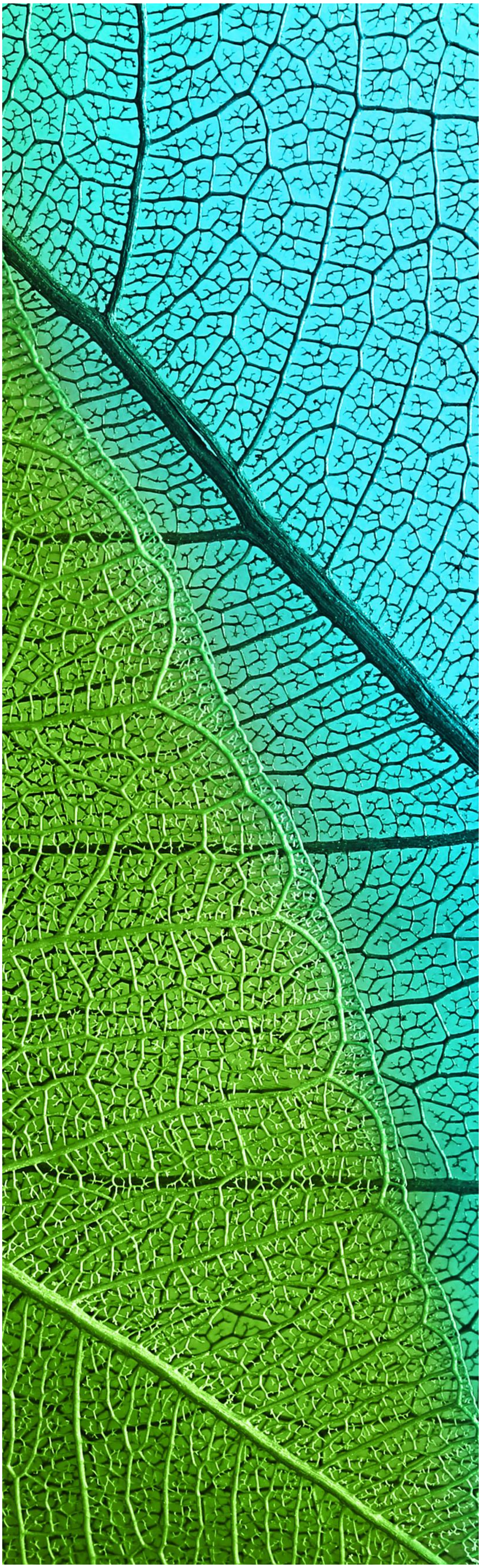

Mumblin Wind Farm

Impacts on Matters of National Environmental Significance

Prepared for
RE Future Pty Ltd

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The proposed Mumblin Wind Farm (MWF) is located on Curdies – Leichfield Rd at Elingamite North, Victoria, approximately 10 km south-west of Cobden, Victoria. The wind farm will consist of up to eight wind turbine generators (Figure 1). The MWF study area encompasses operational dairy farms and is predominantly characterised by actively grazed and/or cropped improved pastures.

Description of the impacts

The proposed MWF requires assessment and approval under the EPBC Act because it has been made a Controlled Action for its potential significant impact on the following two matters of national significance (MNES):

- White-throated Needletail *Hirundapus caudacutus* (WTNT) – *Vulnerable* and *Migratory*;
- Southern Bent-wing bat *Miniopterus orianae bassanii* (SBWB) – *Critically Endangered*.

In addition, other EPBC listed threatened species and communities considered include Grey-headed Flying Fox, seven EPBC listed bird species, and five EPBC listed *migratory* species. Potential impacts are summarised below and discussed in detail in the body of this report.

1.1.1 White-throated Needletail

The WTNT is an aerial species that moves fast over long distances, with a tendency to congregate over native forested areas in eastern Australia. The lack of native treed vegetation makes it highly unlikely that any Needletails in the area would spend much time over the site, so it does not represent important habitat. Furthermore, the small number of turbines and limited spatial extent of the project make regular collisions unlikely. Therefore, the number of WTNT collisions is highly unlikely to reach the nationally significant proportion (0.1%) of the population, equivalent to 41 individuals per year (Table 8). This and the limited size of the project makes its contribution to cumulative impacts from similar projects in the region negligible.

1.1.2 Southern Bent-winged Bat

The SBWB is a cave-roosting species which can fly up to 85 km from their roost site to forage. Due to the proximity of the site to known roost caves, there is the potential for SBWB collisions with turbines. However, with the proposed avoidance, minimisation and mitigation strategy, including a high turbine blade tip height (64m), 260 m turbine buffers to reduce overlap with important SBWB habitat, and a cut-in speed of 4.5 m/s[1], a significant impact on this species is unlikely.

1.1.3 Grey-headed Flying-fox

There are few historical records of the GHFF in proximity to the study area and the development layout has actively placed turbines away from treed foraging resources. Given there will only be eight turbines installed on the site, the potential direct impacts to the Grey-headed Flying-fox population are predicted to be low.

[1]Cut-in speed is the minimum wind speed at which a wind turbine begins generating electricity. Turbines start operating when the wind reaches this threshold, typically below 4.5 m/s. As wind speed increases, the blades spin faster, up to a safe, controlled limit set by the turbine design. Increasing the cut-in speed is a known strategy to reduce bat mortality, as turbine blades will spin very slowly or remain stationary when wind speeds are below the adjusted threshold.

1.1.4 Other Migratory and EPBC listed bird species

Based on the information from a likelihood of occurrence analysis, all but one of the additional bird species are considered unlikely to occur in the study area due to a lack of suitable habitat or a lack of recent nearby records. The exception is the Blue-winged Parrot *Neophema chrysostoma*, which was observed on-site during field surveys. However, due to lack of suitable habitat, it is unlikely that Blue-winged Parrots are using the site regularly. Consequently, it is considered unlikely that any of the additional bird species will be significantly impacted by the proposed MWF.

Avoidance and mitigation

The proponent is developing proactive avoidance, minimisation and mitigation in consultation with DEECA and DCCEEW. This will require a multi-faceted approach that is embedded in the avoidance and mitigation hierarchy but also accounts for the known ecology and behaviour of the two species of concern, site features relating to available habitat and foraging opportunities, and the influence of weather and season on bat activity.

This approach includes a minimum RSH of 64 m AGL, avoidance of potential SBWB habitat, and micro-siting key turbines to allow for a 260 m buffer. Further mitigation commitments include a low-windspeed cut in speed of 4.5 m/s for all turbines at designated times and during designated seasons, and trialling acoustic deterrents. Other species-specific measures are detailed later in this report and, have been incorporated into a Bat and Avifauna Management (BAM) Plan, to be approved before commissioning.

Residual impacts

Residual and cumulative impacts on WTNT, SBWB and GHFF from the project are considered low. Activity levels for SBWB at MWF were comparatively lower than at some other wind farm sites in the region, such as Ryan Corner (1.78 calls/detector night over 46 nights), MacArthur (2.15 over 800 nights), and Hawkesdale (4.25 over 105 nights) (Nature Advisory 2022a). However, caution is warranted when comparing SBWB activity across projects, as survey design, analyst interpretation, equipment type, and detector placement can all influence results. WTNT was not recorded during current surveys, and the small number of turbines at MWF limits the project contribution to regional cumulative impacts. The site also lacks high-quality foraging or roosting habitat for GHFF, reducing the likelihood of regular use.

The unpredictable nature of WTNT and GHFF occurrence should also be considered, and both species are addressed in the BAM Plan.

A key element of project design has been to place wind turbines in areas that will minimise potential impacts on bats. This placement of turbines to avoid habitats most used by bats has minimised the likelihood of collisions with turbines. Due to the small number of turbines, the comparatively high rotor swept area height above the ground (64 m) and the low bat activity recorded on site, the risk of a significant impact on listed bird and bat species is considered very low.

A BAM Plan with specific triggers will be implemented to respond to impacts on these species if impacts are higher than anticipated. This will include trigger levels and a hierarchical response to increasing mortality of species of concern, should this occur. As no significant residual impacts are considered likely to occur, an offset strategy is not required.

2 Introduction

The proposed Mumblin Wind Farm (MWF) is located on Curdies – Leichfield Rd at Elingamite North, Victoria, approximately 10 km south-west of Cobden, Victoria. The wind farm will consist of up to eight wind turbine generators together with ancillary infrastructure required to construct and the operate the wind farm (Figure 1). The study area is highly modified following historical clearing for agricultural purposes, comprised largely of pasture paddocks with scattered native trees, planted windrows and road reserves supporting native vegetation.

The project has been referred under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Australian Minister for the Environment decided on 19 February 2025 that the project is a Controlled Action, requiring Assessment and Approval under that Act. The Assessment method required was a Bilateral Assessment, administered by the Victorian Department of Transport and Planning (DTP). The controlling provisions (and species of concern) included:

- Listed threatened species and communities (sections 18 and 18A), for impacts on:
  - Key listed threatened species:
    - Southern Bent-wing Bat (*Miniopterus orianae bassanii*) – *Critically Endangeredand*
    - White-throated Needletail (*Hirundapus caudacutus*) – *Vulnerable*
  - Other listed species:
    - Grey-headed Flying-fox (*Pteropus poliocephalus*) – *Vulnerable*
    - Curlew Sandpiper (*Calidris ferruginea*) – *Critically Endangered*
    - Sharp-tailed Sandpiper (*Calidris acuminata*) – *Endangered*
    - Blue-winged Parrot (*Neophema chrysostoma) – Vulnerable*
    - Latham's Snipe (*Gallinago hardwickii) – Vulnerable*
    - Australasian Bittern (*Botaurus poiciloptilus) – Endangered*
    - Gang-Gang Cockatoo (*Callocephalon fimbriatum) – Endangered*
    - Common Greenshank (*Tringa nebularia) – Endangered*
- Listed *Migratory* Species (sections 20 and 20A) for impacts on:
  - Key listed *migratory* species
    - White-throated Needletail
  - Other potentially relevant threatened species listed above (also listed *migratory* species):
    - Curlew Sandpiper, Sharp-tailed Sandpiper, Latham's Snipe, and the Common Greenshank
    - Fork-tailed Swift - *Apus pacificus – Migratory*
    - Red-necked Stint - *Calidris ruficollis – Migratory*
    - Wood Sandpiper - *Tringa glareola – Migratory*
    - Marsh Sandpiper - *Tringa stagnatilis - Migratory*

- Glossy Ibis - *Plegadis falcinellus – Migratory*

The DTP issued a draft scope for the preparation of the EPBC Act assessment documentation on 20 March 2025. This report addresses the scope in the sections listed below.

Section 2 provides information on the plans, policies, guidelines and instruments of relevance used in the preparation of this report.

Section 3 presents a description of the project.

Section 4 describes the impacts of the project on MNES.

Section 5 documents the project's proposed impact avoidance and mitigation measures / alternatives.

Section 6 considers if residual impacts are likely and, therefore if offsetting is required.

Section 7 discusses the social and economic considerations of the project.

Section 8 summarises the environmental record of RE Future.

Section 9 lists the information sources used in this assessment.

This report was prepared by a team of Nature Advisory Senior Zoologists comprising Dr Danielle Eastick, Guille Mayor, Dr Robin Leppitt, Dr Sergio Nolazco Plasier, and Senior Ecologist & Project Manager, Dr Kate Callister.

3 Policy guidance

The following policy documents and guidelines have guided the preparation of this report:

- Department of Agriculture, Water and the Environment 2022, Conservation Advice for *Callocephalon fimbriatum* (Gang-gang Cockatoo), Australian Government, Canberra
- Department of Climate Change, Energy, the Environment and Water (2023), Conservation Advice for *Neophema chrysostoma* (Blue-winged Parrot), Australian Government, Canberra.
- Department of Energy, Environment and Climate Action (DEECA) (2023). *Action Statement* Southern Bent-wing Bat *Miniopterus orianae bassanii*, Victoria.
- Department of Climate Change, Energy, the Environment and Water 2024, Conservation Advice for *Gallinago hardwickii* (Latham's snipe), Australian Government, Canberra
- Department of Environment, Land, Water and Planning (2020). *National Recovery Plan for the Southern Bent-wing Bat Miniopterus orianae bassanii*. Victorian Government, Melbourne.
- Department of the Environment (DoE) (2015) *(Draft) Referral guideline for 14 birds listed as migratory under the EPBC Act.* DoE, Canberra.
- Department of the Environment and Energy 2019, Conservation Advice for *Botaurus poiciloptilus* (Australasian Bittern), Australian Government, Canberra.
- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010) *Survey Guidelines for Australia's Threatened Bats. EPBC Act survey guidelines 6.1*, DEWHA, Canberra.
- Threatened Species Scientific Committee (2021). Conservation Advice *Miniopterus orianae bassanii* Southern Bent-wing Bat. Canberra: Department of Agriculture, Water and the Environment, Canberra.
- Threatened Species Scientific Committee (2021). Conservation Advice *Hirundapus caudacutus* White-throated Needletail. Department of Agriculture, Water and the Environment, Canberra.

No threat abatement or wildlife conservation plans have been prepared under the EPBC Act for the species of concern.

4 Project description

The MWF is located on Curdies – Leichfield Rd at Elingamite North, Victoria, approximately 10 km south-west of Cobden, Victoria. The wind farm will consist of up to eight wind turbine generators together with ancillary civil and electrical infrastructure required to construct and the operate the wind farm (Figure 1).

The MWF is bounded by Walshes Road and Hanleys Road to the north, Timboon – Terang Road to the west, Cobden – South Ecklin Rd and Horsteds Road to the east, and Cobden – Warrnambool Road to the south. The MWF boundary is hereafter termed the 'study area'. The MWF study area footprint consists of 23 privately owned parcels, together with ten road reserves adjoining their boundaries which are to be utilised for access and the reticulation and export of electricity. These 33 areas of land constituting the MWF study areas are located on either side of Curdies – Leichfield Rd at Elingamite North Victoria and have a combined area of 1,365 ha.

The MWF development footprint, which is the area corresponding to the construction footprint, is equal to approximately 18.1 Ha, and corresponds to approximately 1.3% of the subject site. The MWF works area, which is the area containing all temporary and permanent works, is equal to 184 ha, and corresponds to approximately 13.4% of the study area. The MWF development footprint is based on the area of all temporary and permanent works, plus an additional buffer of 50 m around all temporary and permanent works (except where such a buffer encroaches on an external property boundary) to ensure that it captures all possible areas where works will be carried out on the MWF development footprint.

For the purposes of assessing the potential impacts associated with the proposed wind farm, a range of turbine dimensions have been considered in order to provide for a degree of flexibility in the contracting phase of the wind farm development process. In particular, two configurations of two separate wind turbine models have been considered in order to assess potential impacts associated with the proposed wind farm. These configurations are as follows:

- Vestas V162 HH150: Maximum RSA height of 231 m, minimum RSA height of 69 m, rotor diameter of 162 m, tower height of 150 m;
- Vestas V162 HH166: Maximum RSA height of 247 m, minimum RSA height of 85 m, rotor diameter of 162 m, tower height of 166 m;
- Vestas V172 HH150: Maximum RSA height of 236 m, minimum RSA height of 64 m, rotor diameter of 172 m, tower height of 150 m; and
- Vestas V172 HH166: Maximum RSA height of 252 m, minimum RSA height of 80 m, rotor diameter of 172 m, tower height of 166 m;

Altogether, the overall dimensional envelope encompassing these four wind turbine configurations is as follows:

- A maximum RSA height of 252 m;
- A minimum RSA height of 64 m;
- A maximum rotor diameter of 172 m; and
- A maximum tower height of 166 m.

4.1 Description of proposed works

The proposed works can be broken into four phases: construction, commissioning, operation and decommissioning.

Construction will commence once all regulatory requirements are satisfied, and will begin with civil works including access tracks, hard stands, staging areas, benches for electrical infrastructure, foundations, site entrances, and the drainage system. The second phase of the construction process will involve the delivery and installation of wind turbine generators, which will remain static until the commissioning process. The third phase of construction will involve the delivery and installation of electrical infrastructure, including reticulation, high voltage transformers, high voltage protection systems, a maintenance and control facility, and a high voltage connection at the point of connection with the electricity network. The final phase of the construction process will involve clean-up, a final grade of all access tracks and permanent hardstands, and revegetation of disturbed areas with pasture grass.

The commissioning process will involve testing of mechanical, electrical and computational components of the wind turbine generators and electrical infrastructure connecting it with the national electricity grid. During this time each turbine will be operated on a stop-start basis for the period of time required to complete all engineering checks and deem that it is safe to operate. Depending on the nature of the faults encountered this process can take weeks or even months, however it is generally completed within a week per wind turbine. During the commissioning process wind turbines will only be operated during daylight hours.

During the operational phase of the wind farm very little activity will occur within the study area. The wind turbine generators and electrical infrastructure operate 24 hours a day and will be remotely monitored and controlled. In the event of a fault maintenance crews will visit the site in a passenger vehicle or light truck and attend to the fault in question.

Decommissioning of the wind farm will take place at the end of the life of the project, which will be at least 25 years after the commencement of operation. As part of decommissioning wind turbine generators and ancillary electrical infrastructure will be dismantled and removed from the site and hardstand areas reinstated to pasture, however access tracks will remain in place after decommissioning for the use of landowners. As part of the decommissioning process wind turbines will be dismantled from the top down, with components removed from the site and disposed of at appropriately accredited recycling facilities. Wind turbine foundations will remain in place following decommissioning but will be covered with a suitable depth of topsoil to enable agricultural activities to continue in their vicinity. Above ground electrical infrastructure will be dismantled and recycled in a similar fashion to wind turbines. Hardstands associated with both wind turbines and above ground electrical infrastructure will be reinstated to pasture by removing compacted gravel material from the site to an appropriate location either on or off site (as per current EPA regulations at the time) and the excavations backfilled with certified clean fill and then reseeded with pasture grasses. Underground electrical infrastructure will be excavated in a manner similar to its installation and removed from the site to a suitable recycling facility, with former trenches to be backfilled to ground level with certified clean fill. All buildings and storage units associated with the ongoing operation of the wind farm will be dismantled and removed from the site in a similar fashion to wind turbines.

4.2 Impacts on MNES

The environmental impacts of the project includes those that have the potential to occur during construction and commissioning, those that have the potential to occur during operation (detailed in Section 5), and those that have the potential to occur during decommissioning.

4.2.1 Impacts on MNES during construction, commissioning and decommissioning

Direct impacts during construction will be limited to ground disturbance. The project is currently projected to impact 0.427 ha of native vegetation, comprised of 0.241 ha of native vegetation patches, four scattered trees (two large and two small) and three large trees in patches. This vegetation is not EPBC listed or part of a TEC. These direct impacts to native vegetation will be offset in accordance with relevant Victorian legislation and regulations. Indirect impacts that have the potential to occur during construction include sediment pollution, introduction of noxious weeds, noise pollution, and disturbance due to increased human activity. These potential impacts will be temporary and limited to the construction period and will be managed via standard planning permit conditions for wind farms in Victoria including the preparation and endorsement of a Construction Environmental Management Plan and Noise Management Plan prior to the commencement of construction.

Due to the short period of time over which construction will take place, limited turbine operation during this time, and the fact that construction will be limited to daylight hours, the process will have a negligible impact on MNES.

During the decommissioning phase direct and indirect impacts will be analogous to those that will occur during the construction phase. While it is not possible to know in advance the amount of native flora, vegetation and/or habitat that will have the potential to be impacted at the time of decommissioning, it will be conducted in accordance with biodiversity conservation legislation and regulations at the time.

