

Final Report

Bat and Avifauna Management Plan, Ferguson Wind Farm, Victoria

Prepared for

Ferguson Wind Farm Pty Ltd

October 2019



Ecology and Heritage Partners Pty Ltd

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LIST OF ACRONYMS

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Date: 10/02/2020

Acronym	Description
BAM	Bird and Avifauna Management (Plan)
CoA	Conditions of Approval
DELWP	Victorian Department of Environment, Land, Water and Planning
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
FFG Act	<i>Flora and Fauna Guarantee Act 1988</i>
PPE	Personnel Protective Equipment
RSA	Rotor Swept Area
VBA	Victorian Biodiversity Database

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1 INTRODUCTION

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Date: 10 April 2017

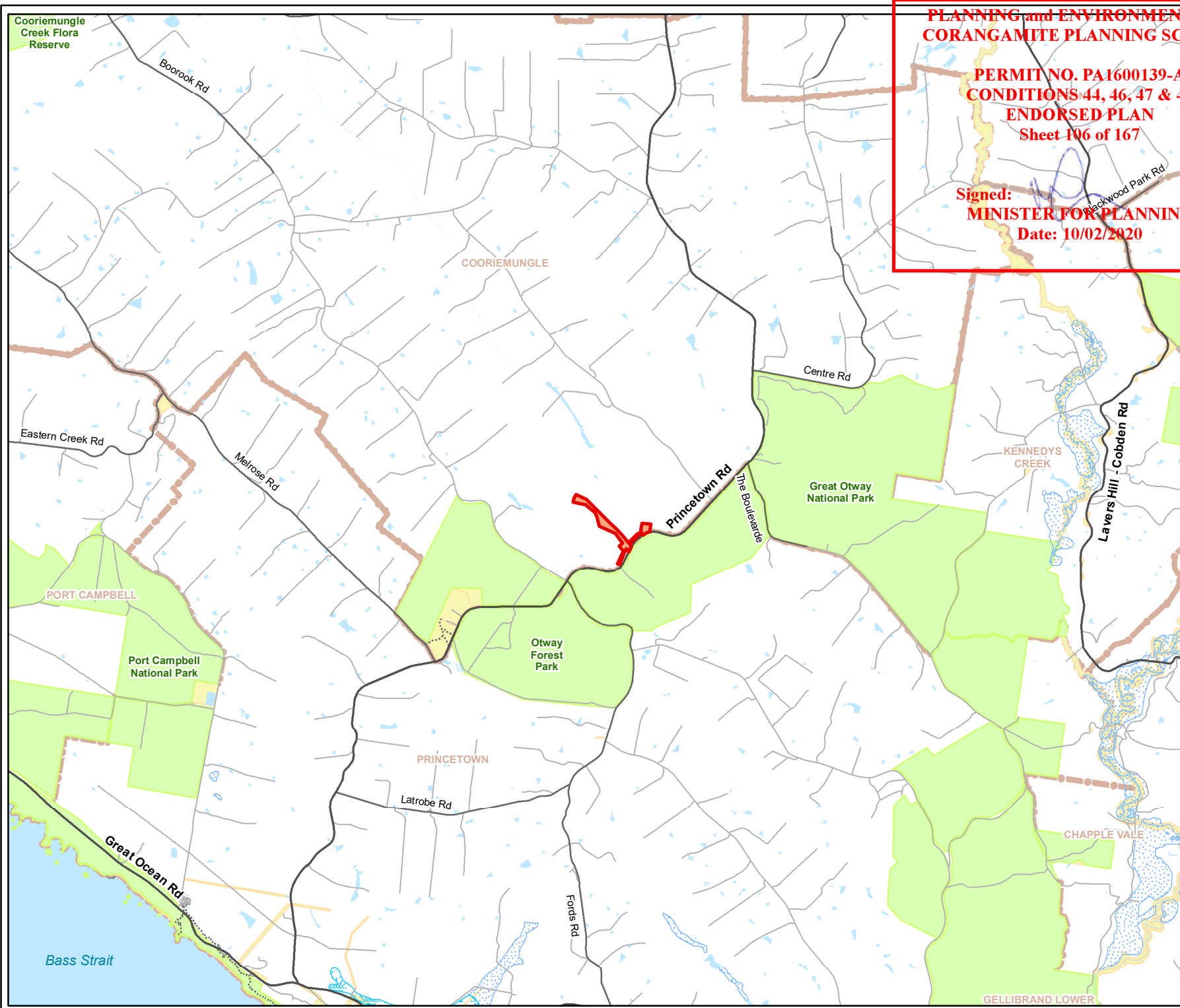
The Ferguson Wind Farm was approved by the Victorian Minister for Planning on 12 April 2017. The wind energy facility is located approximately 6.5 kilometres west of Kennedys Creek (Figure 1) and will consist of three turbines, each with a maximum tip height of 200 metres and a minimum Rotor Swept Area (RSA) height of 64.9 metres (Appendix 1). Construction of the wind farm is scheduled to commence in April of 2019.

The issued Planning Permit (PA1600139-A) states the requirement to prepare a Bird and Avifauna Management (BAM) Plan, aimed at managing and mitigating any significant bird or bat strike events arising from operation of the wind farm. Consultation with representatives of the Victorian Department of Environment, Land Water and Planning (DELWP) indicated that the BAM Plan should focus on microchiropteran bats (microbats), and specifically, the nationally significant Southern Bent-wing Bat *Miniopterus orianae bassanii*. Ecological studies completed for the wind farm identified that low numbers of this species are likely to forage within the study area or fly over the site during migration (Ecology and Heritage Partners Pty Ltd 2016a;2016b).

