of SCWF, and

small numbers of one to three individuals were also observed foraging in different stands of Sugar Gums along roadside reserves;

- One camp of 120 GHFFs was identified and viewed as dispersing from a camp on Woodcutters Ln, south of the Cobra Killuc Wildlife Reserve. This observation confirmed a landholder account confirmed that a camp of GHFF had established on private property south of Cobra Killuc Wildlife Reserve, to the west of Woodcutters Ln; and
- A proposal for on-going monitoring and mitigation measures was proposed and undertaken.

The additional monitoring included:

- Monitoring of the GHFF camp on Woodcutters Lane; and
- Additional carcass searches of the SCWF while the camp of GHFF was still present on Woodcutters Lane.

This monitoring determined that the camp detected off Woodcutters Ln was a temporary one. Four surveys were undertaken between the 28th March – 30th April 2019 which noted that the Sugar Gum were no longer in flower and the food resource had depleted. In addition, no GHFF were observed leaving the temporary camp and none were observed in the region on the nights of the surveys which indicated that the camp had dispersed. There were no additional after the carcass recorded on the 22nd February 2019.

This dispersal of the camp was assessed to coincide with the end of the Sugar Gum flowering period which typically runs from January to March. Other plant species in the area, such as River Red-gum, are reported to flower in spring/summer until January. However, in the 2018/19 season the River Red Gums did not flower abundantly.

Since the temporary camp has dispersed it is considered that the on-going risk of collision of the GHFF colliding with turbines is reduced. However, this matter requires continued attention.

A total of four mortalities have been detected to date at the SCWF. The current national population of GHFF was estimated to be 674,000 (DoEE 2018) and the loss of the four individuals at SCWF, which is less than 0.001% of the population, is considered unlikely to have a significant impact on the national population.

Dr. Rodney van der Ree from the University of Melbourne was consulted on the 29 May 2019 in regards to the spatial and temporal extent of the use of the habitat in and around the SCWF by the GHFF. It was agreed with the Moyne Shire Council and DELWP that a further 12-month monitoring period would inform the likelihood of three possible scenarios in relation to the flying fox camp. These possible scenarios are:

- The camp does not re-establish in 2019/20;
- A temporary camp is re-established in 2019/2020 but disbanded in February/March; or
- A permanent camp is established.

It was noted that each of these different scenarios will require a separate response. Thus, it is proposed that recommendations are provided for ongoing monitoring requirements based on the

results of the 2019/20 monitoring. These results should be discussed with the DELWP and Moyne Council. The recommendations made to DELWP and Council should identify the need for any further camp monitoring and further carcass monitoring outside the regular monitoring.

The following measures are proposed to monitor potential impacts on the GHFF in 2019/2020:

- Undertake monthly monitoring of the location of the temporary camp from October to April. This would include a monthly dusk surveys to ascertain whether the camp has returned;
- Inspection (i.e. exit count) of the GHFF camp location is also triggered immediately (with 3 business days) after any GHFF carcass is recorded.
- If the camp returns undertake:
    - Two- weekly dusk exit counts from the camp;
    - Consultation with the owner of the private property which contained the previous temporary GHFF camp to enable potential access to the camp and obtain any further information or observations if the camp is there; and
    - Undertake monthly carcass monitoring while the colony are located in the camp (if carcass searches are not scheduled for that year).

In keeping with the findings of these surveys, the implementation of mitigation measures may need to be considered should ongoing mortality occur.

6.4. Mortality estimations

The raw mortality data, detectability and scavenger data was provided to Symbolix for analysis for the generation of mortality estimates from the first year of operation of the SCWF. Results are aggregated across surveyor type (i.e. dog and human) but take into account the differences between both.

The detailed results of the Symbolix analysis are provided in Appendix 7 and are summarised below:

For birds:

- Bird detectability is 82% with a 95% confidence interval of [66%, 91%];
- The mean time to total loss via scavenge is 5.9 days, with a 95% confidence window of [4.1, 8.6] days;
- Based on the detected carcasses and measured detectability and scavenge rate, it is calculated that for the 15 turbines there was a total site loss of around 141 birds over the survey period, and are 95% confident that fewer than 202 individuals were lost;

For bats:

- Bat detectability by searchers is 62%, with a 95% confidence interval of [42%, 78%];
- Under these assumptions, the mean time to total loss via scavenge is 5.9 days, with a 95% confidence window of [4.1, 8.6] days;

- Based on the detected carcasses and measured detectability and scavenge rate, it is calculated that there was a total site loss of around 196 bats over the survey period, and are 95% confident that fewer than 279 bats were lost;

In addition, the following is noted:

- The scavenging rate was not statistically different between birds and bats, and was 5.9 days on average; and
- Specific rates for each season cannot be calculated due to a lack of replicates in the seasonal data.

6.4.1. Limitations of mortality estimates

There are substantial limitations in the estimates of mortality from one year of monitoring from a wind farm. Nature Advisory routinely proposed two-years of monitoring as a minimal basis for the overall mortality estimate for a wind farm. This is for the following reasons:

- Patterns of use of the wind farm by birds and bats change on an annual basis in relation to rain, droughts and seasonal factors;
- The first year of operation of the wind farm may influence the pattern of use of the wind farm by birds and bats; and
- The mortality data from wind farms monitored by Nature Advisory fluctuates from year to year. Thus, typically mortality estimates are based on a minimum of two year of data which increases the precision of mortality estimation.

There was considered to be insufficient data to generate valid mortally estimates for the Grey headed Flying Foxes. This mortality estimate was constrained by the length of time the duration of the camp of the Grey-headed Flying Foxes in the wider areas. In addition, the statistical model is limited in the data to available to incorporate the relationship between the presence on the site by this species linked to flowering gum trees.

6.5. Conclusions and recommendations

During carcass searches almost all mortalities were of common and widespread species, common to farmland environments in Western Victoria. These mortalities would be highly unlikely to have a measurable impact on the species given high population numbers, for example the species with the highest mortalities; Australian Magpie.

The only listed species detected during carcass searches was GHFF and the resulting investigations determined that these mortalities would be unlikely to have a significant impact on local or national population numbers, given the current large population numbers existing.

In regards to seasonal variation in results, it is difficult to draw meaningful conclusions given the low numbers of mortalities overall. However, at face value; for birds the highest mortalities occurred during Spring which is not unexpected given that there may be increased activity at this time after likely breeding activity and a higher availability of food. For bats, higher mortalities occurred during Spring, when microbats leave torpor and commence foraging.

The results suggest that turbines closer to River Red-gum woodlands may have higher mortalities for both birds and bats than those in grassland areas, but again, given the low numbers of mortalities it is difficult to draw meaningful conclusions. Additionally, the small size of the wind farm makes this difficult to determine as all turbines are located within one kilometre of woodlands.

It is recommended that additional GHFF monitoring take place in the proceeding SCWF monitoring period, with review at the end of each period, as per Section 6.3.

Monthly carcass searches will continue for the next monitoring period to determine any impacts upon listed species, as per the BAMP. Experience from monitoring at other wind farms in Australia demonstrates that the species impacted by a wind farm may vary on a year to year basis. A single year of data is not a strong basis for the development of a long-term understanding of the impacts of any wind farm. Two years of carcass monitoring data provides a more useful baseline to assess impacts.

7. Discussion and Recommendations

Brolga monitoring results showed no breeding activity occurred within the three-kilometre survey radius during 2018 breeding surveys and no flocking activity has been detected within the five kilometres survey radius. The lack of breeding may have been due to the drier weather conditions during September-October 2018.

The surveys confirmed the Southern Bent-wing Bat was not recorded during Spring 2018 and was recoded in very low number in Summer-Autumn 2019. There is no evidence that this species passes through the site during migration periods. There were no recordings of the species at turbine nacelle height of around 85 metres. Given this, the on-going risk to Southern Bent-wing Bat from the operation of SCWF is determined to remain low.

A response to impact triggers was required for impacts to the Grey–headed Flying–Fox. A single Grey–headed Flying–Fox was stuck by September 2019 and considered as a "one-off". However, the further impacts on this species in February 2019 may have been due to the flowering of Sugar Gum in and around the SCWF. The establishment of a temporary camp of Grey–headed Flying–Fox may have been a "one-off" or it may occur again in the future. It is recommended that the identified temporary Grey–headed Flying–Fox camp be monitored in the future to determine the status of the camp. An approach to addressing Grey–headed Flying–Fox potential impacts have been identified and agreed with the Responsible Authority.

An assessment of the impacts of the SCWF from the first year of monitoring has determined that there no evidence that the SCWF presents an on-going risk of a significant impact to threatened bird and bat species at population scale. However, in-line with the BAMP to ensure an ongoing understanding of the risks associated with the SCWF are fully understood, it is recommended that the following are implemented:

- Brolga monitoring continue for the next 12-month monitoring period as per the BAMP to determine use of wetlands within three-kilometre of the wind farm as possible breeding habitat for Brolga;
- While the bat surveys over 1,017 recording nights did not record significant number of Southern Bent Winged at SCWF (5 confirmed calls and 14 possible calls); There were not flights recorded at Nacelle height indicting bat risk behaviour; no carcasses of SBWB were recorded; and there were insufficient flights to indicate a migratory path across the wind farm. Direct impacts to the SBWB should be detected by the ongoing carcass search program. In the event of any impact to this species being recorded further monitoring may be warranted. However, DEWLP in correspondence from 31 January 2020 indicated that "*ongoing monitoring will increase understanding of SBWB utilisation in the project area and the risks posed by wind farm operations*"; and
- Monthly dusk surveys of the temporary Grey–headed Flying–Fox camp between October to April. If the camp establishes again undertake fortnightly exit counts of the population numbers. Consult the landholder of the camp's location for potential access and further information of the camp. If carcass searches are not scheduled for a particular year, monthly carcass monitoring should be undertaken while the camp is present;

- Monthly carcass searches should be undertaken during the next 12-month monitoring period in accordance with the BAMP.