4.3 Site selection and design response

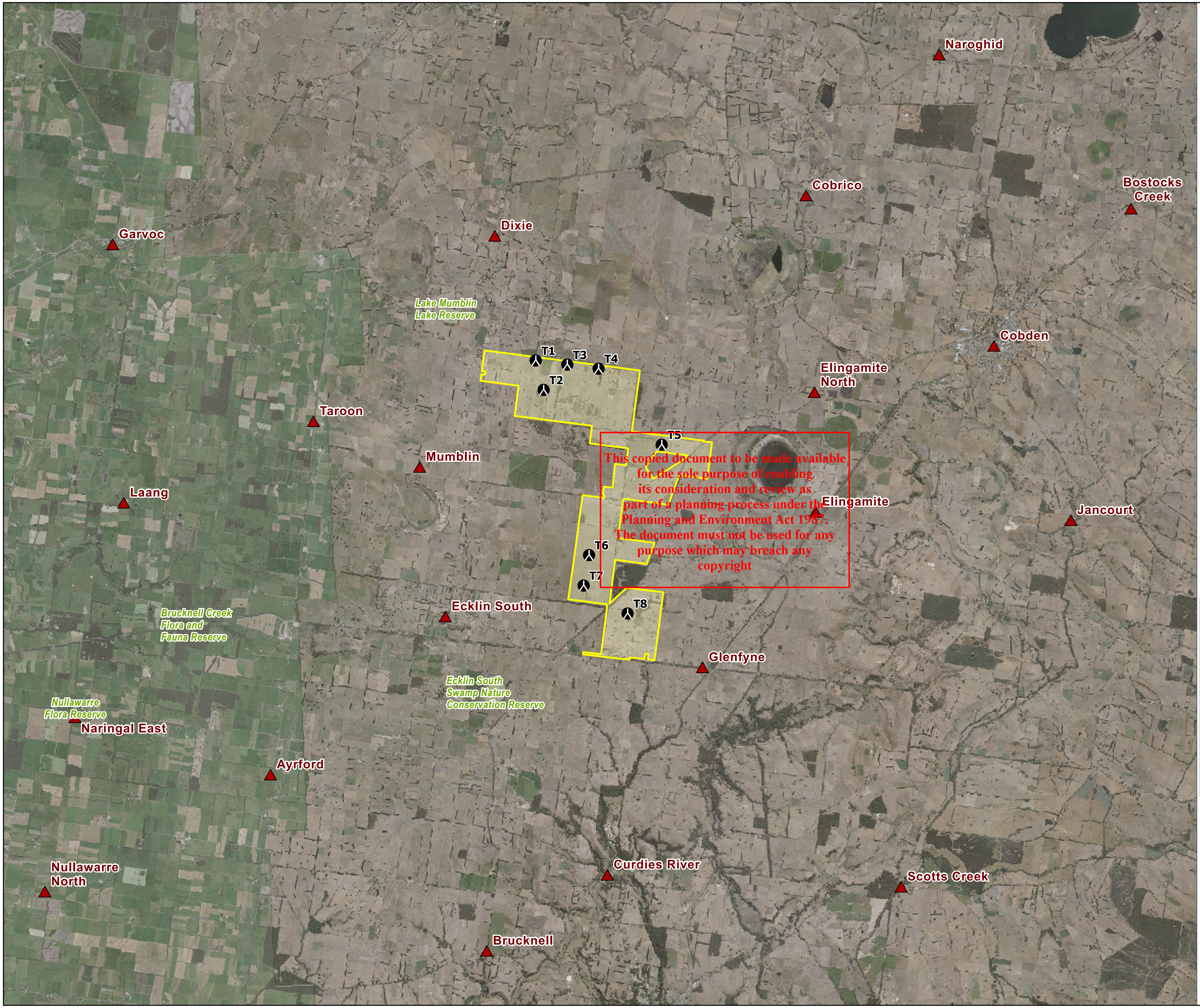
The study area is a highly suitable location for a wind energy facility, and was selected for the following reasons:

- It is located in a region of the national electricity network that has capacity available for the connection of an additional wind farm;
- It is located sufficiently close to a proposed point of connection with the national electricity network such that it is commercially viable to connect the wind farm to the network;
- It is located in an area with sufficient setbacks to neighbouring dwellings to ensure potential impacts to community amenity are acceptable;
- It receives undisturbed wind flow with strong consistent winds;
- It is located in an area dedicated to agricultural land uses that are compatible with a wind energy facility;
- It is well served by existing transport infrastructure;
- It is located away from critical infrastructure that is susceptible to interference from wind energy facilities, such as aerodromes and telecommunications facilities;
- It is located away from significant townships, landscapes, tourist destinations and recreation areas;

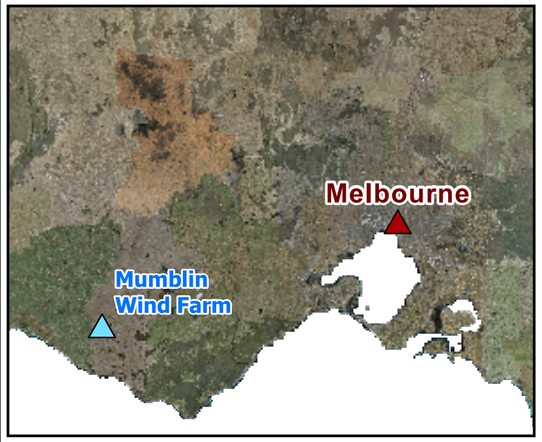
- It is located away from national parks, state parks, coastal reserves and significant wetlands;
- It is not located in an area with known significant Aboriginal cultural heritage; and
- It is not located in an area with high Aboriginal archaeological potential.

Figure 1: Location of Mumblin Wind Farm

Project No: 22238.03
Project location: Mumblin, VIC
Date: 19/06/2025



Site boundary
Wind turbine
Town



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5 Description of the impacts (operational phase)

The proposed MWF requires assessment and approval under the EPBC Act because it is considered likely to have a significant impact on the following two matters of national significance (MNES):

- White-throated Needletail *Hirundapus caudacutus* (WTNT) – *Vulnerable, Marine* and Migratory
- Southern Bent-wing bat *Miniopterus orianae bassanii* (SBWB) – *Critically Endangered*.

In addition, further information is provided to understand whether there are any relevant habitat values present and whether the construction and operation of the project poses any potentially significant impact to 13 other listed species (12 birds and one bat):

- Grey-headed Flying-fox – *Vulnerable*
- Blue-winged Parrot – *Vulnerable*
- Common Greenshank – *Endangered, Migratory*
- Curlew Sandpiper - *Critically Endangered, Migratory*
- Sharp-tailed Sandpiper - *Endangered, Migratory*
- Red-necked Stint - *Migratory*
- Australasian Bittern – *Endangered*
- Fork-tailed Swift - *Migratory*
- Gang-Gang Cockatoo – *Endangered*
- Glossy Ibis - *Migratory*
- Latham's Snipe – *Vulnerable, Migratory*
- Wood Sandpiper - *Migratory*
- Marsh Sandpiper – *Migratory*

Therefore, the relevant, predicted and foreseeable impacts on these species are described below.

5.1 White-throated Needletail

The WTNT is a non-breeding migrant to Australia, with birds ranging throughout eastern Australia from summer to early autumn (TSSC 2021b, Higgins 1999). The *Referral guideline for 14 birds listed as migratory species under the EPBC Act* states that 'an action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.' An ecologically significant proportion of a population for the White-throated Needletail is listed as 1% for internationally significant or 0.1% for national significance, which the guidelines list as 100 and 10 birds respectively. Since the publication of these guidelines, Garnett and Baker (2021) has estimated the population of WTNTs at 41,000 as detailed in the Lotus Creek Notification of Approval (EPBC 2022). This more recent estimate indicates that an ecologically significant proportion of the WTNT population is equivalent to 1% (410 individuals) at the international level and 0.1% (41 individuals) at the national level.

According to the habitat descriptions in the report by Ecology and Heritage Partners (EHP 2024), there is no habitat of particular value for the species within the study area. The Victorian Biodiversity Atlas

(VBA) contains seven records of WTNTs, the nearest of which is of a flock of 1,000 WTNTs observed within the MWF study area from 1986. Bird utilisation surveys conducted during a season in which the species is present in Australia did not record WTNTs (EHP 2024).

The EHP (2024) assessment considers WTNT presence to be of ‘low likelihood’ at this site. Whilst observations at operating wind farms in south-eastern Australia indicate that WTNTs occasionally collide with wind turbines (Maloney et al. 2019, Symbolix 2020), the eight turbines planned for MWF make it one of the smaller wind farms planned for the region. A lack of any WTNT records on the site during surveys and very few records from the region (the most recent six years ago) combined with the small number of turbines makes the likelihood of WTNT collisions highly unlikely. Whilst WTNT mortalities from collisions are still possible, the likelihood that the wind farm would impact a nationally significant proportion of the population (41 birds) is even more unlikely. The small size of the wind farm also reduces any cumulative impacts on WTNTs when combined with other projects in the region to negligible levels.

Nature Advisory has assessed the potential impacts on WTNTs in relation to the MNES significant impact criteria for species listed as *migratory* and *vulnerable* under the EPBC Act (Tables 1 and 2). Nature Advisory was unable to generate a collision risk model for WTNTs, as the model requires a minimum number of observations. As no observations of WTNTs occurred, the model could not be generated. Without a collision risk model or a meaningful number of observations, predicting the number of mortalities as a result of turbine collisions is impossible. For the assessments in these tables, no separate important population of this highly mobile species can be identified. It is likely their mobility makes the population well mixed over its range. Given this, impacts are assessed on the whole population, rather than an important sub-population.

These tables indicate that the proposed wind farm will not have a significant impact on the WTNT.

Table 1: Summary of the potential impacts of the project on White-throated Needletails in relation to MNES impact Criteria for *migratory* species

Significant impact criterion “An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:” (DoE 2013, p. 15):	Assessment of impacts	Significant impact likelihood
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.	The WTNT is predominantly aerial but uses the dense canopies of tall trees or tree hollows to roost (Higgins 1999). The proposed works will not substantially impact important habitat for this species as the site lacks known or potential roosting habitat, shows no evidence of regular foraging use, and is largely cleared for farming in a region with few WTNT records. The species does not breed in Australia.	Unlikely

Significant impact criterion "An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:" (DoE 2013, p. 15):	**Assessment of impacts**	**Significant impact likelihood**
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	WTNTs are almost exclusively aerial (Higgins 1999), only leaving the air to roost at night in tall trees and hollows. WTNT contact with any of the invasive species that are present at the study area is therefore minimal. The study area is currently farmland, so it is unlikely that wind farm construction will result in the establishment of any harmful invasive species that are not already present. Regardless, the adoption of best-practice environmental management measures during construction and operation of the wind farm (as per Clean Energy Council 2018) will ensure monitoring and adaptive control of any invasive plant or animal species that may establish because of works.	Unlikely
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	WTNTs do not breed in Australia. The wind farm site does not represent important non-breeding habitat for the WTNT. There are very few records of WTNTs from the MWF region and no habitat present suitable for them to roost on site. The proposed wind farm lies at the southernmost reaches of the WTNTs migration route, and as such is unlikely to impede migration. Disruption of feeding through turbine collisions may happen occasionally though evidence suggests that an increased number of turbines equates to a higher likelihood of collision (Nature Advisory data). The current proposal is a windfarm of eight turbines, making it one of the smaller wind farms in Victoria. Whilst predicting the number of turbine collisions at the windfarm is not possible (collisions risk models require a minimum number of observations of the target bird) the number of WTNT collision mortalities is highly unlikely to be greater than the nationally significant proportion (0.1%) of the population, which is 41 individuals (Table 8). Similarly, the wind farms small size greatly reduces any additions to cumulative impacts from other wind projects in the region to negligible levels. As such the proposed project will not disrupt the life cycle of the White-throated Needletail.	Unlikely

Table 2: Summary of the potential impacts of the project on White-throated Needletails in relation to MNES impact criteria for *vulnerable* species

Significant impact criterion "An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:" (DoE 2013, p. 10)	**Assessment**	**Significant impact likelihood**
*Lead to a long-term **decrease** in the size of an important **population***	The White-throated Needletail population is estimated at 41,000 (Garnett and Baker 2021). They are migrants to the region, present from summer to early autumn. They are highly mobile and the whole population is likely to be spread over its non-breeding range in Australia. A paucity of historical records, zero detections of WTNTs during on-ground surveys and the lack of any suitable, productive/preferred habitat (i.e., forest) in the study area suggest that they are infrequent visitors to the area. The small number of turbines proposed for the site further lowers the probability of collision-related impacts. If collision mortalities do occur, they will be very infrequent and represent a very small portion of the estimated population, very likely less than the 41 individuals required to be a nationally significant proportion of the population. Due to the small size of the wind farm (eight turbines), its contribution to cumulative impacts is expected to remain minimal. The MWF will not lead to a long-term decrease in the size of the population of this species.	Unlikely
***Reduce** the **area of occupancy** of an important population*	The WTNT is largely aerial in Australia only utilising terrestrial habitats to roost, usually in the dense canopies of tall trees. The proposed study area supports highly modified farmland habitat with no suitable roosting sites. There is no evidence that the WTNT utilises the study area in any capacity on a regular basis. The MWF will not reduce the area of occupancy of the species' population.	Unlikely
***Fragment** an **existing population** into two or more populations*	The WTNT population in Australia is broad-ranging and at low density. A wind farm the size of MWF represents a tiny proportion of this range. WTNT can continue to forage and move through the study area. The MWF will not fragment the existing WTNT population.	Unlikely
*Adversely **affect habitat critical** to the survival of a species*	Defining habitat critical to a wide-ranging, aerial, non-breeding migrant like the WTNT is difficult. Within Australia, habitat critical to the survival of the species is likely limited to roosts such as forested areas with high-reporting rates. There is no evidence that the proposed MWF site represents critical habitat to the WTNT.	Unlikely
***Disrupt the breeding cycle** of an important population*	The WTNT is a non-breeding migrant to Australia. The MWF will not disrupt the breeding cycle of the WTNT.	Unlikely

Significant impact criterion "An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:" (DoE 2013, p. 10)	Assessment	Significant impact likelihood
***Modify, destroy, remove, isolate or decrease** the **availability or quality of habitat** to the extent that the species is likely to decline*	The terrestrial habitat of WTNTs in Australia is tall, canopy-dense trees or tree hollows, of which there is very little present at the MWF site. There is no evidence that WTNTs regularly use the site for foraging activities, but the low number of turbines at the site (eight) means that WTNTs will still be able to forage at the site with low risk when the wind farm is operational. The MWF will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Unlikely
*Result in **invasive species** that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat*	The WTNT is largely aerial, only interacting with terrestrial habitats when roosting high-up in trees. They therefore rarely interact with invasive plants or animals. Regardless, the MWF will be constructed and operated in accordance with a detailed environmental management plan that will include monitoring and adaptive control of weed and pest animal infestations and agricultural and plant diseases. It is unlikely that the MWF will result in invasive species that are harmful to WTNT becoming established in WTNT habitat.	Unlikely
***Introduce disease** that may cause the species to decline*	The MWF will be constructed and operated in accordance with a detailed environmental management plan that will include monitoring and adaptive control of weed and pest animal infestations and agricultural and plant diseases. It is unlikely that the MWF will introduce disease that may cause the species to decline.	Unlikely
***Interfere substantially with the recovery** of the species*	The WTNT are summer migrants to the region, only present from summer to early autumn. A paucity of historical records, zero detections of WTNTs during on-ground surveys and the lack of productive habitat (i.e., forests) on the site indicates that they are infrequent visitors to the area. The site is therefore not likely to be important habitat for the species. The MWF will not interfere substantially with the recovery of the species.	Unlikely
Overall assessment of likelihood of significant impact		***Unlikely***

5.2 Southern Bent-wing Bat

The Southern Bent-wing Bat (SBWB) is listed as *critically endangered* under the EPBC Act and *critically endangered* under the FFG Act (TSSC 2021). The SBWB has undergone serious population decline since the 1960s (DELWP 2020). Survival rates assessed by van Harten et al. (2022) in 2016–2019 showed lowered seasonal survival during summer (December–February) and autumn for juveniles and lactating females, with the lowest survival rates coinciding with drought in early 2016. Population modelling predicts a continued population decline, the cause of which remains uncertain, though resource limitation due to loss of foraging habitat and drought are suspected as primary causes (DELWP 2020; van Harten et al. 2022).

Increasing turbine collision risk due to the development of wind farms within the species' range is also considered a potential threat (TSSC 2021; van Harten et al. 2022). In line with this, the FFG Action Statement (DEECA 2023) highlights the importance of avoiding wind turbine placement near key roost sites (maternity and non-maternity caves[2]), within critical foraging areas, and along potential flight routes between these locations, where feasible.

The proposed MWF site lies within the potential movement range of SBWB individuals traveling between the Starlight maternity cave near Warrnambool (34 km southwest) and the Pomborneit non-maternity cave. However, the site is not adjacent to maternity or non-maternity caves, and intensive seasonal bat detector surveys conducted in the area have recorded low activity levels (see further details in Section 5.2). This suggests it is unlikely that significant numbers of SBWB regularly commute through the MWF site or use it as a key foraging area.

5.2.1 Survey effort

An assessment of this species within the study area was undertaken from 2021–2023 (Nature Advisory 2024a), using roost cave assessment and bat detector surveys with methods consistent with the relevant survey guidelines. Harp-trapping was not used due to a lack of suitable habitat and locations in which to use these effectively.

A desktop review of historical records of SBWB roosting caves within an 80 km radius found 16 potential historical caves but no new roost caves were confirmed (Nature Advisory, 2024a). A ground survey of 15 potential caves did not find any SBWBs. The remaining cave was not surveyed, as per DEECA's request, as the temporal usage of SBWB at this cave was being monitored at the time. This cave is located within 20 – 30 km of the study area.

Ground-level bat-detector surveys of the study area were undertaken to detect SBWB presence based on their echolocation calls. These were conducted during four periods over two years: 1) late November to December 2021, 2) early February until late-March 2022 (EHP 2022), 3) November to December 2022 and 4) February to April 2023 (Nature Advisory 2024a). The survey effort totalled 2,359 bat detector-nights, recording 332 SBWB-definite and 4070 SBWB-complex calls recorded at 23 of the 24 sites (Table 3)[3]. In Australia, several insectivorous bats cannot be reliably distinguished to species level based on their echolocation pulses (Milne, 2002; Pennay et al. 2004). SBWB-complex calls consist of calls with characteristics that could be produced by SBWB, Chocolate Wattled Bat (*Chalinolobus morio*) or Little Forest Bat (*Vespedelus vulturnus*).

[2]SBWBs typically gather at maternity caves in late spring and early summer to give birth and raise their young, then disperse in autumn to use non-maternity caves during the cooler months (Churchill, 2008). However, recent research indicates that roost utilisation is more complex than previously thought, with tracking data showing that non-maternity caves can be used year-round, not just as overwintering sites for extended torpor (TSSC, 2021).

[3]Complex calls recorded during the survey refer to those that could not be confidently assigned to a single species and were attributed to multiple species. Definite calls were confidently identified to a single species.

During Survey 1 (spring 2021), SBWB was recorded at 3 sites (2, 6, and 7) on 5 separate occasions (Table 3), at a relative activity level[4] of 0.01 calls per night. Survey 2 (summer/autumn 2022) recorded SBWB at 3 sites (1, 5, and 7) on 8 separate occasions, at a relative activity level of 0.01 calls per night. Survey 3 (spring/summer 2022) recorded SBWB at 6 sites, on 65 separate occasions, at a relative activity level of 0.13 calls per night. During Survey 4 (autumn 2023) SBWB was recorded at 12 sites, on 254 separate occasions, at a relative activity level of 0.3 calls per night.

