MT FYANS
WIND FARM

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EPBC Act Assessment documentation

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Acronyms

AEMO	Australian Energy Market Operator
AGL	Above the ground level
ARI	Arthur Rylah Institute of Environmental Research
BSW	Barwon South West (team of DELWP)
CEMP	Construction Environmental Management Plan
DAWE	Department of Agriculture, Water and the Environment (Cth)
DELWP	Department of Environment, Land, Water and Planning (Vic.)
EES	Environment Effects Statement
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EVC	Ecological Vegetation Classes
FFG	*Flora and Fauna Guarantee Act 1988* (VIC)
GEWVVP	Grassy Eucalypt Woodland of the Victorian Volcanic Plan
IAT	Impact Assessment Team (of DELWP)
MFWF	Mount Fyans Wind Farm
MNES	Matters of National Environmental Significance
NEM	National Electricity Market
NTGVVP	Natural Temperate Grassland of the Victorian Volcanic Plain
PMST	Protected Matters Search Tool (of EPBC Act)
SCADA	Supervisory Control and Data Acquisition
SBWB	Southern Bent-wing Bat
SBWB-AMP	Southern Bent-wing Bat Adaptive Management Plan
SLL	Striped legless lizard
SHWFTLP	Seasonal Herbaceous Wetland (Freshwater) of the Temperate Lowland Plains
UAD	Ultrasonic Acoustic Deterrent
WNR	Woolnorth Renewables

1. Executive Summary

Mt Fyans Wind Farm (MFWF) is proposed by Mount Fyans Wind Farm Pty Ltd to be constructed north of Mortlake, Victoria.

In August 2017, The Minister for Planning (Victoria) determined that an Environment Effects Statement (EES) was not required for the project, subject to an assessment of the utilisation of the site by the Southern Bent-wing Bat *Miniopterus orianae bassanii* (SBWB) and the presence of the Basalt Greenhood orchid *Pterostylis basaltica*. This proponent's assessment documentation forms the response to the ministers No-EES decision requirement.

The project studies have occurred since 2010 and a planning application was submitted in late 2018 however stalled pending clarification of certain environmental matters.

The Commonwealth determined the project to be a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Ref 2019/8589 with impacts to Matters of National Environmental Significance (MNES) to be assessed using an accredited state assessment process under the Bilateral (assessment) Agreement between the Commonwealth and the State of Victoria to enable a coordinated assessment of this project.

The EPBC Act referral scope is provided at Appendix 1 and focuses on the MNES listed below:

- Southern Bent-wing Bat (*Miniopterus orianae bassanii*) – Critically Endangered
- Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) – Critically Endangered
- Seasonal Herbaceous Wetland (Freshwater) of the Temperate Lowland Plains – Critically Endangered
- Other Listed Species and Ecological Communities
  - Grassy Eucalypt Woodland of the Victorian Volcanic Plain;
  - Curlew Sandpiper (*Calidris ferruginea*);
  - Striped Legless Lizard (*Delma impar*);
  - Dwarf Galaxias (*Galaxiella pusilla*);
  - Yarra Pygmy Perch (*Nannoperca obscura*);
  - Growling Grass Frog (*Litoria raniformis*);
  - Spiny Rice-flower (*Pimelea spinescens* subsp. *spinescens*);
  - Basalt Greenhood (Pterostylis basaltica);
  - Adamson's Blown-grass (*Lachnagrostis adamsonii*);
  - Fragrant Leek-orchid (*Prasophyllum suaveolens*);
  - Small Golden Moths Orchid (*Diuris basaltica*);
  - Hoary Sunray (*Leucochrysum albicans* subsp. *tricolor*);
  - Spiny Pepper-cress (*Lepidium aschersonii*);
  - Swamp Fireweed (Senecio psilocarpus);
  - Swamp Everlasting (*Xerochrysum palustre*); and
  - Clover Glycine (*Glycine latrobeana*); and

- Salt-lake Tussock-grass (*Poa sallacustris*).

As a result of further reviews and additional data being available, the proponent has elected to include Grey-headed Flying-fox *Pteropus poliocephalus* and White-throated Needletail *Hirundapus caudacutus* in this Assessment Documentation.

This document is the proponent's Assessment Documentation and provides data for the conduct of the assessment. Electronic copies of data will be supplied on request.

Southern Bent-wing Bat summary

Activities to investigate and scope potential impact to SBWB have been extensive and included frequent consultation with the Victorian State Department of Environment, Land, Water and Planning (DELWP) Impact Assessment Team (IAT), DELWP Barwon South West, and DELWP advising partners the Arthur Rylah Institute for Environmental Research (ARI), with meetings and correspondence occurring from 2012 to September 2019. To date the investigations have included:

- Ground surveys in 2013, 2014, 2016, 2017, 2018, 2019.
- Acoustic detection of SBWB calls using ground mounted acoustic detectors in 2016 (late summer), 2017 (autumn), 2018 (late autumn/winter), 2019 (spring/early summer) for more than 770 detection-nights of data.
- Acoustic detection of SBWB calls using acoustic detectors mounted at height in 2017.

Numerous requests for further information, additional investigations and extended surveys have been made by the three agencies and all requests have been accommodated. Most, but not all, data within this report has been previously submitted to the three agencies.

The SBWB is listed as Critically Endangered at the national and state level in Victoria, where it is also listed as threatened under the *Flora and Fauna Guarantee Act 1988* (FFG Act). It is listed as Endangered in South Australia. The SBWB population has been in decline since at least the mid-1990s due to habitat removal by clearance of native bush, loss of wetlands (human causes of draining or drought), use of pesticides, and loss or disturbance of maternity roosts. The main locations of population and maternity activities are clearly identified and well understood. Migratory, foraging and general behavioural patterns are not well understood and there is a high degree of uncertainty about the species.

The Scope for Proponent's Assessment Documentation under EPBC Act Bilateral (Assessment) Agreement 2014 considered that five matters about the SBWB need to be addressed:

The potential for a significant roost site for SBWB to occur within or in the vicinity of the project area.

Extensive exploration and surveys have been undertaken throughout the study area, within and in the vicinity of the project site by extensive and repeated ground surveys and active and passive measures such as thermal camera imaging, acoustic detection and use of harp traps. There is no evidence of current significant roost sites. Due to the highly disturbed nature of the majority of the project site and areas in the vicinity of the project site, lack of foraging habitat and as confirmed by extensive surveys to date, there is very low to Unlikely potential for a significant roost site to occur within or in the vicinity of the project site.

Describe other known roost sites for SBWB in the region and how they interact with foraging activity of the SBWB at the project area.

SBWB are more likely to forage at locations near known roosting sites and at locations that provide habitat for their food sources, such as permanent wetlands, swamps, other bodies of water and remnant woodlands. Ephemeral water bodies and wetlands may present additional opportunities for foraging.

The MFWF site and immediate surrounds have been highly disturbed for the purposes of farming activities. There are no significant landscape scale features that are likely to provide a focal point for large numbers of foraging SBWB. Regularly occurring landscape features such as farm dams, low-lying areas and paddock trees are present at the project site. Permanent-water locations suitable for foraging may be found to the south and north of the MFWF project site.

The comparatively low recorded SBWB call activity at the project site is likely to be significantly influenced by the lack of known roost sites in close proximity as well as the relative lack of key foraging habitats.

Characterise SBWB activity within and near the project area including seasonal use of the site and use of different habitat types.

The data does provide a sound basis to infer that foraging habitats are used sporadically on an intensive basis. This is because most activity recorded at foraging sites occurs during very short blocks of time.

The timing of the calls detected supports the documented foraging strategy, i.e. 'individuals constantly in flight sometimes meandering between areas after 5–15 minutes of foraging or flying to a particular foraging area and remaining there for one or more hours'. (National Recovery Plan for the SBWB (DELWP 2020)).

Time of calls after sunset would indicate that bats are arriving at the MFWF project site from regional areas rather than emerging from roosting caves onsite at sunset or shortly thereafter. Although no such habitats were identified from extensive surveys and consultation with a speleologists and geomorphologist experienced in recognising suitable SBWB habitat features, it remains possible that an opportunistic roost(s) occurs nearby from which individuals may emerge and utilise the local area.

The data indicates overall low levels of activity across the entire night-time hours. There does not appear to be any visual trends or indications of trends from the 2017 to 2019 survey years or seasonality.

The wind farm design avoids foraging habitats by buffering and SBWB are four and a half times more likely to be present / have some level of activity in these foraging habitats than in open farmland representative of areas where turbines are proposed.

Characterise SBWB activity within the rotor-swept area and assess the likely SBWB impacts through turbine collision and or barotrauma.

SBWB are detected flying in low wind speed conditions more often than flying in high wind speed conditions. It is likely that SBWB avoid flying in even mild to high wind speed conditions, which become more prevalent with increase in height above ground level. Because wind turbines are located to maximise wind speed conditions within the rotor-swept area, it is likely that SBWB avoid flying in wind conditions typical of the rotor-swept area. Also, the design of the wind farm locates turbines away from foraging habitat to areas of higher wind speed.

Accurate and reliable measurement of SBWB activity at rotor-swept height is not supported by the technology and methods currently available.

Data from other surveys suggests a ratio for Eastern Bent-wing Bats at foraging height cf Eastern Bent-wing Bats at rotor swept height of 9.3:1. For the MFWF, a staged process of ground-based surveys has revealed a low level of activity that does not warrant further assessment of bat utilisation at height.

Overall collision risk is considered to be Unlikely and unlikely to be at levels of significance to the species.

Potential cumulative effects on SBWB from the project in combination with other wind farms

The data does not exist on which to base an assessment of the potential cumulative effects on SBWB from the project in combination with other wind farms. From the data represented in this report, we assess that the Mt Fyans project represents a low to Unlikely likelihood of significant impacts to the population.

Conclusion: SBWB

There are no significant roosting or maternity cave sites on the Project site. The nearest known occupied roosts are non-breeding roosts at Panmure and Grassmere and from the call activity data collected during our work it is possible that a roost may exist within the vicinity of the project site, however the call activity data indicates that this is unlikely to be a roost containing significant numbers of SBWB.

SBWB are present at MFWF site and are found more often (4.5x) around identified specific habitat and wetland sites. It is an intentional avoidance strategy in the design of the project that turbines are located remotely from specific habitats, including wetland areas.

Overall call activity of SBWB is low, compared with other wind farms located in the vicinity/region. The number, timing, location and distribution of bat calls detected are commensurate with bats intensively foraging for short periods of time when wind speed conditions permit. Foraging is mainly conducted at locations that support specific habitat or have wetlands, which are at distances from areas where turbines will be located.

There is a low to Unlikely risk of turbine collisions at MFWF causing a significant impact to the species, due to:

- The overall low numbers of calls detected within the project area.
- The location of turbines being remote from foraging locations and areas of increased call activity (noting that foraging habitats have been deliberately buffered).
- The preference of bats to fly in lower wind speed conditions (noting that the wind farm will not be operating due to low wind at wind speeds of <3.5 metres per second).
- The percentage of time that bats are estimated to be able to fly in low wind speed conditions at rotor-swept height when the blades are rotating.

There is a low to Unlikely likelihood that MFWF, in conjunction with other wind farms, introduces a significant threat or additional impact likely to alter a cumulative impact assessment (if one could be completed) for the SBWB. Land clearing/habitat removal, climate change and drainage of permanent bodies of water, loss and disturbance of roosting and maternity sites have been identified as major risks to the species and are likely to be of far greater significance.

National SBWB Recovery Team have recently carried out Population Viability Analyses for the SBWB population (TSSC 2021). A PVA model will be used to determine the impact threshold level that the MFWF wind farm must be operated within to avoid net significant or lasting impacts on the viability or conservation status of the Victorian SBWB population. . The impact of wind energy on population viability was not considered in the National SBWB Recovery Team run model (TSSC 2021) as there are limited wind energy mortality data inputs available. In time, PVA may inform methods to assess cumulative impacts on the species, from environmental, anthropogenic (including wind energy facilities) and climatic factors.

A range of mitigation measures could potentially be trialled to determine their effectiveness in reducing collision risk for SBWB (and other micro bat species) at MFWF. These range from modifying turbine cut-in according to

wind speed, the implementation of Ultrasonic Acoustic Deterrent (UAD) technology or combining detection technologies with targeted turbine shutdowns. Technologies and techniques that are under development may provide solutions in the medium term.

The SBWB Adaptive Management Plan for MFWF has been prepared in consultation with the National SBWB Recovery team and this consultation is ongoing.

This plan:

- Provides explanatory information and the rationale underpinning design and management of MFWF that are intended to avoid and minimise effects on SBWB.
- Sets out a framework of adaptive measures from project siting and design through to the operational functioning of the planned wind farm, to which Mount Fyans Wind Farm Pty Ltd is committed to ensure the proposed wind farm has minimal effect on SBWB.
- Proposes a SBWB Offset Research Fund to support high quality ecological or other relevant scientific research on SBWB, or management activities, the results of which will assist with the management and protection of the species. Support will be given to research that is scientifically rigorous, conducted by suitably qualified, knowledgeable and experienced scientists, and which is consistent with the objectives of the National Recovery Plan for the SBWB (DELWP 2020), or any subsequent SBWB Recovery Plan.

Summary of Natural Temperate Grassland of the Victorian Volcanic Plain/Seasonal Herbaceous Wetland (Freshwater) of the Temperate Lowland Plains

Mt Fyans Wind Farm site has been extensively surveyed for flora and fauna and documented in both the existing conditions and targeted species reporting (Biosis 2022a&b). Areas containing sensitive flora and fauna species are accurately mapped and included in Work Exclusion Areas for avoidance of any wind farm infrastructure or construction activity and to allow environmental management controls to be effectively initiated and maintained. The design of the wind farm has deliberately included an avoidance strategy that has located wind turbines and other infrastructure remote from sensitive flora and fauna. Consequently, the likelihood of significant impact is Unlikely.

South Road was identified in early 2021 as a construction access route. The existing roadway requires updating which will have the potential to impact a maximum of 3.7 ha of confirmed habitat for Striped Legless Lizard and 0.41 ha of Natural Temperate Grassland of the Victorian Volcanic Plain within the South Road road-reserve only.