8. References

AusWEA (Australian Wind Energy Association) 2005. Wind Farms and Birds: Interim Standards for Risk Assessment. Report prepared by Brett Lane and Associates and AIRA Professional Services; Report No. 2003.35 (2.2), July 2005.

Brett Lane and Associates (now Nature Advisory) (BL&A) 2019. Salt Creek Wind Farm, Grey-headed Flying Fox Impact Assessment Report. Prepared for Tilt Renewables Australia Pty Ltd, report number 15101 (16.3).

Bureau of Meteorology (BOM) 2020. Monthly Rainfall Data. Accessed 17th March 2020. http://www.bom.gov.au

Department of the Environment (DOEE) 2018, *National Flying-fox monitoring viewer*, Department of the Environment, Canberra, viewed 2nd October 2018 <http://www.environment.gov.au>

Department of the Environment and Energy (DOEE) 2019, Species Profile and Threats Database, Department of the Environment and Energy, Canberra, accessed 2019.

Department of Sustainability and Environment (DSE) 2011, 'Interim Guidelines for the Mitigation and Offsetting of Potential Wind Farm Impacts on the Victorian Brolga Population 2011', DSE, East Melbourne, November 2011.

Department of Sustainability and Environment (DSE) 2013, *Advisory List of Threatened Vertebrate Fauna in Victoria*. Department of Sustainability and Environment, East Melbourne, Victoria.

Duncan, A, Baker, GB & Montgomery, N 1999, *The Action Plan for Australian Bats*. Environment Australia, Canberra.

Clean Energy Council 2018. Best Practice Guidelines for Implementation of Wind Energy Projects in Australia. Clean Energy Council, Australia

Jacobs, 2017. Salt Creek Wind Farm Bat and Avifauna Management Plan. Prepared for Salt Creek Wind Farm Pty Ltd, 22nd June 2017.

Menkhorst P 1995, Mammals of Victoria, Oxford University Press, Melbourne.

Appendix 1: Monthly rainfall 1979 – 2019 (Lake Bolac Post Office) (BOM 2020)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Contributing Rainfall	Year classification
1979	55	20.6	16.6	26.4	43.4	31.4	38	75.6	76.4	63	49.6	15.2	511.2		
1980	44.4	4.8	12.8	137.8	46.6	54.8	53.8	57.8	44.8	93.8	30	54.8	636.2	701	INTERMEDIATE
1981	56.6	15.6	15.4	20.4	49.4	76.2	75.8	95	27.6	76.4	25.4	12.8	546.6	631.4	INTERMEDIATE
1982	33.4	9.8	40	24.4	48	36.2	24.2	5.8	37.6	37.2	8.2	26.6	331.4	369.6	DRY
1983	25.6	0.2	70.8	51.4	95.2	63.6	58.4	73.2	99.2	48.8	69.8	8.6	664.8	699.6	INTERMEDIATE
1984	53.2	11.2	82	38.2	23.4	28	103.2	77	117.6	28.2	44.6	31.6	638.2	716.6	INTERMEDIATE
1985	15.8	6	32.8	78.2	31.8	58.2	58.4	52.6	44.8	70	47.8	108.2	604.6	680.8	INTERMEDIATE
1986	27.4	4.2	9.2	72.4	87.6	46	90.8	56	50.4	89.8	27.2	79.2	640.2	796.2	WET
1987	75.4	63.1	23.7	19.6	111.8	49.2	39.7	40.5	29.4	43.4	14.7	79.8	590.3	696.7	INTERMEDIATE
1988	42.7	17.6	19.2	6	89.7	57.4	44.9	70.6	73.4	20.2	52	49.6	543.3	637.8	INTERMEDIATE
1989	25.4	11.6	22.2	46	62.8	77.2	66.2	70	54	79	25	14.1	553.5	655.1	INTERMEDIATE
1990	1.2	137	41.6	34.4	15.6	55.1	56.6	77.8	36.1	80.8	41.8	29.6	607.6	646.7	INTERMEDIATE
1991	94.6	0	24.2	20.8	8.7	83.1	44.1	92.4	87.8	13	52.2	42.9	563.8	635.2	INTERMEDIATE
1992	20.2	19.2	30.1	95.5	54.3	45.5	55.7	83.6	105.3	107.6	75.1	87.3	779.4	874.5	WET
1993	81.9	43.2	16.2	5.4	38.4	46.1	61.8	64.8	87.6	74.9	56.2	70.4	646.9	809.3	WET
1994	25	49.2	2.6	34	35.3	48.6	44.1	33.4	46.5	61.2	40	36.8	456.7	583.3	INTERMEDIATE
1995	24.8	30.8	30.2	93	32.6	99.8	60.4	55.6	25.2	35.2	40.2	35.4	563.2	640	INTERMEDIATE
1996	22.8	60.4	20.2	62	5.4	54.8	80	68.4	79.6	26	18	37.2	534.8	610.4	INTERMEDIATE
1997	39.6	7	12.2	10	56.6	23.6	28.6	46.2	64	51.4	66.6	2.2	408	463.2	DRY
1998	28.8	21	3	54.6	18.4	67.8	63	19	70.4	60.2	77.6	29.4	513.2	582	INTERMEDIATE
1999	44.6	67.6	61.8	6.6	55.8	37.2	24.4	69	25	42.2	65.6	48	547.8	654.8	INTERMEDIATE
2000	13.8	12.4	8.2	77.4	93.8	36.4	41.4	32.2	90	96.2	65.6	25	592.4	706	INTERMEDIATE
2001	14.6	27.8		78.6	25.2		34.2	117	67.4		74	35.4		Incomplete dataset	
2002	20.4	51.8	7.6	29.4	37.8	47	42.6	22.2	40.8	38.8	46.2	23	407.6	517	DRY
2003	15.4	41	28.2	25.4	29.9	58.6	43.5	82.2	39.7	98.4	21.4	54.8	538.5	607.7	INTERMEDIATE
2004	23.6	29	35.6	33.2	27	87.5	52.8	63.2	53.6	19.9	85.7	99.4	610.5	686.7	INTERMEDIATE
2005	30.9	122	14.6	16.6		48.5	34.8	67.3	39.4	58	19.1			Incomplete dataset	
2006	61.4	25.6	6.3		23.1		48.8	31.6	31	11.8	17.9	12.2		Incomplete dataset	
2007	82.5	12	12.4	36.4	91.3	24.5	72.8	34.1	37.1	31.6	78.4	99	612.1	642.2	INTERMEDIATE
2008	71.5	19.8	15.7	12.9	34.7	22	86.4	49.4	36.4	15.6	37.2	97.2	498.8	676.2	INTERMEDIATE
2009	2.4	1	37	33	52.8	40	68.2	81	75.2	21.6	68	27.8	508	642.4	INTERMEDIATE
2010	20.2	63.6	53.8	47.2	23.2	36.2	38.6	169	43.4	69	79.4	105.2	748.8	844.6	WET
2011	131.6	35.6	56.8	35.8	67	37.8	49.4	33	32.4	57.4	34.6	24	595.4	780	WET
2012	19.2	4.6	40.2	32.2	52.4	47.8	76	66	47.6	45.8	38.4	24	494.2	552.8	INTERMEDIATE
2013	1.2	21.6	16.8	12.6	51.6	72.4	62.4	69.6	54.8	78.8	30.8	24	496.6	559	INTERMEDIATE
2014	16.8	15.8	18.8	68.6	27	79.2	38.4	35.4	28	12.6	33	17.2	390.8	445.6	DRY
2015	62.6	9.8	19.8	22.4	51	46.2	46.6	26.4	34.8	5	27.6	34	386.2	436.4	DRY
2016	61	14.2	24	17.6	75.8	57.4	68.6	67.2	138.2	81	27.2	26	658.2	719.8	INTERMEDIATE
2017	67.6	25	24.2	91.6	53	15.6	44	62.6	49.8	45.2	79.2	27.4	585.2	638.4	INTERMEDIATE
2018	9.6	9.6	19	12.4	63.6	44.6	48.4	64.4	16.8	20.8	39.4	53.4	402	508.6	DRY
2019	1.8	13.6	12.8	12.6	97.6	66.2	46.8	50.8	35.4	27.6		6.4		464.4	DRY
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Contributing Rainfall	DELWP Method

Dry = <528mm, Intermediate = 528-752mm, Wet = >752mm.