This BAM Plan establishes monitoring and management procedures consistent with the methods outlined by the Australian Wind Energy Association (AusWea 2005) and endorsed by the Clean Energy Council 'Best Practice Guidelines' (CEC 2013). The objectives of this BAM Plan are as follows:

- Establish an outcome-focussed and adaptive monitoring program aimed at answering the following key questions:
 - Is operation of the wind farm resulting in microbat mortality, and if so:
 - What is the estimated annual mortality rate?
 - What species are being impacted?
 - Is there seasonal variation in the number of microbat mortalities?
 - Are Southern Bent-wing Bats using the wind farm area during peak migration periods, and if so,
 - Are they flying at RSA height?
 - How frequent is bat activity?
 - Are all habitat types being utilised?
- Describe mitigation measures to reduce the risk of bat and bird mortality through turbine strike;
- Provide a framework for responding to detected impacts on bats and birds;
- Detail procedures for the periodic reporting of findings to DELWP; and,
- Provide a clear summary of management actions required to address the subject Conditions of Approval (CoA) and updated Notice of Decision (NoD).

Following endorsement of this BAM Plan by the Minister for Planning, the incorporated management measures will form part of the Planning Permit and BayWa-r.e. Wind Pty Ltd will be responsible for implementation.



PLANNING and ENVIRONMENT ACT
CORANGAMITE PLANNING SCHEME

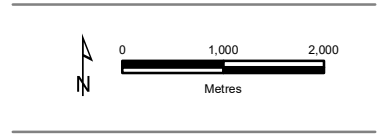
PERMIT NO. PA1600139-A
CONDITIONS 44, 46, 47 & 48
ENDORSED PLAN
Sheet 106 of 167

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- Legend**
- Study Area
 - Major Road
 - Collector Road
 - Minor Road
 - Proposed Road
 - Walking Track
 - Permanent Waterbody
 - Land Subject to Inundation
 - Wetland/Swamp
 - Parks and Reserves
 - Crown Land
 - Localities



Figure 1
Location of the study area
BAM Plan - Ferguson Wind Farm



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2 COMPLIANCE SUMMARY

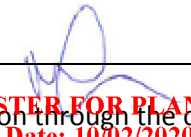
The CoA relating to this BAM Plan are presented in Table 1, with an accompanying reference showing where each point has been addressed. In accordance with the requirements of DELWP, this plan focusses on monitoring and managing potential impacts on microbats, including the nationally significant Southern Bent-wing Bat.

Table 1 CoA relating to this BAM Plan

CoA	Permit Condition Requirements	Comment/ Reference
48	<p>Before development starts, a BAM Plan must be prepared in consultation with DELWP to the satisfaction of the responsible authority.</p> <p>The BAM Plan must include:</p> <ul style="list-style-type: none"> a) A statement of the objectives of the overall strategy for managing and mitigating any significant bird and bat strike arising from the wind energy facility operations. b) A mortality monitoring program of at least two years duration that commenced on the commissioning of the first turbine of the first stage of the use and development approved by this permit or such other time approved by the responsible authority. Requirements to ascertain: <ul style="list-style-type: none"> i) Procedures for reporting any bird and bat strikes to DELWP Environment monthly. ii) Information on the efficacy of searches for carcasses of birds and bats, and, where practicable, information on the rate of removal of carcasses by scavengers, so that correction factors can be determined to enable calculations of the likely total number of mortalities; and, iii) Procedures for the regular removal of carcasses likely to attract raptors to areas near turbines. c) Procedures for periodic reporting, within agreed timeframes, of the findings of the monitoring to the DELWP Environment Portfolio and the local community d) Recommendations in relation to a mortality rate for specified species which would trigger the requirement for responsive mitigation measures to be undertaken by the operator of the wind energy facility to the satisfaction of the Minister for Planning; e) Be approved by DELWP Environment prior to submission to the responsible authority. 	<p>This plan references the outcomes of a meeting held with DELWP representatives on 2nd November 2017.</p> <ul style="list-style-type: none"> a) Section 1 b) Section 3 c) Section 7 d) Section 6
49	<p>When the monitoring program required under the BAM Plan is complete, the operator must submit a report to the responsible authority and DELWP Environment, setting out the findings of the program. The report must be:</p> <ul style="list-style-type: none"> a) The extent and details of the further investigation must be to the satisfaction of the responsible authority and DELWP. b) Made publicly available on the operator's website. 	Section 7.
50	<p>After considering the report submitted under condition 49 and consulting with DELWP Environment, the responsible authority may direct the operator to conduct further investigation of impacts on birds and bats. The wind energy facility operator must undertake the further investigation to the satisfaction of the responsible authority and DELWP Environment.</p>	Section 7.

3 MORTALITY MONITORING PROGRAM

The mortality monitoring program will aim to answer the following key question through the completion of carcass searches, scavenger trials and detectability trials:

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- Is operation of the wind farm resulting in microbat or bird mortality, and if so:
 - What is the estimated annual mortality rate?
 - What species are being impacted?
 - Is there seasonal variation in the number of microbat mortalities?

Mortality monitoring will occur on a monthly basis for a period of two (2) consecutive years. Monitoring will commence upon commissioning of the first turbine.

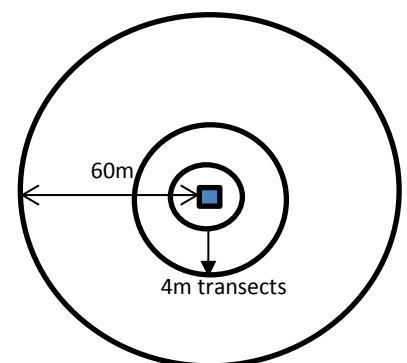
3.1 Carcass Searches

During Years 1 and 2, monthly carcass searches will be undertaken at each turbine site. In order to reduce error and refine mortality estimates, a pulse search method will be employed, whereby a second carcass search (pulse search) will be undertaken two days following each primary search. Carcass searches may be undertaken by either humans or canines trained in the detection of bird and bat carcasses. The methodology will be determined by both the Consultant that is engaged to implement the BAM Plan and BayWa r.e. Wind Pty Ltd prior to implementing the Plan and prior to the commissioning of the first turbine. The preferred method will be implemented for the entire two year period

3.1.1 Human Searches

During each primary and pulse event, all land within 60 metres of the turbine will be searched for bird and bat carcasses (Hull and Muir 2010). The following steps will be undertaken during each event:

1. The Carcass Search Data Sheet will be completed (Appendix 2).
2. Searches will commence in the morning once the sun is high enough to provide good ground visibility. The ecologist will walk in concentric circle transects at four metre intervals, using a GPS device to maintain correct spacings between transect lines. The searcher will walk at approximately 30-60 metres per minute and search thoroughly for bat carcasses.