SBWB was most frequently detected at Site 14 (80 calls), Site 16 (72 calls), Site 1 (60 calls), and Site 7 (25 calls; Figure 2). Sites 1, 14 and 16, which had the highest number of relatively activity, were located in the south-east section of the study area which contains two large patches of remnant Eucalypt woodland. Additionally, Sites 14 and 16 were located next to farm dams. As such, it is likely there are greater foraging opportunities for the species within the vicinity of the woodlands. Furthermore, Sites 1 and 7 are located closely to cypress windbreaks, which may also provide foraging opportunities and/or shelter, and Site 7 was close to the vegetation surrounding Lake Elingamite, which may be used as a drinking and foraging resource for SBWB. However, these habitats are not characteristic of the MWF development footprint, in which the turbines will be located in mostly cleared paddocks used for agricultural purposes.

These patterns were similar for SBWB-complex calls, with higher complex calls produced in the south-east section of the study area and at Site 7 (Figure 3). There were also relatively high SBWB-complex calls from Site 13, which bordered a forest patch.

Table 3: Southern Bent-wing Bat calls recorded during bat detector surveys at the MWF.

Survey	Site	Number bat detector nights	SBWB-definite calls	SBWB-complex calls
1. Spring - summer 2021	1	57	0	15
	2	38	1	28
	3	40	0	0
	4	37	0	13
	5	42	0	4
	6	62	2	6
	7	47	2	21
	8	64	0	16
	9	39	0	1
2. Summer - autumn 2022	1	38	4	323
	2	37	0	81
	3	44	0	0
	4	57	0	85
	5	55	2	3
	6	52	0	119
	7	56	2	422

[4]Relative activity refers to the number of bat calls per night per site. As passively collected echolocation data cannot be used to quantify numbers of bats present in a given area (Hayes, 2000), a measure of relative activity is used instead.

Survey	Site	Number bat detector nights	SBWB-definite calls	SBWB-complex calls
	8	55	0	159
	9	56	0	112
	10	58	0	0
	11	57	0	124
	12	50	0	84
	13	46	0	124
3. Summer 2022 - 2023	1	41	44	252
	2	38	0	39
	3	37	3	25
	4	39	0	22
	5	29	0	2
	6	14	0	12
	7	39	5	40
	8	11	0	0
	9	35	0	7
	10	39	1	16
	11	37	8	15
	12	37	0	28
	13	37	4	28
4. Autumn 2023	1	43	16	204
	2	43	0	22
	3	43	0	2
	4	43	3	28
	5 (also displayed in Table 4)	35	8	10
	6	42	0	5
	7	43	18	141
	8	42	0	31
	9	43	2	52
	10	43	5	3
	11	43	0	30
	12	36	0	48
	13	43	4	189
	14	29	80	689
	15	29	0	22
	16	29	72	212
	17	29	0	1
	18	29	0	48
	19	29	0	0
	20	29	0	8
	21	29	3	66
	22	29	0	9
	23	7	1	0
	24 (also displayed in Table 4)	29	42	24

Survey	Site	Number bat detector nights	SBWB-definite calls	SBWB-complex calls
Totals		**2359**	**332**	**4070**

5.2.2 Met mast surveys

To facilitate an investigation into bat activity at height, paired bat detector microphones were placed at height at two onsite meteorological monitoring masts ('met masts'):

- Site 5 – 60 m tall met mast with SMM-U2 microphones installed at (i) 1 m above ground level (AGL) and (ii) 50 - 60 m AGL.
- Site 24 – 140 m tall met mast with SMM-U2 microphones installed at (i) 1 m AGL and (ii) 90 m AGL.

Overall, the met mast survey comprised four bat detectors at two sites and ran for 679 detector nights across four seasons, with some variation in total detector nights per site due to equipment failure, interference by stock, and lighting strike (Nature Advisory 2024b). From this dataset, 270 SBWB-definite calls were manually identified by visual inspection of spectrograms of the call sequences. Eight of these SBWB-definite calls were recorded at height: four calls were recorded at 50–60 m AGL at Site 5 and four at 90 m AGL at Site 24.

In addition, 13 SBWB-complex calls were identified from the bat detector installed at height at Site 5 between 50 m and 60 m AGL, and 11 SBWB-complex calls at Site 24 from the bat detector installed at 90 AGL (Table 4).

Table 4: Summary of manually identified Southern Bent-wing Bat calls

Site	Bat detector nights	SBWB-definite		SBWB-complex		Definite and complex calls	Combined calls per night
		No. of calls	Calls per bat detector night	No. of calls	Calls per bat detector night		
Autumn 2023							
5 – 1m AGL	35	8	0.23	10	0.29	18	0.51
5 – 50m AGL	26	0	0	0	0	0	0
24 – 1m AGL	29	42	1.45	24	0.83	66	2.28
24 – 90m AGL	29	0	0	0	0	0	0
Total	119	50	0.42	34	0.29	84	0.71
Winter 2023							
5 – 1m AGL	21	6	0.29	20	0.95	26	1.24
5 – 50m AGL	21	0	0	0	0	0	0
24 – 1m AGL	21	5	0.24	6	0.29	11	0.52
24 – 90m AGL	21	0	0	2	0.10	2	0.10
Total	84	11	0.13	28	0.33	39	0.46
Spring 2023							
5 – 1m AGL	44	3	0.07	7	0.16	10	0.23
5 – 60m AGL	42	2	0.05	9	0.21	11	0.26

Site	Bat detector nights	SBWB-definite		SBWB-complex		Definite and complex calls	Combined calls per night
		No. of calls	Calls per bat detector night	No. of calls	Calls per bat detector night		
24 – 1m AGL	44	43	0.98	54	1.23	97	2.20
24 – 90m AGL	30	0	0	1	0.03	1	0.03
Total	160	48	0.30	71	0.44	119	0.74
Summer - autumn 2024							
5 – 1m AGL	79	26	0.33	90	1.14	116	1.47
5 – 50m AGL	79	2	0.03	4	0.05	6	0.08
24 – 1m AGL	79	129	1.63	69	0.87	198	2.51
24 – 90m AGL	79	4	0.05	10	0.13	14	0.18
Total	316	161	0.51	173	0.55	334	1.06

5.2.3 Potential impacts

Wind farms are one of nine potential threats listed in The National Recovery Plan, which describes potential impacts of the wind industry on the global population of SBWB as follows (Department of Environment, Land, Water and Planning 2020, pp 12-13):

"The impact of the recent proliferation of wind farms within the range of Southern Bent-wing Bats is currently unclear, however, it is possible that any wind farm built close to a Southern Bent-wing Bat significant roosting site could have a major impact on that population. International studies suggest there may be cumulative impacts of wind farms on migratory species in particular, with the impacts greater at particular times of the year and under certain weather conditions (Johnson et al. 2004; Kunz et al. 2007). The risk increases the closer the wind farm is to an important site, particularly a maternity site or migration path. Risks include cave destruction during construction, mortalities due to collisions, and altered access to foraging areas (Kerr and Bonifacio 2009)."

Potential impacts to SBWB at MWF are outlined below, and an assessment against the MNES significant impact criteria can be found in Table 6. Due to the limited knowledge on SBWB landscape use, flight heights and documented information on SBWB casualties at operational wind farms, it is difficult to accurately predict the direct and cumulative impacts to the species on a local, state or federal scale. Section 5 outlines the mitigation hierarchy that has been undertaken at MWF based on current knowledge to mitigate impacts to the SBWB.

Direct impacts

Direct impacts to SBWB from MWF include potential collisions with turbine blades. SBWBs were recorded at multiple sites across the study area, particularly close to water bodies and native treed habitats. Consequently, there is a possibility that SBWB could occasionally collide with operational turbines at MWF. As of June 2024, Nature Advisory is aware of a total of 28 SBWB mortalities detected during carcass searches at operational wind farms in Victoria that have been reported to DEECA (Table 5). These mortalities represent actual carcasses found during searches and so the estimated total mortality would be higher, considering survey effort, scavenger removal rates and searcher efficiency.

Table 5: Total Southern Bent-wing Bat mortalities reported to DEECA up to June 2024

Source	Time period	Number of SBWB mortalities
Moloney et al. (2019) and Stark and Muir (2020)	Up to 2018	8
Bennett et al. (2022) - Cape Nelson North Wind Farm	2018 and 2019	3
"DEECA's submission presented to the Mt Fyans Wind Farm Panel on 3 April 2023 (section 6.24.1)"	Not disclosed	3
"DEECA has been notified of 8 SBWB mortalities being found during post-construction monitoring between March to May 2023." Note – one of the 8 carcasses referred to here was previously included in the 3 carcasses documented in DEECA's submission presented to the Mt Fyans Wind Farm Panel on 3 April 2023. Consequently, only 7 SBWB mortalities are listed here.	March to May 2023	7
Five carcasses detected during scent dog searches at two operational wind farms in south-west Victoria. The wind farm operators have provided information on these carcasses to DEECA, but the details have not yet been made public.	Autumn 2024	5
Email correspondence from DEECA in June 2024 states a total of 28 SBWB carcasses reported. Nature Advisory is currently not aware of details of two of these carcasses.	2022-2024	2
	Total	28

The potential collision risk of SBWB at MWF may be mitigated by the planned RSA height of 64 m AGL. Although four SBWB-definite calls were detected above 64 m at MWF, the activity level at height is much lower than at ground level and therefore the risk of collision should decrease as the RSA height increases. Flight heights are determined by pairs of bat detector microphones, one installed on a meteorological tower (met mast) above 45 m AGL and the other placed at ground level. Nature Advisory has investigated SBWB flight heights at numerous wind farm sites in south-western Victoria and has previously only recorded SBWB calls at ground-level, with none recorded at 45 m and above. There are several limitations in recording echolocation calls at height rather than at ground level, such as greater wind noise. Wind may attenuate high-frequency SBWB calls, reducing their likelihood of being recorded. However, studies in international peer-reviewed journals have shown that detectors mounted at height on met masts can record high-frequency (45–50 kHz) bat species, within the SBWB frequency range (Rainho et al. 2023, Roemer et al. 2019, 2017). . Similar findings have been reported at other wind farm sites. However, although the preliminary evidence supports that SBWBs may not be at risk of collision with turbines at the MWF, which are proposed to have a minimum RSA height of 64 m AGL, more long-term evidence across multiple wind farms is required to support this.

Proximity to maternity and roost caves may also influence collision risk. The MWF study area is located approximately 34 km north-east of Starlight Cave—Victoria's primary SBWB maternity cave. At least 50 SBWB roost caves are known (DELWP 2020), and MWF is located approximately 13 km north-west of Timboon Cave, 20 km south-east of Panmure Cave, 30 km west of caves at Pomborneit and Porndon Arch, 41 km east of Grassmere Cave, 53 km north-west of the cave at Cape Valley, and 81 km east of caves at Yambuk and Deen Maar. Recent research indicates that SBWBs fly up to 85 km (on average 35 km) from caves each night and frequently move between roosts more than 60 km apart (Bush et al. 2022); they can commute up to 72 km between roosting caves in a few hours (van Harten et al. 2022).

There is no published information on SBWB flight speeds, but, based on the commute time between caves (van Harten et al. 2022) they can be assumed to be similar to the congeneric Eastern Bent-wing Bat (EBWB). The EBWB is one of the fastest insectivorous bats in Australia, known to fly at speeds of 40–50 km/h (Bullen et al. 2016). Mills and Pennay (2017) found that EBWBs may travel 20–25 km from a roost cave to foraging sites in 30–40 minutes. Assuming that SBWB and EBWB flight speeds are similar, the timing of calls recorded in Surveys 3 and 4 suggests most SBWBs recorded in the study area could have been roosting as far as 20–30 km away from the MWF (Nature Advisory 2024a). However, there is potential for SBWB flight speeds to be faster than EBWB.

Overall, the intensive bat detector surveys of the study area indicate a low level of SBWB activity (0.234 calls per night across 1327 detector nights; Nature Advisory, 2024a). This suggests that it is unlikely that large numbers of SBWBs commute across the MWF site, however due to proximity of the study area to roost caves and potential key foraging areas, collisions with turbine blades may be possible.

Barotrauma

Impact trauma from direct collision and barotrauma are the two leading theories to explain the high fatality rates of bats around operating wind turbines. Barotrauma occurs when a bat encounters sudden and extreme changes in atmospheric pressure. It has been proposed that bats succumb to this rapid change in pressure when they fly within close proximity to an operating turbine blade (Durr and Bach, 2004). Baerwald et al. 2008, first published evidence of barotrauma in bats, reporting that more than 50% of dead bats they found near operating turbines had internal haemorrhaging consistent with barotrauma. However, Grodski et al. 2011 found that it was difficult to attribute individual fatalities exclusively to either direct collision or barotrauma.

Newer research has provided quantitative data that indicates barotrauma is unlikely to be the cause of the majority of bat deaths around operating turbines. Rollins et al. 2012 used forensic techniques to evaluate the competing hypotheses of traumatic injury and barotrauma, and concluded that their data strongly suggests that traumatic injury is the major cause of bat mortality at wind farms. Lawson et al. 2020 estimated the characteristics of the sudden pressure change bats may experience when flying near wind turbines by investigating barotrauma impacts in rodents. They found that the magnitude of pressure change produced by a turbine blade is 8 times smaller than that which causes mortality in rats, and 80 times smaller than the magnitude which causes 50% mortality in mice, which are similar in size to many bat species. They also considered it unlikely that bats would be able to fly in close enough proximity to the turbine blades to experience such a change in pressure, without being struck by the blade.

Due to the above findings, it is considered unlikely that barotrauma poses a major risk to SBWB at MWF.

Indirect impacts

As outlined in The National Recovery Plan (Department of Environment, Land, Water and Planning 2020), indirect impacts to SBWB caused by wind farm development and/or operation could include:

- Disturbance to maternity and non-maternity caves.
- Removal or degradation of foraging habitats.

The proposed MWF is unlikely to have any indirect impacts to SBWB. No known roost caves are present within the study area (Nature Advisory 2024a); therefore, no caves will be disturbed during construction or operational phases of the wind farm. Native vegetation within the MWF study area has been extensively cleared for agricultural purposes, with open grazing paddocks comprising the majority of the site. Remnant vegetation includes forest, aquatic herbland, plains grassy wetland, large trees in patches and scattered trees. Exotic grassland, dominated by a range of introduced pasture grasses and herbaceous weeds, are also present. There are several small farm dams within open grazing paddocks, but no natural wetlands with emergent vegetation, which is thought to be the preferred wetland habitat for SBWB (DELWP 2020; Stratman 2005). A small amount (0.427 ha) of native vegetation would be removed during the construction phase of the project, including the removal of five large trees from within the study area. This vegetation removal is unlikely to have any impact on the SBWB population.

Cumulative impacts

Although the proposed MWF only has eight turbines, the study area is located within the south-west Victoria where a number of other wind farms have also been approved. Therefore, cumulative impacts on SBWB remain a risk when combined with impacts from other wind farms within the SBWB range. However, it is anticipated that the mitigation measure proposed below will minimise impact to this species to a level that is considered not significant.

Studies in the Northern Hemisphere have shown that impacts to bats caused by wind farms can be cumulative, particularly for migratory species (Arnett and Baerwald 2013; Kunz et al. 2007). To address this, Moloney et al. (2019) and Stark and Muir (2020) estimated total mortalities using combined values for carcass counts, persistence rate, searcher efficiency, and turbine search percentage. However, due to the small number of SBWB carcasses detected, plus variable factors across sites where carcass searches were conducted, the resulting mortality estimates have very wide confidence intervals. Moloney et al. (2019) emphasise it is not possible to use carcass detections from one wind farm to accurately predict mortality rate at another wind farm without recorded collisions. Currently, there is no total collision estimate to quantify industry wide impacts to the SBWB population, which makes it difficult to predict cumulative impacts.

Table 6 provides a summary of potential impacts to SBWB against the MNES significant impact criteria for species listed under the EPBC Act as Critically Endangered or Endangered. This assessment concludes that the project is unlikely to lead to a significant impact on the SBWB.

Table 6: Impacts on Southern Bent-winged Bats in relation to MNES impact criteria for *critically endangered* or *endangered* species

Significant impact criterion	Assessment of impacts	Significant impact likelihood
*Lead to a long-term **decrease** in the size of a **population***	During the 2020/21 breeding season, 17,233 – 18,299 SBWBs were estimated to use the Warrnambool maternity cave. In 2020, 1000 – 1500 SBWBs used the Portland maternity cave. In the 2020/21 breeding season, 28,800–35,200 individuals were estimated to be roosting at Bat Cave in Naracoorte, SA (Southern Bent-wing Bat National Recovery Team 2022). While bat detector surveys do not provide an accurate representation of numbers of individuals in an area, SBWB-definite and SBWB-complex calls were recorded at a number of sites across the study area. While the overall level of SBWB activity was much lower than that recorded for other high-frequency calling species, SBWB were recorded relatively regularly, with a notable increase in activity during the year 2 surveys in line with a significantly increased survey effort. This suggested the SBWBs do move through or utilise the MWF study area during spring and autumn. There is currently no data on the flight heights of SBWB when foraging or commuting across the landscape; however, eight SBWB-definite and 26	Unlikely

Significant impact criterion	Assessment of impacts	Significant impact likelihood
	SBWB-complex calls were recorded by bat detectors placed on the two MWF met masts at heights of 50 m and 90 m AGL. The majority of these calls were within spring 2023 and summer-autumn 2024. Other met mast surveys conducted within the geographic range of SBWB in Victoria have generated similar results to those presented in this report, with very few or no SBWB calls recorded at RSA heights. However, SBWB collisions with turbines have occurred. The minimum RSH of the turbines at MWF will be 64 m AGL. This would be one of the highest minimum RSHs of turbines at a wind farm in south-western Victoria. Analysis of bat mortalities from 21 windfarms in eastern Australia between 2004 – 2024 shows that the observed mortality rate of bats decreases significantly as turbine minimum rotor swept area (RSA) above ground level increases (Nature Advisory 2024c). Nature Advisory have not been made aware of any SBWB mortalities with turbines with a RSH of 40 metres and above. Furthermore, this RSH is approximately twice the minimum RSH of turbines at operational wind farms in Victoria where the majority of SBWB mortalities have been reported. Native vegetation within the MWF study area has been extensively cleared for agricultural purposes, with open grazing paddocks comprising the majority of the site. Remnant vegetation includes forest, aquatic herbland, plains grassy wetland, large trees in patches and scattered trees. Exotic grassland, dominated by a range of introduced pasture grasses and herbaceous weeds, are also present. 0.427 ha of native vegetation and five large trees will be removed. There are several small farm dams within open grazing paddocks, but no natural wetlands with emergent vegetation, which is thought to be their preferred wetland habitat (DELWP 2020; Stratman 2005). While the proximity of the study area to roost caves and potential key foraging areas may lead to the potential for collisions with turbine blades, the avoidance, minimisation and mitigation measures outlined in Section 5 are expected to mitigate these impacts. These measures include micrositing turbines to avoid SBWB habitat, increasing the rotor swept area to 64 m, and a low wind speed cut-in of 4.5 m/s during SBWB active periods. Systematic monitoring and mitigation measures will be deployed, and their effectiveness assessed during the operational phase at MWF through implementation of a BAM Plan (outlined in Section 5). Proposed mitigation measures in response to recorded mortalities during intensive systematic scent dog surveys include: (i) increasing nighttime cut-in speed during periods of increased SBWB activity (spring and autumn), and (ii) testing the efficacy of ultrasonic acoustic deterrents in reducing bat mortalities. With the proposed mitigation measures, small number of turbines, the comparatively high rotor swept area height above the ground (64 m) and the low bat activity recorded on the site, the risk of a consistent, ongoing impact of a scale leading to a long-term decline in the total population is considered low.	
***Reduce** the **area of occupancy** of the species*	The proposed wind farm site supports mostly highly modified habitat comprising open grazing paddocks used for agriculture. Bat detector surveys show that SBWBs are present in the study area at very low levels of activity compared to other bat species with high-frequency calls. The proposed turbine locations and associated infrastructure will be primarily located within grazing paddocks with no trees and therefore will not affect areas that could provide foraging or roosting resources to SBWB. Existing land use and	Unlikely