Appendix 2: Brolga flocking season survey results

Date	Survey No.	Surveyor	Wetland	No. of Brolga	Activity	Status - Wetlands Information
6/12/2018	1	Beau Meney	1			Currently holds water, though cattle still access this waterbody in high numbers, viewed from a distance.
			29150			Completely dry. No birds present.
			29162			Completely dry. No birds present.
			29170			Completely dry. No birds present.
			29182			Completely dry.
			29190			Dry. Now densely vegetated with grasses
			29200			Dry. Now densely vegetated with grasses
			29205			Water level has dropped, now shallow. However, still a reasonable area of water remains. Still supports a variety of waterbirds; Sharp-tailed Sandpiper, Red-capped Plover, Red-necked Avocet, Black-winged Stilt, Masked Lapwing, Pink-eared Duck, Grey Teal. No Black Swans present.
			29213			Completely dry. No waterbirds present.
			29214			Considerably lower water level, nearly dry. Only Red-capped Plover present.
			29226			Water levels here are similar to previous visits. Large surface area, generally shallow. No aquatic veg. Waterbirds present; Banded Stilt, Chestnut Teal, Black-winged Stilt, Sharp-tailed Sandpiper, Grey Teal. Grey Teal pair seen sitting on Black Swan nest with at least three large eggs present.
			29243			Very low water levels, almost entirely exposed mud flats with isolated pools. Waterbirds present: Black Swans with large juveniles, Red-necked Stint, Black-winged Stilt, Pink-eared Duck, Grey Teal, Silver Gull and Masked Lapwing.
			29250			Dry wetland, has been all season.
			29253			No wetland present. Dry.
			29316			Dry. Sheep currently present. Drained wetland, likely supplying wetland #1.
			29339			Dry. Sheep currently present.
			30374			Still holding a considerable amount of water. Emergent veg is abundant. Waterbirds present; Australian White Ibis, Australian Wood Duck, Dusky Moorhen, Eurasian Coot and Grey Teal.
31/01/2019	2	Khalid Al-Dabbagh	29150			Dry wetland - no Brolga sighted
			29162			Dry wetland - no Brolga sighted
			29170			Dry wetland - no Brolga sighted
			29182			Dry wetland - no Brolga sighted
			29205			Dry wetland - no Brolga sighted
			29213			Dry wetland - no Brolga sighted
			29214			Dry wetland - no Brolga sighted
			29226			Dry wetland - no Brolga sighted
			29243			Dry wetland - no Brolga sighted
26/02/2019	3	Beau Meney	29150			Dry wetland - no Brolga sighted
			29162			Dry wetland - no Brolga sighted
			29170			Dry wetland - no Brolga sighted
			29182			Dry wetland - no Brolga sighted
			29205			Dry wetland - no Brolga sighted
			29213			Dry wetland - no Brolga sighted
			29214			Dry wetland - no Brolga sighted

Date	Survey No.	Surveyor	Wetland	No. of Brolga	Activity	Status - Wetlands Information
			29226			Dry wetland - no Brolga sighted
			29243			Dry wetland - no Brolga sighted
29/03/2019	4	Beau Meney	29150	0		Dry wetland - no Brolga sighted
			29170	0		Dry wetland - no Brolga sighted
			29162	0		Dry wetland - no Brolga sighted
			29205	0		Dry wetland - no Brolga sighted
			29214	0		Near completely dry. One tiny section contains water, but only supports White-faced Heron.
			29213	0		Dry wetland - no Brolga sighted
			29226	0		Dry wetland - no Brolga sighted
			29243	0		Dry wetland - no Brolga sighted
			29182	0		Dry wetland - no Brolga sighted
			30369	2	Feeding, walking	Good coverage of water. Possible breeding qualities. Sighted feeding near grazing sheep soon after sunrise.
17-18/04/2019	5	Beau Meney	29150	0		Dry wetland - no Brolga sighted
			29182	0		Dry wetland - no Brolga sighted
			30369	2	Feeding, flying, walking.	18/4 - Good coverage of water. One individual sighted feeding in paddock next to wetland very soon after first light, with the other adult flying up from the wetland to join it in the paddock (prior to 7am). Sighted feeding near grazing sheep.
23-24/5/2019	6	Beau Meney	29150	0		Wetland remains completely dry. Sheep are currently grazing on-site. No birds present.
			30369	2	Roosting, walking, feeding	23/5 - No Brolga sighted at roost site. 24/5 - Arrived at the wetland site just prior to sunrise. Range of waterbirds were sighted roosting at the wetland (at the end near the wind mill) with an additional Brolga pair. Brolgas began feeding/walking after sunrise. By this stage, all other waterbirds had left the wetland.
18-19/6/2019	7	Beau Meney	29150	0		Wetland is now holding water, with numerous Black Swans and Australian Shelduck present. Sheep are currently grazing on-site. No brolgas present.
			30369	2	Roosting, walking, feeding	18/6 - No Brolga sighted at roost site. 19/6 - Arrived at the wetland site just prior to sunrise. Brolga pair sighted leaving the wetland and feeding, heading north from the wind mill. By this stage, all other waterbirds had left the wetland.
			29182	0		Wetland is now holding water, though it doesn't yet seem to be support an array of waterbirds. Reasonable coverage of fallen logs and woody debris remains.

Appendix 3: Brolga breeding survey results July to September 2018

Wetland Number	Wetland description (July)	Drainage	Habitat Quality	Wetland description (August)	Habitat Quality	Wetland description (September)
1	Dry	Dammed and cropped	Unlikely breeding habitat	From past aerial photography there were two wetlands in a paddock near the breeding record. These two wetlands are currently in a canola crop. No open water. Unlikely Brolga will breed in them this year. There is also a farm dam nearby that has planted trees around its edge. It is holding water though no emergent vegetation. The dam had a drainage line running into it and out the back into Salt Creek.		Did not access.
29150	20% water cover and a few Black Swan congregating	No	High	This large wetland has 20% surface water cover, emergent vegetation and is grazed by sheep. Black Swan are nesting in it. Waterbirds present Black Swan, Masked Lapwing, Black-winged Stilt, White-faced Heron, White-necked Heron.	High	Brolga pair present. Large wetland with 20-30% of water present. Fringing vegetation with multiple nests on-site (Black Swan nests). Waterbirds; Black Swan, Silver Gull, Red-necked Avocet, White-faced Heron, White-necked Heron, Masked Lapwing, Australian Shelduck.
29162	No access			Access limited this month due to sheep lambing, access should be ok for next month's visit.	Low	Limited view due to cattle presence. Appears to be too deep for nesting, with little fringing vegetation present.
29170	No access			Access limited this month due to sheep lambing, access should be ok for next month's visit.	Moderate	20-30% capacity with some fringing vegetation present. Water level may be suitable, but wet zone is reasonably small. Waterbirds: Pacific Black Duck.
29182	90% water cover	No	Moderate	The wetland was full of water, there was emergent vegetation and it was grazed by sheep. A pair of Black Swan were nesting. Waterbirds present Red-kneed Dotterel, Black-fronted Dotterel, Black Swan, Silver Gull, Australian Shelduck, Grey Teal, Pacific Black Duck, Masked Lapwing.	Moderate	Grazed by sheep, with logs and dead stags scattered throughout. Water level is quite low. Waterbirds; Black Swan, Silver Gull, Grey Teal, Masked Lapwing.
29190	Dry		Currently unsuitable	No surface water, dry, grass, Australian Shelduck and sheep grazing.	Currently unsuitable	Dry wetland, currently supporting pasture. Does not appear to currently contain sheep.
29200	Dry		Currently unsuitable	No water, dry, sheep grazing.	Currently unsuitable	Dry wetland, large in size. Does not appear to currently contain sheep.
29205	Dry	No	Moderate	Water levels full, stock excluded, limited emergent vegetation, fenced. Masked Lapwing, Silver Gull, Australian Shelduck, Black Swan, Pacific Black Duck, Grey Teal, Australasian Shoveler, Black-winged Stilt, Banded Stilt, Red-necked Avocet.	Moderate	Higher capacity than 29213 and 29214, but similar trend with limited vegetation. Many waterfowl present; Black Swan, Red-necked Avocet, Grey Teal, Pink-eared Duck, White-faced Heron, Black-winged Stilt.
29212	Dry	Yes	Unsuitable	Wetland has been permanently drained, no surface water, grazed by sheep. No need to survey in the future.		
29213	Dry	No	Moderate	Wetland was 80% full, not a lot of emergent vegetation but still time for it to grow, stock excluded by fencing. Grey Teal, Black Swan, Australian Shelduck, Masked Lapwing, Black-winged Stilt.	Moderate	30% capacity, with limited emergent/fringe veg cover. Waterbirds; Silver Gull.
29214	Dry	No	Moderate	Wetland was 90% full, no emergent vegetation, stock excluded with fencing. Black Swan, Masked Lapwing, Black-winged Stilt, Silver Gull, Grey Teal.	Moderate	40% capacity, though not a lot of emergent/fringe veg cover. Waterbirds; Black Swan and Silver Gull.
29226	Dry	No	Low	Wetland 90% full, no emergent vegetation, stock excluded. Black Swan, Grey Teal, Masked Lapwing.	Moderate	Reasonably good cover of water, but again with limited vegetation. Waterbirds: Red-necked Avocet.
29243	Dry	No	Moderate	Wetland approximately 90% full, some emergent vegetation, surrounded by crop so stock excluded. A pair of Black Swan Nesting, Waterbirds present Black Swan, Grey Teal, Australasian Shoveler, Eurasian Coot, Australian Shelduck.	Moderate	Good coverage of water, with a noticeably shallower section. Similar story with poor vegetation coverage. Waterbirds; Black-winged Stilt, Black Swan, Australian Shoveler.
29250	Dry	Yes	Currently unsuitable	Not a lot of surface water, only fills on average 1 in five years. Australian Shelduck grazing.	Currently unsuitable	Currently dry with sheep currently grazing. Fills only in particularly wet years according to landowner.
29252	Dry	Dammed	Unsuitable	Wetland has been permanently drained. No need to survey in the future.		
29253	Dry		Currently unsuitable	Very shallow water, only fills one in five years according to landholder. Silver Gull, White Ibis, Masked Lapwing, Australian Shelduck.	Currently unsuitable	Currently dry with sheep access. Infrequently fills in only wet years according to landowner. Dam at far south has some water.
29316	Dry	Yes	Low	Wetland has been drained, looks like it could be swampy in southern section if high rainfall. Only drainage line holds surface water.	Currently unsuitable	Drained wetland that is now supporting pasture and sheep.
29339	Dry	Yes	Currently unsuitable	This wetland has many drains in it. Only drains show signs of holding surface water. May be possible breeding site in times of high rainfall. Waterbirds foraging in southern section including Black Swan, Australian Shelduck, White-faced Heron, White-necked Heron.		
29340	No access	Dammed		No access		No access
29341	No access			No access		No access
29366	No access			No access		No access
29367	Wetland has been drained, cropped and a farm dam	Drained, cropped and dammed	Unsuitable	Wetland has been drained, cropped and a farm dam installed. No need to survey in future.		Wetland has been drained, cropped and a farm dam installed. No need to survey in future.