A range of measures will be implemented to ensure that these sensitive species and communities are not impacted by general construction/operational works – including but not limited to weed and disease controls, controlling of dust, controlling of turbid water run-off, not significantly altering surface water flows, wildfire prevention – or any work on adjacent lands likely to cause an impact.

Summary of Other Listed Species and Ecological Communities

All other EPBC Act listed species and ecological communities have also been assessed in the existing conditions and targeted species reporting (Biosis 2022a&b). A range of surveys were conducted to target suitable habitats for these species. Consequently, the design of the wind farm has deliberately included an avoidance strategy that has located wind turbines and other infrastructure remote from sensitive flora and fauna. This includes avoidance of impacts to all assessed MNES except for Grey-headed Flying-fox and White-throated Needletail. .

Grey-headed Flying-fox was added to the list of assessed MNES species as it has recently (since 2018) begun to utilise the local area. Work is currently underway as part of the national monitoring of the population that has allowed us to review satellite tracking data from one individual that was moving from a temporary roost site near

Hexham and heading north to forage. Biosis has made observations at the nearby Salt Creek wind farm of this species moving north at dusk and south again before dawn. The temporary roost site has also been located near Hexham.

White-throated Needletail was also added to the list of assessed MNES species as it is known to utilise much of south-eastern Australia and as a mostly aerial species is potentially at risk of turbine collision.

The likelihood of significant impact to all other EPBC Act listed species and ecological communities is Unlikely.

2. Introduction

2.1 The Proponent

Mount Fyans Wind Farm Pty Ltd is a wholly owned subsidiary of Woolnorth Wind Farms Holding Pty Ltd (Woolnorth Renewables) and is the applicant and proponent for the Mt Fyans Wind Farm project.

Due to the nature of the relationship between Mount Fyans Wind Farm Pty Ltd and Woolnorth Wind Farms Holding Pty Ltd, the subsidiary company adopts the same corporate structure, governing and operational documents. They may, for the purpose of this document, be viewed as interchangeable.

Woolnorth was established in 2012 and is one of Australia's largest wind energy producers. Currently, they operate three wind farms across northern Tasmania: Musselroe (MRWF), Bluff Point (BPWF) and Studland Bay Wind Farms (SBWF). These wind farms have a combined capacity of 308 MW and generate approximately 9% of Tasmania's energy needs.

Each of Woolnorth's wind farms have active and enforceable EPBC Act approvals (BPWF and SBWF 2000/12 and MRWF 2002/683). Reporting on compliance against these approvals has been consistently undertaken by Woolnorth since it took ownership over these projects in 2012 (BPWF and SBWF) and 2013 (MRWF). These projects also have state permits issued under Tasmanian Environmental Management and Pollution Control Act 1994 (EMPCA) and again there is a well-documented history of compliance with these permit conditions. Woolnorth has ISO14001 certification, and this has been maintained since 2013. The scope of Woolnorth's EMS and certification includes the three assets currently owned.

Woolnorth Renewables and Mt Fyans Wind Farm Pty Ltd are both joint ventures between Hydro Tasmania, a Tasmanian government business enterprise, and Guohua Energy Investment Corporation, a subsidiary of Shenhua Clean Energy Holding, one of China's largest energy producers with a growing renewable energy division.

Further information about Woolnorth is available on their website: http://www.woolnorthwind.com.au/.

2.2 Mt Fyans Wind Farm Project background

Mount Fyans Wind Farm Pty Ltd (the Proponent) is proposing to develop the Mt Fyans Wind Farm (the Project) approximately 140 kilometres west of Geelong and 4 kilometres north of the town of Mortlake in southwest Victoria. The Project will comprise of a maximum of 81 wind turbines, with a maximum blade tip height of up to 200 metres, and a combined capacity of approximately 400 megawatts (MW). The Project also includes infrastructure associated with exporting electricity to the National Electricity Market (NEM) via the nearby Mortlake Terminal Substation. Electrical infrastructure will include onsite and offsite substations and overhead and underground cabling.

The Project was first proposed in 2008 and a planning permit for up to 81 turbines with a maximum tip height of 200 metres was submitted in late 2018.

In August 2017 the Minister for Planning (Victoria) determined that an Environment Effects Statement (EES) was not required for the project, subject to an assessment of the utilisation of the site by the SBWB and the presence

of the Basalt Greenhood orchid. This proponent's assessment documentation forms the response to the ministers No-EES decision requirement.

To ensure that all potential impacts of the proposed MFWF project were assessed, 18 specialist studies were undertaken covering a wide range of disciplines, as outlined in Table 2.1 below. These studies inform the planning application by identifying the potential impacts and, where appropriate, recommend mitigation measures.

Table 2.1 Specialist reports

Specialist reports	Author
Aviation safety	Aviation Projects
Background noise	Marshall Day Acoustics
Brolga	Biosis Pty Ltd
Community consultation	Hydro Tasmania
Electromagnetic interference	DNV GL
Environmental noise	Marshall Day Acoustics
Fire and bushfire	GHD
Flora and fauna existing conditions	Biosis Pty Ltd
Geomorphology	Environmental GeoSurveys Pty Ltd
Hydrogeological	Entura
Landscape and visual impact	Urbis
Pre-construction predictive noise audit	EnviroRisk
Preliminary cultural heritage	Biosis Pty Ltd
Shadow flicker and blade glint	Entura
Southern Bent-wing Bat	Gavin Thomas Environmental Consultant Biosis Pty Ltd (provided scientific inputs to EPBC Act Assessment Documentation)
Surface water	Entura
Targeted ecological surveys and impact	Biosis Pty Ltd
Traffic impact	GHD

2.2.1 Project Context

The Project is located near the township of Mortlake, approximately 200 kilometres west of Melbourne in the Moyne Shire Local Government Area (Figure 2-1). It covers approximately 12,549 hectares and is bordered to the south by the Hamilton Highway, to the north by Woorndoo–Dundonnell Road, to the east by Six Mile Lane and Darlington–Nerrin Road and to the west by the Hamilton Highway and Salt Creek (Figure 2-1).

The majority of the Project is within the Farming Zone (Moyne Shire), with some areas of roadside within Road Zone. No overlays relevant to flora and fauna are located within the study area.

The Project is contained within the Victorian Volcanic Plain Bioregion, and the surface geology is the result of quaternary basalt flows, with small areas of more recent alluvial sediments (derived from basalt) around lakes and waterways. The most recent basalt flows, which are confined to the northern section of the study area, have formed complex stony rises, interspersed with low-lying areas and wetlands. Older basalt flows in the southern section of the study area have weathered to an undulating or flat landscape.

The land within the project site boundary is highly disturbed and intensively farmed, privately owned freehold. Small pockets of specific ecological or cultural heritage values have been identified (see 'Works Exclusion Areas' below). The agricultural production areas are used primarily for beef and sheep grazing with cropping. Due to the highly disturbed and modified nature of the agricultural production areas, they provide limited habitat for any native species present in the landscape.

Most of the Project has been cleared of native vegetation and is currently managed for grazing and cropping. However, areas of remnant native vegetation persist within the stony rises, and in low-lying areas associated with depressions and drainage lines. Several roadsides within the wider area are known to support high-value native grasslands. Ten individual remnant native trees are present within the main wind farm area.

The Project area includes upper reaches of Blind Creek, several unnamed tributaries of Stony Creek and Mount Emu Creek and farm dams. It lies within the Hopkins River Basin and the management area of the Glenelg Hopkins Catchment Management Authority.

The Project also includes the proposed transmission line corridor, which extends from the southwest edge of the wind farm, through an area supporting open River Red Gum woodland and a commercial Blue Gum plantation before terminating at the Mortlake Power Station.

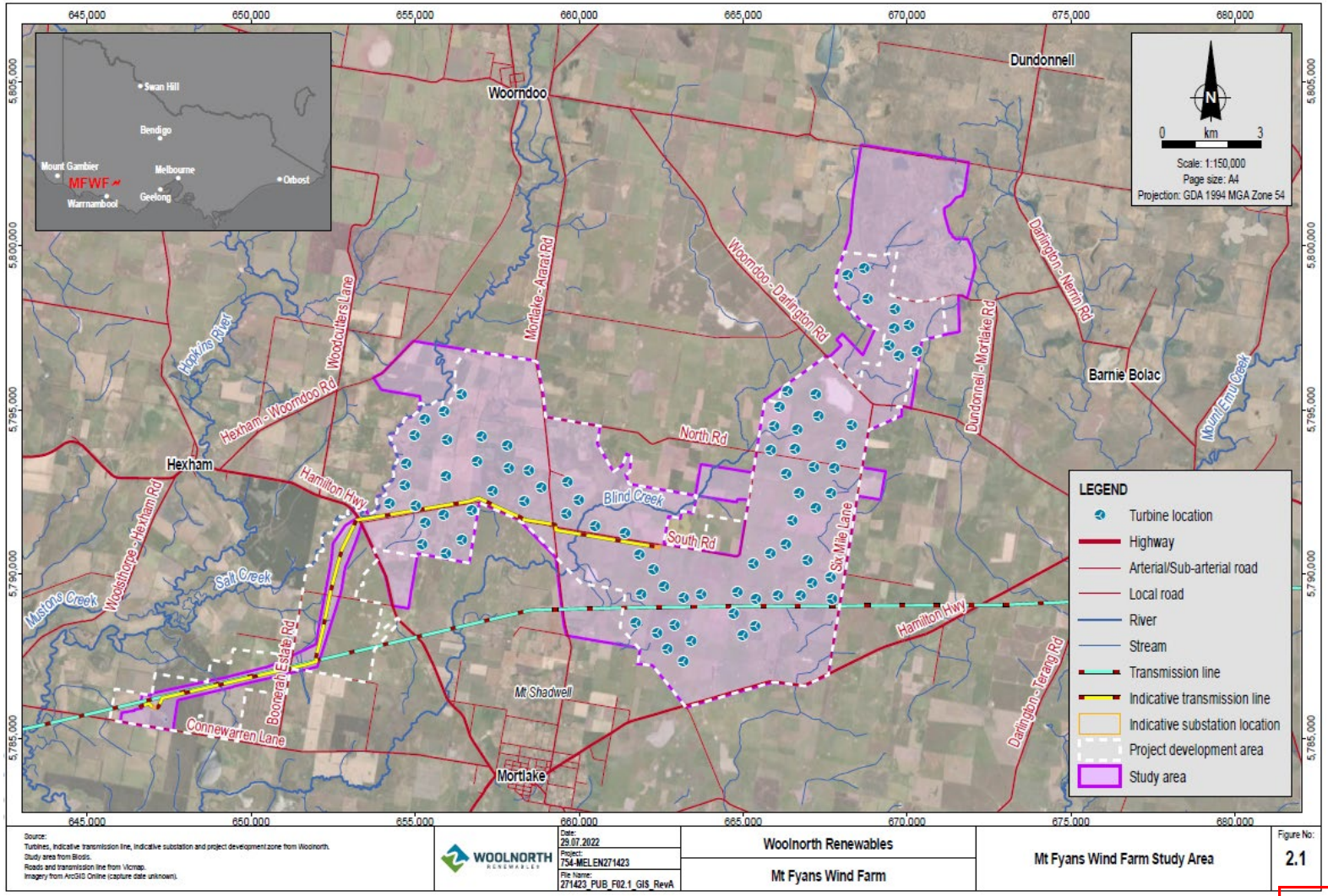


Figure 2-1 Location of the Mt Fyans Wind Farm study area

2.2.2 Project Description

Investigations into the development of the MFWF commenced in 2008. Since that time the project site has evolved significantly in response to competing challenges. These included the creation of a viable project by capitalising on its proximity to the 500 kV Victoria-South Australia interconnector and Mortlake Terminal Substation, while avoiding or minimising a range of ecological, environmental, heritage, landscape and amenity impacts.

The development of the MFWF has adopted an 'avoidance' approach from a macro conceptual level through to a site planning level as outlined below:

1. The initial Mt Fyans Wind Farm site for investigation included approximately 6,000 ha of land comprised of stony rises used for sheep grazing in the north as well as a large area of heavily grazed and cropped farmland that was considered suitable for a wind farm. The northern section of this land was determined as unsuitable for development as it contained significant areas of high ecological and cultural values.

2. The site was then expanded South and South West to include 4,000 ha of land comprised predominately of cleared and relatively flat, cropping and grazing land with good access to the Hamilton Highway. However, it also contained more neighbouring dwellings than the initial site and isolated areas of significant ecological or cultural values.

3. The project site was extended a second time to include 3,200 ha of cropping and grazing land to the west of the initial site. This area contained a relatively lower density of dwellings, fewer areas of high ecological or cultural values and brought the site closer to the Mortlake Terminal Substation

4. Within the broader wind farm site, a 'development area' where infrastructure could be located was identified. The entire extent of this area was surveyed and extent of areas of cultural and environmental values mapped appropriately.

5. The wind farm (including turbines, internal access tracks, transmission lines and cables, substations etc.) was then designed within this area to avoid impacts to all mapped sensitive areas (with the exception of public roads)

Key factors that have combined to shape the MFWF project site include:

- location and siting of nearby dwellings
- avoiding areas with threatened species and vegetation communities
- areas with a high level of sensitivity for Aboriginal heritage
- maintaining view lines of Mt Shadwell from the Hamilton Highway
- brolga breeding sites and flock sites
- areas with high geo-heritage values

The extents of the turbine layout are informed by various important factors and buffer considerations. A key objective of the development of layout is the avoidance of impacts to known and identified values. In summary, the layout takes into consideration:

- Distance from neighbouring dwellings (a minimum of 1km with no exceptions sought)
- Distance from wetlands due to:
  - recognised brolga and other wetland fauna habitats

  - potential foraging areas for SBWB
- Avoidance of sites of cultural and historic significance
- Avoidance of permanent and ephemeral waterways and water bodies
- Landowner requirements and primary production
- Areas of important vegetation (both naturally occurring and planted)
- Access to existing farm and public roads.

2.2.3 Project components

The key components of the Project are summarised in the below subsections.

2.2.3.1 Wind turbines

A maximum of 81 turbines will be installed with a maximum blade tip height of 200 metres and a minimum blade tip height of 30 metres. Each turbine will be three-bladed with a steel tower and finished in a non-reflective material. A network of access tracks will connect each turbine. The turbine layout caters for a range of turbine models with differing generation capacities and the combined capacity of the wind farm is anticipated to be approximately 400 MW.