Significant impact criterion	Assessment of impacts	Significant impact likelihood
	vegetation will remain largely unchanged, and no key habitat for SBWB will be removed during construction and therefore the project will not reduce the overall area of occupancy of the species within its geographic range across south-western Victoria.	
***Fragment** an existing **population** into two or more populations*	As the project will not entail substantive alterations to existing habitats, there are no effects or mechanisms that might fragment the existing population. Furthermore, there is similar, and in some instances better quality, habitat in the wider landscape surrounding the study area.	Unlikely
*Adversely **affect habitat critical** to the survival of a species*	Habitat critical to the survival of the species includes the three known breeding caves in South Australia (TSSC 2021), Warrnambool and Portland. The closest of these (Starlight Cave) is approximately 34 km away from the MWF site. Non-maternity caves are also critical habitat for the SBWB, the closest of these are Timboon, (approximately 13 km from the MWF site), Panmure (~20 km away) and Pomborneit and Pordon Arch (~30 km away). There are no other known non-maternity caves closer to the site and no new caves were discovered during cave assessments conducted during this investigation. No known maternity or non-maternity caves would be directly impacted by the construction or operation of the MWF. Foraging habitat (e.g., woodland, wetlands with emergent vegetation) in proximity to the above-mentioned caves is also critical habitat to SBWB. None of this critical habitat occurs on the proposed MWF site. There are some farm dams present, however there is low to no emergent vegetation.	Unlikely
***Disrupt the breeding cycle** of a population*	The proposed MWF site is located approximately 34 km from the nearest maternity cave (Starlight Cave, near Warrnambool) and about 120 km from the Portland maternity cave. The construction and operation of the proposed MWF would not have any direct impact on maternity caves, however collisions by bats roosting in the maternity cave during the breeding season are possible, but unlikely after the avoidance, minimisation and mitigation measures outlined in Section 5 are implemented. As outlined above, the likelihood that the numbers of bats affected would disrupt the breeding cycle of bats using the Starlight Cave is considered very low.	Unlikely
***Modify, destroy, remove, isolate or decrease** the **availability or quality of habitat** to the extent that the species is likely to decline*	The proposed MWF site does not support any SBWB roosting habitat. There is a small area of treed habitat on site, a small native woodland and linear planted features, and the dams present on site have low to no emergent vegetation. For this reason, the construction and operation of the proposed MWF would not decrease the availability or quality of suitable habitat for SBWB in the region and the overall population would not decline as a result.	Unlikely
*Result in **invasive species** that are harmful to an Endangered species becoming established in the endangered species' habitat*	The project will be constructed and operated in accordance with a detailed environmental management plan that will include monitoring and adaptive control of weed and pest animal infestations and agricultural and plant diseases. It is therefore unlikely to result in an outbreak of any invasive species or diseases on the site.	Unlikely

Significant impact criterion	Assessment of impacts	Significant impact likelihood
Introduce disease *that may cause the species to decline*	See previous comment.	Unlikely
Interfere with the recovery *of the species*	The site does not constitute important habitat that could contribute to the recovery of this species – there are no known roost caves, only a very small amount of native woodland, and the dams present on site have low to no emergent vegetation. The study area will continue to be used for farming, including grazing, and will not be revegetated in a way that might increase suitable SBWB foraging habitat within south-western Victoria. A low number of SBWB were recorded on the site, therefore without mitigation, collisions with turbine blades are possible. However, the avoidance, minimisation and mitigation measures outlined in Section 5 are expected to mitigate these impacts. Therefore, the site is not considered critical to the recovery of the species.	Unlikely
Overall significant impact likelihood		**Unlikely**

5.3 Other listed threatened species or communities

5.3.1 Grey-headed Flying-fox

The Grey-Headed Flying-fox is currently listed as vulnerable under the EPBC Act (DCCEEW 2023a) and threatened under the FFG Act. The species occurs in a coastal belt from south of Gladstone in central Queensland to Adelaide in South Australia (Australasian Bat Society 2024). Only a small proportion of the range is in use at any one time, as the species forages according to food availability. As a result, patterns of occurrence and relative abundance vary greatly between places, seasons and years.

The species typically commutes each day between colony sites and foraging areas, usually within 15–20 km of the day roost site (Tidemann 1999). Grey-Headed Flying-foxes have been recorded foraging up to 50 km from their roosting sites. All individuals typically leave the roosting site synchronously at dusk (Parry-Jones and Augee 1992). The species is primarily a canopy-feeding frugivore and nectivore, most commonly utilising rainforests, open forest, and closed and open woodlands.

A census of the Grey-Headed Flying-fox conducted in May 2005 estimated the population at 674,000 individuals (Birt 2005; Eby 2004). This contrasts with a 2004 census, which estimated it to be 425,000. It has been suggested that this large difference could be due to estimation error or higher survivorship of young in 2004 due to greater food availability and reduced culling (Birt 2005). More recent assessments were conducted as part of the National Flying-fox Monitoring Program (CSIRO 2019), which estimated the population to comprise approximately 700,000 individuals.

The VBA contains three records of Grey-headed Flying-foxes from 1986 within 15 km of the study area. However, the Atlas of Living Australia (ALA 2024) contains 45 records, mostly 10–15 km west of the study area. The nearest known roosting camps for the Grey-headed Flying-fox are the Warrnambool (202) camp, approximately 40 km south-west, and the Hexham (1238) camp, approximately 45 km north-west, although it is unknown if the Hexham camp was only a temporary camp. MWF lies within the mapped GHFF distribution (BatMap 2024) and mapped foraging habitat (DEECA 2024). Therefore, the MWF may be within the daily home range of Grey-headed Flying-foxes using these camps.

Within the MWF site, there are patches of native vegetation (Herb-rich Foothills Forest) that contain eucalypts, including 193 large trees. The site also contains 249 scattered trees, most of which are eucalypt species which is a GHFF foraging resource.

Potential impacts

Wind farm developments pose a risk to the species, which is known to collide with turbine blades (Lumsden et al. 2019). Though there is limited published literature on flight altitude for GHFF, several studies have investigated Pteropodidae flight altitude through aircraft strike data (e.g., Meade et al. 2019, Parsons et al. 2008, McCracken et al. 2021). Parsons et al. (2008) states that the majority (96%) of aircraft strikes occurred at or below approximately 300 m with 63.2% occurring at 152.4 m. The proposed wind turbines have an RSA range of 64–252 m, aligning with the majority of aircraft strike altitudes reported in the study. Therefore, based on this flight altitude data, there is a potential risk for the species to fly within the height range of the proposed wind turbines. It is important to note that there are few historical records of the GHFF in the study area and the development layout has actively placed turbines away from foraging resources. Given there will only be eight turbines installed on site, the potential direct impacts to the Grey-headed Flying-fox global population are predicted to be low.

The Recovery Plan does not outline what constitutes an indirect impact to GHFF, however given there is no high quality foraging or roosting habitat within the study area, the overall indirect and cumulative effects to the GHFF are likely to be low.

Table 7 provides a summary of potential impacts to GHFF and the MNES significant impact criteria for species listed under the EPBC Act as *vulnerable*.

Table 7 Assessment of the Grey-headed Flying Fox (GHFF) at the MWF against MNES impact criteria for *vulnerable* species

Significant impact criterion	Assessment	Significant impact likelihood
Lead to a long-term ***decrease*** *in the size of an important* ***population***	GHFF are highly mobile and individuals have the potential to travel >1000 km seasonally and up to 500 km in a 48-hour period (Vanderduys et al. 2024). The study area does not contain high quality foraging or roosting habitat for the GHFF, and as such is unlikely to support an important population. The wind farm is located between two known camps of GHFF, Warrnambool and Hexham, and the currently inactive temporary camp at Colac, and there is the potential for the species to occur on site as they travel to each camp. Therefore, there is a collision risk to GHFF transiting the site, though losses are likely to be negligible due the large GHFF population size. Avoidance and mitigation measures for this species are outlined in Section 6, and include 200 m buffers around turbines to avoid GHFF habitat. Systematic monitoring and mitigation measures will be deployed, and their effectiveness assessed, during the operational phase at MWF through implementation of a BAM Plan (outlined in Section 5).	Unlikely
Reduce *the* ***area of occupancy*** *of an important population*	The MWF plans to remove 0.427 ha of native vegetation, some of which is eucalypts which may be an occasional foraging resource for GHFF. However, due to the eucalypt	Unlikely

Significant impact criterion	Assessment	Significant impact likelihood
	species present, this is unlikely to be primary foraging habitat for GHFF, and the species is not known to roost at this location. Therefore, it is unlikely the proposed action will reduce the area of occupancy of an important population.	
***Fragment** an **existing population** into two or more populations*	Several populations occur throughout Victoria and studies suggest that roost membership is not static, and thus represent a node in a network across the landscape (Vanderduys 2024). GHFF can change roosts frequently, and as mentioned above, they can travel tens to hundreds of kilometres in a night. Though the wind farm is located between two known GHFFs camps, due to their movement to and from multiple roosting sites, it is unlikely that the proposed development will further fragment the existing populations.	Unlikely
*Adversely **affect habitat critical** to the survival of a species*	The recovery plan for the GHFF lists important winter and spring foraging plants for GHFF (DAWE 2021). The main species of eucalypt at MWF, Manna Gum, Swamp Gum and Messmate, are not included on this list. Habitat critical to the survival of the GHFF may also include vegetation communities not supporting important winter and spring tree species, but which: ▪ contain native species that are known to be productive as foraging habitat during the final weeks of gestation, and during the weeks of birth, lactation and conception (August to May) ▪ contain native species used for foraging and occur within 20 km of a nationally important camp as identified on the Department's interactive flying-fox web viewer, or ▪ contain native and or exotic species used for roosting at the site of a nationally important GHFF camp as identified on the Department's interactive flying-fox web viewer. The MWF does not contain high quality foraging or roosting habitat, and is not within 20 km of a roost camp, thus the proposed development is unlikely to affect habitat critical to the survival of the species.	Unlikely
***Disrupt the breeding cycle** of an important population*	Roosts constitute the only breeding sites for the species (Mo *et al.* 2024). Though the wind farm is located between two camps of GHFFs, and poses a collision risk to bats transiting to roost caves, it is unlikely to critically disrupt the breeding cycle.	Unlikely
***Modify, destroy, remove, isolate or decrease** the **availability or quality of habitat** to the extent that the species is likely to decline*	The MWF does not contain high quality foraging or roosting habitat. Although the project plans to remove 0.427 ha of native vegetation including five large eucalypt trees, the proposed development will unlikely modify, destroy, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Unlikely

Significant impact criterion	Assessment	Significant impact likelihood
Result in ***invasive species*** *that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*	The project will be constructed and operated in accordance with a detailed environmental management plan that will include monitoring and adaptive control of weed and pest animal infestations and agricultural and plant diseases. It will therefore not result in an outbreak of any invasive species or diseases on the site.	Unlikely
Introduce disease *that may cause the species to decline*	The MWF does not contain suitable roosting habitat. Therefore, the introduction of a disease that may cause the species to decline is unlikely.	Unlikely
Interfere substantially with the recovery *of the species*	The site is not considered prime habitat for the recovery of this species. It will continue to be used for intensive grazing and will not be available for revegetation that might increase the area of habitat within the species' range. Though there may be some interference with the recovery of the species based on the proposed location of the windfarm, it is unlikely to have a substantial impact with the recovery of the species.	Unlikely
Overall likelihood of significant impact		***Unlikely***

5.3.2 Other Birds

The guidance from DTP included a requirement to assess project impacts on seven additional EPBC listed bird species and five EPBC-listed migratory species. Firstly, we completed a likelihood of occurrence table for these bird species (Table 8). This table includes information on the species' habitat preferences, as well as information on the number and date of records in the VBA within a 10 km search region around the MWF (VBA 2025), and e-bird (eBird 2025). If no suitable habitat exists in the study area and there have been no recent records in the search region this indicates it is unlikely to occur regularly in the study area, indicating it is unlikely a significant impact will occur. Ten species were found to be likely or have potential to occur within, or flying over the study area.

A detailed likelihood of occurrence analysis was performed on the 12 EPBC-listed birds outlined by DTP in the draft scope for the preparation of the EPBC Act assessment documentation. This analysis involved collating results from field surveys performed by Ecology and Heritage Partners, records in the VBA and eBird, as well as an assessment of the available habitat for each species within the study area and surrounding region. eBird records are the number of times a species featured in checklists within 10 km of the MWF. Therefore, the same individual of a species may have been recorded multiple times on multiple checklists.

10 of these species were found to have the potential to occur, be likely to occur or are known to occur in the study area (Table 8). The Wood Sandpiper and Marsh Sandpiper were found to be unlikely to occur, and as such are not considered further in this report. The Common Greenshank, Curlew Sandpiper, Red-necked Stint and Sharp-tailed Sandpiper are of a similar guild, being migratory shorebirds that are, in the Mumblin region, dependant on wetland habitat. These four species are considered together. The remaining six species are considered individually below.

Table 8 Historical records and likelihood of occurrence of the 12 listed birds. Source: Victorian Biodiversity Atlas, eBird and EHP (2024).

Species	Records during field surveys	Ebird Records within 10 km	Date of last eBird record	VBA Records within 10 km	Date of last VBA record	Habitat	Likelihood of occurrence
Australasian Bittern *Botaurus poiciloptilus*	0	30	18/12/2024	3	4/12/2020	Terrestrial wetlands, including a range of wetland types but prefers permanent water bodies with tall dense vegetation, particularly those dominated by sedges, rush, reeds or cutting grass (Marchant & Higgins 1990).	Recent (2023, 2024) records in the region from Lake Elingamite and Lake Cobrico (eBird 2025, BirdLife Australia 2025) and is likely to occur in Ecklin South NCR based on distance from known records and habitat characteristics. Data from New Zealand (DOC 2024) suggest the species flies within RSA when flying between wetlands and in longer travels and covers up to 300 km during migration within the country. Australasian Bittern could fly through the study area during migration or moving between the abovementioned wetlands. **Potential to occur.**
Blue-winged Parrot *Neophema chrysostoma*	2	10	27/3/2024	12	12/04/2015	Occupies coastal, subcoastal and inland habitats ranging into semi-arid zones. Throughout much of range inhabits grasslands and grassy woodlands and forest (Higgins 1999).	Recorded during site surveys. Likely to occur occasionally foraging on pasture and weeds, as well as passing through in longer movements. The species could breed in remnant woodlands in the site provided hollows are present. The species flight heights overlap with RSA. **Known to occur.**

Species	Records during field surveys	Ebird Records within 10 km	Date of last eBird record	VBA Records within 10 km	Date of last VBA record	Habitat	Likelihood of occurrence
Common Greenshank *Tringa nebularia*	0	3	27/1/2019	2	27/01/2019	Occupies a variety of freshwater and marine wetlands, including estuaries, sandy or muddy coastal flats, saltmarshes, mangroves, swamps and lakes; also on artificial wetlands, such as sewage farms, dam lakes, saltworks and inundated rice crops; less often on open coast, sometimes along quiet stretches of rivers (Higgins 1999).	Unsuitable habitat within the study area. Records from Lake Elingamite and likely to occur in other wetlands such as Lake Cobrico and Ecklin South NCR. May fly over the study area as it sits between these three wetlands. Flight heights in local movements over land are unknown for the species, and there is potential for flights within the study area at RSA height. **Potential to occur.**
Curlew Sandpiper *Calidris ferruginea*	0	0	No eBird records	0	No VBA records	Inhabits a wide range of coastal or inland wetlands with varying levels of salinity; mainly muddy margins or rocky shores of wetlands (Higgins & Davies 1996).	eBird data records from within 10 km of the study area show a likelihood of occurrence in Lake Elingamite and potential to occur in Lake Cobrico and Ecklin South NCR. Species potential to travel between these wetlands in local movements. The species is known to fly well above RSA during migration (thousands of metres high), but no data is available on flight heights in local movements over land. The species may fly over the study area when moving between the abovementioned wetlands. **Potential to occur.**

Species	Records during field surveys	Ebird Records within 10 km	Date of last eBird record	VBA Records within 10 km	Date of last VBA record	Habitat	Likelihood of occurrence
Fork-tailed Swift *Apus pacificus*	0	0	No eBird records	No records within 10 km of study area.	No VBA records	The species can occur in wet sclerophyll forest but mainly prefers open forest or plains. It is almost exclusively aerial and feeds up to hundreds on metres above the ground, but can feed among open forest canopy. The species breeds internationally and seldom roosts in trees (Higgins 1999).	No records in the region. Species may occur anywhere in Victoria in the summer months, usually associated to late summer storm fronts. The species flies at RSA and may occur on occasion flying over the study area. **Potential to occur**.
Gang-Gang Cockatoo *Callocephalon fimbriatum*	0	28	17/3/2025	18	27/04/2018	In summer generally in tall mountain forests and woodlands, particularly in heavily timbered, mature wet sclerophyll forests and woodlands. Prefer Eucalyptus-dominated assemblages. Also occurs in subalpine snow gum woodlands and occasionally in temperate rainforests and regenerating forests. In winter occurs at lower altitudes in drier, more open Eucalyptus woodland (Higgins 1999).	Multiple nearby records in woodlands and farmland. Suitable foraging habitat within the study area in patches of remnant woodland, particularly in the south. Species may occur as a nonbreeder, foraging in canopy. Generally, it is expected that the species will fly below RSA in open flat terrain, following treed areas and flying close to the canopy. **Likely to occur**.
Glossy Ibis *Plegadis falcinellus*	0	10	19/1/2020	0	No VBA Records	Requires shallow water and mudflats, so is found in well-vegetated wetlands, floodplains, mangroves and rice fields (Higgins 1999).	Unsuitable habitat within the study area, however several records of groups of up to 42 individuals in Lake Elingamite (2018, 2019, 2020) suggest the area is visited. The species flights overlap with RSA height and is potential to traverse the study area during local and long-distance movements. **Potential to occur**.