Wetland Number	Wetland description (July)	Drainage	Habitat Quality	Wetland description (August)	Habitat Quality	Wetland description (September)
	installed. No need to survey in future.					
29372	Wetland has been drained, cropped and a farm dam installed. No need to survey in future.	Drained, cropped and dammed	Unsuitable	Wetland has been drained, cropped and a farm dam installed. No need to survey in future.		Wetland has been drained, cropped and a farm dam installed. No need to survey in future.
30264	No access			No access		No access
30374	Full (of water).		Moderate	The wetland was full of water, some emergent vegetation, sheep grazing, and a swan nesting. Many waterbirds present including Black Swan, Grey Teal, Chestnut Teal, Pink-eared Duck, Australasian Shoveler, Eurasian Coot, Purple Swamphen, Australian Shelduck, Black-fronted Dotterel, Australasian Grebe, Pacific Black Duck, Masked Lapwing.	Moderate	Wetland is at full capacity and contains emergent veg. Dammed and is likely to be too deep. Waterbirds; White-faced Heron, Black Swan, Eurasian Coot, Australian Wood Duck.
30441	No access, unsure who the landholder is. The neighbouring landholder told me that Brolga use to breeding the wetland each year but since the new owners attempted to drain the wetland three years ago and cropped the surrounding paddocks the Brolga have not returned. There was visible earth works done at the wetland that you can see from the road though can not see the wetland.	Yes		No access		No access

Appendix 4 Brolga breeding survey results October to December 2018

Wetland Number	Habitat Quality	Wetland description (October)	Habitat Quality	Wetland Description (November)	Habitat Quality	Wetland Description (December)
1	Low	Likely too deep. Some emergent vegetation, particularly around centre island. Trees present, with cattle accessing the wetland. Unfenced. Waterbirds; Eurasian Coot.	Low	Still holds reasonable amount of water. Cattle present.	Poor/Unsuitable	Currently holds water, though cattle still access this waterbody in high numbers, Viewed from a distance.
29150	Low/Moderate	Water levels are noticeably down since last survey. Only Australian Shelduck are present. 10% capacity. Previous nests are mostly away from areas of water now.	Currently Unsuitable	Completely dry. No birds present.	Currently unsuitable	Completely dry. No birds present.
29162	Low	Similar condition to previous survey. Minimal aquatic vegetation visible from a distance.	Low	Similar condition to previous survey. Minimal aquatic vegetation visible from a distance.	Currently unsuitable	Completely dry. No birds present.
29170	Moderate	Reasonably good coverage of water present with aquatic veg present. Close to pine hedge. Waterbirds; Grey Teal and Australian Shelduck.	Low	Nearly dry, considerably less water.	Currently unsuitable	Completely dry. No birds present.
29182	Currently unsuitable	Completely dry.	Currently Unsuitable	Completely dry.	Currently unsuitable	Completely dry.
29190	Currently unsuitable	Dry wetland, currently pasture. Sheep currently absent.	Currently Unsuitable	Dry. Now densely vegetated with grasses	Currently unsuitable	Dry. Now densely vegetated with grasses
29200	Unsuitable	Dry wetland, . Sheep currently absent.	Currently Unsuitable	Dry. Now densely vegetated with grasses	Currently unsuitable	Dry. Now densely vegetated with grasses
29205	Moderate	Many waterfowl present. Good coverage of water. Waterbirds; Australian Shelduck, Black Swan, Silver Gull, Black-winged Stilt, Grey Teal.	Moderate	Many waterfowl present. Good coverage of water. Waterbirds; Australian Shelduck, Black Swan, Silver Gull, Black-winged Stilt, Grey Teal.	Currently poor/unsuitable	Water level has dropped, now shallow. However, still a reasonable area of water remains. Still supports a variety of waterbirds; Sharp-tailed Sandpiper, Red-capped Plover, Red-necked Avocet, Black-winged Stilt, Masked Lapwing, Pink-eared Duck, Grey Teal. No Black Swans present.
29212						
29213	Moderate	30% capacity, limited vegetation (fringe/emergent). Waterbirds; Black Swan, Silver Gull, Black-winged Stilt, Grey Teal.	Low	Nearly dry, minimal water remaining.	Currently unsuitable	Completely dry. No waterbirds present.
29214	Moderate	Very similar conditions to wetland 29213 - limited veg. Waterbirds; Black Swan; Silver Gull, Black-winged Stilt, Masked Lapwing.	Low	Water levels have noticeably dropped since previous visit.	Currently unsuitable	Considerably lower water level, nearly dry. Only Red-capped Plover present.
29226	Moderate	Good coverage of water, though little aquatic/fringing veg. Black Swan incubating. Many waterbirds present. Waterbirds; Black Swan, Black-winged Stilt, Grey Teal, Masked Lapwing, Chestnut Teal.	Moderate	Still contains a good coverage of water. No aquatic vegetation.	Poor	Water levels here are similar to previous visits. Large surface area, generally shallow. No aquatic veg. Waterbirds present; Banded Stilt, Chestnut Teal, Black-winged Stilt, Sharp-tailed Sandpiper, Grey Teal. Grey Teal pair seen sitting on Black Swan nest with at least three large eggs present.
29243	Moderate-High	Some aquatic vegetation scattered across the wetland. Black Swan incubating. Many waterbirds present. Black Swan, Red-necked Stint, Eurasian Coot, Grey Teal, Black-winged Stilt, Masked Lapwing.	Moderate	Similar condition to previous survey, though water levels have noticeably dropped.	Unsuitable	Very low water levels, almost entirely exposed mud flats with isolated pools. Waterbirds present: Black Swans with large juveniles, Red-necked Stint, Black-winged Stilt, Pink-eared Duck, Grey Teal, Silver Gull and Masked Lapwing.
29250	Currently unsuitable	Dry wetland. Vegetation remains present with sparse coverage of rushes. Waterbirds; Australian Shelduck.	Currently unsuitable	Dry wetland, has been all season.	Currently unsuitable	Dry wetland, has been all season.
29252						
29253	Unsuitable	No wetland present	Currently unsuitable	No wetland present. Dry.	Unsuitable	No wetland present. Dry.
29316	Unsuitable	Drained wetland supporting sheep.	Currently unsuitable	Dry. Sheep currently present. Drained wetland, likely supplying wetland #1.	Currently unsuitable	Dry. Sheep currently present. Drained wetland, likely supplying wetland #1.
29339	Currently unsuitable	From main roadside, appears to be dry and supporting sheep.	Currently unsuitable	Dry. Sheep currently present.	Currently unsuitable	Dry. Sheep currently present.
29340		No access		No access		No access
29341		No access		No access		No access
29366		No access		No access		No access

Wetland Number	Habitat Quality	Wetland description (October)	Habitat Quality	Wetland Description (November)	Habitat Quality	Wetland Description (December)
29367		Wetland has been drained, cropped and a farm dam installed. No need to survey in future.		Wetland has been drained, cropped and a farm dam installed. No need to survey in future.		Wetland has been drained, cropped and a farm dam installed. No need to survey in future.
29372		Wetland has been drained, cropped and a farm dam installed. No need to survey in future.		Wetland has been drained, cropped and a farm dam installed. No need to survey in future.		Wetland has been drained, cropped and a farm dam installed. No need to survey in future.
30264		No access		No access		No access
30374	Moderate	Good volume of water, perhaps too deep. Favourable amount of emergent veg. Black Swan nest present. Waterbirds; Black Swan, Eurasian Coot, Australian Shoveler, Red-kneed Dotterel.	Moderate	Good volume of water, perhaps too deep. Favourable amount of emergent veg. Black Swan nest present. Waterbirds; Black Swan, Eurasian Coot, Australian Shoveler, Red-kneed Dotterel.	Moderate/Low	Still holding a considerable amount of water. Emergent veg is abundant. Waterbirds present; Australian White Ibis, Australian Wood Duck, Dusky Moorhen, Eurasian Coot and Grey Teal.
30441		No access		No access		No access

Appendix 5: Summary of number of files analysed between 45-55 hertz and bat species recorded at each location.