GPS devices will be set to record tracks and this data will be collated and provided as GIS Shapefiles with the annual raw data submission to DELWP.

3. If a carcass is found, the relevant sections of the Carcass Search Data Sheet will be completed (Appendix 2). The carcass will be:
 - Removed to avoid re-counting;
 - Handled by personnel wearing gloves, packed into a plastic bag, wrapped in newspaper and placed in a second plastic bag;
 - Clearly labelled with the species name, turbine number and survey date; and,

- Transferred to a freezer for future use in scavenger/ detectability trials. Any specimens not used for subsequent monitoring will be stored for a minimum of 12 months and offered to DELWP prior to disposal.
4. Where the searcher is unable to identify the species of any carcass found, specialist advice will be sought to confirm the subject species (e.g. Museum of Victoria).
 5. In event that any carcasses of conservation-listed species are recorded, DELWP will be notified within two (2) days of discovery. Records of non-conservation-listed species will be incorporated into annual reporting. Conservation-listed species include those listed as threatened or rare under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) or Victorian Advisory List (DSE 2013).

Whilst the carcass searches will be focussed on bats, any recorded bird carcasses will be treated in accordance with the procedures outlined above.

3.1.2 Canine searches

Canines trained in the detection of bird and bat carcasses are considered a suitable alternative to humans with regard to mortality monitoring. Published studies undertaken by Paula *et al.*, (2011) and Mathews *et al.*, (2013) reported:

- Dogs are found to be more accurate than humans;
- The Paula *et al* (2011) study reported that dogs had a 92% search accuracy, whereas humans had 9% search accuracy. The reliability of the dog was 100%, as ‘no false alerts were registered’ (i.e. the dog did not incorrectly alert trainers of non-existent targets);
- The Paula *et al.*, (2011) also states that ‘properly trained dogs are more accurate than humans to detect bird carcasses under different vegetation conditions. Furthermore, it also shows that weather conditions, distance to target, and carcass decomposition conditions, do not affect the accuracy of the dog’; and
- The Mathews *et al.*, (2013) study reported that dogs located 73% of bats, whereas humans found 20%. The dogs averaged 40 minutes to complete a survey, which was less than 25% of the time taken by humans.

If dogs are to be used for carcass detection the following methodology will be used:

1. Dogs will begin search patterns downwind of the turbine and will generally walk across the direction of the wind;
2. Under ideal conditions dogs and handlers may walk up to 20 metre spaced transects, which is reduced in unfavourable conditions (Bennett, 2014);
3. A small GPS unit will be attached to the dog's collar to record all tracks taken by the dog during searches and a handheld GPS is carried by the handler with the search areas pre-loaded to provide consistent searching and to enable the handler to ensure the dog is reaching the full perimeter of the search area. The handler will make daily decisions on weather and topography and how this will impact the dog's searching ability and make any necessary alterations to methodology;
4. Searching protocol will be based on a minimum detection ability where dogs must maintain a searcher efficiency of 50% or greater during efficiency trials;
5. Carcasses found outside the defined search area will be recorded and collected as an incidental find;

6. GIS data will be provided to DELWP on request. Dog handler(s) must have demonstrated capacity to identify bird and bat species of southern Victoria; and,
7. All handling of carcasses will follow the methodology as outlined in Section 3.1.1 (human searches).

3.2 Scavenger Trials

During Year 1, scavenger trials will be undertaken to estimate the length of time bat carcasses remain detectable before being taken by scavengers (Red Fox, Feral Cat etc.). The average carcass duration and confidence interval will be used to refine mortality estimates and account for the likely effects of scavengers on carcass detectability.

Two one-month scavenger trials will be undertaken in Year 1, one when vegetative ground cover is high and lush (September or October), and one when vegetative cover is low (March or April). The following steps will be undertaken during each event:

1. At each turbine, four bat carcasses or surrogates (e.g. mice/rats) will be placed randomly within the 60 metre search area. Fresh carcasses will be used where possible and all handling of carcasses will be undertaken with latex gloves.
2. A remote camera will be focussed on each carcass and set to record when triggered by movement.
3. Weekly checks will be undertaken to record the state of carcasses and ensure that any scavenged carcasses have been moved outside the 60 metres search area.
4. All carcasses will be removed at the completion of the trial.
5. The mean persistence of carcasses and confidence interval at each turbine will be calculated and the results will be incorporated into the mortality estimate.

3.3 Detectability Trials

During Year 1, detectability trials will be undertaken to estimate searcher efficiency and refine mortality estimates. Two detectability trials will be undertaken randomly during the monthly carcass search events. Each detectability trial will use 12 deployed carcasses (as per scavenger trials). The following steps will be undertaken during each event:

1. The detectability trials will be undertaken concurrently with the monthly carcass searches. The timing of the two detectability trials will be randomly selected; however the selection process will ensure seasonal variation (i.e. Survey 1 undertaken in September or October, and Survey 2 undertaken between March and April).
2. Carcasses will be deployed by personnel not performing the searches and will be placed in a variety of exposures to simulate a range of conditions. All personnel undertaking carcass searches will be subject to detectability trials.
3. If canines are to be used when implementing the BAM Plan actual carcasses rather than artificial or substitute carcasses will be employed during efficiency trials. This will account for the fact that canines rely on scent rather than visual cues.
4. The searcher will not know the location of the carcasses and will apply the same search method as intended for normal carcass searches.

5. The mean proportion of placed carcasses found by the searcher and confidence interval will be calculated and incorporated into the mortality estimate.

3.4 Incidental Finds Protocol

During operation of the wind farm, carcasses may be discovered by personnel not engaged to implement this BAM Plan (e.g. technicians or landowners). All site users will be informed of their responsibilities regarding incidental finds, including the requirement to report any carcasses to the BayWa r.e. Wind Pty Ltd Project Manager.