Each turbine has the following elements:

- Foundation – a reinforced concrete gravity foundation.
- Tower – a tubular steel structure painted matte off-white.
- Nacelle – the housing for the components of the turbine that convert the wind energy from the blade into electricity. These include the drive train, generator, gearbox, braking system as well as a computer linked to the central Supervisory Control and Data Acquisition (SCADA) system in a control building.
- Rotor and blades – three variable pitched blades are connected to a rotor. The blades capture wind turning the rotor, which spins the drive train.

2.2.3.2 Hardstands

Hardstand areas are required at the base of each wind turbine to support the cranes, equipment and assets associated with construction and maintenance of wind turbines. The hardstand is typically a 50 x 50 metre area of crushed rock adjacent to an access track. Hardstands are left in place following construction to enable cranes to be used over the operational life of the wind farm.

2.2.3.3 Access tracks

A network of internal access tracks will link each turbine and provide access to the project from the public road network. Where required, access tracks will be constructed to provide access to the overhead power lines. Generally, the width of the trafficable lanes on access tracks will range from 5 metres to 9 metres. The width of shoulders and corners will vary to accommodate long or wide wheel-base vehicles. The majority of access tracks will be newly formed; however, wherever possible, existing farm lanes will be upgraded. The total length of new access tracks required is approximately 90 kilometres. Public road access will be constructed to Victorian Government standards for all construction and operational traffic (including over-dimension vehicles) to access and egress the Project.

2.2.3.4 Underground cables

Each turbine will be connected to the onsite substation via a network of 22/33 kV underground cable. Trenching of cables will be to a depth of approximately 1 metre. A portion of cabling and new roads or road upgrades will be co-located to reduce the amount of earthworks that are required.

2.2.3.5 Overhead cable

A double-circuit 132 kV or single/double-circuit 220 kV overhead electrical line is proposed to transmit the electricity from the onsite substation to the grid connection substation adjacent to the Mortlake Terminal Substation. The total length of the proposed overhead line is approximately 19 kilometres. The overhead line will comprise of steel poles of up to an approximate maximum height of 43 metres.

The overhead transmission line is shown in Appendix 2 Map 2 of 5 feature is "Indicative Transmission Route" and is the scope of transmission line for consideration in the EPBC and planning arenas.

2.2.3.6 Onsite substation and control building

An onsite substation, switchyard and control building will be housed at a single facility within an area of approximately 100 m x 200 metres. The substation facility will consist of 132/220 kV electrical equipment, a step-up transformer that converts electricity from the internal cables to the voltage of the overhead line and 22/33 kV electrical switchgear. A chain mesh fence will be constructed around the facility. Security and emergency lighting will be installed as part of the compound.

A control building will be located next to the substation compound. The control building will be fully enclosed and contain office, amenity facilities and rooms for SCADA equipment. Areas for maintenance and storage facilities, including parking, will be located adjacent to the control building.

2.2.3.7 Grid connection / offsite substation

The Australian Energy Market Operator (AEMO) has identified the Mortlake Terminal Station, operated by AusNet Services, on the 500 kV Victoria–South Australia interconnector as the preferred hub for the connection of new renewable generation in the area. The off-site substation will transform electricity from the overhead transmission line from 132/220 kV to 500 kV and will be developed immediately to the east of the existing Mortlake Terminal Substation.

The works to connect the Project to the 500 kV Mortlake Substation will comprise the construction of new circuit-breaker bays, conductor landing gantry structures, busbars, new step-up transformers and associated fencing, access roads and drainage.

2.2.3.8 Wind monitoring

Up to six meteorological monitoring masts may be erected during construction and commissioning and may be permanently maintained on site.

2.2.3.9 Temporary construction facilities

During the construction stage of the Project, the following temporary infrastructure is proposed:

- A construction compound containing office space, meeting rooms, a first-aid room and toilets. The compound area will also contain an area for parking workers' vehicles and for storage of materials.

- Laydown areas for the delivery of wind turbine and electrical equipment, prior to its use in the construction process.
- Two concrete batching plants.
- Three locations for temporary construction facilities and infrastructure have been identified within the Study Area.

A decommissioning plan will be prepared to give effect to requirements under land agreement and any regulatory requirements that will be undertaken. The proponent will work with each landowner to determine if any wind farm infrastructure and associated access tracks should remain on the land. Where required under land agreement, land will be returned to rural pasture as part of the decommissioning of the wind farm.

2.2.4 Work Exclusion Areas (WEA)

The proponent has chosen to avoid impacts on areas of specific ecological or cultural values, including both direct and indirect impacts to EPBC communities, significant vegetation communities and areas with a high probability of containing Aboriginal Cultural Heritage by delineating and maintaining Work Exclusion Areas (WEA). WEA will be implemented prior to commencement of construction works and will be maintained, monitored and measured during the course of construction and this shall be described specifically in a project-specific CHEMP.

WEAs range considerably in size and shape, are located throughout the Development Area and overlap each particular area of significance. For example, in the northern stony rise dominated landscapes the mapped WEA generally extend at least 30m beyond the areas of significance.

WEA are currently well defined and implemented on the Site with only one exception, being the one area where WEA are to be implemented within the road reserves of South Road. A conservative approach has been adopted to proposing the existing of upgrade works required to the road, and whilst at the pre-construction stage this should be possible to design the road to avoid impacts to habitats and grassland communities, WEA shall be established in all non-worked areas of the road reserve of South Road to prevent impact on the species and communities present. The final extents of this single or multiple WEA shall be determined during the design process of the road upgrade

2.2.5 Project Design and Alternatives

The project has specifically considered an appropriate strategy for dealing with environmental risks and impacts by adopting a mitigation hierarchy. This hierarchy is shown below in Figure 2-2 and nominates “avoidance” as the primary mitigation measure. This section of the report describes how the policy of avoidance has strongly influenced this development and the overall site layout design.

The Project has adopted a mitigation hierarchy to manage environmental risk and has sought to avoid all potential environmental impacts. This section of the report described how the development and site layout of the Project has been strongly influenced by the avoidance of environmental impacts.

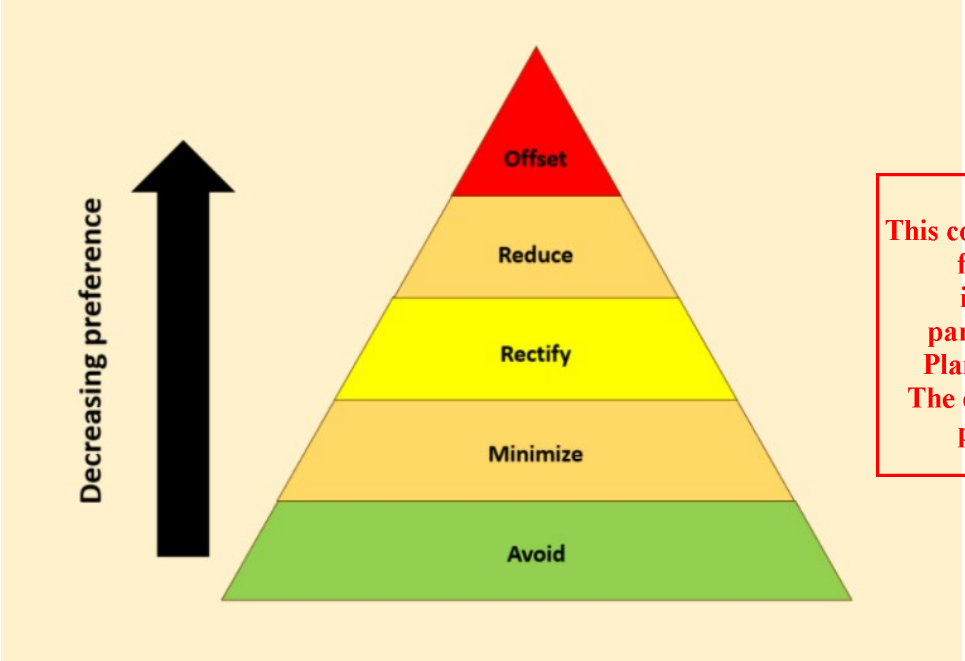


Figure 2-2 Hierarchy of controls adopted to manage environmental impacts

2.2.5.1 Transport Options and Alternatives

In 2020 VicRoads advised that the preferred transport route for wind turbine blades from the port of Portland is via the Henty Highway/Glenelg Highway, and then north of the site via Mortlake-Ararat Road (as per the Dundonnell and Mortlake South Wind Farms). This route was most recently used by Mortlake South to accommodate 73m blades with suitable turning circles and minimal vegetation clearance. This is the most suitable transport route from the port at Portland as it avoids travelling directly through townships on major routes (including Mortlake).

When using the above route, blades are unable to access the site via Hamilton Highway without impacting trees on the State Heritage Registered Avenue of Honour (VHR H2342). This would also require the blades and other long and heavy loads (tower sections) to enter the Mortlake town boundary resulting in potential impact on local road users. To minimise transport impacts to road users in Mortlake, a major access to the eastern section of site off the Mortlake-Ararat Road is now required.

Four site access options off Mortlake-Ararat Road were considered in order to create access for oversized vehicles coming from the port of Portland to northern and eastern sections of the site, as shown in Figure 2.3 and discussed below.

Option A involves constructing a new access south of Manooka Lane as the only access off Mortlake-Ararat Road; this provides two means of avoiding South Road:

- Option A.2 uses roads currently designed for turbine access tracks as accesses to the south, west and north sections of the site.
- Option A..1 involves using the farming access tracks from Mortlake–Ararat Road through the entire farm being upgraded as a major construction route. This road would be approximately 200m from a neighbouring dwelling that is already impacted by the project. Further impacts to this neighbour in the form of noise and dust generation via heavy construction vehicles over a 21-month construction period is unacceptable. Use of these route options as a major access will segregate a large farming property,

make stock routes unusable and farming operations unviable over the construction period of the Wind Farm.

However, there are significant long-term impacts resulting from the use of this access. Frequent use of this access for the duration of the construction period will result in significant impacts on all landowners and significantly curtail existing farming operations across all properties involved.

It is therefore considered that using the access to the south of Manooka Lane as the only access off Mortlake-Ararat Road is an unviable option.

Option B involves the construction of a new junction off Mortlake-Ararat Road with the new access located south of South Road. The new access will traverse the road reserve which is confirmed to be Striped Legless Lizard habitat.

Construction of a new major access avoids issues experienced at Manooka Lane and would not significantly impact the operation of the farm. However, it will segregate paddocks in short term. More significantly though, this option will require significant infrastructure to cross Blind Creek and the floodplain either side of the creek. This is, however, against commitments within the Project's Cultural Heritage Management Plan (CHMP), stating that only existing bridges will be upgraded and no new crossings over Blind Creek will be constructed. This is informed by advice received from Aboriginal heritage groups through development of the CHMP. Blind Creek and Salt Creek are the two named creeks on the site that are considered to be places of likely cultural significance by regulators.

Given that this access will be required to re-join South Road or detour several kilometres through the site to avoid a large wetland immediately south of South Road, the impacts on the capacity for farming operation to continue over the construction period make this option unviable.

Option C involves using North Road. In comparison to South Road, North Road experiences a higher volume of local traffic which needs to use this road to access adjoining farms and dwellings. The road services eight houses and includes the local school bus route. While this is a viable option, given the impact on both adjoining residents and local traffic, using North Road is considered unsuitable as the transport route for the project. This route, together with the section of South Road heading south from the intersection with North Road heading south, will also require improvement and widening. The presence of Striped Legless Lizard and NTGVVP in the road reserves along this route are confirmed. The considerably greater linear length of road reserve needing improvement in this option is twice that of Option D. This option is almost certain to result in double the impact to threatened vegetation communities and species compared with Option D.

Option D involves using South Road. This option is considered to be the most suitable route to provide a link between the Mortlake-Ararat Road and the eastern section of the project site. Local traffic that uses the road to move between Mortlake and Dundonnell area is able to avoid this route and use North Road as an alternative. The disadvantage of this option is the potential impact on MNES, including the Natural Temperate Grassland of the Victorian Volcanic Plains (NTGVVP) as well as the Striped Legless Lizard. While the proposal assumes worst case scenario with regard to native vegetation removal to meet necessary road upgrade requirements, the post approval design process will be able to avoid and minimise impacts to threatened vegetation communities and species (refer Sections 9.3 for NTGVVP and 11.3 for Striped Legless Lizard).