Season	Turbine	Position	Total Number of files 10-55kHz	Total Number of files 45-55kHz	SBWB calls	SBWB Sp. Complex	Chocolate Wattled Bat	Little Forest Bat	Forest Bat sp *Vespadelus darlingtoni / V. Regulus / V. vulturnus*	Long-eared species *Nyctophilus geoffroyi / gouldi*	Tot. nights of recording
spring	T2	gr.	1827	253			y	y	y		53
		nac	1061	10			y		y		92
	T5	gr.	3494	135			y	y	y		53
		nac	934	2			y		y		91
	T10	gr.	3854	901			y	y	y	Y	53
		nac	818	0							95
	T13	gr.	368	7					y		53
		nac	1116	0							95
Autumn	T2	gr.	3108	268	2	3	y	y	y		49
		nac	1335	6			y				31
	T5	gr.	5943	882			y	y	y	y	49
		nac	1949	1					y		63
	T10	gr.	1607	599	1	7	y	y	y		49
		nac	1481	0							67
	T13	gr.	3849	528	2	4	y	y	y	y	49
		nac	1730	0			Y				69

Notes: gr. = ground; nac. = Nacelle.

Appendix 6: Year 1 raw carcass search data

Date	Weather (past 5 days)	Common name	Scientific name	Threatened Status	Report (R)/ Feather spot (FS)/ Incidental (INC)	Turbine number	Distance from turbine (m)	Bearing from turbine (°)	Notes
18/07/2018	Raining	Nankeen Kestrel	*Falco cenchroides*		INC18.7.1	1	40	?	Stored in freezer
24/07/2018	Strong wind/rain	Welcome Swallow	*Hirundo neoxena*		R18.7.2	2	80	SE	Stored in freezer, farming shed nearby
24/07/2018	Strong wind/rain	Australian Magpie	*Cracticus tibicen*		R18.7.1	8	140	S	Stored in freezer, open wound on chest, photo not taken
22/08/2018	Some rain, windy, followed by mild conditions	Brown Falcon	*Falco berigora*		R18.8.1	2	20	S	Found by staff but left in field for survey. Stored in freezer at BLA office
24/09/2018	Gentle wind, mild	Nankeen Kestrel	*Falco cenchroides*		R18.9.1	1	15	S	Desiccated, carcass discarded, head missing
25/09/2018	Gentle wind, mild	Stubble Quail	*Coturnix pectoralis*		R18.9.2	4	50	S	Few days old, mostly intact, heavily damaged, discarded
25/09/2018	Gentle wind, mild	Grey Headed Flying Fox	*Pteropus poliocephalus*	EPBC - Vulnerable	R18.9.3	5	41	SW	Fresh intact, stored in freezer, broken wing, bone exposed
25/09/2018	Gentle wind, mild	Australian Magpie	*Cracticus tibicen*		R18.9.4	7	20	SW	Intact, stored in freezer
26/10/2018	Some rain, fresh wind, mild	Australian Magpie	*Cracticus tibicen*		FS18.10.1	10	89	SW	Feather spot
24/10/2018	Some rain, fresh wind, mild	Brown Falcon	*Falco berigora*		R18.10.1	6	21	W	Desiccated, 2-3 weeks on the ground
25/10/2018	Some rain, fresh wind, mild	Australian Magpie	*Cracticus tibicen*		R18.10.3	9	45	N	Maggot ridden, cut in half, discarded
24/10/2018	Some rain, fresh wind, mild	Eurasian Skylark*	*Alauda arvensis*		R18.10.2	6	81	N	Fresh, head missing, crushed
25/10/2018	Some rain, fresh wind, mild	Common Starling*	*Sturnus vulgaris*		R18.10.5	14	30	NW	Dry, stiff, chest wound, intact.
18/12/2018	Some heavy rain, sun	White-striped Freetail Bat	*Austronomus australis*		R18.12.1	1	5	E	Desiccated, carcass discarded
19/12/2018	Some heavy rain, sun	Welcome Swallow	*Hirundo neoxena*		R18.12.2	7	27	E	Desiccated, carcass discarded
24/01/2019	Fine, some clouds, hot	Australian Magpie	*Cracticus tibicen*		FS19.1.1	12	-	-	Difficult to ID but most likely a magpie
24/01/2019	Fine, some clouds, hot	Common Starling*	*Sturnus vulgaris*		R19.1.1	4	145	NW	Intact, stored in freezer
24/01/2019	Fine, some clouds, hot	Eurasian Skylark*	*Alauda arvensis*		R19.1.2	9	35	SSW	Intact, desiccated, disposed of
23/01/2019	Fine, some clouds, hot	Gould's Wattled Bat	*Chalinolobus gouldii*		R19.1.3	3	3	W	Intact, desiccated, disposed of
23/01/2019	Fine, some clouds, hot	Gould's Wattled Bat	*Chalinolobus gouldii*		R19.1.4	3	23	SE	Intact, desiccated, disposed of
20/02/2019	Fine, some clouds, mild	White-striped Freetail Bat	*Austronomus australis*		R19.2.1	2	66	SW	Intact, some desiccation. Stored in freezer

Date	Weather (past 5 days)	Common name	Scientific name	Threatened Status	Report (R)/ Feather spot (FS)/ Incidental (INC)	Turbine number	Distance from turbine (m)	Bearing from turbine (°)	Notes
20/02/2019	Fine, some clouds, mild	Chocolate Wattled Bat	*Chalinolobus morio*		R19.2.2	3	33	N	Desiccated. FA 44mm
20/02/2019	Fine, some clouds, mild	Grey Headed Flying Fox	*Pteropus poliocephalus*	EPBC - Vulnerable	R19.2.3	3	24	E	Head injury, intact, stored in freezer. 1-3 days old
20/02/2019	Fine, some clouds, mild	Chocolate Wattled Bat (TBC)	*Chalinolobus morio*		R19.2.4	7	10	W	Desiccated. Stored in freezer to be confirmed
21/02/2019	Fine, some clouds, mild	White-striped Freetail Bat	*Austronomus australis*		R19.2.5	7	60	S	Used in trials immediately
21/02/2019	Fine, some clouds, mild	Gould's Wattled Bat	*Chalinolobus gouldii*		R19.2.6	10	10	N	Intact, bones visible on underside, desiccated
21/02/2019	Fine, some clouds, mild	Grey Headed Flying Fox	*Pteropus poliocephalus*	EPBC - Vulnerable	R19.2.7	10	15	S	Intact, strong smell, decomposition beginning, stored in freezer
21/02/2019	Fine, some clouds, mild	Australian Magpie	*Cracticus tibicen*		R19.2.8	15	90	E	Only head remained.
22/02/2019	Fine, some clouds, mild	Grey Headed Flying Fox	*Pteropus poliocephalus*	EPBC - Vulnerable	INC19.2.1	14	15	?	Found by staff but left in field for survey. Stored in freezer at site (I assume)
20/03/2019	Fine, hot, little wind	Eastern Barn Owl	*Tyto javanica*		R19.3.1	1	66	S	Well decomposed, only bones remained
20/03/2019	Fine, hot, little wind	White-striped Freetail Bat	*Austronomus australis*		R19.3.2	1	4	N	Decomposed but intact
20/03/2019	Fine, hot, little wind	Gould's Wattled Bat	*Chalinolobus gouldii*		R19.3.4	1	38	NW	Desiccated. 1 week
21/03/2019	Fine, hot, little wind	Gould's Wattled Bat	*Chalinolobus gouldii*		R19.3.5	8	41	W	Fresh, stored in freezer
21/03/2019	Fine, hot, little wind	Galah	*Eolophus roseicapilla*		FS19.3.1	7	33	NW	Feather spot
21/03/2019	Fine, hot, little wind	White-striped Freetail Bat	*Austronomus australis*		R19.3.6	9	8	E	Decomposed. Intact
21/03/2019	Fine, hot, little wind	White-striped Freetail Bat	*Austronomus australis*		R19.3.3	9	48	S	Intact, fresh
21/03/2019	Fine, hot, little wind	Australian Magpie	*Cracticus tibicen*		FS19.3.2	9	65	NE	Feather spot
30/04/2019	Fine, overcast	Gould's Wattled Bat	*Chalinolobus gouldii*		R19.4.1	1	40	N	FA 4.6cm, stored in freezer
30/04/2019	Fine, overcast	Gould's Wattled Bat	*Chalinolobus gouldii*		R19.4.2	6	111	E	Desiccated. Discarded.
30/04/2019	Fine, overcast	Australian Magpie	*Cracticus tibicen*		FS19.4.1	6	71	S	Feather spot
1/05/2019	Fine, overcast	Unknown bat sp.			R19.4.3	5	44	S	Only tail and feet remain. No ID features
2/05/2019	Storm previous night	White-striped Freetail Bat	*Austronomus australis*		R19.4.4	14	80	SW	Desiccated. Discarded.
9/04/2019	Some rain, overcast, mild	European Goldfinch*	*Carduelis carduelis*		INC19.4.1	1	53	S	additional search outside of formal searches
9/04/2019	Some rain, overcast, mild	White-striped Freetail Bat	*Tadarida australis*		INC19.4.2	2	25	W	additional search outside of formal searches
10/04/2019	Some rain, overcast, mild	White-striped Freetail Bat	*Tadarida australis*		INC19.4.3	5	20	E	additional search outside of formal searches
10/04/2019	Some rain, overcast, mild	White-striped Freetail Bat	*Tadarida australis*		INC19.4.4	7	111	S	additional search outside of formal searches