The Project Manager will undertake the following tasks in the event that an incidental find is recorded:

- If a carcass is identified within five (5) days prior to a scheduled carcass search the carcass will be recorded per the below protocol and left *in situ*. Any carcasses identified within five (5) days prior to the scheduled carcass search will be incorporated into that months mortality estimate;
- Carcasses will be photographed where they are found and the Carcass Search Data Sheet will be completed (Appendix 2).
- The carcass will be handled, removed and stored in accordance with the procedures outlined for carcasses searches (Section 0) unless the carcass is found within five (5) days prior to a scheduled carcass search in which place the carcass will be left *in situ*.
- Any injured animals will be treated in accordance with the Injured Bird and Bat Protocol (see below).
- In the event that any carcasses of conservation-listed species are recorded, DELWP will be notified within two (2) days of discovery. Records of non-conservation-listed species will be incorporated into annual reporting.

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

3.5 Injured Bird and Bat Protocol

All site users will be informed of their responsibilities regarding injured wildlife, including the requirement to report any finds to the BayWa r.e. Wind Pty Ltd Project Manager. The project manager will undertake the following tasks if notified of any injured wildlife:

- The animal will be handled as little as possible. Appropriate Personnel Protective Equipment (PPE) will be worn when handling any injured fauna, including a long-sleeved shirt, gloves and eye protection.
- Injured bird or bats will be placed in a box or cloth bag and kept in a warm, quiet and dark location.
- Wildlife Victoria (1300 094 535) will be called to identify local carers and arrange pickup or delivery of the injured animal. Where required, injured animals will be transported directly to a licensed wildlife carer or shelter.

- In event that any carcasses of conservation-listed species are recorded, DELWP will be notified within seven days of discovery. Records of non-conservation-listed species will be incorporated into annual reporting.

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

3.6 Data Analysis

The methods outlined in this BAM Plan have been developed in consultation with Symbolix Pty Ltd. A letter confirming the suitability of the adopted approach is provided in Appendix 3.

The results of mortality monitoring will be analysed to provide the following information:

- The species, number, age and sex (if possible) of birds and/or bats struck by turbines (or effected by barotrauma);
- Any seasonal variation in the number of bat strikes; and,
- An estimate of the annual number of bats killed as a result of wind farm operations.

To compare impact levels with other facilities the observed mortalities must be corrected for detectability, scavenger loss and incomplete coverage of the possible fall zone area. The estimated total mortality will be calculated for bats and reported as (at least) an average (mean) loss and upper bound (upper 95% confidence level).

There are a number of modern methods available to generate the mortality estimate. The selected method will be statistically unbiased, able to generate the likely range of mortalities (not just an average) and be able to account for the uneven timing between surveys used in the pulse survey design. Simulation methods have been applied at other sites with similar survey designs.

All raw data generated from carcass searches, detectability trials, scavenger trials, incidental finds within five (5) days prior to a scheduled carcass search and the Southern Bent-wing Bat monitoring will be incorporated into annual and monthly reporting (Section 7). Raw data will include GPS tracks from each carcass search event.


4 SOUTHERN BENT-WING BAT MONITORING

Monitoring for Southern Bent-wing Bat will aim to answer the following key question through the completion of Anabat surveys:

- Are Southern Bent-wing Bats using the wind farm area during peak migration periods, and if so,
 - Are they flying at RSA height?
 - How frequent is bat activity?
 - Are Southern Bent-wing Bat utilising all habitat types within the study area?

Monitoring will be undertaken over two years, with a monitoring event undertaken between October-November and February-March each year (seven (7) week call survey per event, a total of 14 weeks of survey per year). This timing is consistent with assumed migration periods, when bats move between roosting caves across south-west Victoria and maternity caves located in Warrnambool and Naracoorte in South Australia (Lumsden and Jemison 2015).

During each event, seven (7) Anabat units will be deployed across the site in a stratified manner whereby all habitat types will be surveyed during the event including: at RSA height, in areas of woodland habitat and over aquatic habitat within the study area. Anabats will be deployed for a period of seven weeks per event. At least one Anabat unit will be attached to the hub of each turbine, (at RSA height) to monitor bats flying at RSA height (64.9-200 metres), or three anabats will be attached at RSA height on the meteorological mast and directed into the wind farm. Two (2) anabats will be deployed in areas of vegetation to determine whether Southern Bent-wing Bat are utilising woodland habitat within the study area, and two (2) units at a distance of 30 metres from waterbodies to determine whether Southern Bent-wing Bat is utilising aquatic habitat within the study area (Figure 2). Following completion of each survey, the downloaded data will be analysed by competent personnel, with any calls of Southern Bent-wing Bat or other conservation-listed microbat species (e.g. Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris*) recorded. All monitoring data will be incorporated into annual reporting (Section 7).

Signed:  for
MINISTER FOR PLANNING
Date: 10/02/2020



PLANNING and ENVIRONMENT ACT
CORANGAMITE PLANNING SCHEME

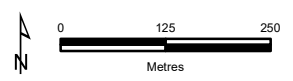
PERMIT NO. PA1600139-A
CONDITIONS 44, 46, 47 & 48
ENDORSED PLAN
 Sheet 114 of 167

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 Date: 10/02/2020

- Legend**
- Site Envelope
 - Development Footprint
 - ⊕ Wind turbine
 - ⊗ Meteorological mast
 - SpiDAR mast
 - + Anabat
 - 3 anabats will be attached to the meteorological mast at RSA height



Figure 2
Anabat locations
BAM Plan - Ferguson Wind Farm




Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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5 MITIGATION MEASURES TO REDUCE RISK

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MINISTER FOR PLANNING
Date: 10/02/20

The Ferguson Wind Farm is considered to present a mostly negligible to low risk to bird and bat species. The following mitigation measures will be implemented to further reduce the risk of bird and bat mortality, and address CoA attached to the issued Planning Permit.