Species	Records during field surveys	Ebird Records within 10 km	Date of last eBird record	VBA Records within 10 km	Date of last VBA record	Habitat	Likelihood of occurrence
Latham's Snipe *Gallinago hardwickii*	0	16	12/11/2024	5	27/01/2019	Occurs in variety of permanent or ephemeral freshwater wetlands, generally with dense cover, including meadows, bogs, swamps, edges of creeks and rivers, flooded areas and rice paddies (Higgins 1999).	Some suitable foraging habitat in the study area in the form of grassy drainage lines and old drained swamps that may saturate the soil moisture in rainy periods. Lake Elingamite has potential to qualify as important habitat due to a recent record of 17 individuals in 2020 (eBird 2025), with 18 individuals the threshold for an area to be considered important habitat according to the *Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (Commonwealth of Australia 2017). There is potential for individuals from Lake Elingamite visit the study area to forage occasionally. Due to its nocturnal flights and lack of flight data, RSA height overlap is unknown. **Potential to occur.**
Marsh Sandpiper	0	1	30/1/2010	0	No VBA Records	Commonly seen singly, or in small to large flocks in fresh or brackish wetlands such as rivers, water meadows, sewage farms, drains, lagoons and swamps (Higgins 1999).	Unsuitable habitat within the study area. Scarcity of records in the vicinity suggest the species is an infrequent visitor to the area, with a single 2010 observation at Lake Elingamite. Given the scarcity of observations in the area there is a very low potential for birds flying over the site, at RSA or outside this height range. **Unlikely to occur.**

Species	Records during field surveys	Ebird Records within 10 km	Date of last eBird record	VBA Records within 10 km	Date of last VBA record	Habitat	Likelihood of occurrence
Red-necked Stint	0	23	1/12/2021	2	3/04/2004	Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins & Davies 1996).	Unsuitable habitat within the study area. Both records of this species were observed at Lake Elingamite, with up to 1432 individuals observed in 2009 (eBird 2025). Flight heights during local movements are unknown, and so there is potential for the species to traverse the study area at RSA height when traveling into or out of Lake Elingamite if heading west. **Potential to occur.**
Sharp-tailed Sandpiper *Calidris acuminata*	0	26	4/2/2025	2	23/01/2019	Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins & Davies 1996).	Unsuitable habitat within the study area. Recent records (2025, eBird 2025) in Lake Elingamite, which holds historical records of up to 391 individuals in 2009 (eBird 2025). May utilise other wetlands in the vicinity such as Lake Cobrico and Ecklin South NCR and travel between these wetlands in local movements. The species is known to fly well above the usual RSA during migration, thousands of metres high, but no data is available on flight heights in local movements over land. The species may fly over the study area when moving between the abovementioned wetlands. **Potential to occur.**

Species	Records during field surveys	Ebird Records within 10 km	Date of last eBird record	VBA Records within 10 km	Date of last VBA record	Habitat	Likelihood of occurrence
Wood sandpiper	0	2	14./1/2024	0	No VBA Records	Inhabits well vegetated, shallow, freshwater wetlands, such as swamps, lakes, pools, and waterholes; typically with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reed. In Victoria, they are mostly from Port Phillip Bay and in mid-Murray Valley (Higgins & Davies 1996).	Unsuitable habitat within the study area. Two records in the vicinity, with all observations recorded in Lake Elingamite (eBird 2025). Given the low numbers of this species, and scarcity of observations in the area there is a very low potential for birds flying over the site, at RSA or outside this height range. **Unlikely to occur.**

5.3.3 Australasian Bittern

There are a total of 33 records on the VBA and eBird of Australasian Bittern within 10 km of the study area (Table 8). They were not recorded during on-site field surveys (EHP 2024). This species is closely tied to wetland habitats (DEE 2019), which are absent within the study area. The most likely potential impact of MWF on the Australasian Bittern would be turbine collisions during local movements between wetlands. Thirty of the historical records are from Lake Elingamite, where it appears that between one and six individuals have been observed each year since 2020, with no records in 2025 to date (Figure 1, Table 8). Lake Elingamite is situated to the east of the project boundary, with no records on eBird or the VBA to the west of the study area for more than 20 km. This suggests that there is not a frequent flight path for the Australasian Bittern through the MWF. During wetter years when ephemeral wetlands appear, Bitterns will likely disperse across the countryside into lower densities as more wetlands become available, likely making Lake Elingamite a less important site to the species. The small scale of the proposed wind farm (eight turbines) coupled with the low density of Bitterns in Victoria make the likelihood of a bittern interacting with a turbine low. Construction and operation will not affect wetland habitats or disrupt breeding cycles. A significant impact is unlikely.

Although significant impacts on Australasian Bitterns are unlikely, a precautionary response strategy for any collision incidents will be incorporated into the BAM Plan to address potential long-term population effects.

Table 9 provides a summary of potential impacts to the Australian Bittern against the MNES significant impact criteria for species listed under the EPBC Act as *endangered*.

Table 9: Assessment of the Australian Bittern at the MWF against MNES impact criteria for *critically endangered* and *endangered* species

Significant impact criterion	Assessment of impacts	Significant impact likelihood
*Lead to a long-term **decrease** in the size of a **population***	The population of Australasian Bittern is estimated at approximately 1,300 individuals (Garnett and Baker 2023). There are historical records of the Australian Bittern from the search region around the study area, but none within its boundaries as there is no wetland habitat. Despite the sedentary behaviour of the Australasian Bittern, the species can sometimes travel long distances (Garnett and Baker 2023), and some of the movements can be irruptive as a response to wet years or exceptionally dry conditions (Kushlan and Hancock 2005). However, due to limited empirical data on their flight heights during longer-distance movements, the potential risk of collision at wind farms within their distribution ranges cannot be ruled out. However, the low number of turbines (eight), the low density of Bitterns and the high number of ephemeral wetlands that will be available during these wetter years means that probability of a bittern encountering a turbine is low and a significant impact leading to a decline in their populations is unlikely. However, as collision risk remains, the species will be covered in the BAM Plan under the general framework of response actions to impact triggers for listed species to address potential impacts that could contribute to long-term population declines.	Unlikely
***Reduce** the **area of occupancy** of the species*	There are no suitable wetlands within the study area (i.e., no rivers, creeks, swamps, inundated grasslands, or DEECA-mapped wetlands); therefore, activities during construction, operation or decommissioning will not	Unlikely

Significant impact criterion	Assessment of impacts	Significant impact likelihood
	adversely affect habitat that will lead to a reduction on the area of occupancy for any of these species.	
Fragment *an existing* ***population*** *into two or more populations*	The MWF will not fragment an existing population of these species, as project activities will not affect wetland habitats located outside the study area.	Unlikely
Adversely ***affect habitat critical*** *to the survival of a species*	There are no suitable wetlands within the study area (i.e., no rivers, creeks, swamps, inundated grasslands, or DEECA-mapped wetlands); therefore, activities during construction, operation or decommissioning will not adversely affect the habitats of these species.	Unlikely
Disrupt the breeding cycle *of a population*	The project will not disrupt the breeding cycle of these species, as activities will not affect wetland habitats located outside the study area.	Unlikely
Modify, destroy, remove, isolate or decrease *the* ***availability or quality of habitat*** *to the extent that the species is likely to decline*	There are no suitable wetlands within the study area (i.e., no rivers, creeks, swamps, inundated grasslands, or DEECA-mapped wetlands); therefore, activities during construction, operation or decommissioning will not modify, destroy, remove or isolate or impact the habitats of these species.	Unlikely
Result in ***invasive species*** *that are harmful to an Endangered species becoming established in the endangered species' habitat*	The site currently hosts invasive species such as foxes and feral cats, that may directly predate on this species, and the proposed action is unlikely to increase their abundance or bring any new invasive species.	Unlikely
Introduce disease *that may cause the species to decline*	The proposed action is unlikely to introduce disease harmful for these species or their habitats.	Unlikely
Interfere with the recovery *of the species*	The project is unlikely to interfere with the recovery of the species, as no suitable habitats occur within the study area and it is not expected to significantly increase known threats to this species or its habitat (National Recovery Plans; DCCEEW 2022).	Unlikely
Overall significant impact likelihood		**Unlikely**

5.3.4 Blue-winged Parrot

There were 22 records of Blue-winged Parrots within 10 km of MWF on the VBA and eBird (Table 8). In addition, two individuals were recorded during pre-construction (BUS) surveys, flying below RSA height (EHP 2024). Blue-winged Parrots are a highly mobile species and utilise a range of habitats. They generally nest in the hollows or stumps of living or dead trees within coastal and sub-coastal eucalypt forest and woodland. They forage on the ground in low, open, native or introduced grasslands, pasture and saltmarsh, often near wetlands, and are often observed in altered environments such as airfields, golf courses and paddocks (Menkhorst et al. 2019; DCCEEW 2023b).

Whilst the study area does not represent high-value habitat for the Blue-winged Parrot due to widespread modification for agriculture, it is likely that Blue-winged Parrots opportunistically utilise habitat within the study area on occasion as they are habitat generalists. The highly-modified habitat present in the study area is widespread in western Victoria, with the MWF site representing a very small proportion of this type of habitat. Blue-winged Parrots are therefore likely to be at very low density within the MWF region, which is supported by the paucity of historical records. Consequently, Blue-winged Parrots are unlikely to be significantly impacted by the proposed MWF (Table 10).

Table 10: Assessment of the Blue-winged Parrot (BWP) at the MWF against MNES impact criteria for *vulnerable* species

Significant impact criterion	Assessment	Significant impact likelihood
*Lead to a long-term **decrease** in the size of an important **population***	The BWP population is roughly estimated at 10,000 mature individuals (Holdsworth et al. 2021). They are highly mobile, with their population spreading across a vast range in mainland Australia that extends up to north-eastern South Australia, south-western Queensland, and western New South Wales (BirdLife International 2022). A single detection during intensive surveys at the MWF site suggest that BWPs are infrequent visitors who may only occasionally forage on pastures and clearings on site. It is therefore considered that the individuals on site do not represent part of an important population. If collision mortalities do occur, they are anticipated to be infrequent and represent a very small portion of the estimated population, very likely less than the 10 individuals required to be a nationally significant proportion of the population. Due to the small size of the wind farm (eight turbines), its contribution to cumulative impacts is expected to remain minimal. The MWF will not lead to a long-term decrease in the size of the population of this species.	Unlikely
***Reduce** the **area of occupancy** of an important population*	The study area comprises highly modified farmland. Reductions in area of occupancy are more critical in relation to breeding habitats outside the MWF region, where large-scale agriculture expansion is a major threat and conservation efforts prioritise woodland protection (Holdsworth et al. 2021). The small amount of native vegetation planned to be removed (0.427 ha), including the removal of five large eucalyptus trees, is unlikely to have any impact on the BWP occupancy. This level of clearance is not expected to directly or indirectly impact on-site habitat, which consists mainly of cleared land and grazing paddocks that may occasionally be used for BWP foraging, with woodland vegetation on site unsuitable for breeding. The MWF will not reduce the area of occupancy of the BWP population. As noted above, the BWP records noted on site are unlikely to represent an important population.	Unlikely
***Fragment** an **existing population** into two or more populations*	The BWP vulnerability to habitat fragmentation is most critical during the breeding season, where the loss of woodland	Unlikely

Significant impact criterion	Assessment	Significant impact likelihood
	directly impacts nesting sites and reproductive success (reviewed in DCCEEW 2023b). In contrast, during the non-breeding season the species primarily forages on ground in already disturbed landscapes, such as pastures and clearings in farmland (Collar & Boesman 2020). Although farmland activities such as livestock grazing can degrade grassland habitat and reduce food resource availability (reviewed in DCCEEW 2023b), the project activities during construction, operations and decommissioning are not expected to worsen these impacts or contribute further to habitat fragmentation. In inland Victoria, it is typically seen in small flocks using a range of open habitats, indicating broad post-breeding dispersal across the state and no evidence of defined migratory routes through the Project Area (Higgings 1999). It is not expected that the population in the area would be impacted through fragmentation.	
*Adversely **affect habitat critical** to the survival of a species*	According to the Conservation Advice for this species (DCCEEW 2023b), habitat critical to the survival of this species includes foraging and staging habitats including grasslands, grassy woodland and semi-arid chenopod shrubland, as well as hollow bearing trees or stumps. Breeding habitat in the study area is unsuitable, as the site supports very few mature trees with hollows. Foraging habitat on site mainly comprises grazing paddocks and cleared farmland. It is not anticipated that the relatively small degree of impacted foraging habitat represents habitat critical to the survival of this species. There is no indication that the proposed MWF site will affect critical BWP habitat.	Unlikely
***Disrupt the breeding cycle** of an important population*	The project will not disrupt the breeding cycle of the BWP, as the site is unlikely to provide opportunities for breeding.	Unlikely
***Modify, destroy, remove, isolate or decrease** the **availability or quality of habitat** to the extent that the species is likely to decline*	BWP habitat on site is associated with foraging areas, mainly grazing paddocks and cleared farmland. These areas will not be further altered in a way that would significantly impact the availability or quality of BWP habitat. There is no indication that the MWF will affect BWP habitat availability or quality.	Unlikely
*Result in **invasive species** that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*	The project will implement an Environmental Management Plan to control the spread and proliferation of invasive species and disease. It is unlikely that the MWF will introduce invasive species that may cause the species to decline.	Unlikely
***Introduce disease** that may cause the species to decline*	The proposal will not engage in any activities likely to introduce disease harmful to this species.	Unlikely

Significant impact criterion	Assessment	Significant impact likelihood
	The project will implement a Environmental Management Plan to control the spread and proliferation of invasive species and disease. It is unlikely that the MWF NMEP will introduce disease that may cause the species to decline.	
Interfere substantially with the recovery *of the species*	No recovery plan is in place for the species. The BWP is expected at the study area primarily as an occasional, non-breeding visitor. Given the limited number of turbines and negligible impacts on the habitat, the project is not anticipated to significantly increase the known threats to the species that may affect its recovery.	Unlikely
Overall likelihood of significant impact		***Unlikely***

5.3.5 Fork-tailed Swift

Fork-tailed Swifts were not recorded in the study area during on-site surveys (EHP 2024) and there are no records on the VBA or eBird within 10 km of the study area (Table 8). However, the Fork-tailed Swift is a wide-ranging, aerial species that has been recorded over most habitat types, sometimes in vast flocks. Like the WTNT, the appearance of Fork-tailed Swift flocks often precedes or accompanies weather fronts. Therefore, it is possible that Fork-tailed Swifts may utilise the study area occasionally, but records suggest they are uncommon in the region. Fork-tailed Swifts are known to collide with turbine blades (Nature Advisory unpublished data), but due to their low density in the region the probability of collision is low. In addition, their large population size means on the rare occasion of a collision, the impact is considered unlikely to be significant.

Although significant impacts on Fork-tailed Swift are unlikely, a precautionary response strategy for any collision incidents will be incorporated into the BAM Plan to address potential long-term population effects.

Table 11 provides a summary of potential impacts to the Glossy Ibis against the MNES significant impact criteria for species listed under the EPBC Act as *migratory.*

Table 11: Assessment of the Fork-tailed Swift at the MWF against MNES impact criteria for *migratory* species.

Significant impact criterion	Assessment	Significant impact likelihood
Substantially modify *(including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.*	The species is widespread and not bound to a particular habitat in Australia, as long as there are aerial insects. The area impacted by the project is negligible in terms of habitat for Fork-tailed Swift due to its widespread but scattered occurrence in Australia.	Unlikely

Significant impact criterion	Assessment	Significant impact likelihood
Result in an ***invasive species*** *that is* ***harmful*** *to the migratory species becoming established in an area of important habitat for the migratory species.*	The Fork-tailed Swift is only likely to utilise the study area in an aerial capacity. The proposed action is unlikely to introduce any invasive species that are harmful to an aerial species like the Fork-tailed Swift.	Unlikely
Seriously disrupt the lifecycle *(breeding, feeding, migration or resting behaviour) of an* ***ecologically significant proportion*** *of the population of a migratory species.*	The species has not been recorded in the study area to date but has potential to occur in the study area sparsely in flocks over the summer months. On this basis, an ecologically significant proportion of the population (which is large) is unlikely to be present.	Unlikely

5.3.6 Gang-Gang Cockatoo

Whilst Gang-gang Cockatoos (GGC) were not recorded in the study area during field surveys (EHP 2024) there are a total of 46 records of GGCs in the VBA and on eBird within 10 km of the study area, the most recent of which was this year (Table 8). These database records suggest Gang-gang Cockatoos at least occasionally utilise the site, likely to feed on flowering trees. The project may have two direct impacts upon Gang-gang Cockatoos; loss of habitat through the clearing of woodland and collision with turbines. The project will clear 0.4 ha of native vegetation, comprised of 0.241 ha of native vegetation patches, four scattered trees (two large and two small) and three large trees in patches, which represents a very small reduction in available habitat for a species that is considered nomadic and migratory and is widespread across Victoria and southern NSW (DAWE 2022, Higgins 1999). Nature Advisory data suggests that Gang-gang Cockatoos do not frequently collide with turbines, with a single collision recorded to date. The few records of Gang-gang Cockatoos in the MWF region suggest they are infrequent visitors to the area, further lowering the likelihood of turbine collision.

Although significant impacts on Gang-gang Cockatoos are unlikely, a precautionary response strategy for any collision incidents will be incorporated into the BAM Plan to address potential long-term population effects.

Table 12 provides a summary of potential impacts to the Gang-gang Cockatoo against the MNES significant impact criteria for species listed under the EPBC Act as *endangered*.

Table 12: Assessment of the Gang-gang Cockatoo at the MWF against MNES impact criteria for *endangered* species

Significant impact criterion	Assessment	Significant impact likelihood
*Lead to a **long-term decrease** in the size of a population*	No records of GGCs during field surveys and 18 historical records suggest the GGC infrequently uses the site, likely because habitat is suboptimal. The primary risk to the GGC posed by the project is turbine collision, but low site utilisation coupled with few records of GGC collisions in Nature Advisory's database suggest the likelihood of collision is very low.	Unlikely
***Reduce the area of occupancy** of the species*	The project is removing 5 large trees and less than 0.5 ha of native vegetation. The removal of this small patch of vegetation is unlikely to affect the use of the site by GGCs as it represents a very small percentage of the habitat available to them on site.	Unlikely
***Fragment an existing population** into two or more populations*	The GGC is a broad ranging species that is present across much of Victoria. The study area represents non-breeding habitat for the GGC, which breed in summer in mature, wet sclerophyll forests. The project is unlikely to result in the fragmentation of the GGC population.	Unlikely
***Adversely affect habitat critical** to the survival of a species*	The GGC is a broad ranging species that is present across much of Victoria. The study area represents non-breeding habitat for the GGC, which breed in summer in mature, wet sclerophyll forests. The project is unlikely to adversely affect habitat critical for the survival of the GGC.	Unlikely
***Disrupt the breeding cycle** of a population*	GGCs breed in tall, mature, wet sclerophyll forests which are not present in the study area. The project is unlikely to disrupt the breeding cycle of the GGC.	Unlikely
Modify, destroy, remove, isolate or decrease the availability or quality of habitat** to the extent that the species is likely to **decline	The project is removing 5 large trees and less than 0.5 ha of native vegetation. The removal of suboptimal GGC habitat is unlikely to result in the decline of the GGC.	Unlikely
***Result in invasive species** that are **harmful** to a **critically endangered or endangered species** becoming established in the endangered or critically endangered species' habitat*	The proposal will not result in any invasive species being introduced which may be harmful to these species. The project will implement an Environmental Management Plan to control the spread and proliferation of invasive species and disease.	Unlikely
***Introduce disease** that may cause the species to **decline**, or*	The proposal will not engage in any activities likely to introduce disease harmful to this species. The project will implement an Environmental Management Plan to control the spread and proliferation of invasive species and disease.	Unlikely
Interfere with the recovery of the species	The proposal, with its small degree of habitat loss in an area rarely frequented by these species, is not anticipated to interfere substantially with their recovery.	Unlikely

5.3.7 Glossy Ibis

There are no records of Glossy Ibis in the VBA and no Glossy Ibis were recorded during pre-construction surveys (Table 8). However, eBird records suggest they are infrequent visitors to the nearby Lake Elingamite (a cluster of 10 records across the 2018/2019 and 2019/2020 summers, Table 8). Glossy Ibis are reliant on wetland habitat, of which there is none within the study area. The primary risk to Glossy Ibis from MWF is turbine collision during local movements between wetland habitats. Glossy Ibis are only present in the MWF region in the warmer months; they migrate north for winter. The scarcity of historical records coupled with them being absent from the region in the colder months of the year suggest that if Glossy Ibis are flying over the study area, they are doing so infrequently and are therefore at low likelihood of interacting with the eight turbines on site.

Although significant impacts on Glossy Ibis are unlikely, a precautionary response strategy for any collision incidents will be incorporated into the BAM Plan to address potential long-term population effects. Table 13 provides a summary of potential impacts to the Glossy Ibis against the MNES significant impact criteria for species listed under the EPBC Act as *migratory.*

Table 13: Assessment of the Glossy Ibis at the MWF against MNES impact criteria for *migratory* species.