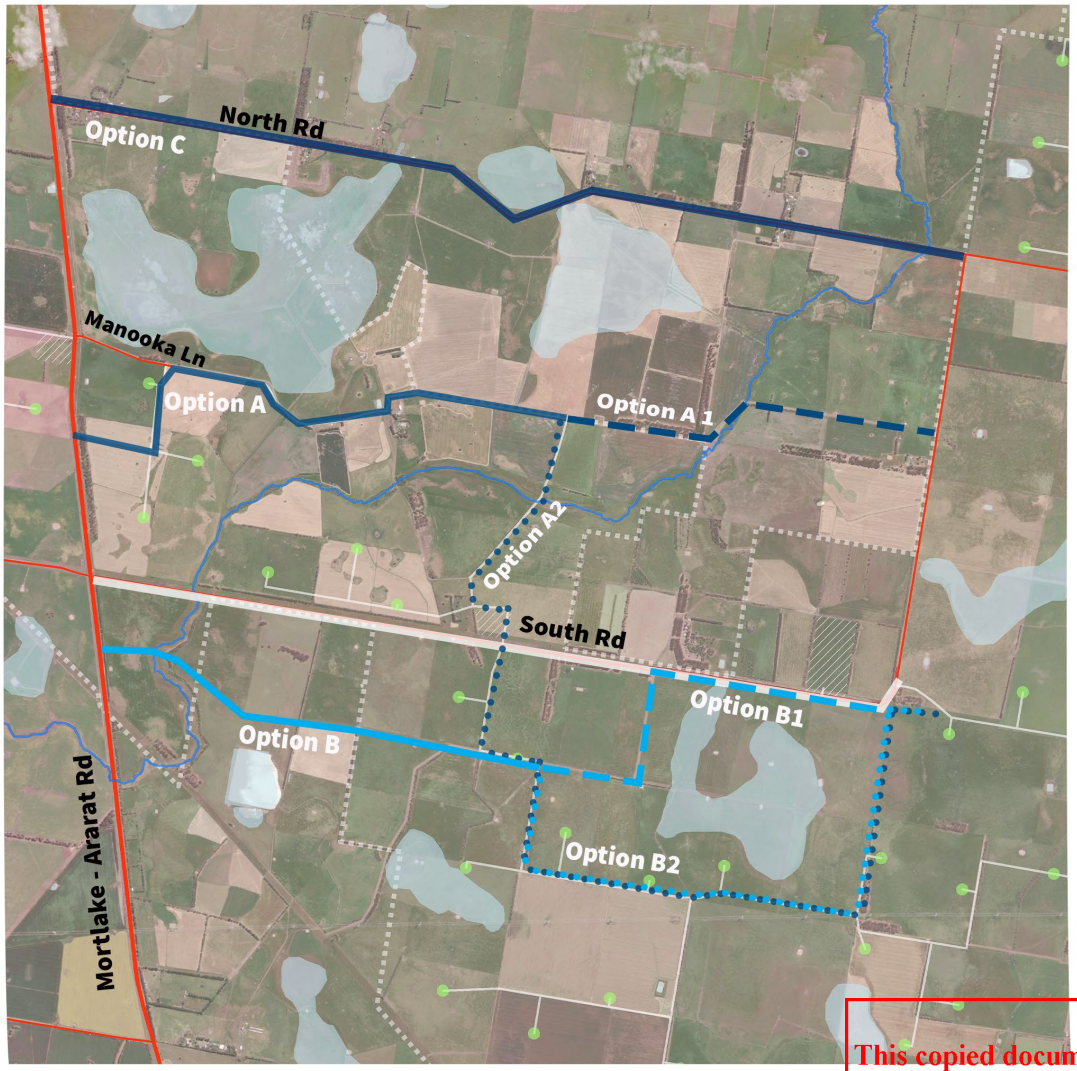


Figure 2-3 Transport options considered

2.2.6 Field Survey Methods and Key Limitations

Detailed field surveys and targeted assessments have been carried out within the study area between 2009 and 2021 for all threatened flora and fauna species and communities listed under the EPBC Act as well as other species and communities of state significance. This significant body of work includes, but is not limited to, the following:

- Targeted survey for 11 flora species listed under the EPBC Act was undertaken in winter 2013 and the spring/summer season of 2014/15.
- Migratory wader survey – August 2012 and January/February 2013, July 2013 and January/February 2014.
- Targeted survey for Corangamite Water Skink - October 2012 – January 2013, October 2013 – January 2014.
- Targeted survey for Dwarf Galaxias, Yarra Pygmy Perch, Hairy Burrowing Crayfish and Screech Beetle between November 22, 2012 and January 3, 2013.

- Targeted survey for Striped Legless Lizard – October – December 2013 and 2021.
- Southern Bent-wing Bat acoustic site survey – September 2013, acoustic survey in 2016, 2017,2018 and 2019 and monitoring of potential roost habitat in late 2017, early 2018 and 2019.
- Targeted survey for Golden Sun Moth – Summer 2014/15.
- Targeted survey for Growling Grass Frog – November/December 2014.
- Brolga - Extensive brolga studies between 2009 and 2020 including desktop studies, landowner surveys with 57 landholders in and around the project site, field surveys, aerial surveys and habitat surveys

The species and communities surveyed, methods and results, the ecological features and location of targeted surveys for threatened species and any limitations, uncertainties and assumptions related to surveys for these species and communities are fully described in detail in the following documents:

- Biosis 2022a. [Authors: Gibson, M., Cable, T., Venosta, M. and Sofo, K.] *Mt Fyans Wind Farm: Flora and Fauna Existing Conditions.* Report for Hydro Tasmania. Biosis Pty Ltd, Ballarat. Project no. 21630.
- Biosis 2022b. [Authors: Gibson, M., Cable, T., Venosta, M. and Sofo, K.] *Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment.* Report for Hydro Tasmania. Biosis Pty Ltd, Ballarat. Project no. 14369.

2.3 Socio-economic benefits and impacts of the project

The proposed Mt Fyans Wind Farm is a $600 million plus project from Tasmania-based renewable energy developer, Mount Fyans Wind Farm Pty Ltd.

The Project will incorporate up to 81 turbines, with a tip height of up to 200 metres.

The Project will have an installed capacity of about 400 megawatts and generate up to 1,500 GWh of renewable energy each year, enough to power about 300,000 homes, or a city the size of Geelong more than twice over.

It will make significant contributions to the local economy – through landholder payments, benefit-sharing initiatives, and community benefit funds, for the projected minimum 25-year life of the project.

WNR has undertaken extensive community engagement, including focused meetings with key community representatives and an online survey to determine the social and economic needs of the Mortlake district community. This feedback has been analysed to shape the benefit sharing program, which is now in a comprehensive draft for internal review prior to being shared for public feedback. WNR has continued to provide updates through newsletters, Community Engagement Committee meetings, newspapers advertisements and responses to the Project's 1800 number and email address.

The Project will create up to 150 jobs during a construction phase of up to two years and 10 ongoing positions. It will provide farmers with a reliable income stream for at least a quarter of a century, drought-proofing their farms, aiding with succession planning, and diversifying income streams.

Economically the impact of the Mt Fyans project will be overwhelmingly positive. It is estimated the project will deliver more than $3.3million annually into the local community each year through landholder payments, benefit sharing initiatives and rates payable to the Moyne Shire. During construction, the increased demand for services, such as accommodation, grocery items, food, and fuel, will provide businesses with increased incomes and opportunity for growth, as well as work for local trades and other people. The flow on impacts of many millions of dollars a year being injected into a small geographical area for at least quarter of a century will see greater prosperity and opportunity for community groups, businesses, schools, and families.

A potential negative impact is that the financial gap between the eight participating landholders and other farmers will widen, potentially limiting some farmers ability to compete for purchasing of land and stock.

Socially, the project will generate greater opportunity and community growth in terms of increased investment and financial support for community groups and other initiatives. This financial investment will likely lead to social growth, with community and other groups able to grow and develop. An example of this already has been the development of an all-weather helicopter landing facility at the Mortlake Football Oval, funded by a $50,000 donation from the Mt Fyans Wind Farm. While this has a financial framework, it is a social impact as it provides the community with a service that boosts social confidence and may even save lives.

Concerns will remain around the impact of the project on property values, although multiple Australian and international studies have been undertaken that indicate wind farms do not negatively impact property prices (NSW Department of Lands report, Urbis report commissioned by the NSW Department of Environment). There is also social concern around visual impact, although visual impacts will largely be away from the Mortlake township and population base, with the turbines largely located to the north of the Mortlake township, at its closest point five kilometres away from the General Residential Zone. There are some challenges around the availability of social housing in south-west Victoria and this could be compounded by the workforce requiring accommodation during construction. The town will also likely be busier during the construction phase, which may cause social impacts for residents through increased demand for services, including parking and goods and services. There will also be increased traffic on the road and impacts on the local road network, which will be addressed through a detailed Traffic Management Plan.

3. Scope of Assessment

In early 2020, the Mt Fyans Wind Farm (MFWF) project was deemed a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act, project number EPBC 2019/8589) by the Department of Agriculture, Water and the Environment (DAWE). The project requires approval under the EPBC Act because it is considered to have a significant impact on nationally listed threatened species and communities, namely:

- Southern Bent-wing Bat *Miniopterus orianae bassanii* (SBWB)
- Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP)
- Seasonal Herbaceous Wetland (Freshwater) of the Temperate Lowland Plains (SHWFTLP)
- Other listed species and ecological communities (n. 15).

Prior to the EPBC Act determination, many SBWB studies had already been conducted across the site in preparation for the Planning Application (see Section 4 for historical summary). The current state of scientific knowledge about this species generally – its ecology and status – can be readily summarised although many gaps remain (see Section 5). Additional SBWB studies (see Section 6) were further conducted following the submission of the Planning Application in response to discussion with the Victorian State Department of Environment, Land, Water and Planning (DELWP).

Based on the combined historical data, current scientific knowledge and recent additional studies on the SBWB, this present document therefore addresses the following in particular regarding the SBWB and the MFWF project site:

- The potential for a significant roost site for SBWB to occur within or in the vicinity of the project area (see Section 6.1).
- Describe other known roost sites for SBWB in the region and how they interact with foraging activity of the SBWB at the project area (see Section 6.2).
- Characterise SBWB activity within and near the project area including seasonal use of the site and use of different habitat types (see Section 6.3).
- Characterise SBWB activity within the rotor-swept area and assess the likely impacts to SBWB through turbine collision and or barotrauma (see Section 6.4).
- Potential cumulative effects on SBWB from the project in combination with other wind farms (see Section 6.5).

Also outlined in this document regarding the SBWB and the MFWF project site are:

- Proposed alternatives, avoidance and mitigation measures (see Section 7)
- Residual impacts and offsets (see Section 8).

Sections 9 and 10 and 11 of this document address, respectively, the likely impacts of the MFWF project to the NTGVVP, SHWFTLP and Striped Legless Lizard *Delma impar* – in particular:

- Potential for impact
- Proposed alternatives, avoidance and mitigation measures
- Residual impact and offsets.

Section 12 of this document addresses likely impacts of the MFWF project to other listed species and ecological communities, being:

- Curlew Sandpiper *Calidris ferruginea*
- Striped Legless Lizard *Delmar impar*
- Dwarf Galaxias *Galaxiella pusilla*
- Yarra Pygmy Perch *Nannoperca obscura*
- Growling Grass Frog *Litoria raniformis*
- Spiny Rice-flower *Pimelea spinescens* subsp. *spinescens*
- Basalt Rustyhood *Pterostylis basaltica*
- Adamson's Blown-grass *Lachnagrostis adamsonii*
- Fragrant Leek-orchid *Prasophyllum suaveolens*
- Small Golden Moths Orchid *Diuris basaltica*
- Hoary Sunray *Leucochrysum albicans* subsp. *tricolor*
- Spiny Pepper-cress *Lepidium aschersonii*
- Swamp Fireweed *Senecio psilocarpus*
- Swamp Everlasting *Xerochrysum palustre*
- Clover *Glycine latrobeana*
- Salt-lake Tussock-grass *Poa sallacustris*
- Grassy Eucalypt Woodland of the Victorian Volcanic Plain
- Grey-headed Flying-fox *Pteropus poliocephalus*
- White-throated Needletail *Hirundapus caudacutus*

This document is provided as the 'assessment documentation' and is submitted to the DELWP for agreement and sign-off to satisfy the EPBC assessment and the No-EES condition.

3.1 Assessment of Significant Impact on MNES

The potential for Mount Fyans Wind Farm to result in a significant impact on matters of national environmental significance listed under provisions of the EPBC Act have been assessed in accordance with significant impact guidelines published by the Australian Government. These include *Matters of national environmental significance significant impact guidelines 1.1* (DoE, 2013) and species-specific significant impact guidelines where those have been published. Under "When is a significant impact likely?" *Matters of national environmental significance significant impact guidelines 1.1* (DoE 2013) says (in part):

> *"To be 'likely, it is not necessary for a significant impact to have a greater than 50% chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility".*

The assessment against criteria set out in significant impact guidelines in tables in sections 7,9-13, are thus either 'likely' or 'unlikely'. Assessments against relevant criteria provided here are set out in those terms.

4. History of Southern Bent-wing Bat Surveys at Mt Fyans Wind Farm Study Area

The MFWF study area has been identified as supporting potential habitat for the EPBC Act listed critically endangered SBWB. The species is known to range over much of southwest Victoria and southeast South Australia and is known to utilise naturally occurring lava and limestone caves that provide non-breeding sites and maternity sites for breeding.

Table 4.1 provides a summary of the multiple investigations, surveys and analyses specifically relating to the SBWB for MFWF over the past eight years.

Table 4.1 Summary of SBWB investigations for Project

Time period	Summary of work
2012 – 2013	**Proposal for volcano habitat surveys** During the initial stages of the project in 2012, discussions occurred with DELWP on the scope and extent of threatened species surveys. Survey for bats, SBWB specifically, or roost habitat was not required by DELWP. In 2013 after informal discussion, and based on the advice of Lindy Lumsden, DELWP's SBWB expert, an experienced speleologist, Ken Grimes undertook a cave habitat survey with an ecologist from Biosis. The late Ken Grimes is a well-recognised geologist, geomorphologist and speleologist with 25 years' experience in investigation and mapping southwest Victorian basalt and limestone cave systems.
2014 – 2016	**Reporting and documentation** Site assessments for general biodiversity were undertaken and reporting provided to the proponent.
2017	**Initial provision of information** A meeting was held with the Barwon South West (BSW) team of DELWP in November 2017 on the process of progressing the assessments associated with the Minister's Environment Effects Statement (EES) decision. In early 2018, DELWP were provided with: • Information on potential SBWB calls for the eight sites monitored during March–April 2017. • A copy of a letter from Biosis outlining the SBWB proposed methodology for the next stage of the assessment process.
2018	**Additional 'trapping' survey at Mondilibi Hill, Down Ampney property** In January 2018, BSW advised that while it was supportive of the initial 'trapping' survey at Mondilibi Hill, it believed that this should be repeated in April–May, since the previous April acoustic survey recordings had detected bats there. A second 'trapping' survey was conducted in April 2018 following this advice.