5.1 Carrion Removal Protocol

The wind farm is located within an agricultural setting, within paddocks supporting livestock and native macropods. Animal carcasses are known to attract raptors and as such, their regular removal is required to reduce the risk of bird mortality through turbine strike. The following protocol will be adopted during the operational life of the wind farm and will be written into landowner agreements:

- Prior to the commissioning of the first turbine, a qualified ecologist will induct the relevant landowners with regard to their responsibilities in relation to the BAM Plan including, but not limited to:
 - The restriction of grain feeding to areas at least 250 metres distance from all turbines;
 - Domestic animals are to be excluded from land within 100 metres of turbine locations in order to avoid the removal of any carcasses or the disruption of scavenger trials; and
 - The requirement of all landowners to notify Ferguson Wind Farm of any bird or bat carcasses that are detected as part of regular farming activities.
- The landowner will be consulted regarding the requirement to ensure any carrion stockpiles/ pits (i.e. during lambing) are located at least 500 metres from the nearest turbine;
- All site personnel will be responsible for notifying the BayWa r.e. Wind Pty Ltd Project Manager of any identified carrion within 250 metres of the turbines. The Project Manager will notify the landowner and arrange for any identified carrion to be removed. Carcass occurrence and removal will be recorded by the Project Manager.
- Control programs for European Rabbit *Oryctolagus cuniculus* will be implemented within 250 metres of all turbines.
- An annual summary of carcass removal will be provided in the annual monitoring reports (Section 7).

5.2 Additional Mitigation Measures

- Any on site lighting will be recessed using baffles and directed to avoid excessive light spillage. Where feasible, low pressure sodium or mercury lamps with UV filters will be used to reduce brightness.

6 SIGNIFICANT IMPACTS AND RESPONSES

This section provides a decision making framework to be used if the monitoring program detects a significant impact on conservation-listed or non conservation-listed species. Conservation-listed species include those listed as threatened or rare under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) or Victorian Advisory List (DSE 2013).

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Date: 18/02/20

6.1 Conservation-listed Species

6.1.1 Definition of Significant Impact

A significant impact will be confirmed if:

A conservation-listed bird or bat species (e.g. a bird or bat species listed under the Environment Protection and Biodiversity Conservation Act 1999, Flora and Fauna Guarantee Act 1988, or DELWP's Advisory List of Threatened Vertebrate Fauna in Victoria (2013) is found dead or injured within the wind farm site during any mortality search, or incidentally by wind farm personnel (Year 1 or Year 2).

6.1.2 Decision Making Framework

In the event that a significant impact for conservation-listed species occurs, the process outlined in Figure 3 will be implemented to investigate the cause and identify measures to further reduce the risk of reoccurrence.

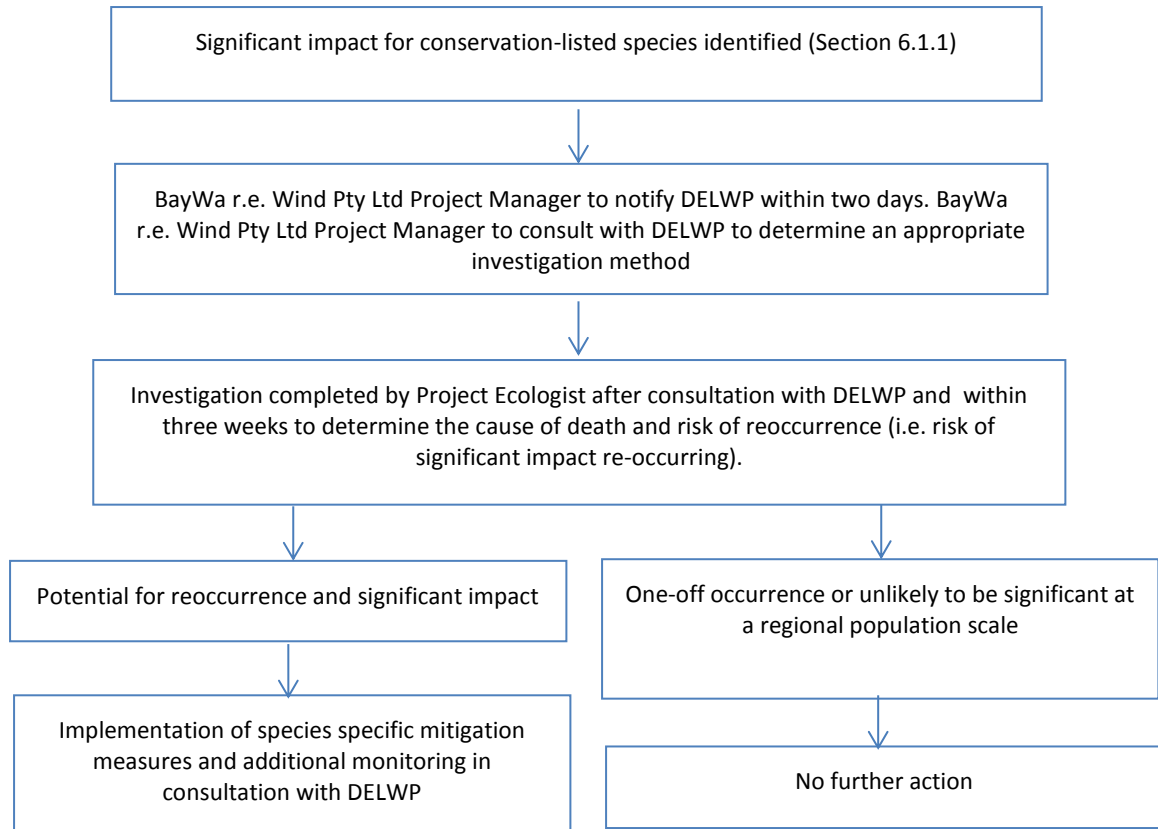


Figure 3. Decision Making Framework for Impacts on Conservation-listed Species

6.2 Non Conservation-listed Species

6.2.1 Definition of Impact Trigger and Significant Impact

An significant impact for non conservation-listed species will occur if two or more bird or bat carcasses (or parts thereof) of a non-threatened species, other than ravens or magpies are found within the wind farm footprint in any two consecutive monthly carcass searches (i.e. a total of four (4) or more carcasses of the same species in two (2) consecutive months (Year 1 or Year 2).

6.2.2 Decision Making Framework

In the event that a significant impact for non conservation-listed species occurs, the process outlined in Figure 3 for conservation-listed species will be implemented to investigate the cause and identify measures to further reduce the risk of reoccurrence.