Significant impact criterion	Assessment	Significant impact likelihood
Substantially modify *(including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.*	There is no Glossy Ibis habitat on the study area (wetland). The MWF is not anticipated to impact any Glossy Ibis habitat.	Unlikely
Result in an ***invasive species*** *that is* ***harmful*** *to the migratory species becoming established in an area of important habitat for the migratory species.*	The Glossy Ibis is only likely to utilise the study area by flying over. The construction of the MWF is unlikely to introduce any invasive species capable of impacting the Glossy Ibis. There are already numerous invasive species established in the region.	Unlikely
Seriously disrupt the lifecycle *(breeding, feeding, migration or resting behaviour) of an* ***ecologically significant proportion*** *of the population of a migratory species.*	The species has not been recorded in the study area to date but has potential to occur in the study area as it flies between wetlands during the summer months. On this basis, an ecologically significant proportion of the population (which is large) is unlikely to interact with the eight turbines of MWF.	Unlikely
Overall likelihood of significant impact		***Unlikely***

5.3.8 Latham's Snipe

Latham's Snipe was not been recorded during on-site surveys (EHP 2024) but has 21 records on the VBA and eBird, with the most recent record from 2024 (Table 8, VBA 2025). The majority of records were from Lake Elingamite to the east of MWF, with a handful of records from the township of Terang to the north-west. Latham's Snipe are most often observed in a variety of wetland types, often within dense vegetation. There is very little of their preferred habitat within the study area, but they may occasionally occur in temporarily flooded areas including grassy drainage lines and low-lying areas that retain soil moisture during rainy periods (DCCEEW 2024c). There is some potential for individuals from nearby wetlands such as Lake Elingamite to visit the site to forage or pass over the site moving between wetlands, though database records indicate they are at low density in the region. There are no confirmed records of collisions at wind farms (Nature Advisory unpublished data) and the height at which they move between wetlands is not known.

Table 14 provides a summary of potential impacts to the Latham's Snipe against the MNES significant impact criteria for species listed under the EPBC Act as *vulnerable.*

Table 14: Assessment of the Latham's Snipe at the MWF against MNES impact criteria for *vulnerable* species

Significant impact criterion	Assessment	Significant impact likelihood
*Lead to a long-term **decrease** in the size of an important **population***	Latham's Snipe has not been recorded at the site during intense on-ground surveys and is expected at best to be rare or occasional in the study area. It is therefore considered that an important population of this species does not occur within the project boundaries. There is a possibility that Snipes may pass through the site when moving between wetlands, but this is likely to happen during wetter years as new wetlands form across the landscape. At these times Snipes will disperse and be at low density, and are therefore at low likelihood of interacting with the eight turbines at MWF.	Unlikely
***Reduce** the **area of occupancy** of an important population*	No significant habitats suitable to this species occur at the site. The species has the potential to use flooding area, including drainage lines within the study area. However, these potential areas on the site are small and isolated, largely degraded, and are not considered to be important for the species. There are larger higher quality areas of suitable habitat in the region, away from the wind farm (e.g., Lake Elingamite). Therefore, it is not expected that the proposal would reduce the area of occupancy of the species.	Unlikely
***Fragment** an **existing population** into two or more populations*	This species has not been recorded at the site and no important population is considered to occur at the site.	Unlikely
*Adversely **affect habitat critical** to the survival of a species*	This species usually inhabits open, freshwater wetlands with low, dense vegetation (DCCEEW 2024c). No wetlands occur within the site. It is not anticipated that the proposal would impact habitat critical to this species survival.	Unlikely
***Disrupt the breeding cycle** of an important population*	This species was not recorded during on-ground surveys and is expected to remain absent or as a rare visitor in the study area. It is therefore considered that an ecologically significant proportion of the population of these species does not occur on the site.	Unlikely
***Modify, destroy, remove, isolate or decrease** the **availability or quality of habitat** to the extent*	No substantial suitable habitat for this species occurs within the site. Farm dams and drainage line are not proposed to be removed as part of the project. The small loss of vegetation	Unlikely

Significant impact criterion	Assessment	Significant impact likelihood
that the species is likely to decline	due to the proposal is not anticipated to lead to the decline of the species.	
*Result in **invasive species** that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*	The proposal will not result in any invasive species being introduced which may be harmful to these species. The project will implement an Environmental Management Plan to control the spread and proliferation of invasive species and disease.	Unlikely
***Introduce disease** that may cause the species to decline*	The proposal will not engage in any activities likely to introduce disease harmful to this species. The project will implement an Environmental Management Plan to control the spread and proliferation of invasive species and disease.	Unlikely
***Interfere substantially with the recovery** of the species*	The proposal with its small degree of habitat loss in an area not frequented by these species, is not anticipated to interfere substantially with their recovery.	Unlikely
Overall likelihood of significant impact		***Unlikely***

5.3.9 *Wetland-associated migratory shorebird species (Common Greenshank, Curlew Sandpiper, Red-necked Stint and Sharp-tailed Sandpiper)*

There are 58 records of these four species within 10 km of MWF on the VBA and eBird (Table 8). The study area lacks suitable wetlands and therefore does not provide habitat for wetland-associated migratory shorebird species of the East Asian–Australasian Flyway (EAAF). The absence of suitable foraging and roosting habitat within the study area means that the proposed development will not have a direct impact on habitat for these species.

The most likely impacts of the MWF on wetland dependant species would be potential collisions during local movements between wetlands. The nearby Lake Elingamite is a permanent wetland that is an important refuge for waterbird species during drier years (Figure 1). During wetter years, ephemeral wetlands on farmlands (e.g. Ecklin Swamp, Crawley's Swamp) may attract wetland dependant birds. However, during wetter years, waterbird numbers disperse across the countryside in lower densities as more wetlands become available. Coupled with the small scale of the proposed wind farm (eight turbines), the likelihood of a wetland-associated migratory shorebird species to interact with a turbine is low.

Although significant impacts on wetland-associated migratory shorebird species are unlikely, a precautionary response strategy for any collision incidents will be incorporated into the BAM Plan to address potential long-term population effects. Table 15 provides a summary of potential impacts to these species against the MNES significant impact criteria for species listed under the EPBC Act as *migratory*, *vulnerable* and *endangered*.

Table 15: Assessment of wetland-associated *migratory* species (Common Greenshank, Curlew Sandpiper, Red-necked Stint and Sharp-tailed Sandpiper) against MNES impact criteria for *migratory*, *vulnerable* and *endangered* species

Significant impact criterion	Assessment	Significant impact likelihood
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species (for ***non-threatened migratory species*** *only)*	All of these species are East Asian–Australasian Flyway (EAAF) visitors that typically arrive in Australia between spring to summer. Although the study area is near wetlands known or likely to support non-breeding individuals of these species (e.g., Lake Elingamite, Lake Cobrico, Ecklin South NCR), it lacks suitable wetland habitat itself. The only waterbodies are farm dams, and some areas classified as Plains grassy wetland that may occasionally create ephemeral wetlands but not during summer. Therefore, the project will not substantially modify, destroy or isolate an area of important habitat for a migratory species.	Unlikely
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species (for ***non-threatened migratory species*** *only)*	The site currently hosts invasive species such as foxes and feral cats, and the proposed action is unlikely to increase their abundance or bring any new invasive species of fauna or flora. The project will implement a CEMP to control the spread and proliferation of invasive species and disease.	Unlikely
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species (for ***non-threatened migratory species*** *only)*	These species do not breed in Australia. Further, the study area does not provide suitable habitat for regular feeding or resting for any of these migratory species. Although there are some wetlands within 10 km of the study area that may provide suitable non-breeding habitat, migration is not expected to be seriously disrupted, particularly given the small scale of the wind farm and the absence of important foraging or roosting habitat within the development area.	Unlikely

Significant impact criterion	Assessment	Significant impact likelihood
Lead to a long-term decrease in the size of an important population of a species (for ***vulnerable*** *species); or* *Lead to a long-term decrease in the size of a population of a species (for* ***endangered*** *species)*	No habitat loss or disturbance that can interrupt or prevent feeding will occur as no suitable wetlands lie within the project boundaries. The only concern is direct mortality through collision (DEE 2017, DoE 2015a). Local movements are not expected to pose a significant collision risk as waterbirds typically use waterway corridors as flyways instead of flying long distances over open ground. The main waterways in the area extend outside the 10 km radius towards the north-east of the study area. Flights from local movements over the study area are expected to occur occasionally. Seasonal migration movements may still result in collision mortalities, but due to the small size of the wind farm (eight turbines), its contribution to cumulative impacts is expected to be relatively low. However, due to the complexity of predicting impacts on wetland-associated migratory birds at wind farm developments, it is difficult to estimate this potential impact. A response strategy to any collisions involving wetland-associated species of concern should be incorporated into the BAM Plan, using a group-specific strategy with hierarchical impact triggers, investigations, and proportional mitigation actions to address impacts that could lead to long-term population declines.	Unlikely
Reduce the area of occupancy of an important population (for ***vulnerable*** *species); or* *Reduce the area of occupancy of the species (for* ***endangered*** *species)*	There are no suitable wetlands within the study area; therefore, activities during construction, operation or decommissioning will not adversely affect habitats that will lead to a reduction on the area of occupancy for any of these species.	Unlikely
Fragment an existing important population into two or more populations (for ***vulnerable*** *species); or* *Fragment an existing population into two or more populations (for* ***endangered*** *species)*	The MWF will not fragment an existing population of any of these species, as project activities will not affect wetland habitats located outside the study area.	Unlikely
Adversely affect habitat critical to the survival of a species (for ***vulnerable*** *or* ***endangered*** *species)*	There are no suitable wetlands within the study area; therefore, activities during construction, operation or decommissioning will not adversely affect habitat for any of these species.	Unlikely

Significant impact criterion	Assessment	Significant impact likelihood
Disrupt the breeding cycle of an important population (for ***vulnerable*** *species); or* *Disrupt the breeding cycle of a population (for* ***endangered*** *species)*	The study area falls within the non-breeding range of these species. The project will not disrupt the breeding cycle of these species.	Unlikely
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline (for ***vulnerable*** *or* ***endangered*** *species)*	There are no suitable wetlands within the study area; therefore, activities during construction, operation or decommissioning will not modify, destroy, remove or isolate or impact the habitats of these species.	Unlikely
Result in invasive species that are harmful to a vulnerable species becoming established in the ***vulnerable*** *or* ***endangered*** *species' habitat*	The site currently hosts invasive species such as foxes and feral cats, that may directly predate on these species, and the proposed action is unlikely to increase their abundance or bring any new invasive species.	Unlikely
Introduce disease that may cause the species to decline (for ***vulnerable*** *or* ***endangered*** *species), or*	The proposed action is unlikely to introduce disease harmful for these species or their habitats.	Unlikely
Interfere substantially with the recovery of the species (for ***vulnerable*** *or* ***endangered*** *species)*	No species-specific recovery plans are in place for any of these species. In accordance with the Wildlife Conservation Plan for Migratory Shorebirds (DoE 2015b) actions for the protection, conservation and management of migratory shorebirds should ensure all important areas in Australia continue to be considered in development assessment processes. No Ramsar sites or Internationally Important Wetlands occur on site. The absence of suitable habitat and species records within the study area and nearby significant wetlands suggests the development is unlikely to substantially increase threats to this group of species or affect their recovery.	Unlikely

6 Avoidance and mitigation measures

Mortalities due to collision with operational turbines at MWF are possible for SBWBs, but unlikely for WTNT and GHFF. The proponent is developing proactive avoidance, minimisation and mitigation in consultation with DEECA and DCCEEW, to be documented in a BAM Plan that will be approved before the wind farm is operational.

It is proposed that if a mortality of this species occurs, the mitigation response will be strengthened and enhanced to a level where an ecologically significant impact on the species is no longer expected to occur. The proponent recognises that managing the risk of bat collisions with turbines requires a multi-faceted approach that is embedded in the avoidance and mitigation hierarchy but also accounts for the known ecology and behaviour of the species, site features relating to available habitat and foraging opportunities, and the influence of weather and season on bat activity. This approach aims to achieve a balanced outcome that enables wind farm operations whilst minimising, as far as practicable, the risk to SBWB.

Table 16 summarises the proposed avoidance and mitigation plan for MWF, which includes a minimum RSH of 64 m AGL, micro-siting of turbines based on habitat quality, and increasing cut in wind speeds when MWF is operational.

6.1 Pre-construction and construction measures

6.1.1 Avoid and minimise

Turbine specifications

In the most recent annual update, the SBWBRT acknowledge that there could be a relationship between the physical characteristics of newer model turbines and collision risk to SBWB (Southern Bent-wing Bat National Recovery Team 2022):

"Wind turbine characteristics continue to evolve. Newer proposed turbines are typically higher, with longer blades, and set higher off the ground. These features may alter mortality risk to SBWB however this has yet to be quantified."

The minimum height of blade tips for the proposed turbine model at MWF is 64 m above the ground. The minimum RSH of turbines at the wind farms where SBWB carcasses have been detected are under 40 m above the ground. Given that information on all SBWB mortalities detected to date at operational wind farms have not been made publicly available, it is unknown if the minimum RSH of 40 m incorporates all turbines where mortalities have occurred.

Nature Advisory is currently undertaking analysis of existing monitoring data to investigate how turbine model specifications influence mortality rates for Australian bat species. Mortality data are being sourced from post-commissioning monitoring conducted at more than a dozen operational wind farms in Victoria, ACT and NSW. Preliminary results to date suggest total bat mortality significantly decreases as minimum RSH increases above 40 m AGL. Further, as turbine blades are raised higher above the ground, the number of microbat species impacted decreases, with open-space adapted taxa accounting for most mortalities (Nature Advisory 2024). These findings are similar to those reported from the Northern Hemisphere, where risk of colliding with turbines has been shown to correlate with wing morphology and echolocation frequency (characteristics that are used to group bats into foraging guilds) and the proportion of time that bats from different foraging guilds spend flying high above the canopy at RSA heights (Arnett et al. 2016; Roemer et al. 2019b 2017).

No new powerlines

The proposed point of connection with the national electricity grid is an existing powerline that follows Cobden – Warrnambool Rd that runs directly adjacent to the site and the internal electrical reticulation will be located underground. Accordingly, with the exception of the powerline between the substation and the point of connection with the electricity grid, no new overhead powerlines will be installed. This removes the potential for birds or bats to collide, or be otherwise affected, by additional above ground infrastructure.

Turbine-habitat buffers

There are currently no Australian guidelines that prescribe appropriate buffer distances between turbine blade tips and habitat features that are important for insectivorous bats (e.g., treed areas and water bodies) to reduce collision risks to an acceptable level. Therefore, design of the proposed MWF considered the EUROBATS guidelines where a minimum 200 m buffer is implemented from the nearest habitat feature (woodland, tree lines, hedgerow networks, wetlands, waterbodies and watercourses) to blade-tips (Rodrigues et al. 2015). Using the formula in the EUROBATS guidelines, a maximum of 260 m buffer is required to achieve 200 m separation between blade tip and habitat (Nature Advisory 2024a).

The wind turbine layout of the proposed MWF has been through three revisions. The first revision consisted of 15 wind turbines, the second revision consisted of nine wind turbines, and the third, and current, revision of the wind turbine layout consists of eight wind turbines (Figure 2 & 3). With each revision, all reasonable attempts have been made to place wind turbines further than 260 m from as much potential SBWB habitat as possible, with a hierarchy of habitat types adopted where waterbodies were the highest priority, woodlands were the next most important habitat type, and planted windbreaks the lowest priority.

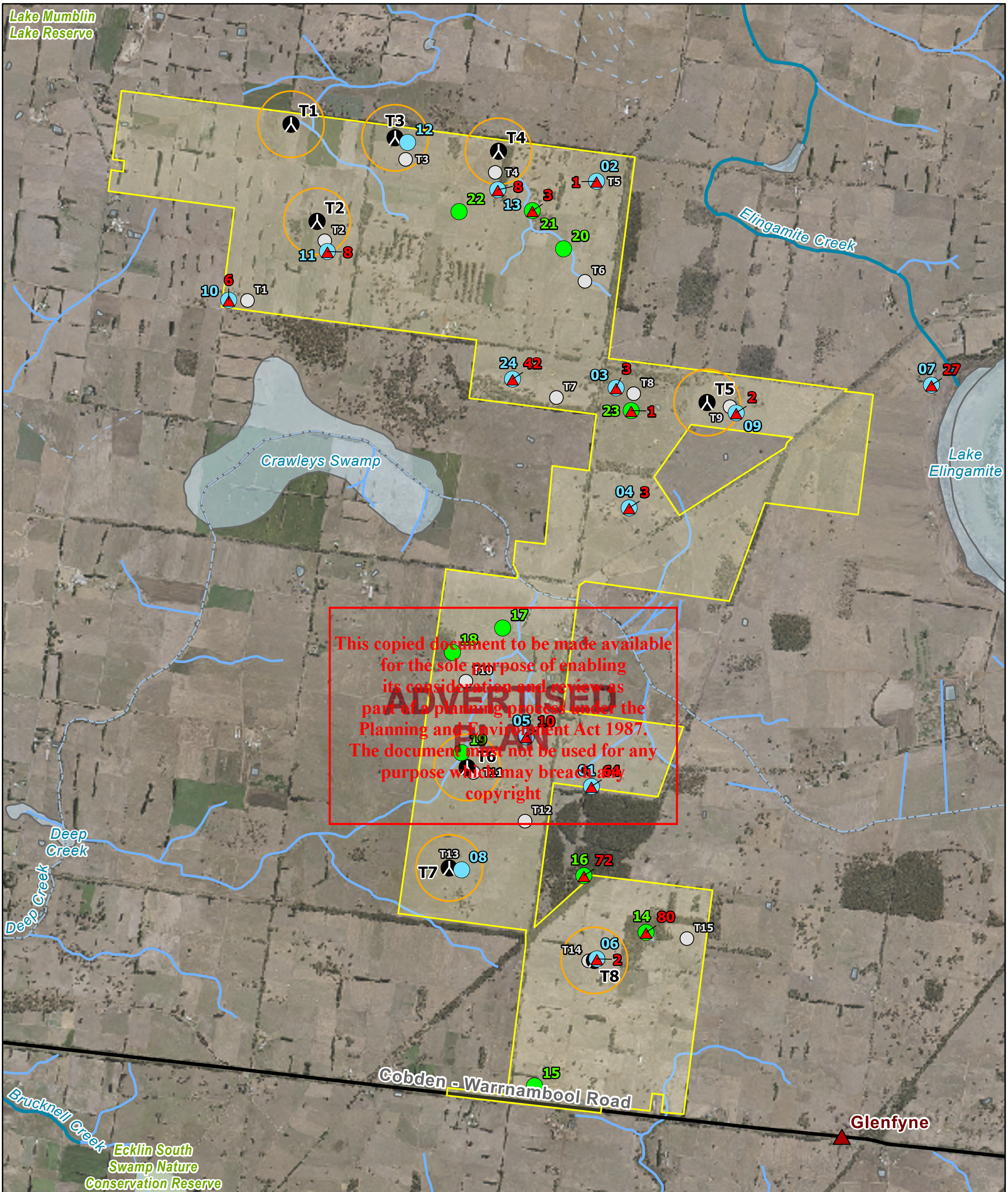

Figure 2: MWF turbine buffers, bat detector locations, ecological features and location of SBWB-definite calls.