Time period	Summary of work
2018	**Additional multi-site ground surveys** Following comments of BSW on the adequacy of the initial two-week ground survey of eight locations across the site, an additional ground survey of four weeks was proposed over April–May 2018. At the suggestion of DELWP that a longer survey would be preferable, the survey was extended to five weeks.
2018	**Review of suitability of collecting at height recordings** Following a meeting in February at which Biosis outlined their view that 'at blade height' bat recording was not useful due to the failed outcomes of the surveys undertaken for the Penshurst Wind Farm, BSW requested further information on the bat survey data. Biosis obtained the permission of the wind farm company to provide DELWP with this information to assist its knowledge on this aspect of the assessment method.
2018	**Further explanation of 'cave' investigation method** At a meeting with BSW in July 2018, DELWP advised that a way of resolving a difference of opinion on the veracity of the speleologist's conclusion that there is no suitable habitat for SBWB to roost at Mondilibi Hill would be to have a greater explanation of the survey method. The applicant acted on the advice from DELWP. The consultant ecologist who undertook the survey with the speleologist Mr. Grimes, prepared a supplementary report that explained the survey methodology and the reasons for their joint findings. The supplementary report provides a detailed description of the surveys undertaken at Mondilibi Hill and outlines that the field work was able to establish that: • The small rock overhangs were not suitable for SBWB roosts. • The small cavities in the surface of the volcano ranged from 30 centimetres to 1 metre in length and did not expand into larger cavities. • There was no evidence showing bat use of any cavities/overhangs. • The survey assessment concluded that: • There was no suitable habitat for a major SBWB roost site • Any further assessment of the Mondilibi Hill would not provide any additional scientific evidence.
2019	**Request for additional information following submission of Planning Application** The Planning Application for the MFWF was submitted to the Minster for Planning in September 2018. In late January 2019, a request for additional information was received from DELWP. The request referred to documents prepared by BSW on a wide range of biodiversity matters and asked for comments in response. Meetings were held with BSW over February–April 2019. The main issue raised by BSW was in relation to the degree of rigour used to assess fractures and fissures at Mondilibi Hill as potential SBWB roost habitat. Additional information on this matter was provided. In August 2019, BSW formally agreed that the issues that had been raised (including SBWB matters) had been resolved. BSW noted that the Impact Assessment Team was undertaking its own review.

Time period	Summary of work
2019	**Assessment and consultation by DELWP's Impact Assessment Team** In April 2019, the Impact Assessment Team (IAT) of DELWP advised that it would be undertaking an assessment of the MFWF planning application. In mid-May 2019, the IAT, following advice from BSW, advised on the additional information/reporting that it required. This included: • Information on the number of calls in comparison to other wind farm sites • Information on how roost sites were defined • An assessment of difference in call behaviour when foraging and not foraging • More information on the risk of flying at blade height • More assessment of proposed buffers • Specific information on the types of mitigation techniques that may be suitable. The planning application and associated technical reports were amended to provide the additional information requested. These updated documents were provided to the IAT in early July 2019.
2019	**BSW peer review and additional information** In late June 2019, BSW advised that they believed a 'peer review' of the MFWF SBWB assessment should be undertaken. As the IAT was undertaking an assessment of how the proponent has satisfied the Minister's no-EES condition, the IAT took on the role of organising the peer review. The IAT, in consultation with BSW, scoped the questions to be asked of the peer reviewers and provided these to Lindy Lumsden and Amanda Bush of DELWP in late July 2019. In summary, the questions posed included: • Is the SBWB assessment suitable to determine utilisation? • Is the scoria cone (Mondilibi Hill, Down Ampney property) assessment suitable to determine the presence of a roost site and specifically is the definition of a 'major roost' suitable? • Is the analysis of SBWB calls suitable? • Are there any key gaps in the assessment which limit an understanding of potential impact? • Is the finding that there is not likely to be a significant impact valid? • Are the proposed avoidance and mitigation measures suitable and are there other techniques which could be assessed or applied? The draft report addressing the questions posed was completed on 18 August 2019 and a meeting with the proponents (Hydro Tasmania for WNR and Biosis assisting) and DEWLP representatives to discuss the draft report was held on 6 September. At the end of the meeting, DEWLP requested a proposal outlining additional surveys and assessments that would be undertaken to address the issues identified in the peer review. The draft proposal was provided to DELWP on 17 September 2019.

Time period	Summary of work
2019 – 2020	**Field survey work** In late 2019, field survey work was undertaken as proposed to DELWP. The findings of that survey work are documented in this response to the EPBC Act scoping requirements.
2019 – 2020	**EPBC Referral** The proposed action was referred to DAWE by WNR in late 2019. On 22 April 2020, the project was deemed to be a controlled action to be assessed under the assessment bilateral agreement with the Victorian Government. The scoping requirements were then provided by DELWP under cover of reference EPBC 2019/8589.

4.1 SBWB Legislative status

The SBWB is listed as Critically Endangered under the EPBC Act. Under the EPBC Act the taxa is referred to as *Miniopterus orianae bassanii*.

Under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act), the taxa is listed as Critically Endangered, and is referred to as *Miniopterus scheibersii bassanii*. It is listed as Endangered in South Australia (*National Parks and Wildlife Act 1972*, as *Miniopterus orianae bassanii*).

Throughout this report, the taxa will be referred to as the Southern Bent-wing Bat (SBWB).

A National Recovery Plan for the SBWB (DELWP 2020) has been recently adopted.

There is no approved FFG Act Action Statement for the SBWB.

Summary

- The SBWB is listed as Critically Endangered at the national level. The SBWB is listed as Critically Endangered under the Victorian FFG Act. It is listed as Endangered in South Australia. The National Recovery Plan sets out the recovery initiatives endorsed by DAWE (DELWP 2020).

5. Southern Bent-wing Bat Ecology and Status

Much of the content in Section 5 is taken from the SBWB National Recovery Plan (DELWP 2020). DELWP (2020) and the recently published Conservation Advice (TSSC 2021) provide the most up to date descriptions of the species ecology and population status.

5.1 Description

The SBWB was described as a distinct subspecies (of the Large or Common Bent-wing Bat) in 2000, based on genetic and morphological differences, with recent genetic studies suggesting that it may warrant full species status. It is an obligate cave-dwelling bat (meaning that it relies on caves for roosting and breeding) with a distribution across southeast South Australia and southwest Victoria. During the non-breeding season, SBWB individuals are distributed throughout this broad/expansive region, roosting in a large number of caves and rock crevices with 52 (TSSC 2021) caves documented in South Australia and 18 (TTSC 2021) Victorian caves widely distributed across the southwest region. During the non-breeding season, some caves may hold several thousand SBWB individuals; however, smaller colonies are more typical, and the bats may also roost singly (DELWP 2020). During the breeding season, most of the population congregates in two, regularly used breeding caves, located at Naracoorte in South Australia and near Warrnambool in Victoria. The Naracoorte site is approximately 200 kilometres northwest of the MFWF site, being well outside daily movement distances, and the Warrnambool site is approximately 55 kilometres southwest of the MFWF site. A third maternity cave with a much smaller population located near Portland Victoria was discovered in 2015 (TSSC 2021).

The total population of the SBWB was last estimated at 44,300 mature individuals (TSSC 2021). The population has reportedly declined by 67% since the mid-1990s, when the species was estimated to be 134,500, consisting of 122,500 from Naracoorte Bat Cave and 12,000 from Starlight Cave (Reardon 2001).

While a number of potential threats to the species have been identified, there is little empirical evidence on which to base one or more causes for the current decline. The most important factors for decline in southwest Victoria are likely to be destruction and disturbance of maternity and non-maternity roost sites and habitat clearance and wetland draining for agriculture, where the impact due to loss of foraging habitats may be significant, and an emerging risk from White-nose Syndrome (TSSC 2021). Agricultural practices such as pesticide spraying may also reduce prey species abundance (DELWP 2020).

5.1.1 Morphology and taxonomy

There are three subspecies of the Common Bent-wing Bat, which form separate maternity colonies (Cardinal and Christidis 2000). The SBWB was described in 2000 based on genetic and skull morphological differences (Cardinal and Christidis 2000). Further genetic analysis suggests it may warrant full species status (Reinhold et al. 2000; Wood and Appleton 2010). The SBWB has a mean weight of 15.7 grams and a mean forearm length of 47.6 millimetres (Churchill 2008). It is currently not possible to reliably distinguish this subspecies from the Eastern Bent-wing Bat using traditional field-based techniques (DELWP 2020).

5.1.2 Important populations

Since 2000, in Naracoorte South Australia Bat Cave fly-outs have been filmed regularly with a 2008–2009 population estimate of 20,000 (Kerr and Bonifacio 2009). The population in 1963–1964 was 75,000–150,000 and remained stable until the mid-1990s (Reardon 2001). The Naracoorte population is most recently estimated in 2019 at 30,700 by a fly out count (TSSC 2021).

The Warrnambool population was estimated at 10,000–15,000 in 2004 (Grant and Reardon 2004 cited in Kerr and Bonifacio 2009) and 12,000 in 2001 (Grant 2001 cited in Kerr and Bonifacio 2009). In 1963–1964, the population was estimated at 10,000–20,000 (Dwyer and Hamilton-Smith 1965). All estimates include juveniles (Kerr and Bonifacio 2009). Due to potential inaccuracy in estimating the population numbers, a primary priority for the recovery of the species is to develop techniques to accurately estimate the population size at the maternity sites. The Warrnambool population is most recently estimated in 2020 at 17,00 to 18,000 mature adults and juveniles and approximately 3,000 pups (TSSC 2021).

The maternity cave located near Portland is much smaller in terms of population however seems proportionally to be a successful breeding location with 97% or females at Portland giving birth to pups cf 39% at the Warrnambool maternity cave (TSSC 2021).

Maternity roosts at Mt Widderin (Victoria) and Robertson Cave (South Australia) have disappeared due to guano mining in the 1800s, while Thunder Point Blowhole (Victoria) has ceased as a maternity roost since its collapse (Kerr and Bonifacio 2009). The National Recovery Plan for the SBWB (DELWP 2020) mentions there may have been other maternity caves in the region that are no longer used.

DAWE and DELWP have advised that the SBWB is to be managed as two discrete populations, the South Australian population and the Victorian population. The assessment of potential impacts from Victorian wind farm(s) on the SBWB population is to be determined on the basis of the Victorian population.

The National Recovery Plan for the SBWB (DELWP 2020) notes that due to the severe decline in numbers of the SBWB, all populations are considered important. The most recent Conservation Advice in June 2021 (TSSC 2021)confirms that populations are centred on the three regularly used maternity caves and their associated non-breeding caves. These areas are generally described below:

- **Victoria**: Warrnambool and Portland maternity caves, plus 18 known caves (TSSC 2021) used as non-breeding sites in southwest Victoria, including in the Lower Glenelg, Bats Ridge, Portland, Byaduk Caves, Yambuk, Grassmere, Panmure, Pomborneit and Otways areas.
- **South Australia**: Naracoorte maternity cave, plus 52 known (TSSC 2021) caves used as non-breeding sites in southeast South Australia, including Naracoorte Range, Mount Burr Range, Millicent, Mt Gambier and coastal sea cliffs.

Summary

- The population was reported to be in decline prior to the installation of any wind farms in the region. The causes and mechanisms of the decline are not fully understood.
- Population sizes at important breeding and maternal locations have been estimated by various parties. Large swings in these estimates are noted.
- Main concentrations of the population and maternity activity are well understood and located a significant distance from study area.

5.1.3 General ecology

The species is long lived, with a couple of individuals being recaptured 18 and 20 years from original capture and banding (DELWP 2020). It is likely, however, that these individuals are not representative of the likely lifespan of the species, with it probably being considerably less. Little data exists to substantiate this.

Habitat preference is associated with the availability of foraging areas and proximity to suitable roosting caves. The species primarily roosts underground in caves (limestone and lava tubes), with some observations of usage

of coastal cliff rock crevices and tunnels (Churchill 2008). The species is dependent on the seasonal microclimatic conditions provided by these habitats, particularly at the regularly used maternity caves. At these maternity sites, structural characteristics are present which allow heat and humidity to build up so that conditions are suitable for the nursing of young bats (Dwyer and Hamilton-Smith 1965). Since January 2015, a cluster of well-developed pups were observed in a sea cave near Portland in far southwest Victoria. At the Portland maternity cave, 700 pups were born in 2020 from a total adult and juvenile count of 1900 individuals (TSSC 2021).

The traditional assumption was that during late August, the bats commence their annual migration to one of three maternity caves, Bat Cave at Naracoorte in South Australia, Starlight Cave at Warrnambool, Victoria, and Portland, Victoria. Almost the entire population, including males and females, were thought to make the journey from overwintering caves to the maternity sites, stopping at transition caves along the way. By October, the migration is complete. The majority of the bats (70% to 90% depending on the year) will go to Bat Cave in South Australia (TSSC 2007). Births occur from late October to late November at Bat Cave and in early December at Starlight Cave. After four to five weeks, the young are fully furred and able to fly. The young are fully weaned by their third month, and, together with the adults, begin their dispersal to the non-breeding sites (TSSC 2007). More recent research from tracking of South Australian SBWB reveals a more complex pattern whereby “overwintering caves” can be used at any time of year (TSSC 2021).

Climatic conditions in non-breeding caves are cooler and allow the species to enter torpor (reduced state of physiological activity) during the colder months of the year (April–August) when the SBWB is dispersed over a wide region of southeast South Australia and western Victoria. In South Australia, surveys of these caves have only accounted for a portion of the total population, suggesting that there are further non-maternity sites (Kerr and Bonifacio 2009).

The species has three main movement patterns: movement to maternity caves, dispersal to non-maternity caves and foraging movements (Kerr and Bonifacio 2009). Foraging habitat includes locations that support populations of nocturnally active insects (as the principal diet of the SBWB). SBWB foraging activity therefore is largely aligned to include treed areas and areas of insect activity around standing water bodies, and as well as over grazing and cleared agricultural land (TSSC 2021). In forested/treed areas, the species typically forages above the canopy but in open environments it has been recorded foraging close to the ground as well as at height. Activity is likely to closely align to the activity of the foraging resource. The Eastern Bent-wing Bat and several other bat species have recently been recorded infrequently flying at approximately 100 metres above the ground in New South Wales, particularly when compared to the level of call activity recorded closer to ground level and up to approximately 30 metres in height (Mills and Pennay 2017). The National Recovery Plan for the SBWB (DELWP 2020) notes the availability of limited information on foraging habitat used by the species.