Date	Weather (past 5 days)	Common name	Scientific name	Threatened Status	Report (R)/ Feather spot (FS)/ Incidental (INC)	Turbine number	Distance from turbine (m)	Bearing from turbine (°)	Notes
10/04/2019	Some rain, overcast, mild	Gould's Wattled Bat	*Chalinolobus gouldii*		INC19.4.5	7	40	E	additional search outside of formal searches
10/04/2019	Some rain, overcast, mild	White-striped Freetail Bat	*Tadarida australis*		INC19.4.6	9	10	N	additional search outside of formal searches
10/04/2019	Some rain, overcast, mild	Australian Magpie	*Cracticus tibicen*		INC19.4.7	9	35	E	additional search outside of formal searches
11/04/2019	Some rain, overcast, mild	Gould's Wattled Bat	*Chalinolobus gouldii*		INC19.4.8	5	50	E	additional search outside of formal searches
11/04/2019	Some rain, overcast, mild	Southern Forest Bat	*Vespadelus regulus*		INC19.4.9	10	15	W	additional search outside of formal searches
22/05/2019	Fine, clear	Australian Magpie	*Cracticus tibicen*		R19.5.1	1	70	S	Fresh. Used in scav trials
22/05/2019	Fine, clear	Australiasian Pipit	*Anthus novaeseelandiae*		R19.5.2	3	110	S	Unlikely a collision, too far and bird not typically in RSA range
23/05/2019	Fine, clear	Chocolate Wattled Bat	*Chalinolobus morio*		R19.5.3	15	66	E	Fresh, FA 4cm. Stored
23/05/2019	Fine, clear	Gould's Wattled Bat	*Chalinolobus gouldii*		R19.5.4	15	70	S	Fresh. Stored
19/06/2019	Heavy rain, cold	Australian Magpie	*Cracticus tibicen*		R19.6.1	10	59	SE	Old carcass >1 week. Discarded
19/06/2019	Heavy rain, cold	White-striped Freetail Bat	*Austronomus australis*		R19.6.2	12	15	SE	Desiccated. Wing only. Discarded

Appendix 7: Symbolix statistical analysis of Year 1 mortality data

symbolix

Salt Creek Wind Farm Mortality Estimate - Year 1

Prepared for Nature Advisory, 14 August 2019, Ver. 1.0

This report outlines an analysis of the mortality data collected at the Salt Creek Wind Farm from 2018-07-23 to 2019-06-20. The analysis is broken into the three related components below:

- Searcher efficiency / detectability – estimated from trials in October 2018, February 2019, May 2019 and June 2019
- Scavenger loss rates – consisting of trials in October 2018, November 2018, December 2018, February 2019, April 2019 and May 2019
- Mortality estimates - based on monthly surveys at all 15 turbines, from 2018-07-23 to 2019-06-20

The data was collected and provided by Nature Advisory and is analysed "as-is". A brief summary of the data is provided below, and the ultimate focus of this report is a discussion of the potential mortality.

Available data

The data analysed was collected, verified and provided to us from Nature Advisory[1].

Methodology overview

Mortality through collision is an ongoing environmental management issue for wind facilities. Different sites present different risk levels; consequently different sites have different monitoring requirements. In order to estimate the mortality loss at a given site (in a way that is comparable with other facilities) we must account for differences in survey effort, searcher and scavenger efficiency. We used a Monte-Carlo simulation to achieve this.

The analysis used survey data to estimate the average time to scavenge loss and searcher efficiency (and related confidence intervals). The algorithm then simulated different numbers of virtual mortalities. We could then estimate how many carcasses were truly in the field, given the range of searcher and scavenger efficiencies, and the survey frequency and coverage, and

[1] Symbolix mortality spreadsheet SCWF 190801.xlsx

the true "found" details. After many simulations, we can estimate the likely range of mortalities that could have resulted in the recorded survey outcome.

This method has been benchmarked against analytical approaches (Huso (2011), F. Korner-Nievergelt et al. (2011)). Its outputs are equivalent but it is able to robustly model more complex survey designs (e.g. pulsed surveys, rotating survey list).

Searcher efficiency

Four searcher efficiency trials were held (2018-10-25, 2019-02-21, 2019-05-23 and 2019-06-20). A human did the first two months, and a dog was used for the last two months. A range of bird sizes were used, ranging from small (Common Myna), to medium (Peregrine Falcon), to large (Australian Magpie). Both bat and "bat proxy" (mouse) carcasses were used to determine bat searcher efficiencies. Both small (White-striped Freetail) and large (Grey-headed flying fox) bats were used.

The detectability trials used both bird (39 replicates) and bat carcasses (27 replicates, of which 6 were mice as bat proxies). We found evidence that searcher efficiency differed between birds and bats ($z = 3.552$, $p < 0.001$), and also between dog and human searchers ($z = -2.003$, $p = 0.045$). We have therefore kept bat and bird searcher efficiency separate, and used a weighted average to account for the difference between human and canine searcher efficiency.

Table 1 summarises the results prior to aggregating with a weighted average.

Bat detectability is 62%, with a 95% confidence interval of [42%, 78%]

Bird detectability is 82% with a 95% confidence interval of [66%, 91%]

Table 1: Detection efficiencies for birds and bats by observer type.

Variable	Bat_Human	Bat_Dog	Bird_Human	Bird_Dog
Number found	4	13	16	15
Number placed	11	16	21	18
Mean detectability proportion	0.36	0.81	0.76	0.83
Detectability lower bound (95% confidence interval)	0.11	0.54	0.53	0.59
Detectability upper bound (95% confidence interval)	0.69	0.96	0.92	0.96

Scavenger efficiency

Scavenger efficiency trials were conducted at the same time as the searcher efficiency trials. Trials ran over 30 days, and used the same set of species as the searcher efficiency trials.

Survival analysis (Kaplan and Meier (1958)) was used to determine the average time until complete loss from scavenge. Survival analysis was required to account for the fact that we

do not know the exact time of scavenge loss, only an interval in which the scavenge event happened. By performing survival analysis we can estimate the average survival percentage after a given length of time, despite these unknowns.

Based on these surveys there is no evidence that birds and bats have significantly different scavenger rates, based upon AIC selection (ΔAIC = 1.2). Therefore, in the following mortality estimate, bird and bat scavenger rates are aggregated.

Figure 1 shows a survival curve fitted to the combined cohort of bat and bird. The survival curves (solid lines) show the estimated proportion of the sets remaining at any given time. The shaded portions are the 95% confidence intervals on the estimates. For example, we see that we expect around 5% to 32% of carcasses to remain after ten days with the expectation being around 13%.

Under these assumptions, the mean time to total loss via scavenge is 5.9 days, with a 95% confidence window of [4.1, 8.6] days.

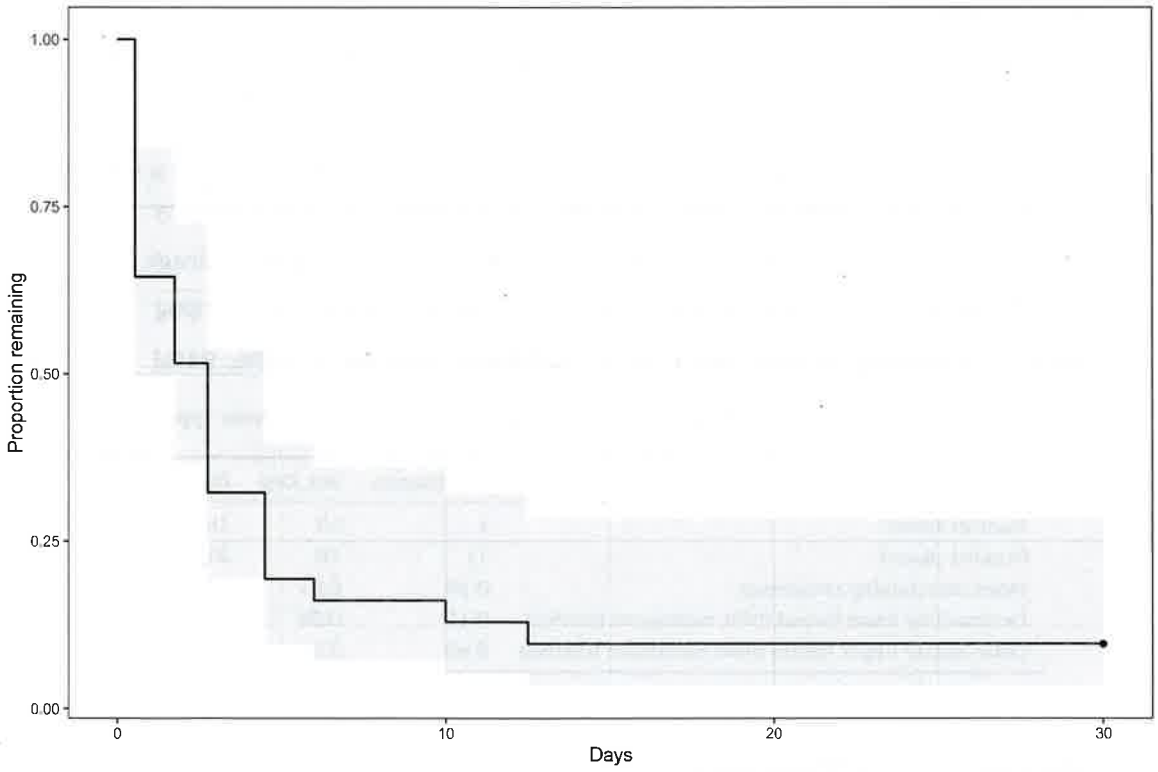

Figure 1: Combined survival curves for birds and bats, with 95% confidence interval shaded.