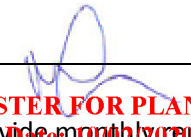
6.3 Supplementary Mitigation Measures

Supplementary measures will be implemented in the event that a significant impact occurs and the subsequent assessment identifies the potential for reoccurrence (Figure 3). Although it is unknown what measures will be required, hypothetical examples are provided in Table 2 below.

Table 2 Potential Responses to Significant Impacts

Cause of impact	Potential measures
Farming practices are identified to be attracting birds	Reinforce the Carrion Removal Protocol (Section 5.1) and additional measures provided in Section 5.2.
Lights are identified to be attracting bats	Ensure the measures relating to lighting described in Section 5.2 are implemented. Remove or relocate lights where feasible.
Vegetation or another resource is identified to be attracting birds and bats	<ul style="list-style-type: none"> Improve habitat areas in the surrounding landscape to divert use away from the wind farm.
Turbines are causing significant impacts on Southern Bent-wing Bat	<ul style="list-style-type: none"> Consult with DELWP to identify suitable measures Turbine curtailment

7 REPORTING AND COMMUNICATION

Signed:  for
MINISTER FOR PLANNING
Date: 09/07/20

The BayWa r.e. Wind Pty Ltd Project Manager will make a commitment to provide monthly reports to DELWP detailing the following:

- Records of bird and bat mortality rates for that month;
- Any detected mortality for all other species recorded during the carcass searches;
- Any other wind turbine related bird and bat mortality recorded on site but not during designated carcass searches (i.e. incidental records by site personnel, etc.); and,
- Any dead or injured species identified within the wind farm footprint.

An annual report will be submitted to DELWP within one month of completing the monitoring program. The report will detail the methods and results of monitoring, and focus on providing recommendations for Year 2. The contents of the annual report will include, but not be limited to the following:

- Detailed survey methods (including list of observers, dates and times of observations);
- Results of the Southern Bent-wing Bat monitoring;
- Estimates of bird and bat mortality rates;
- Any detected mortality for all other species recorded during the carcass searches;
- Any other wind turbine related bird and bat mortality recorded on site but not during designated carcass searches (i.e. incidental records by site personnel, etc.);
- Raw data sourced from carcass searches, detectability trials, scavenger trials and the Southern Bent-wing Bat monitoring;
- A shapefile showing the search transects walked by either humans or dogs; and,
- A discussion of the results, including:
 - Whether indirect impacts on bat use of the site are of significance at a regional, state or national level, or if listed species were affected indirectly;
 - Whether the level of mortality was ecologically significant of priority bat species.
 - Whether continuation of the monitoring program is warranted and, if so, in what form.
 - Any discernible differences in collision rates between lit and unlit turbines, where relevant.
 - Any recommendations for reducing mortality, if necessary.

A second annual report will be submitted to DELWP following the completion of Year 2. This report will detail activities undertaken during the second year of monitoring (or the outcomes of alternative measures) and provide an overview of the two-year program of works. Following completion of Year 2, the results of monitoring will be reviewed by DELWP and the Responsible Authority to determine whether further monitoring and reporting is required. A copy of the Year 1 and Year 2 reports will also be made

readily available to the local community with access to the reports being provided through the company website.

In the event that any carcasses of conservation-listed species are recorded, DELWP will be notified within two (2) days of discovery. Records of non-conservation-listed species will be incorporated into annual reporting. If a significant impact is detected, as defined in Section 6, DELWP will be informed immediately and discussions initiated to define the best approach to investigating the impact further to inform mitigation measures, if required. Any significant impact events will be documented and included in annual reporting.

Following completion of the post-construction monitoring program, any incidental carcass finds will be recorded and provided to DELWP on an annual basis. In the event that the carcass of a conservation-listed species is recorded, DELWP will be notified within seven days.

8 SUMMARY OF BAM PLAN MEASURES

A summary of required actions directed by this BAM Plan is provided in Table 3.

Table 3 Summary of Management Actions

Action	Personnel Responsible	Timing
Year 1		
Ensure that the landowner and all site personnel are aware of their responsibilities outlined in this plan.	BayWa r.e. Wind Pty Ltd Project Manager	Prior to operation of the turbines.
Contact Wildlife Victoria to identify local wildlife carers.	BayWa r.e. Wind Pty Ltd Project Manager	Prior to operation of the turbines.
Identify site lighting requirements and align with the recommended specifications provided in Section 5.2.	BayWa r.e. Wind Pty Ltd Project Manager	Prior to operation of the turbines.
Ensure resources are available to commence the monitoring program (e.g. a freezer for collected carcasses).	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Prior to operation of the turbines.
Carcass searches	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Monthly checks (12/year)
Pulse searches	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Monthly checks (12/year). To be undertaken two (2) days following each primary search.
Scavenger trials	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Two one-month trials undertaken in September or October and March or April.
Detectability trials	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Two trials undertaken randomly in conjunction with monthly carcass searches (between September or October and March or April).
Southern Bent-wing Bat Monitoring	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Two seven week surveys undertaken between October-November and February-March.
Notify DELWP of any carcass finds	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Within two (2) days of discovering a carcass of a conservation-listed species.

Action	Personnel Responsible	Timing
Notify DELWP of any impact triggers or significant impacts	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Within two (2) days of a significant impact event.
Submit Year 1 report to DELWP	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Within one month of the completion of Year 1 monitoring.
Year 2		
Carcass searches	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Monthly checks (12/year)
Pulse searches	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Monthly checks (12/year). To be undertaken two (2) days following each primary search.
Southern Bent-wing Bat Monitoring	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Two seven week surveys undertaken between October-November and February-March.
Notify DELWP of any carcass finds	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Within two (2) days of discovering a carcass of a conservation-listed species.
Notify DELWP of any significant impacts	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Within two (2) days of a significant impact event.
Submit Year 2 report to DELWP	<ul style="list-style-type: none"> BayWa r.e. Wind Pty Ltd Project Manager Project Ecologist 	Within one month of the completion of Year 2 monitoring.