Radio tracking of individuals from the Naracoorte maternity site showed that they mostly foraged along a forested ridgeline within 3–4 kilometres of the cave (Grant 2004). Wetlands are also used extensively, with individuals recorded flying distances to reach these foraging areas as provided below. Limited foraging occurred in open pastures and Radiata Pine (*Pinus radiata*) plantations (Grant 2004). Foraging has been recorded over vineyards (Bourne 2010) and in lower southeast South Australia wetlands are the preferred foraging habitat, with tracks through both native forest and pine plantations also being used (Stratman 2005). Swamps with terrestrial vegetation occurring around the fringes and aquatic vegetation within the swamp itself characterise the wetland habitat used by the SBWB (Stratman 2005). Swamps with terrestrial vegetation occurring around the fringes and aquatic vegetation within the swamp itself characterise the wetland habitat used by the subspecies (Stratman 2005). All swamp sites used by the subspecies provided open areas for flight and most were prone to seasonal inundation (Stratman 2005). The typical foraging strategy involves individuals constantly in flight, sometimes meandering between areas after 5–15 minutes of foraging or flying to a particular foraging area and remaining there for one or more hours (Grant 2004).

The SBWB can travel long distances from the roost site, with lactating females recorded repeatedly returning to areas 23–25 kilometres from the Naracoorte maternity cave (Grant 2004; Bourne 2010). One radio-tracked male was recorded 35 kilometres from the roost site (Bourne 2010).

Van Harten (2021)found that individuals can fly distances up to 70 kilometres from a roost site in a single night and that use of roost caves may vary considerably on a night-by-night and/or seasonal basis..

In eastern Australia, the diet of the closely related Common Bent-wing Bat consists predominantly of moths, with small quantities of a range of other insect orders also taken (Vestjens and Hall 1977). Little is known of the diet of the SBWB; however, it is likely that it also feeds predominantly on moths (TSSC 2021), with moth wings frequently found in the entrances to caves used as roost sites (DELWP 2020).

Summary

- SBWB is obligately associated with caves for roosting, breeding and non-breeding.
- Foraging activity is associated with wetland and forested areas.
- Foraging activity is likely to be closely aligned to the foraging resource (e.g. moths).
- Foraging is mostly conducted at ground level (less than 30 metres from ground), above the tree canopy and occasionally observed at heights of 100 metres.

5.1.4 Distribution within the region

The distribution of the SBWB largely reflects the distribution of caves in southwest Victoria and southeast South Australia. The current known distribution of the SBWB encompasses the area between Robe, Naracoorte and Port MacDonnell in South Australia, extending eastwards across southwest Victoria. The most easterly sites confirmed by genetic analysis are at Lorne and Pomborneit (Cardinal and Christidis 2000).

Genetic sampling of bent-wing bats using disused mines in central Victoria revealed only the Eastern Bent-wing Bat, suggesting that the distribution of the SBWB does not extend into central Victoria (Lumsden et al. 2012). Extensive banding studies were undertaken in the 1960s, and there are several records of individuals moving between the Warrnambool/Naracoorte population and sites northeast of Melbourne and in southeast New South Wales within the range of the Eastern Bent-wing Bat (Dwyer 1969; Seebeck and Hamilton-Smith 1967). The longest movement recorded was of an adult male banded in 1963 in northeast New South Wales and recaptured in 1965 at a cave at Panmure, near Warrnambool – a distance of 1,300 kilometres (Dwyer 1969). As there are very few of these long-distance records compared to the number of recaptures within the normal range, it is assumed that these are not typical but represent vagrant or possibly human-assisted movements.

(See Section 6.2.1 for detailed discussion on SBWB distribution in relation to the MFWF project area, along with a related map and information table, respectively Figure 6-1 and Table 6.2.

The SBWB's extent of occurrence and area of occupancy have diminished since European settlement, with the number of breeding colonies declining from five documented breeding sites (and possibly more) to the currently known three breeding caves. Likely factors contributing to the decline include clearance of native bush, including open woodlands in southeast South Australia, and human disturbance. No recolonisation of previous breeding caves has occurred despite the considerable period since abandonment, highlighting the potential precariousness of the last two remaining breeding caves (TSSC 2007).

Summary

- Decline in species linked to habitat removal and human disturbance.

- Breeding locations are well understood and do not include the study area.

5.1.5 Threats and mortality

Key threats to the SBWB population are summarised in Table 5.1. This list is extracted from TSSC 2021 and lists the threats impacting the SBWB in approximate order of severity of risk from highest to lowest based on available evidence.

Table 5.1 Threats to the SBWB population

Threat factor	Threat type andstatus	Evidence base
Habitat loss and degradation		
Damage or destruction ofroost sites	Known past and potential	There have been historic losses of major roost sites due to the extraction (mining) of bat guano, which entailed enlarging holes in cave roofs (Lewis 1977). In some cases,these modifications significantly altered the microclimate of caves, rendering them unsuitable to bats (Simpson & Smith 1964; Baudinette et al. 1994; Hamilton-Smith 1998). One significant maternity cave, Thunder Point Blowhole inVictoria, has collapsed due to natural weathering. Some roost sites have been abandoned by bats due to theiruse as rubbish dumps, or intentionally closed as part of riskmitigation or for the protection of Aboriginal rock art (Kerr & Bonifacio 2009). Bent-wing bats generally do not tolerate gates installed over cave entrances – even those designed to allow the movement of bats (Slade & Law 2008). Both major maternity caves are now managed for bat conservation. The Warrnambool cave is situated in a dynamic section of the coast, putting it at risk of collapse. Small parts of the cave have collapsed in recent years due to natural weathering, and previous land management practices may have weakened the structural integrity of the roof of the cave. Increased storm frequency due to climate change may exacerbate the rate of collapse (DELWP 2020). Vegetation growth around the entrance to some caves hasobstructed the flight space, and, in some cases, preventedbat access to the roost site (DELWP 2020).
Clearing and modification of foraging habitat	Known past and potential	Historic land clearing and the draining of large wetland complexes have greatly reduced foraging habitat for the Southern Bent-wing Bat. Habitats surrounding all three maternity roosts, as well as non-maternity caves, have beensignificantly modified and fragmented, with over 90% of the native vegetation removed (TSSC 2007). Further destructionof remaining habitat in these areas could be highly detrimental to the survival of the subspecies (DELWP 2020).

Threat factor	Threat type andstatus	Evidence base
Disease		
Disease	Known past and potential	There are recorded observations of mortality events attributed to disease or ill health. In 1967, an unidentified virus, combined with a severe drought, reduced the numbersat the Naracoorte maternity site (E. Hamilton-Smith pers. comm. 2010, cited in DELWP 2020). In 2008, there was a high mortality of pups at the Naracoorte site, with some individuals suffering from severe ulcerative skin lesions and malnutrition (Bourne 2010). In 2009, a large proportion of thepopulation was observed with small ulcers that were attributed to parasites and a pox virus (Bourne 2010; McLelland et al. 2013). However, it is unclear whether these lesions and ulcers affected the bats' survival. The extensive health study by Holz (2018) did not find any health issues that would clearly explain significant population declines. However, further work is needed to continue surveillance fordisease in the population, as it is difficult to exclude the possibility of long-term impacts of minor diseases and episodic or epidemic disease events. In North America, White-nose Syndrome (WNS) caused by the fungus *Pseudogymnoascus destructans* has resulted in the deaths of millions of cave-roosting bats in North Americasince 2006 (Puechmaille et al. 2010). It has spread rapidly across the United States of America and Canada and has also been recorded in Asia and Europe (Puechmaille et al. 2010; Zukal et al. 2016). It has not yet been recorded in Australia, but its introduction could have devastating consequences for Australian cave-dwelling bats (DELWP 2020). The entire distribution of the Southern Bent-wing Bat is within the optimal temperature range for growth of the fungus (Turbill and Welbergen 2020). A risk-assessment for bats in Australia concluded that the introduction of WNS intoAustralia was 'highly likely/almost certain' over the next 10 years, and that the Southern Bent-wing Bat would be the most severely impacted taxon (Holz et al. 2016, 2019c; Turbill and Welbergen 2020). The most likely method of introduction into Australian cave systems is via cavers (e.g. inadvertently introduced via contaminated equipment) (Holz et al. 2019c). The recent discovery that Southern Bent-wing Bats are capable of regular, long-distance flights makes it likely that the Victorian and South Australian populations interact, perhaps sharing non-maternity caves located between the maternity caves. There is a high-level of contact between individuals within each population throughout the year, as they cluster in tightly packed groups and regularly switch between roost caves. If WNS was to infect Southern Bent- wing Bats anywhere in its distribution, it is highly likely that it would spread quickly throughout the entire population. It is also highly likely that if the fungus was introduced, it would not be possible to control its spread.

Threat factor	Threat type andstatus	Evidence base
Climate change		
Climate change	Suspected past and potential	Drought may affect reproductive success and adult survival by reducing water availability and prey availability, particularly if critical wetland foraging sites dry up. During the2006 breeding season, drought, in conjunction with unusually low temperatures, is believed to have been the cause of significant mortalities in the Naracoorte maternity cave, with >500 dead pups recorded, and large numbers of emaciated pups observed (Bourne & Hamilton-Smith 2007). Survival analysis undertaken at the Naracoorte maternity cave revealed a 37% lower survival rate of both juveniles and adults during a year of severe drought compared to subsequent years with average rainfall (E. van Harten, pers. comm. 2020). Similarly, low levels of survival and breeding success have been recorded for the Eastern Bent-wing Bat (D. Mills pers. comm. 2019). Periods of low rainfall are likely to increase under ongoing climate change (Grose et al.2015; Timbal et al. 2015).
Human disturbance		
Human visitation to caves	Known past and current	The Southern Bent-wing Bat is highly susceptible to human disturbance, especially from the use of white lights (Bush et al. 2016). Many caves used by the bats receive significant levels of human visitation, although visitation to the Naracoorte maternity cave is now strictly regulated (DELWP2020). The young are particularly vulnerable during the breeding season. Disturbance may lead to young being dislodged from the ceiling and falling to the floor, where they are unlikely to be reunited with their mother and will consequently die. Adults in torpor are also vulnerable. If disturbance causes them to arouse from torpor, they use upvaluable fat reserves. If this occurs a number of times over the cooler months, bats may starve to death or be in poor condition when they leave the roost site in spring. If disturbance occurs repeatedly, a roost site may be abandoned (Kerr & Bonifacio 2009). In addition to inadvertent disturbance, there have been examples of vandalism at the Warrnambool maternity site,with an attempt to set fire to surrounding vegetation and large timber logs thrown into the caves through the small surface holes.

Threat factor	Threat type andstatus	Evidence base
Introduced predators		
Feral cats (*Felis catus*), European red foxes (*Vulpes vulpes*) and black rats (*Rattus rattus*)	Suspected past and current	The impact of introduced predators on the Southern Bent- wing Bat is unknown. However, feral cats (*Felis catus*) and European red foxes (*Vulpes vulpes*) have been recorded preying on bats as they exit caves, sometimes taking significant numbers (DELWP 2020). A fox and numerous foxscats have been observed in the Warrnambool maternity cave and several non-maternity caves, and feral cats have been trapped in and around the Naracoorte maternity cave (DELWP 2020). Black rats (*Rattus rattus*) have been observed in both the major maternity caves. Dwyer (1966) reported the accumulated remains of 476 Eastern Bent-wingBats taken by a fox at a cave in NSW over a two-year period, indicating that predation rates can be substantial.
Infrastructure		
Fencing (especially barbed wire fencing)	Known past and potential	Trauma has been identified as the primary cause of death ofSouthern Bent-wing Bats at a maternity site where fencing and other infrastructure has been positioned around the cave (Holz et al. 2020c). Bats are known to become trapped in barbed wire. Barbedwire fences placed in flight paths to/from a roost site may cause locally significant levels of mortality (DELWP 2020.
Windfarms	Current and potential	The impact of windfarms on the Southern Bent-wing Bat are unknown, but any windfarms close to a roosting site could potentially have a major impact on that population (DELWP 2020). Windfarm developments pose a number of risks to bats, including cave destruction, mortalities due to collisions and barotrauma (a result of changing air pressure around moving blades), and altered access to foraging areas (Kerr &Bonifacio 2009). Southern Bent-wing Bat mortalities have been recorded at wind turbines (Moloney et al. 2019), however, the population-level and cumulative impacts are still being assessed. International studies suggest that there may be cumulative impacts of windfarms on migratory species, with impacts greater at certain times of the year or under certain weatherconditions (Johnson et al. 2004; Kunz et al. 2007). The riskincreases with proximity of windfarms to important sites, particularly maternity sites or migration paths.
Fire		
Severe bushfire	Potential	The impact of fire on bats is not well understood. Severe bushfire has been shown to reduce the relative abundanceof Eastern Bent-wing Bats (Jemison et al. 2012). Fire coulddirectly impact roosting bats if smoke was drawn into the caves, and foraging habitat and prey availability could be negatively affected (DELWP 2020).

Threat factor	Threat type and status	Evidence base
Accumulation of toxins		
Accumulation of pesticides or other toxins	Potential	A range of pesticide residues, including DDT and DDE, havebeen found in Southern Bent-wing Bats and bat guano at both the major maternity sites (Mispagel et al. 2004; Allinsonet al. 2006). It is unknown if these chemicals have contributed to the population decline of the subspecies. However, sub-lethal exposure to DDE has been reported to increase metabolic rates, which may lead to reductions in body weight and overwinter survival (Allinson et al. 2006). Agricultural pesticides may also severely reduce the abundance of prey species such as moths and their larvae(DELWP 2020).

5.1.6 Current state of knowledge and gaps

The SBWB is one of five Australian mammals listed as Critically Endangered under the EPBC Act. Many aspects of the species ecology and biology remain poorly described and key aspects of proposed conservation measures include investigating what could be driving the decline of the species' population.'

There is a growing body of knowledge about the species movements, both regularly and between maternity caves and non-breeding roosts. Accurate data exists on the reproductive cycle and likely timing of adults arriving to give birth and adults/pups departing at the end of the breeding season. Survey work over recent years Van Harten (2021) has demonstrated that there appears to be movement between, and absences from, non-breeding caves during the non-breeding season, which is a departure from previous opinion that once in torpor, the species would occupy that roost for the duration, emerging at times to forage. This demonstrates that we continue to learn more about patterns of movement and that further work is required to characterise and predict the movements of such cryptic species.

Summary

- There has been increased understanding about the species ecology, however, there are still gaps in knowledge on the movement of the species to/from maternity locations and non-breeding roosts (including non-breeding locations and foraging sites).