Other scavenger patterns

There are three general types of scavenger behaviour:

- "perfect"
- "olfactory"; and
- "visual"

These names are classifiers only, and not necessarily accurate descriptions of the actual processes employed by the scavenger. A "perfect" scavenger will find the carcass with constant efficiency, irrespective of the amount of time it has lain on the ground. "Visual" scavengers are more efficient in the earlier period post-mortem, and are less likely to find a carcass the longer it has lain there. "Olfactory" scavengers are the opposite of "visual" scavengers. They require the carcass to lie for some period, before their efficiency of detection increases.

Due to the small number of trials, we have focused on the mean loss rate, and not the shape. This means that we have assumed all scavengers to be "perfect", which is the middle of the two other types.

Mortality projection inputs

Carcass search data

The mortality estimate was based on a dated list of turbine surveys. The survey frequency is summarised in Table 2. All fifteen turbines were selected, and were generally surveyed once each month. All fifteen were surveyed out to a radius of 132 metres.

Table 2: Number of surveys per month.

Date	Standard
2018 Jul	15
2018 Aug	15
2018 Sep	15
2018 Oct	15
2018 Nov	15
2018 Dec	15
2019 Jan	15
2019 Feb	15
2019 Mar	15
2019 Apr	4
2019 May	26
2019 Jun	15

The breakdown of found carcasses per species are summarised in Table 3.

Table 3: Carcasses found during formal surveys over the first year.

Species	Bat	Bird	Feather Spot
Australian Magpie	0	6	4
Australian Pipit	0	1	0
Brown Falcon	0	2	0
Chocolate Wattled Bat	3	0	0
Common Starling*	0	2	0
Eastern Barn Owl	0	1	0
Eurasian Skylark*	0	2	0
Galah	0	0	1
Gould's Wattled Bat	8	0	0
Grey Headed Flying Fox	3	0	0
Nankeen Kestrel	0	1	0
Stubble Quail	0	1	0
Unknown bat sp.	1	0	0
Welcome Swallow	0	2	0
White-striped Freetail Bat	8	0	0

Mortality estimate

Mortality estimation – methodology

With estimates for scavenge loss and searcher efficiency we then converted the number of bat and bird carcasses detected into an estimate of overall mortality at Salt Creek from 2018-06-23 to 2019-06-20 (we allow for collisions to occur up to a month prior to the first survey). We have not generated seasonal estimates due to insufficient data.

The mortality estimation is done via Monte-Carlo simulation. We used 25000 simulations with the survey design simulated each time. Random numbers of virtual mortalities were simulated, along with the scavenge time and searcher efficiency (based on the measured confidence intervals). The proportion of virtual carcasses that were "found" was recorded for each simulation. Finally, those trials that had the same outcome as the reported survey detections were collated, and the initial conditions (i.e. how many true losses there were) reported on.

The complete set of model assumptions are:

- There were 15 turbines on site.
- Search frequency for each turbine was taken from a list of actual survey dates (see Table 2 for a summary).
- Mortalities were allowed to occur up to a month before the initial survey (2018-07-23) and until the final surveyed date (2019-06-20).
- Birds are on-site at all times during this period.
- Bats are on-site from October to April.
- Finds are random and independent, and not clustered with other finds.
- There was equal chance of any turbine individually being involved in a collision / mortality.
- We assumed an exponential scavenge shape ("perfect" scavengers).
- We took scavenge loss and search efficiency rates as outlined above.
- All 15 turbines were selected to be surveyed, and were searched out to a 132 metre radius. We estimated the "coverage factor" for the survey – i.e. the total fall zone surveyed for birds and bats (using estimates from Hull and Muir (2010)). We assumed that the coverage factor was 100% for birds and 100% for bats.

Mortality projection results

After running the simulation we investigated the distribution of mortalities that could have resulted in the actual numbers found during the surveys.

Bat mortality estimate – results

During the year of formal surveys a total of 23 bats were (Table 3). The resulting estimate of total mortality, accounting for searcher efficiency, scavenge rate, search area and timing of surveys is an expectation (mean) of 196 bats and a median of 195 bats lost on site over the twelve months.

Table 4 and Figure 2 display the percentiles of the distribution, to show the confidence interval in this average.

Based on the detected carcasses and measured detectability and scavenge rate, we expect that there was a total site loss of around 196 bats over the survey period, and are 95% confident that fewer than 279 bats were lost.

Table 4: Percentiles of estimated total bat losses over the first year of surveys.

0%	50% (median)	90%	95%	99%	99.9%
100	195	262	279	315	348

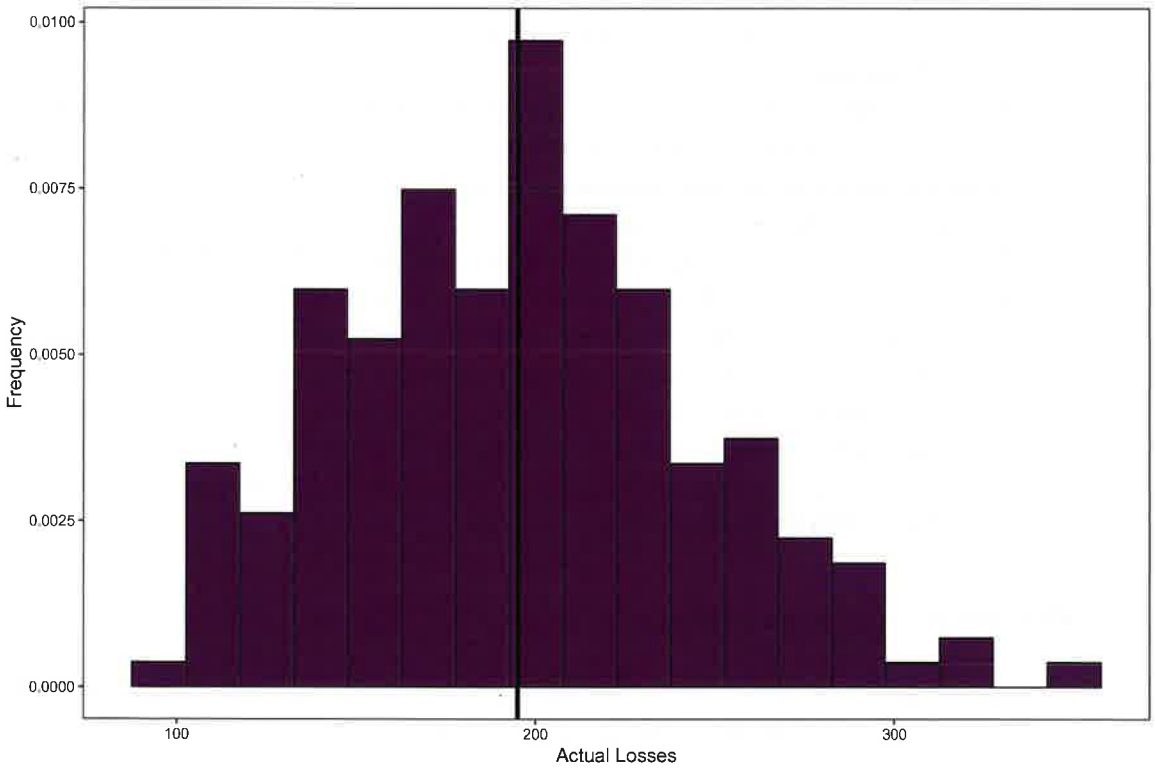

Figure 2: Histogram of the total losses distribution (bats), given 23 were detected on-site. The black solid line shows the median.

Bird mortality estimate - results

During the year of formal surveys a total of 23 birds were found (Table 3. The resulting estimate of total mortality, accounting for searcher efficiency, scavenge rate, search area and timing of surveys is an expectation (mean) of 141 and a median of 141 birds lost on site over the twelve months.

Table 5 and Figure 3 display the percentiles of the distribution, to show the confidence interval in this average.

Based on the detected carcasses and measured detectability and scavenge rate, we expect that there was a total site loss of around 141 birds over the survey period, and are 95% confident that fewer than 202 individuals were lost.