REFERENCES

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- Ecology and Heritage Partners Pty Ltd 2016b. Proposed Ferguson Wind Farm: Targeted Surveys for Southern Bent-wing Bat *Miniopterus schreibersii bassanii*, Timboon West, Victoria. Unpublished report prepared for Future Energy. Melbourne, Victoria.
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- Lumsden, L. F. and Jemison, M. L. 2015. National Recovery Plan for the Southern Bent-wing Bat *Miniopterus schreibersii bassanii*. Department of Environment, Land, Water and Planning. Canberra, ACT.
- Mathews, F., Swindels, M., Goodhead, R., August, T. A., Hardman, P., Linton, D. M. and Hosken, D. J. 2013. Effectiveness of search dogs compared with human observers in locating bat carcasses at wind-turbine sites: A blinded randomized trial. Wildlife Society Bulletin 37(1):34-40
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APPENDIX 1- TURBINE SPECIFICATIONS

**PLANNING and ENVIRONMENT ACT
CORANGAMITE PLANNING SCHEME**

PERMIT NO. PA1600135-A
www.ehp.com.au
CONDITIONS 44, 46, 47 & 48
ENDORSED PLAN
Sheet 124 of 167

Signed:  for
MINISTER FOR PLANNING
Date: 10/02/2020

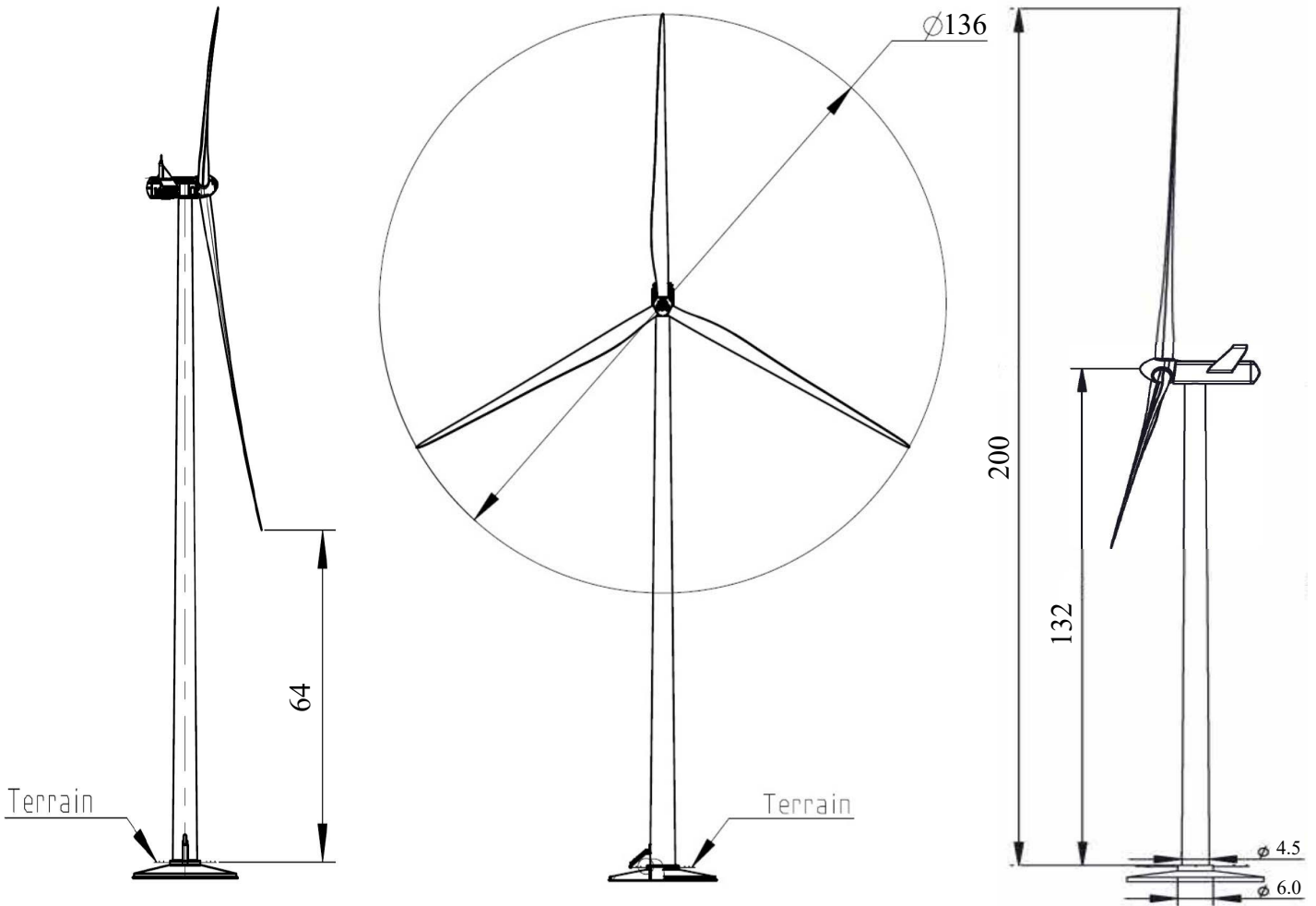
**PLANNING and ENVIRONMENT ACT
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CONDITIONS 44, 46, 47 & 48
ENDORSED PLAN
Sheet 125 of 167**

Signed:  for
MINISTER FOR PLANNING
Date: 10/02/2020


Make: VESTAS
Model: V136
Capacity: 4.0 MW
Nacelle/Cooler Top/ Rotor Hub Material: Steel framed construction with fibreglass composite cover
Blade Material: Fibreglass composite
Tower Material: Steel
Foundation Material: Concrete with steel reinforcement
Stair Material: Aluminium
Colour and Finish of Stairs: Natural Aluminium
Colour and Finish of Turbines (nacelles, cooler tops, rotor hubs, blades and towers): light grey (RAL 7035). {Industry Standard, Non-Reflective}
Colour and Finish of Foundations: Cement Grey, Natural Concrete

Turbine	X Coordinate	Y Coordinate	Coordinate System	Distance to Nearest Boundary (m)	Bearing
Turbine 1	690086	5724321	MGA94 Z54	80	SE
Turbine 2	689744	5724028	MGA94 Z54	80	SE
Turbine 3	689459	5724346	MGA94 Z54	166	SW