Project No: 22238.03 **Project location:** Mumblin, VIC **Date:** 19/06/2025

N

Kilometres
0 1
GDA2020 Vicgrid

- Site boundary
- Wind turbine
- Turbine buffer (260m radius)
- Original layout turbine
- Park or conservation reserve
- Town

Bat detectors
- MiniBAT
- SM4BAT-ZC
- SBWB definite call location (labelled with total number of calls)

Watercourse
- River
- Stream
- Drain / channel

Watercourse connectors
- Watercourse connector
- Water area

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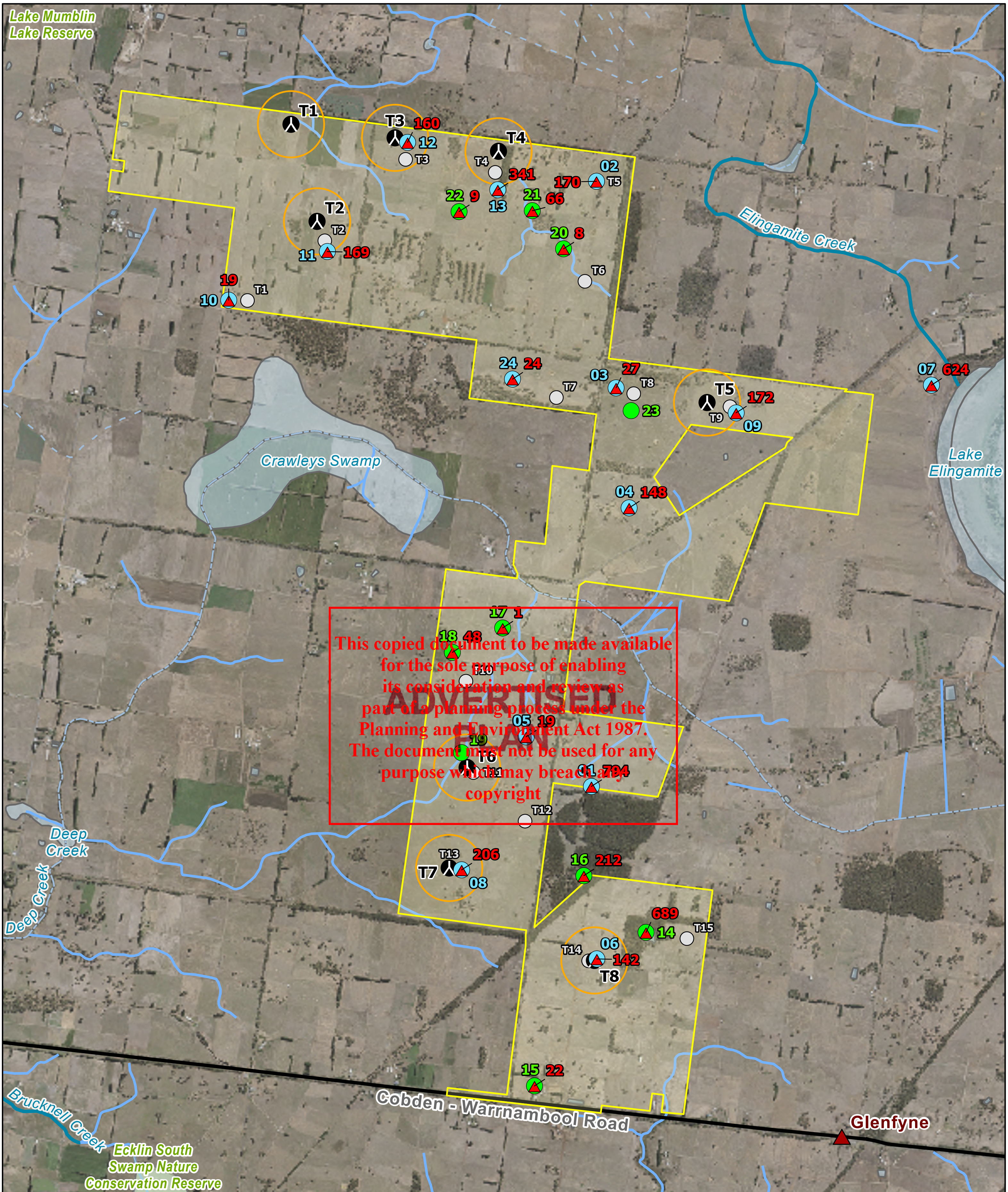

Figure 3: MWF turbine buffers, bat detector locations, ecological features and location of SBWB-complex calls

Project No: 22238.03 **Project location:** Mumblin, VIC **Date:** 19/06/2025

Site boundary
Wind turbine
Turbine buffer (260m radius)
Original layout turbine
Park or conservation reserve
Town

Bat detectors
MiniBAT
SM4BAT-ZC
SBWB complex call lcoation (labelled with total number of calls)

Watercourse
River
Stream
Drain / channel
Watercourse connectors
Watercourse connector
Water area

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6.2 Operational mitigation measures

6.2.1 *Mitigation of potential impacts to SBWB*

Feathering and increasing low wind speed cut-in

Low wind-speed curtailment is an approach to mitigate bat mortality at wind farms that involves modifying nighttime turbine operations during periods of elevated risk to bats (Arnett et al. 2011). This is achieved by adjusting turbine blade orientation to align with the wind (known as feathering) and increasing the cut-in speed of the turbines, both known to be effective at reducing bat mortalities (Bennett et al. 2022; Maclaurin et al. 2022; Adams et al. 2021; Arnett et al. 2013, Whitby et al. 2024). Feathering involves rotating the blades parallel to the wind to reduce the amount of wind they catch and therefore slow or stop rotation. When applied at or below the cut-in wind speed—when turbines would not typically generate electricity—feathering helps minimise unnecessary blade movement, reducing the risk of bird and bat collisions during periods of low wind when wildlife activity is often higher. Increasing the cut-in speed above the manufacturer's specified speed, which is the wind speed at which electricity generation begins, stops blades rotating until a designated, higher wind-speed occurs. Increasing turbine cut-in speed can reduce bat fatalities because bats tend to be less active at higher wind speeds (Arnett et al. 2011; Baerwald et al. 2009).

The effectiveness of nighttime low wind-speed curtailment in significantly reducing mortality among insectivorous bats is recognised on a global scale (Arnett et al. 2016; Lloyd et al. 2023; Whitby et al. 2021). Results from a meta-analysis of bat fatalities at wind energy facilities in the United States showed that, for every 1.0 m/second increase in nighttime cut-in speed, total bat fatalities were reduced by approximately 33% (Whitby et al. 2021).

Only one study has investigated the effectiveness of nighttime low wind-speed curtailment in reducing bat impacts at an operational wind farm in Australia. The study by Bennett et al. (2022) was undertaken in response to SBWB mortalities resulting from collisions with turbines at Cape Nelson North Wind Farm, near Portland, Victoria. Bennett et al. (2022) experimented with implementing seasonal and nightly turbine curtailment during periods of low wind speeds. Turbines were set to start operating at wind speeds of 4.5 m/s, which was a 1.5 m/second increase from the manufacturer's default cut-in speed of 3.0 m/s. This adjustment resulted in a 54% decrease in overall bat mortality. The potential loss in total annual energy generation as a result of applying the increased cut-in speed was estimated to be 0.16%, accompanied by a revenue loss of 0.09% (Bennett et al. 2022). These wind turbines have a minimum RSH of 34 m AGL and are located on the coast approximately 10 km from the maternity cave near Portland.

The project proponent proposes to implement the following low wind speed curtailment regime in order to mitigate the potential risk posed to SBWB by the project. The details of this curtailment regime are as follows:

- Curtailment to consist of increasing the cut-in wind speed for all wind turbines from 3.0 m/s to 4.5 m/s.
- Curtailment to be implemented during spring, summer and autumn (nine months in total).
- Curtailment to commence from the commencement of commercial operation of the wind farm (i.e., following commissioning).
- Curtailment to commence 30 minutes following sunset and extend until 30 minutes before sunrise.

The proponent will commit to this curtailment regime as part of a broader BAM Plan in the view that the curtailment regime will be reviewed at regular intervals, in line with the overarching BAM Plan, and redesigned where warranted in light of intervening developments in scientific research, government policy and alternative mitigation measures, such as acoustic deterrence.

It is estimated that this curtailment regime will result in a reduction in energy generation of 0.25% – 0.50%, however the financial implications of this reduction in generation cannot be accurately predicted prior to the finalisation of contracts pertaining to the sale of electricity.

Acoustic deterrents

Ultrasonic acoustic deterrent systems have been proposed as a method to reduce activity of echolocating bats to mediate bat-human conflicts (Zeale et al. 2016), including close to wind turbines. These systems generate ultrasonic sound within the frequency range used by bats that is designed to mask returning echoes from the bat's echolocation signal, forcing them to leave the airspace (Arnett et al. 2013). Findings presented by Weaver et al. (2020) and Good et al. (2022) provide promising evidence that ultrasonic acoustics deterrents can reduce bat collisions, but the effectiveness appears to be species-specific. While this technology has the potential to play a role in impact reduction for at least some bats species, its efficacy for reducing impacts to Australian bats needs to be systemically tested.

In the interests of furthering the understanding of this potential mitigation measure, the project proponent is committed to conducting a feasibility trial of a commercially available acoustic deterrent system. It is acknowledged that as an emerging technology, the application and effectiveness of these devices is largely inconclusive, particularly for Australian bat species. However, it is also recognised that without efficacy trials of available technologies it is impossible to know whether they may yield acceptable results for future use as a formal mitigation measure. Accordingly, the proponent proposes to include a trial of this technology as part of BAM Plan, with continuation of the technique should it prove effective.

Other technologies in development or testing

Potential methods for deterring bats from airspace within turbine RSAs include light, radar and sound (Werber et al. 2023). Most technologies in the active deterrent space appear to be in early testing phases, with limited evidence of efficacy when implemented at-scale at operational wind facilities. Consequently, while there are some promising developments, most of these technologies are not yet commercially available as off-the-shelf products ready for use at operational wind farms. These include:

- Electromagnetic radiation produced by marine radar as a deterrent (Gilmour et al. 2020).
- Using drones to disturb wildlife (Kuhlmann et al. 2022; Werber et al. 2023).
- Creating ultrasonic noise by ejecting compressed air from nozzles as a supersonic jet (Romano et al. 2019).
- Attaching passive ultrasonic whistle directly onto turbine blades (Zeng and Sharma, 2023).
- Attaching miniaturised speakers directly onto turbine blades (Cooper et al. 2020).
- Visual deterrents, such as dim ultraviolet light (Gorresen et al. 2015).
- Automated monitoring systems incorporating thermal video, radar and/or echolocation to trigger short-term curtailment when target species are detected approaching a turbine (McClure et al. 2021; Rabie et al. 2022).

The evolution of these emerging technologies may help manage collision risk and residual impacts on threatened species but will require further assessment for their applicability to any emerging problem and as such are not considered as part of this report.

6.2.2 Mitigation of Potential Impacts to WTNT

Species-specific WTNT mitigation measures will be considered as part of the BAM Plan, including but not limited to:

- *Targeted turbine curtailment or temporary shutdown*, including two hours before dawn and two hours after dusk during high risk periods; and
- Smart curtailment systems utilising optical or radar technologies.

These mitigation measures will be implemented in the event that a significant impact trigger is reached for the species, where a significant impact trigger is defined as 0.1% of the population in accordance with the EPBC Act policy statement on listed migratory species and the definition of an important population at a national level (Commonwealth of Australia 2017). Mitigation measures will be defined within a stepwise hierarchical approach to address impact triggers (strikes) as part of the species-specific management strategy for WTNT within the BAM Plan

6.2.3 Monitoring, reporting and adaptive management

Overview of BAM Plan

Monitoring, reporting and mitigation measures will be implemented for species of concern through a framework outlined in a BAM Plan. The following listed species will require dedicated management strategies as they are identified as species of concern at MWF:

- Blue-winged Parrot
- Fork-tailed Swift
- Gang-gang Cockatoo
- Grey-headed Flying-fox
- Listed Waterbirds
- Southern Bent-wing Bat (EPBC: *Critically Endangered*, FFG: *Critically Endangered*).
- White-throated Needletail (EPBC Act: *Vulnerable & Migratory*; FFG Act: Vulnerable).

The BAM Plan will stipulate species-specific adaptive management strategies in the event that a mortality involving a species of concern is detected. The species-specific management strategies will follow a hierarchical framework of impact triggers and responses, scaled proportionally to the frequency of mortalities and the conservation status of the species. These strategies will aim to enhance mitigation effectiveness in response to mortality events, with the goal of preventing significant impacts on the population or subpopulation level. Any further mitigation measures for WTNT and SBWB considered by the BAM Plan will be supplementary to those outlined immediately above, including the low wind speed curtailment regime.

The BAM Plan will establish an operational-phase monitoring program that will involve bird utilisation surveys and a carcass detection program. The bird utilisation surveys will monitor the utilisation of the site by birds, including WTNT, once the wind farm becomes operational using fixed-point bird surveys to record flight height, location and flight paths for each observation. The carcass monitoring program will involve regular searches beneath every turbine by scent detection dogs to detect mortalities, including SBWB and WTNT.

Although species with a low likelihood of occurrence or collision susceptibility are not explicitly addressed in these targeted strategies, all listed species will remain protected under the broader adaptive response framework of the BAM Plan. This overall framework will include general response triggers that can be tailored to meet the specific needs of any affected species. The species-specific strategies will be finalised as part of the BAM Plan endorsement process.

Endorsement and Implementation of BAM Plan

In order to avoid the potential for duplication of conditions of approval under both Commonwealth and State legislation, it is proposed that the BAM Plan is endorsed and reviewed by the Victorian Department of Energy, Environment, and Climate Change, in consultation with the Commonwealth Department of Climate Change, Energy, the Environment and Water.

Under such an arrangement the BAM Plan would be prepared in accordance with a range of standard conditions concerning the preparation and endorsement of BAM Plans in Victoria, including but not limited to the requirement for the BAM Plan to be endorsed prior to the commencement of the permitted use.

Finally, it is proposed that the BAM Plan include an annual or biennial review procedure to ensure that monitoring and mitigation measures are updated in line with intervening developments in scientific research, government policy and mitigation technologies.

6.3 Decommissioning measures

As WTNT, SBWB or GHFF do not roost within the study area the decommissioning process will not result in further removal of any WTNT, SBWB and GHFF roosting habitat. Accordingly, there are no potential impacts predicted from the decommissioning process.

Table 16: Summary of measures proposed for MWF to minimise impacts to SBWB, WTNT and GHFF

Principle	Area	Targeted species	Measure	Section ref.
Pre-construction and construction measures				
Avoid & minimise	Turbine specifications	SBWB	Minimum RSH 64 m AGL.	0
	No new powerlines	WTNT, SBWB and GHFF	Use of existing powerlines underground transmission lines to avoid more infrastructure above ground.	0
	Micro-siting: turbine habitat buffers	SBWB & GHFF	Microsite the proposed turbines to avoid SBWB/GHFF habitat within 260 m of turbines.	0
			Avoid high quality habitat.	
			Avoid areas with high SBWB and SBWB complex calls.	
			Minimise turbine buffer overlays with medium and low-quality SBWB habitat.	
Operational measures				
Mitigate	Increasing low-windspeed cut-in	SBWB	Increasing nighttime low windspeed cut-in to a minimum of 4.5 m/second during periods when SBWB are most actively moving across the landscape (informed curtailment).	0
	Acoustic deterrents	SBWB	Investigate the feasibility of trials.	0

Principle	Area	Targeted species	Measure	Section ref.
Monitoring, reporting & adaptive manageme nt	BAM Plan implementation	WTNT, SBWB and GHFF	Outlines monitoring protocols and responsibilities, trigger responses to a listed species being impacted by the wind farm, and reporting requirements, as well as a tool box of possible mitigation measures and investigations to refine those.	0
	Carcass searches	WTNT & SBWB	Monthly searches at 100% of turbines.	
			More intensive surveys during peak SBWB activity.	
	Bat detectors	SBWB	Acoustic monitoring to collect further data on temporal activity patterns of SBWB in the study area in response to continued impacts to inform the development of a refined turbine operating regime to minimise collision risk.	
Assess & Offset	Assessment of residual impacts	SBWB, GHFF & WTNT	Residual impacts are not considered likely for SBWB, GHFF & WTNT. If SBWB & WTNT mortality is recorded, enhanced monitoring and mitigation measures will be put in place (outlined in BAM Plan). GHFF occurs in low number and may be recorded colliding occasionally. No significant residual impacts are considered likely to occur.	7
	Offsetting	WTNT & SBWB	As residual impacts are not considered likely to be significant, offsets are not required at this stage. Should impacts occur beyond what is anticipated, species-specific adaptive management procedures outlined in the endorsed BAM Plan will be triggered and further avoidance and mitigation measures developed with the goal of preventing significant impacts to WTNT and SBWB.	N.A.
Decommissioning measures				
Mitigate	Decommission	WTNT, SBWB and GHFF	No foreseeable impacts during decommissioning.	6.3

7 Residual impacts

Residual impacts to WTNT and SBWB at the MWF are not considered to be significant given the avoidance and mitigation measures outlined above, and the likely efficacy of the measures committed to as part of an approved BAM Plan. Therefore, an offset strategy is not required. However, in the event that residual impacts are greater than predicted, the species-specific adaptive management procedures outlined in the endorsed BAM Plan will be triggered and avoidance and mitigation measures developed with the goal of preventing significant impacts to WTNT and SBWB.

8 Social and economic considerations

8.1 Economic Considerations

The proposed wind farm will not impact surrounding land uses or infrastructure. The proposal is located in an area dominated by agriculture, with major infrastructure in the vicinity including roads, agroforestry and light industry. The landscape of the surrounding area is not a key point destination for tourism or of cultural significance. There are no significant land use conflicts between the proposed facility and surrounding land uses, nor with other major infrastructure of roads, rail and airports. The site is well positioned to take advantage of existing transport and electricity infrastructure and will not have a detrimental impact on either during operation. Potential impacts through construction will be suitably managed via industry standard management measures.

The proposed facility is located in an area dominated by dairy farming and grazing, is not located in the vicinity of other sensitive agricultural land uses and will not have a significant impact on the current agricultural productivity of the site. Moreover, by adding a new and drought-proof income stream for the owners of the agricultural properties involved in the wind farm, the proposed use and development of the site will contribute towards the diversification and resilience of agriculture in the state of Victoria.

Further, the proposed wind farm will contribute to the strengthening and diversification of the regional and Victorian economy. Construction of the proposed wind farm will support the Victorian wind industry via the supply and installation of wind turbine generators and ancillary infrastructure, and the Victorian high voltage electrical industry via the supply and installation of high voltage electrical plant and the completion of high voltage line works. Construction of the wind farm will support local manufacturers, heavy industry and small business via the supply of concrete, road building materials, electrical cabling, equipment hire, accommodation, consumables and hospitality services.

Maintenance and operation of the wind farm will contribute to ongoing employment in the Victorian wind industry and high voltage electrical industry, much of which benefits rural townships where personnel are required.

Further, in line with the objectives of the *Community Engagement and Benefit Sharing in Renewable Energy Developments – A Guide for Renewable Energy Developers*, the proposed wind farm will be accompanied by a community benefit scheme. While the details of this scheme will ultimately be determined in consultation with the local community, it will include as a minimum the following measures which will contribute to the diversity and strength of the local economy:

- Annual cash payments to immediate neighbours;
- Subsidies for energy efficiency measures for nearby dwellings;
- An annual fund for support of general community projects; and
- An annual fund for support of local education.

8.2 Social Considerations

To date a number of consultation activities have been undertaken to inform the community of the proposal and give local residents an opportunity to meet face-to-face with a company representative, including:

- The distribution of detailed information packages to all residents located within 5 km of a proposed wind turbine location;

- The launch of a project website; and
- Face-to-face house visits for all dwellings located within 3 km of a wind turbine location, and anywhere else that a house visit is requested.

As part of the planning permit application process, a similar range of consultation activities will be undertaken to further inform the surrounding community of the proposal, including but not limited to the distribution of additional information pamphlets, updates to the project website, further house visits, and community information sessions.