6. Response to Scoping Requirements

Note: The risks and impacts referred to in this Section 6 consider the design strategy of the wind farm and in particular the turbine layout. Turbines have been intentionally located to avoid waterways, native vegetation and habitats that support foraging habitat for SBWB. Therefore, the risks and impacts are to be noted as post-mitigation.

6.1 The potential for a significant roost site for SBWB to occur within or in the vicinity of the project area

As has been signalled in Section 5, the distribution of the SBWB is closely aligned to the distribution of caves in southwest Victoria and southeast South Australia. With only two known maternity caves, where significant numbers of the species congregate (August to March inclusive), there is clear evidence that no maternal cave exists within, or in the vicinity of, the MFWF project site. During the non-breeding period, the SBWB is known to disperse across the landscape and the species is documented to primarily use caves for overwintering/roosting. There are a number of lava caves in southwest Victoria, some of which are known to support habitat for breeding, roosting and overwintering SBWB.

Small numbers have occasionally been documented roosting in other regularly occurring landscape features such as rock crevices, rock overhangs, culvert pipes and tunnels. These locations represent an irregular, random spread of a small percentage of the overall population across the landscape. The focus of investigations has been on the potential for a significant, cave-based roost but other, less significant features have also been assessed both on and near the project area.

The cave systems in southwest Victoria are broadly geographically divided into two zones: one of volcanic origin that generally lies inland away from the coast, and the other that is in a belt of limestone and sedimentary rocks along the coast of southwest Victoria. On account of the volcanic-based geology of the MFWF project site, and surrounding landscape, it is relevant to investigate the potential for the presence of caves formed during or after landscape-forming volcanic events (as a potential significant roost site). Caves of volcanic origin develop in association with volcanic vents and scoria cones. In relation to the project site, volcanic vents and scoria cones form landscape features such as Mount Hamilton to the north of the study area and Mount Napier near Penshurst. Also formed were other, smaller landscape features including Mount Fyans to the north of the study area and a smaller scoria cone within the MFWF site known as Mondilibi Hill. Around such features, lava caves and overhangs can/have developed as a result of the partial collapse of lava tube systems that were developed on the flanks and slopes of these features during volcanic formation.

After extensive, ground-based investigation, it can be stated that the MFWF site does not contain any features including underground caves/cavities sufficient or likely to support a significant roost site. It is also unlikely that this habitat occurs within the vicinity of the wind farm site. Further discussion is provided below to support this view.

Table 6.1 includes a list of known cave systems in the vicinity of – i.e. closer than 20 kilometres from – the MFWF site (Davey and White 1986) and includes some historic and current records of SBWB (Mr. K. Grimes pers. comm.) and those listed in the Dundonnell Wind Farm – Flora and Fauna Assessment (BLA 2015). The table also provides evidence that the presence of a cave does not necessarily result in the presence of bats. Figure 6.1 provides the location of the study area in relation to lava caves with records of roosting SBWB in the broader region. The southern edge of the wind farm project site is at least 35 kilometres to the north of all known caves with current records of SBWB roosting activity (see Table 6.2).

From the currently available information, including the National Recovery Plan for the SBWB (DELWP 2020), the MFWF site is not within close proximity to any known roost sites.

Table 6.1 Roost caves in the vicinity of MFWF site in southwest Victoria with records of roosting bats

Location	Location Name	Bat Records	Cave type	Proximity to study area (approx. km)
Dundonnell	Mount Fyans Wildlife Reserve	No evidence of bats	Lava cave/ exposed through quarry activity	8
Mount Hamilton	Private land	Old guano documented at southern end of system. No evidence of current use as breeding or non-breeding site.	Lava cave	17

Summary

- There are no known maternity or non-breeding sites within the vicinity of the MFWF site.

6.1.1 Ground-based assessments of locations with potential habitat structures

To assess the potential for a significant roost within the vicinity of the project site, caves, cave complexes and overhangs at Mount Hamilton, Mount Fyans and Mondilibi Hill were systematically searched by a Biosis zoologist and two experienced speleologists (affiliated with the Victorian Speleological Association) on 4–5 September 2013. There is documented evidence of cavities and cave complexes from Mount Hamilton and Mount Fyans based on previous inspections (Mr. K. Grimes pers. comm.). Mondilibi Hill had not been previously inspected for potential roost habitat. All possible roost sites at each location were examined by going underground (where underground habitat was found) and looking for evidence of bats, which included searching for roosting bats, new or old guano, skeletal remains and any other evidence that might suggest occupation. The system at Mount Hamilton is relatively complex and includes three portals which were accessed from the surface. Owing to its complexity, this cave took a full day with three experienced staff and contractors to fully examine all possible parts of the system.

Three locations that occur within and within the vicinity of the MFWF project site were identified as sites with some potential to be used by roosting SBWB. They are all unique in their layout and complexity and each of the sites is described in detail below.

- **Mount Hamilton complex** – seventeen kilometres northeast of the MFWF study area. This is a complex lava cave system and one of the largest volcanic cave systems in Victoria. The Mount Hamilton cave complex is divided into three sections, each of which is accessed by a separate, small porthole-style entrance. Plate 6.1 illustrates the entrance known as H-3 which gives entry to what is known as Sausage Cave. This is the northernmost of the three complexes at Mount Hamilton. The main complex consists of

a series of interconnecting passages, enlarged chambers and domes. The system is gently dipping from north to south and reflects the topography of the surrounding site. Water pools in the lowest portion of the complex were present during the survey.

- All portions of the complex were accessible during the 2013 survey, despite several constriction points that made access more difficult. No evidence of recent bat roosting activity was observed. Historic guano (guano that was considered to have been present for many years without any recent accumulations) was evident at several locations within the main complex. The porthole entrance at H-3 was blocked by wire netting, and it was considered that entry and exit by bats was not possible through this blockage. Mr. K. Grimes noted that previous visits in the past had also observed the presence of this blockage and of historic guano, which had not further accumulated since previous visits.
- The conclusion of the assessment at Mount Hamilton was that SBWB were currently not utilising the cave system. Based on the multiple visits by Mr. K. Grimes and his observations of no additional accumulation of guano, it was concluded that no future investigation was warranted. The Victorian Speleological Society has been contacted regarding any further information it may hold to support the SBWB roost investigation; however, no reply has been received.

Plate 6.1 Porthole-type entrance known as H-3 at the Mount Hamilton lava cave complex

- **Mount Fyans** – nine kilometres northeast of the MFWF study area. The cave complex at Mount Fyans is within the Mount Fyans Wildlife Reserve. This is the site of a former scoria stone quarry. Past quarrying operations have exposed several narrow vertical tubes and pipes up to 5 metres long and an interconnecting, sub-horizontal passage about 1.2 metres high and about 30 metres long in the floor of

the former quarry. The passage is accessed via a small porthole-type entrance in the western section of the quarry. The passage is largely free of debris and can be followed to either end before pinching out and ending. There appear to be no other surface indications that more passages or lava caves occur within the Mount Fyans Wildlife Reserve.

  - The site was fully searched during the 2013 field survey and again in 2019. No evidence of roosting bats was observed, and there was no evidence of guano to suggest any historical usage by bats.

- **Mondilibi Hill** – a small scoria cone on Down Ampney property, located east of Salt Creek. This site has several small overhangs near the summit and on the eastern flank that extended laterally for several metres. Several smaller openings as shown in Plate 6.2 were found on the southern flank of the scoria cone; however, these were too small to be entered and it could be clearly seen that they did not extend laterally for any distance and did not develop into larger chambers. The survey undertaken was able to demonstrate that:
  - No evidence of roosting bats was observed, and there was no evidence of guano to suggest any past usage by bats.
  - Rock overhangs on the scoria cone were not typical of SBWB roosts due to their small size, level of exposure and lack of lateral extent.
  - Small surface cavities did not extend into larger cavities that could form suitable roosting habitat.

Plate 6.2 Small lateral entrance on southern flank of the Mondilibi Hill scoria cone, Down Ampney property

A supplementary report was prepared (Thomas 2019) following discussions with DELWP. The report is included in Appendix 3 and describes, in further detail, the methods used, and conclusions reached – supporting the initial assessment of Mondilibi Hill as providing no potential bat roosting habitat. A short summary of the findings of the report follows:

An investigation of Mondilibi Hill was carried out by Thomas (2019) with assistance from Mr. K. Grimes. Due to his extensive knowledge of cave systems within the range of SBWB and his prior involvement in assisting with ecological projects involving bats, Mr. K. Grimes was recommended by Dr Lindy Lumsden (DELWP bat expert and co-author of the SBWB recovery plan).

For the purposes of the assessment, Thomas (2019) defined a 'major roost site' as containing tens of individuals of SBWB, roosting infrequently over multiple years. Based on the definition, a fine-scale survey was carried out to identify small landscape features. We note, however, that it is well documented and agreed that large cave systems are preferred overwintering habitat. Thomas (2019) notes that all known major roost sites in Victoria's volcanic plain are in caves formed by lava tubes and no scoria cone volcano has been identified as having cavities that support a major roost site.

Individually, small landscape features could not be reasonably considered as significant roosting sites.

The survey effort at Mondilibi Hill identified and investigated all small overhangs and openings. These were determined to be either not typical of SBWB roosting habitat or did not extend inwards for any distance or develop into a larger chamber. The largest cavity observed had an opening of 25–30 centimetres in diameter and was estimated to extend inwards approximately one metre; it showed no indication of opening up laterally in any one direction.

At no time while conducting surveys of the Mondilibi Hill did Thomas (2019) observe any evidence of roosting bats, nor was any evidence found of guano or skeletal remains to suggest any historical usage by bats. All observable surface joints at the summit of the cone were investigated and were found to be too narrow (i.e. pinched towards the base of the joint), with no observable cavities.

Additional investigation of Mondilibi Hill was carried out in 2019, to further identify any evidence of potential roosting by SBWB. This was carried out by a combination of Biosis staff and sub-contractor Gavin Thomas who had carried out the previous surveys (Biosis 2020, provided in Appendix 5). Many fissures were considered to provide poor or unsuitable habitat due to a combination of shape and size, giving poor protection from the elements or predators. All joints and fissures were examined for evidence of current or historical use by SBWB. The results of these surveys further reinforced the initial findings as no evidence of SBWB roosting or a significant roost site could be identified.

To complement a significant and already reasonable field-based survey effort, a supplementary report was prepared (Rosengren 2019, provided in Appendix 4) which describes the geomorphology of the Mondilibi Hill scoria cone and the likelihood of the landform containing cavities that could be used as a major SBWB roost.

Rosengren (2019) states, due in part to his experience with the work of Mr. K. Grimes, that he supports the findings of Thomas and Grimes (Thomas 2019) that the structural features of the Mondilibi Hill cone did not provide any cavities or openings large enough to be considered suitable habitat for a major SBWB roost site.

Rosengren (2019) also included assessment of the likelihood of the surrounding area containing cavities with a surface opening. For the Mondilibi lava flow, Rosengren (2019) found that if cavities beneath the lava flow existed then the likelihood of entrances occurring would be very low. The area with a higher likelihood of cavities with surface access is the Mount Fyans lava flow, 12 kilometres northeast of Mondilibi Hill, where there is evidence of a system of underground water conduits (which may indicate cavities suitable for bat roosting) but no evidence of SBWBs (or any other bats species).

It was determined during 2019, in consultation with DELWP, that additional assessments should be undertaken at Mondilibi Hill and other areas with potential to support roosting habitat in the surrounding landscape. These additional assessments would be based on the geomorphological features of the site, identifying other areas that had not previously been examined in detail (Rosengren 2019).

The following habitat was determined the most likely to support SBWB roost habitat:

- Salt Creek escarpment
- Stradbroke property stony rises
- Mt Fyans Lane – Stradbroke property
- Mondilibi Hill – Down Ampney property
- Mount Fyans Wildlife Reserve
- Mondilibi lava flow

These assessments were conducted in October, November, and December of 2019. Full details of the additional ground surveys are provided in a separate report (Biosis 2020).

In summary, the ground surveys were carried out across the site within habitat that was determined to be the most likely to support SBWB roosting, based on Rosengren (2019) and discussions with DELWP. The assessment of each habitat included investigation of all cracks, fissures, lava caves, cave complexes and overhangs within discrete landscape features/areas. All potential roost habitat at each location was examined by visual inspection, and, where feasible, searching in cavities, under rocks and in cracks and fissures between rocks to look for evidence of bats – including new or old guano, skeletal remains, and any other evidence suggesting occupation by bats. Where underground inspections were possible, an assessment of the internal structure of the cavities was also made to identify any internal architecture consistent with that observed in other caves known to support significant roost sites. The inside of each of these cavities, where identified, was examined with a high-powered LED torch to check for current or historical use by SBWB. Cavities that were not physically accessible were visually inspected using a video burrow scope. Extensive images of individual openings were recorded and geo-tagged using a camera with a built-in GPS.

Based upon these observational findings, it can be concluded that none of the landscape features contains any evidence to indicate the presence of SBWB, nor do they indicate current or historical use as a SBWB roost. Biosis (2020), provided in Appendix 5 states: "*Furthermore, none of the cavities inspected during this survey could be considered as suitable habitat for a significant SBWB roosting site.*" At meeting with DELWP in December 2020, L Lumsden supported the conclusions of this survey Biosis (2020), at Appendix 5 and the lack of evidence of any significant roost habitat onsite or nearby.

6.1.2 Mondilibi Hill potential roost investigation using other methods

To complement the ground-based investigations of Mondilibi Hill, several other survey techniques have been carried out. These surveys have consisted of deploying harp traps over openings described above, the use of SM4 Songmeters and Anabat Swift Detectors, the use of Flir E60 handheld thermal imaging camera and handheld Echometer Touch to monitor any bats in real time and monitor for any bats exiting openings. Zoologists were present to monitor the harp traps, Echometer Touch and Flir E60 from before sunset until several hours past sunset when the harp traps were removed. Key dates for surveys were:

- 20 December 2017. It is acknowledged that in December, the female breeding population and many males will largely be resident at known breeding sites. Nonetheless, we undertook this survey onsite in December to account for any non-breeding individuals that might have been present.
- 19 April 2018. This survey was carried out in consultation with DELWP to investigate the site during a period in which SBWB calls had previously been recorded at Mondilibi Hill. Call analysis was completed using Anascheme.
- 22–23 October 2019, 4–5 November 2019 and 4–5 December 2019. This period was chosen again to investigate the site during a period in which SBWB calls had previously been recorded at Mondilibi Hill.