DIMENSIONS ARE IN METRES	NAME	DATE	Ferguson Wind Farm Turbine Specifications	
	DRAWN	T Brandao 13/01/2020		
	CHECKED		Turbine Specifications	
	ENG APPR.			
	MFG APPR.			
PROPRIETARY AND CONFIDENTIAL	Q.A.		SIZE DWG. NO. A4 132 m Hub Height, 136 m Swept Area	REV. 4
DO NOT SCALE DRAWING				SHEET 1 OF 1


APPENDIX 2- CARCASS SEARCH DATA SHEET

Signed:  for
MINISTER FOR PLANNING
Date: 10/02/2020

**PLANNING and ENVIRONMENT ACT
CORANGAMITE PLANNING SCHEME**


PERMIT NO. PA1600135-A
CONDITIONS 44, 46, 47 & 48
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Sheet 127 of 167

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Signed:  for
MINISTER FOR PLANNING
Date: 10/02/2020

Carcass Search Data Sheet

FERGUSON WIND FARM – MORTALITY MONITORING PROGRAM: CARCASS DATA-SHEET				
Please fill out all details above the heavy line for each site searched. All details below the heavy line are required if a carcass is found.				
Collector:	Date:	Start Time:	Finish Time: Date: 10/02/2020	
Turbine identifier (incl. lit/unlit):				
Vegetation	Description (incl. veg type):			
	Ave. height:	Density: Very Dense / Dense / Moderate / Sparse / Very Sparse		
Temperature:	Wind direction/speed:		Humidity:	
Search purpose (e.g. scavenger trial):	If scheduled search; search completed: Yes / No			
Onsite works in last 5 days:				
Weather conditions in last 5 days:				
Comments:				
Carcass details	Time:	Coordinates:		Substrate:
Distance from Tower(m):		Bearing from Tower (deg):		
Species common name:			Age/sex?:	
Scientific name:				
Photo Taken	Yes / No			
Carcass condition:	Describe:			
Intact, Scavenged, Feather spot:				
Signs of injury:				
How old is carcass estimated to be (tick category):	<24 hrs	1-3 days	> 3 days	Other
Other Notes: (incl. presence of stock or other factors affecting results)				
Post Find Actions:				
<ol style="list-style-type: none"> 1. Place carcass in sealable plastic bag then wrap it in newspaper and take to freezer at site office. 2. A copy of this completed form will be sent to the Regional Director, South West Region, DELWP, within seven days of the date of the carcass find if the subject species is conservation-listed. 3. One form should be completed for each carcass found 				

Signed:  for
MINISTER FOR PLANNING
Date: 10/02/2020

APPENDIX 3 - LETTER OF ADVICE, SYMBOLIX

Signed:  for
MINISTER FOR PLANNING
Date: 10/02/2020



symbolix

**PLANNING and ENVIRONMENT ACT
CORANGAMITE PLANNING SCHEME**

**PERMIT NO. PA1600139-A
CONDITIONS 44, 46, 47 & 48
ENDORSED PLAN
Sheet 130 of 167**

Signed:  **for
MINISTER FOR PLANNING
Date: 10/02/2020**

To: Thorin Robertson
Ecology & Heritage Partners
Via EMAIL

Ref #: EHPBAM20190207

Date: 7 February 2019

CC:

Re: Advice regarding the Ferguson WF BAM Plan

Dear Thorin,

I'm writing to summarise and document the outcome of the BAM Plan review I undertook last year for the Ferguson WF. I reviewed the proposed BAM plan and provided comments and edits (relating to statistical rigour) to Chad Browning when he was the project officer with Ecology and Heritage Partners.

The review concerned itself with the statistical implication of key monitoring program elements, namely:

- The decision to undertake one year of carcass monitoring first then extend to two years if required.
- The field design of the carcass searches including radius (60m), data collection form, and monthly two-day return 'pulse' timing.
- The number of scavenger and searcher efficiency trials (two in the first year); and the number of trials I each (4 small bird/bat in each)
- Data analysis methods

Initial year of monitoring

Ferguson is a small facility with predicted low impact to birds and bats; however there is a need to monitor for potential Southern Bent Wing Bat (SBWB) activity and potential collisions. As such, it is feasible to review the program after one year and continue or adapt it as required.

Field design of carcass searches

The pulsed survey timing is designed to ensure that turbines are visited twice in quick succession to allow for more precise mortality estimates for quickly scavenged animals (.e.g bats). The survey timing that we suggested is based on our experience of scavenger rates and carcass detectability at other sites and is optimized based on this. The 60m survey radius is appropriate given the focus on bats and the size of the turbines

Design of scavenger and searcher efficiency trials

Typically, over 10 replicate trials are recommended for estimating scavenger and detectability trials. However, for a site as small as this, care must be taken that the survey does not attract scavengers by placing 'too many' (this is difficult to define) carcasses down in a restricted area.

making your data work harder

It is our opinion that the latest proposed survey design strikes a reasonable balance between these requirements. The data will be sufficient to estimate the scavenger rate using survival analysis techniques.

If the scavenger rate survey returns unusual or unexpected results, or the program shows that risk is higher than expected, the scavenger data can be supplemented with further data collection. An additional trial could be run or (optionally, and assuming the site proceeds) data could be obtained from the Timboon Wind Farm. Based on our experience of survey results at other sites in SW Victoria, we do not expect these steps to be necessary, but highlight that there are options.

Proposed data analysis methods

The proposed data analysis represents current best practice in Australia. The results can be analysed using modern estimators. One example of these is the Monte-Carlo simulation model that Symbolix maintain. A method like the simulator would be able to generate an estimate of the average mortality (including 95% confidence interval) from the inputs generated from these surveys.

This estimate can be generated even if no carcasses are detected (and we have successfully undertaken an analysis of this nature previously).

It has to be expected that the 95% confidence range on the estimate would be larger than for a bigger site (with higher carcass count). Regardless of the number of replicates used for the adjunct surveys, we expect a very low count of carcasses would dominate the uncertainty in the estimate. This is a fact of low count systems, where the only (statistical) remedy would be a large number of turbine strikes.

I hope this letter provides a bit more context to the advice we have previously discussed when compiling the BAM plan.

Please don't hesitate to contact me if you require any further analysis or discussion.

Regards,



Elizabeth Stark
Symbolix Pty Ltd