Table 5: Percentiles of estimated total bird losses over the first year of survey.

0%	50% (median)	90%	95%	99%	99.9%
70	141	183	202	228	284

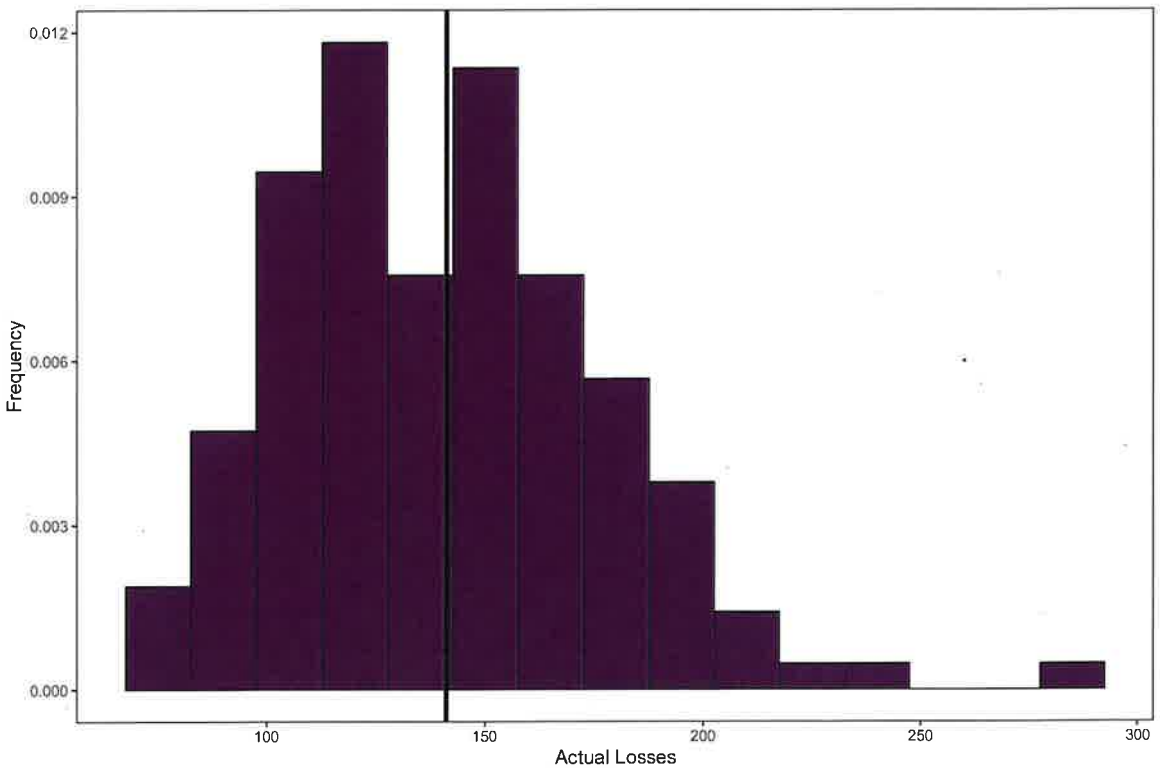

Figure 3: Histogram of the total losses distribution (birds), given 23 were detected on-site. The black solid line shows the median.

Concluding remarks

In evaluating the potential impact, it is important to remember that all mortality estimators have an inherent assumption that there is an unlimited supply of carcasses to be found. Fore example, we did not apply an upper limit on the number of bats that could be onsite. The ecological feasibility of this assumption should be accounted for if using these results to comment on overall ecological impact.

References

Hull, CL, and Stuart Muir. 2010. "Search Areas for Monitoring Bird and Bat Carcasses at Wind Farms Using a Monte-Carlo Model." *Australasian Journal of Environmental Management* 17 (2). Taylor & Francis: 77–87.

Huso, Manuela MP. 2011. "An Estimator of Wildlife Fatality from Observed Carcasses." *Environmetrics* 22 (3). Wiley Online Library: 318–29.

Kaplan, Edward L, and Paul Meier. 1958. "Nonparametric Estimation from Incomplete Observations." *Journal of the American Statistical Association* 53 (282). Taylor & Francis: 457–81.

Korner-Nievergelt, Fränzi, Pius Korner-Nievergelt, Oliver Behr, Ivo Niermann, Robert Brinkmann, and Barbara Hellriegel. 2011. "A New Method to Determine Bird and Bat Fatality at Wind Energy Turbines from Carcass Searches." *Wildlife Biology* 17 (4). BioOne: 350–63.

Appendix 8: Data of all carcasses deployed in the scavenger trials

Season	Species	Carcass size	Placement Date	Days in the field	Scavenger
Spring	Brown Falcon	Large	24/10/2018	30	Unknown
Spring	Australian Magpie	Medium	24/10/2018	30	Unknown
Spring	Common Myna	Small	22/11/2018	1	Raven?
Spring	Common Myna	Small	22/11/2018	-	N/A
Spring	House mouse	Bat proxy	22/11/2018	1	Raven
Spring	House mouse	Bat proxy	22/11/2018	1	Raven
Spring	Common Myna	Small	22/11/2018	1	Unknown
Spring	House mouse	Bat proxy	22/11/2018	1	Magpie?
Spring	Common Myna	Small	22/11/2018	1	Unknown
Spring	Common Myna	Small	22/11/2018	3	Unknown
Spring	House mouse	Bat proxy	22/11/2018	-	Unknown
Spring	House mouse	Bat proxy	22/11/2018	3	Magpie
Summer	Common Myna	Small	19/12/2018	5	Fox
Summer	Common Myna	Small	19/12/2018	13	?
Summer	Common Myna	Small	19/12/2018	3	?
Summer	Common Myna	Small	19/12/2018	2	Fox
Summer	Common Myna	Small	19/12/2018	2	Fox
Summer	Common Myna	Small	19/12/2018	1	Magpie
Summer	Common Myna	Small	19/12/2018	-	N/A
Summer	Gould's Wattled Bat	small	21/02/2019	-	N/A
Summer	Brown Falcon	Large	21/02/2019	3	Fox
Summer	White-striped Freetail Bat	Bat	21/02/2019	3	Unknown
Summer	Peregrin Falcon	Medium	21/02/2019	5	unknown
Summer	Common Myna	Small	21/02/2019	-	N/A
Summer	Gould's Wattled Bat	Bat	21/02/2019	1	Magpie
Summer	White-striped Freetail Bat	Bat	21/02/2019	-	N/A
Summer	Nankeen Kestrel	Medium	21/02/2019	5	Fox
Summer	Common Myna	Small	21/02/2019	-	N/A

Autumn	Australian Magpie	Medium	17/04/2019	-	Unknown
Autumn	White-striped Freetail Bat	Bat	17/04/2019	1	Raven
Autumn	Chicken	Large proxy	17/04/2019	-	Unknown
Autumn	White-striped Freetail Bat	Bat	17/04/2019	1	Raven
Autumn	Long-billed Corella	Medium	17/04/2019	1	Wedge-tailed Eagle
Autumn	White-striped Freetail Bat	Bat	17/04/2019	3	Red Fox
Autumn	Whistling Kite	Large	17/04/2019	-	Unknown
Autumn	White-striped Freetail Bat	Bat	17/04/2019	-	Unknown
Autumn	Chicken	Large proxy	17/04/2019	2	Inconclusive
Autumn	Gould's Wattled Bat	Bat	23/05/2019	5	Red Fox
Autumn	Gould's Wattled Bat	Bat	23/05/2019	-	
Autumn	Chicken	Large proxy	23/05/2019	2	Raven
Autumn	Chicken	Large proxy	23/05/2019	10	Unknown
Autumn	Australian Magpie	Medium	23/05/2019	-	
Autumn	White-striped Freetail Bat	Bat	23/05/2019	-	
Autumn	Australian Magpie	Medium	23/05/2019	-	
Autumn	Grey-headed Flying-Fox	Fruit Bat	23/05/2019	30	Raven
Autumn	Grey-headed Flying-Fox	Fruit Bat	23/05/2019	7	Red Fox
Winter	Chicken	Large proxy	20/06/2019	1	Red Fox
Winter	Chicken	Large proxy	20/06/2019	1	unknown
Winter	Bat	Bat	20/06/2019	1	unknown
Winter	Bat	Bat	20/06/2019	1	Red Fox
Winter	Chicken	Large proxy	20/06/2019	1	Crows
Winter	Bat	Bat	20/06/2019	9	Magpie
Winter	Bat	Bat	20/06/2019	1	Magpie
Winter	Chicken	Large proxy	20/06/2019	3	Crows
Winter	Bat	Bat	20/06/2019	14	Fox
Winter	Bat	Bat	21/06/2019	-	

Winter	Bat	Bat	21/06/2019	-	
Winter	Bat	Bat	21/06/2019	8	Cat
Winter	House mouse	Bat sub	21/06/2019	1	Magpie
Winter	Common Myna	Small	21/06/2019	-	
Winter	Brown Falcon	Large	21/06/2019	-	
Winter	Blue Wing Parrot	Small	21/06/2019	2	Fox
Winter	Common Myna	Small	21/06/2019	3	Fox
Winter	Spotted Dove	Small	21/06/2019	1	Unknown

*Yellow cells indicate failed scavenger events