Further, as part of the development process, a community benefit scheme will be developed which will provide direct payments to neighbouring landowners, subsidies for energy efficiency measures, and a fund for community projects and local education.

The impact of the proposal on community amenity will be low and acceptable, as detailed in planning permit application. With few non-participating dwellings located within 1.5 km of a proposed wind turbine location, the wind farm will comfortably comply with the relevant noise regulations and will result in no shadow flicker at surrounding dwellings. Further, landscape screening will be provided to owners of non-participating dwellings as part of the development process, further mitigating the amenity impact of the proposal.

9 Environmental record of RE Future Pty Ltd

The applicant is Mumblin Wind Farm Pty Ltd, a special purpose project company wholly owned by REF Developments Pty Ltd, the registered business name of which is RE Future. RE Future is an Australian owned and funded enterprise operated by a small group of seasoned wind industry professionals. With over 60 years of combined experience in the wind industry the REF team contains extensive experience in wind farm development. Since 2001 the REF team have worked independently or as partners and successfully developed over 840 MW of wind projects that are now built and operating.

REF Developments Pty Ltd is an Australian owned and funded company which is based out of Geelong Victoria. Neither REF Developments Pty Ltd nor any of its directors have ever been the subject of an investigation, complaint or fine in relation to environmental management practices.

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Appendix 1: Summary of literature on mitigation measures for bat impacts of wind farms.

Mitigation method	Citation	Title	Study type	Method investigated	Brief summary
Acoustic deterrent	Weaver et al. (2020) Global Ecology and Conservation, 24, e01099	Ultrasonic acoustic deterrents significantly reduce bat fatalities at wind turbines	Trial at operational wind farm	Ultrasound	Deterrents mounted on the nacelles significantly reduced bat fatalities at a wind farm in US (Texas) for *Lasiurus cinereus* and *Tadarida brasiliensis* by 78% and 54%, respectively. We observed no significant reduction in fatalities for other species in the genus *Lasiurius*.
Acoustic deterrent	Sievert et al. (2021) Report by University of Massachusetts. Report for US Department of Energy. Report No. DE-EE0007032.	A Biomimetic Ultrasonic Whistle for Use as a Bat Deterrent on Wind Turbines	Trial outside wind farms	Ultrasound	Passively activated (blown by the wind) ultrasonic deterrent that is intended to be implemented on turbine blades. The developed deterrent produce ultrasound in the 25-35 kHz, 35-45 kHz, and 45-55 kHz ranges. Researchers played recordings of these sounds to bats in a laboratory setting, and showed that flight paths of Mexican free-tailed bats *Tadarida brasiliensis* were affected, but tricolored bats *Perimyotis subflavus* were not.
Acoustic deterrent	Good, R. E., Iskali, G., Lombardi, J., McDonald, T., Dubridge, K., Azeka, M., & Tredennick, A. (2022) The Journal of Wildlife Management, 86(6), e22244.	Curtailment and acoustic deterrents reduce bat mortality at wind farms	Trial at operational wind farm	Smart curtailment	Tested with curtailment combined with acoustic deterrent. Curtailment alone reduced bat mortality by 42.5%. Curtailment plus deterrent reduced mortality by 66.9% (species dependent, ranging from 58.1% in some species to 94.4% in others.
Acoustic deterrent	Arnett, E. B., Hein, C. D., Schirmacher, M. R., Huso, M. M., & Szewczak, J. M. (2013). PloS One, 8(6), e65794.	Evaluating the Effectiveness of an Ultrasonic Acoustic Deterrent for Reducing Bat Fatalities at Wind Turbines	Trial at operational wind farm	Ultrasound emission	Used waterproof box (~45x45 cm, 0.9 kg) that housed 16 transducers that emitted continuous broadband ultrasound from 20–100 kHz (manufactured by Deaton Engineering, Georgetown, Texas). 21–51% fewer bats were killed per treatment turbine than per control turbine.
Acoustic deterrent	Cooper, D., Green, T., Miller, M., & Rickards, E. (2020). Frontier Wind LLC, Rocklin, CA (United States).	Bat Impact Minimization Technology: An Improved Bat Deterrent for the Full Swept Rotor Area of Any Wind Turbine (No. DE-EE0007034; CEC-500-2020-008)	Trial at operational wind farm	Ultrasound emission	The Strike Free system developed for this project extended the ultrasonic coverage to the entire area swept by the turbine blades, not just the centre of the turbine. Did this by attaching transmitters onto the blades of the turbines. Saw approx. 73.5% less fatalities at turbines with treatment in contrast to control turbines.
Acoustic deterrent	Gilmour, L. R., Holderied, M. W., Pickering, S. P., & Jones, G. (2021). Journal of Experimental Biology, 224(20), jeb242715.	Acoustic deterrents influence foraging activity, flight and echolocation behaviour of free-flying bats	Trial not on wind farm	Ultrasound emission, thermal video	Used stereo thermal videogrammetry and acoustic methods. Filmed bats using two synchronised thermal imaging cameras (Optris PI640 thermal imaging camera). Deaton ultrasonic speakers, emitted ultrasound at a frequency range of 20–100 kHz. Overall bat activity was reduced by 30%.

Mitigation method	Citation	Title	Study type	Method investigated	Brief summary
Acoustic deterrent	Kinzie, K., Hale, A., Bennett, V., Romano, B., Skalski, J., Coppinger, K., & Miller, M. F. (2018). General Electric Co., Schenectady, NY (United States).	Ultrasonic Bat Deterrent Technology (No. DOE-GE-07035)	Trial at operational wind farm	Ultrasound emission, thermal video	Tried different setup but found no statistically significant benefit compared to previously existing systems. Up to 60% bat activity reduction.
Acoustic deterrent	NRG Systems (2021)	Exploring How Attenuation Affects NRG Systems' Bat Deterrent System	Trial at operational wind farm	Ultrasound emission	Investigates attenuation of ultrasound, study showed a 6db loss of sound volume for every doubling of radius. Also showed ultrasound devices performed better with lower humidity and temperature.
Acoustic deterrent	Romano, W. B., Skalski, J. R., Townsend, R. L., Kinzie, K. W., Coppinger, K. D., & Miller, M. F. (2019). Wildlife Society Bulletin, 43(4), 608-618.	Evaluation of an Acoustic Deterrent to Reduce Bat Mortalities at an Illinois Wind Farm	Trial at operational wind farm	Ultrasound emission	29.2% - 32.5% reduction in bat mortality, air jet ultrasonic emitters mounted on turbine nacelles. The deterrent system jets (nozzles) produced a broad-band sound designed to overlap the entire range of frequencies (~30–100 kHz) generated by and audible to most bat species
Acoustic deterrent	Zeng, Z., & Sharma, A. (2023). arXiv preprint arXiv:2302.08037.	Novel ultrasonic bat deterrents based on aerodynamic whistles	Lab	Ultrasound emission	Explores single to six whistle acoustic design outputting 20 Hz - 50 kHz frequency range.
Radar and acoustic deterrent	Gilmour et al. (2020) Plos One, 15(2), e0228668.	Comparing acoustic and radar deterrence methods as mitigation measures to reduce human-bat impacts and conservation conflicts	Trial outside wind farms	Radar and ultrasound	Ultrasonic speakers were effective as bat deterrents at foraging sites, but radar was not. In riparian sites (border of England and Wales), ultrasonic deterrents decreased overall bat activity (filmed on infrared cameras) by ~80% when deployed alone and in combination with radar. Species responded differently to the ultrasound treatments.
Visual and acoustic deterrent	Werber et al. (2023) Remote Sensing in Ecology and Conservation, 9(3), 404-419.	Drone-mounted audio-visual deterrence of bats: implications for reducing aerial wildlife mortality by wind turbines	Trial outside wind farms	Drone	A drone with auditory and visual signals decreases bat activity. Activity decreases significantly (~40%) below and significantly above (~50%) the drone flight altitude at Northern Israel. LIDAR was used to assess the drone impact below its flight altitude and RADAR to assess impact above its flight altitude.
Visual and acoustic deterrent	Kuhlmann, K., Fontaine, A., Brisson-Curadeau, É., Bird, D. M., & Elliott, K. H. (2022). Methods in Ecology and Evolution, 13(4), 842-851.	Miniaturization eliminates detectable impacts of drones on bat activity	Trial at operational wind farm	Drone	Found that smaller UAV models had negligible impact on bat activity, suggest that when employing drones as a deterrent, the size of the drone should be taken into consideration.
Visual deterrent	Cryan et al. (2022) Animals, 12(1), 9.	Influencing activity of bats by dimly lighting wind turbine surfaces with ultraviolet light	Trial at operational wind farm	Ultraviolet light	No significant change in nighttime bat, insect, or bird activity at wind turbines when lit with UV light compared with that of unlit nights (US, Colorado).

Mitigation method	Citation	Title	Study type	Method investigated	Brief summary
Visual deterrent	Gorresen, P. M., Cryan, P. M., Dalton, D. C., Wolf, S., Johnson, J. A., Todd, C. M., & Bonaccorso, F. J. (2015). Endangered Species Research, 28(3), 249-257.	Dim ultraviolet light as a means of deterring activity by the Hawaiian hoary bat *Lasiurus cinereus semotus*	Trial not on wind farm	Ultraviolet light	44% reduction in bat detections in treatments with dim, flickering UV light compared to control, despite increased insect biomass with UV treatment. Duty cycle of flickering was 0.1-5sec, peak wavelength 365nm, spectral spread 10nm, power density of 1 microwatt cm^-2 over circular area of 20m. Hawaii.
Curtailment	Bennett et al. (2022) Austral Ecology, 47(6), 1329-1339.	Curtailment as a successful method for reducing bat mortality at a southern Australian wind farm	Trial at operational wind farm	Low wind-speed curtailment	Increasing turbine cut-in speed from 3.0 to 4.5 ms-1 from dawn to dusk at a southern Australian wind farm significantly reduced bat fatalities by 54%.
Curtailment	Anderson et al. (2022) Facets, 7, 1281-1297.	Effects of turbine height and cut-in speed on bat and swallow fatalities at wind energy facilities	Correlational at operational wind farms	Low wind-speed curtailment	Raising cut-in speeds result in fewer bat fatalities in Canada (Ontario). Turbines under nocturnal mitigation killed 33% fewer bats than turbines without cut-in adjustments in late summer.
Curtailment	Adams et al. (2021) PloS ONE, 16(11), e0256382.	A review of the effectiveness of operational curtailment for reducing bat fatalities at terrestrial wind farms in North America	Trials at operational wind farms	Low wind-speed curtailment	Meta-analysis of experimental studies (n = 36 control-treatment studies from 17 wind farms in US) 63% decrease in fatalities. A non-linear model shows that fatality rates decreased when the difference in curtailment cut-in speeds was 2m/s or larger.
Curtailment	Martin et al. (2017) Journal of Mammalogy, 98(2), 378-385.	Reducing bat fatalities at wind facilities while improving the economic efficiency of operational mitigation	Trial at operational wind farm	Low wind-speed and high T curtailment	Raising cut-in speed of turbines (from 4 to 6 m/s) reduced bat fatalities by 62% (CI 34–78%) at a US wind farm (Vermont). Cut-in speed at 6.0 m/s was always done at T > 9.5°C, unlike cut-in at 4 m/s (wind speed only).
Curtailment	Baerwald et al. (2009) Journal of Wildlife Management, 73(7), 1077-1081.	A Large-Scale Mitigation Experiment to Reduce Bat Fatalities at Wind Energy Facilities	Trial at operational wind farm	Low wind-speed curtailment and turbine modifications	Increasing turbine cut-in speed from 4.0 to 5.5 m/s resulted in a significant 60% reduction in bat fatalities. Comparing turbines with cut-in speed at 4.0 m/s against turbines with modified angles to reduce rotor speed (blades near motionless in low-wind speeds), resulted in a significant reduction in bat fatalities by 57.5%. Study conducted at a wind farm in Canada (Alberta).

Mitigation method	Citation	Title	Study type	Method investigated	Brief summary
Curtailment	Rnjak et al. (2023) Mammalia, 87(3), 259-270.	Reducing bat mortality at wind farms using site-specific mitigation measures: a case study in the Mediterranean region, Croatia	Trial at operational wind farm	Low wind-speed curtailment	Wind turbine curtailment was implemented in the high collision risk period at a wind farm in Croatia. Estimated total number of bat fatalities decreased by 78% when implementing curtailment from sunset to sunrise at variable turbine cut-in speeds (5.0 - 6.5 m/s).
Curtailment	Whitby, M. D., Schirmacher, M. R., & Frick, W. F. (2021). Bat Conservation International, Austin, Texas.	The State of the Science on Operational Minimization to Reduce Bat Fatality at Wind Energy Facilities. A report submitted to the National Renewable Energy Laboratory.	Trial across multiple wind farms.	Low wind-speed curtailment	33-79% fatality reduction estimate based on 5m/s increase in cut in speed (extrapolated). 0.06-3.2% annual energy production loss.
Curtailment	Rabie, P. A., Welch-Acosta, B., Nasman, K., Schumacher, S., Schueller, S., & Gruver, J. (2022). PloS ONE, 17(4), e0266500.	Efficacy and cost of acoustic-informed and wind speed-only turbine curtailment to reduce bat fatalities at a wind energy facility in Wisconsin	Trial at operational wind farm	Low wind-speed curtailment	Used Turbine Integrated Mortality Reduction (TMIR) system reduced bat fatalities by 75-84%, compared to wind-speed only curtailment (WOC) (47%). Using software and acoustic detection of bats in real time.
Curtailment	Arnett, E. B., Schirmacher, M., Huso, M. M., & Hayes, J. P. (2009). Bat Conservation International. Austin, Texas, USA.	Effectiveness of Changing Wind Turbine Cut-in Speed to Reduce Bat Fatalities at Wind Facilities. An annual report submitted to the Bats and Wind Energy Cooperative	Trial at operational wind farm	Low wind-speed curtailment	Tested curtailment at low wind speeds. Found now difference between cut-in speeds of 5m/s vs 6.5m/s. Fully operation turbines had ~5.2 times as many fatalities as curtailed ones. Pennsylvania, USA.
Curtailment	Arnett, E. B., Huso, M. M., Schirmacher, M. R., & Hayes, J. P. (2011). Frontiers in Ecology and the Environment, 9(4), 209-214.	Altering turbine speed reduces bat mortality at wind-energy facilities	Trial at operational wind farm	Low wind-speed curtailment	Bat mortality 5.4 and 3.6 times that of 2008 & 2009 compared to turbines employing low wind speed curtailment in this study, with less than a 1% loss of power generation annually. Pennsylvania, USA.
Curtailment	Maclaurin, G., Hein, C., Williams, T., Roberts, O., Lantz, E., Buster, G., & Lopez, A. (2022). Wind Energy, 25(9), 1514-1529.	National-scale impacts on wind energy production under curtailment scenarios to reduce bat fatalities	Trial at operational wind farm	Low wind-speed curtailment	Focusses more on implications for annual energy production rather than mitigating bat fatalities. Compares smart curtailment against blanket curtailment, under low, medium and high levels of curtailment. USA.

Mitigation method	Citation	Title	Study type	Method investigated	Brief summary
Curtailment	Mǎntoiu, D. Ș., Kravchenko, K., Lehnert, L. S., Vlaschenko, A., Moldovan, O. T., Mirea, I. C., & Voigt, C. C. (2020). European Journal of Wildlife Research, 66(3), 1-13.	Wildlife and infrastructure: impact of wind turbines on bats in the Black Sea coast region	Trial at operational wind farm	Low wind-speed curtailment	Found that WT in Romania in migration corridor killed approx. 30 bats/WT/year, curtailment reduced fatality rates by 78%. Used hydrogen stable isotope rations to est. Origin of some bats, came from as far away as Ukraine, Belarus & Russia. Test involved raising cut-in speeds from 4m/s to 6.5m/s, applied during high-risk migration periods.
Curtailment	Smallwood, K. S., & Bell, D. A. (2020). The Journal of Wildlife Management, 84(4), 685-696.	Effects of Wind Turbine Curtailment on Bird and Bat Fatalities	Trial at operational wind farm	Shut down curtailment	Found that curtailment helped reduce bat fatalities significantly but had substantially less effect on reducing bird fatalities. Found that bats were twice as likely to pass through the rotors of operating turbines compared to inoperable ones, suggesting again that some species may be attracted to operating rotors. Findings also suggest that designing turbines without accessible interior spaces could reduce fatalities of cavity-nesting and cavity-roosting birds.
Curtailment	Squires, K. A., Thurber, B. G., Zimmerling, J. R., & Francis, C. M. (2021). Animals, 11(12), 3503.	Timing and Weather Offer Alternative Mitigation Strategies for Lowering Bat Mortality at Wind Energy Facilities in Ontario	Data from operational wind farms	Multiple weather variables for curtailment	Rain and low temperatures saw reduced bat activity and fatalities. Wind conditions, moon illumination, and rain to primarily influence migration flights, while temperature, humidity, air pressure, and rain to influence foraging. Mortality and activity were lower when it rained, highest with above-average temperatures, and declined with wind speed.
Curtailment	Hayes, M. A., Hooton, L. A., Gilland, K. L., Grandgent, C., Smith, R. L., Lindsay, S. R., & Goodrich-Mahoney, J. (2019). Ecological Applications, 29(4), e01881.	A smart curtailment approach for reducing bat fatalities and curtailment time at wind energy facilities	Trial at operational wind farm	Smart curtailment	A new system of tools for analysing bat activity and wind speed data to make near real-time curtailment decisions when bats are detected treatment turbines (N=10) vs. control turbines (N=10) at a US wind farm (Wisconsin). Overall reductions in bat fatalities (~74% to 91% per species). ~3.2% loss in power output, 48% reduction in downtime compared to other USA windfarms using standard curtailment.
Curtailment (Smart)	Matzner, S., Warfel, T., & Hull, R. (2020). Ecological Informatics, 57, 101069.	ThermalTracker-3D: A thermal stereo vision system for quantifying bird and bat activity at offshore wind energy sites	Trial with drone	Smart curtailment	Thermal tracking to predict flight paths of flying animals. Software was able to estimate drone within +-20m of actual position against GPS for 90% of data points.
Curtailment (Smart)	Barré, K., Froidevaux, J. S., Sotillo, A., Roemer, C., & Kerbiriou, C. (2023). Science of the Total Environment, 866, 161404.	Drivers of bat activity at wind turbines advocate for mitigating bat exposure using multicriteria algorithm-based curtailment	Trial at operational wind farm	Smart curtailment	Investigated algorithm controlled curtailment compared to traditional blanket curtailment. Reduces fatal collisions by 7-31% compared to blanket curtailment.

Mitigation method	Citation	Title	Study type	Method investigated	Brief summary
Curtailment (Smart)	Hayes, M. A., Lindsay, S. R., Solick, D. I., & Newman, C. M. (2023). Wildlife Society Bulletin, 47(1), e1399.	Simulating the influences of bat curtailment on power production at wind energy facilities	Trial at operational wind farm	Low wind-speed curtailment and smart curtailment	Focusses more on implications for annual energy production, comparing blanket curtailment to smart curtailment, rather than any impacts on mortality. Energy losses ranged between 0.2 and 1.7% for blanket curtailment, vs 0.0 to 0.9% for smart curtailment. Canada.
Thermal video detection	Georgiev, M., & Zehtindjiev, P. (2022) Wind Europe.	Real-Time Bird Detection and Collision Risk Control in Wind Farms	Trial at operational wind farm	Thermal imaging	Used thermal imaging to detect birds. Testing detection rates of birds, 83.1 to 91.8% correct detection rates. Detection ranges: 60cm wingspan at 350m, 100cm at 600m, 150cm at 1050m.Detection rates of bats looks <10%.