Two harp traps were deployed on these dates as described above as well as collecting call data and using the thermal camera.

No SBWB or other bats were observed via thermal camera exiting the locations monitored on the two nights of survey at Mondilibi Hill in December 2017 and April 2018, and the same result was noted during the 2019 surveys. A single bat was observed via the thermal camera flying above Mondilibi Hill during both the December 2017 and April 2018 surveys, and a Long-eared Bat call was recorded in the December 2017 survey. No bats were trapped in the December 2017 survey, and one Lesser Long-eared Bat was trapped in the April 2018 and the October 2019 surveys. The active and passive detectors that were used during the three surveys (2017, 2018 and 2019) did not record any calls of SBWB at sunset. The passive detectors that were deployed overnight did not detect any SBWB activity on the night of the December 2017 survey; however, SBWB calls were recorded during the night of the second survey, in April 2018, and the 2019 surveys also recorded SBWB call activity. Further analysis of call timing is provided in Section 6.3.

Summary

- 'Significant' or 'major' roost sites are defined as those supporting tens of individuals of SBWB, roosting infrequently over multiple years.
- Extensive exploration and surveys have been undertaken throughout the study area, within and in the vicinity of the MFWF project site.
- No evidence supports the theory of current significant roost sites in the vicinity of the project site. This is demonstrated by extensive and repeated ground surveys and active and passive measures, such as the use of a thermal imaging camera, acoustic detection and use of harp traps.
- Due to the highly disturbed nature of the majority of the project site, lack of foraging habitat and as confirmed by extensive surveys to date, there is very low potential for a significant roost site to occur within or in the vicinity of the project site. It is more likely that a roost exists somewhere within the vicinity of the site that is used opportunistically by smaller numbers of individuals.

6.2 Describe other known roosts for SBWB in the region and how they interact with foraging activity of the SBWB at the project area

6.2.1 Known roosting sites in the region

As has been described above, it is known that the SBWB is reliant principally on cave systems for roosting habitat. The known significant roosting locations in the region are well documented. Figure 6-1 and Table 6.2 are provided to describe these known sites. In terms of proximity to significant roost sites, the MFWF site is located approximately 50 kilometres northeast of Starlight Cave maternity site and 35 kilometres northeast of non-breeding roosts at Panmure and Grassmere. These locations are noted as supporting important populations for breeding and non-breeding roosts in the National Recovery Plan for the SBWB (DELWP 2020).

As has also been outlined above, there is evidence that smaller numbers of the SBWB are likely to roost at other regularly occurring landscape features. Based on the available evidence, individual locations cannot be described.

Figure 6-1 provides the location of the study area in relation to lava caves with records of roosting SBWB in the broader region.

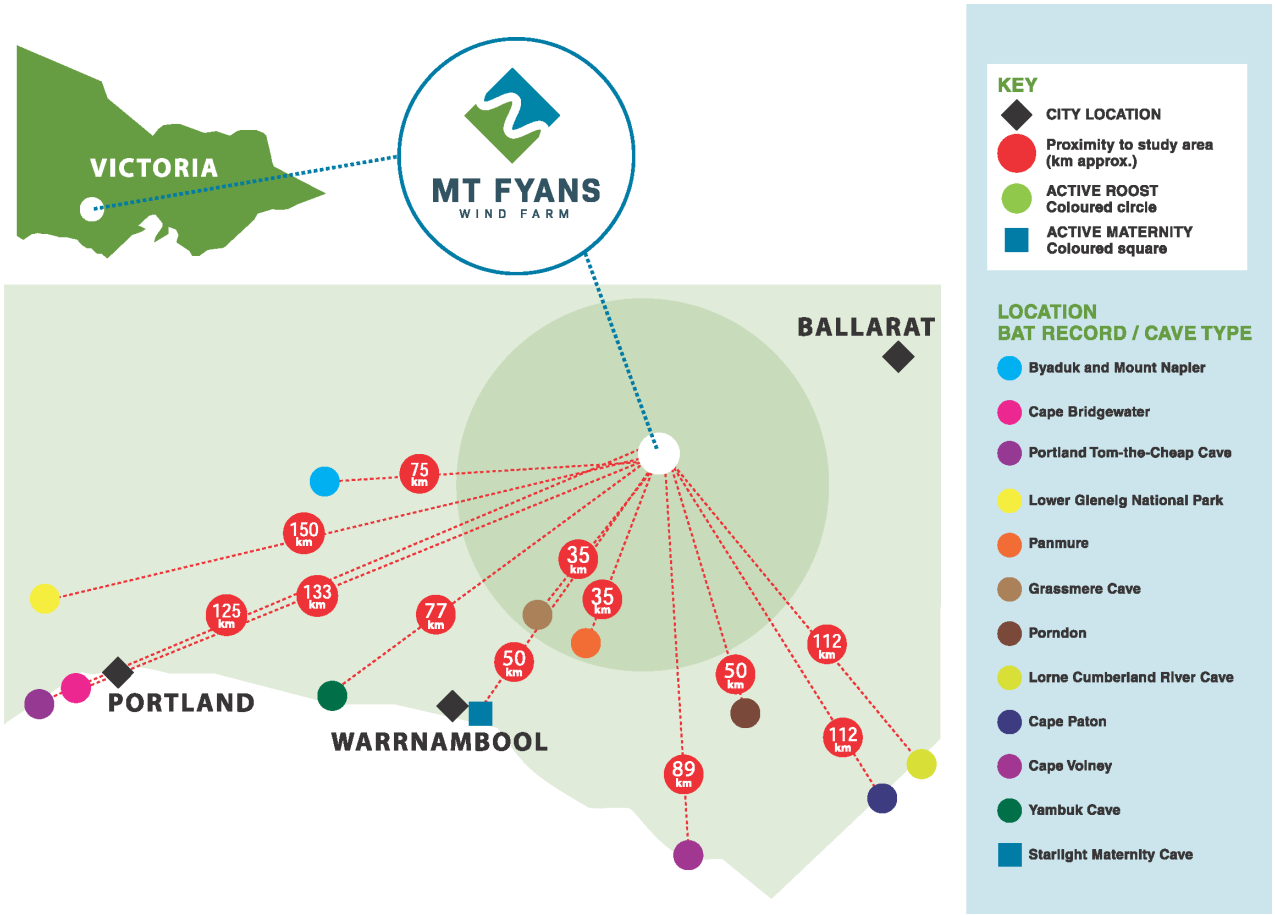


Figure 6-1 MFWF study area in relation to SBWB cave roosting records within the region

Table 6.2 Roost caves in southwest Victoria with records of roosting bats

Location	Location Name	Bat Records	Cave type	Proximity to study area (km approx.)
Panmure	Panmure	Many bats, SBWB. Currently used as an identified, important non-breeding roost.	Lava cave	35
Grassmere	Grassmere Cave	Currently used as an identified, important non-breeding roost.	Lava cave	35
Skipton	Mount Widderin	Extensive guano (mined). SBWB (skeletal only, no live bats since mining at the end of the 1880s, prior to which they were known to be abundant).	Lava cave	45
Timboon	Timboon	VCAT Reference No. P1648/2018 *Naroghid Wind Farm Pty Ltd v Minister for Planning [2019]* VCAT 800 pg. 37. Currently used as a non-breeding roost.	Lava cave	45
Warrnambool	Starlight Cave	Critically important, currently used maternity cave.	Sea/Limestone cave, maternity cave	50
Porndon (SSW of Pomborneit)	Porndon Arch	Formerly mined for guano, many bats including SBWB. Currently used as a non-breeding roost.	Lava cave	50
Byaduk and Mount Napier	Byaduk Caves	Many bats including SBWB. Currently used as a non-breeding roost.	Lava cave	75
Yambuk	Yambuk Cave	Recorded use in past 10 years.	Limestone cave	77
Budj Bim National Park	Mount Eccles	No bats recorded or guano records.	Lava cave	80
Cape Volney	Western Otways (Un-named)	Currently used as an identified, important non-breeding roost.	Sea/Limestone cave	89
Cave Eastern Otways	Lorne Cumberland River	Currently used as an identified, important non-breeding roost.	Sea/Limestone cave	112
Eastern Otways	Cape Paton	Currently used as an identified, important non-breeding roost.	Sea/Limestone cave	112
Portland, Bats Ridge Wildlife Reserve	Tom-the-Cheap Cave	Currently used as an identified, important non-breeding roost.	Limestone cave	125

Location	Location Name	Bat Records	Cave type	Proximity to study area (km approx.)
Portland	Cape Bridgewater	Currently used as an important roost and maternity cave.	Sea/Limestone cave	133
Lower Glenelg National Park	Un-named	Currently used as an identified, important non-breeding roost.	Limestone cave	150

6.2.2 Foraging activity (behaviour) and habitat

A general summary of SBWB foraging activity and habitat is described in Section 5.1.3.

The Mt Fyans Wind Farm Flora and Fauna Existing Conditions Report (Biosis 2022a) Table 2 describes the sparse nature of vegetation and wetland habitat that may be considered focal points for the species on the site. Treed vegetation exists almost entirely as planted shelter belts consisting of rows of sugar gums, cypress, and other shrubby vegetation. There are ten individual remnant trees within the turbine layout occurring predominantly as single, isolated trees. These are not considered focal points for foraging SBWB. There are no remnant woodland areas that are within or near to the turbine layout.

Many wetlands in the region have been modified and some have been permanently drained. In order to determine which further waterbodies may represent reliable foraging and drinking resources for Southern Bent-wing Bats a study was undertaken by CPU Australia (2021). It scrutinized publicly available water observations from space (WOfS) datasets available from Geoscience Australia for a 32-year period (1987 to 2019) to assess the likelihood of water bodies occurring within the project site. The analysis of the WOfS dataset using frequency of surface water provides a reliable indication of the position of semi-permanent and ephemeral waterbodies within the Mt Fyans project site. Refer to Fig 6.2 showing the position of water bodies meeting those parameters.

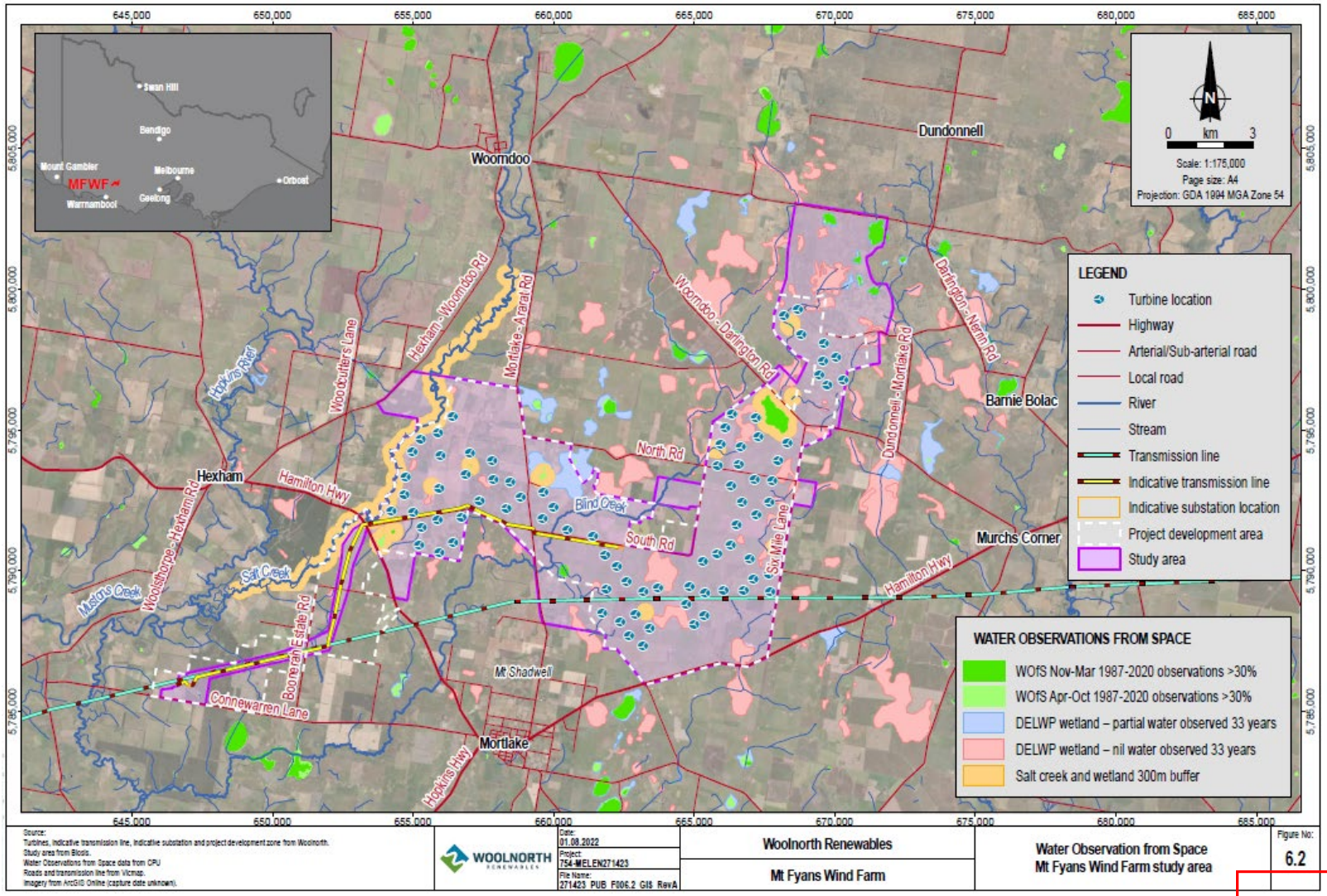


Figure 6-2 Mt Fyans Wind Farm Water Observation from Space

6.2.3 Knowledge of SBWB movements

The pattern of SBWB roosting activity and associated behaviour is now known to be far more complex and diverse than has previously been described.

Previously SBWB roosting and 'migration' behaviour was generally understood as:

- SBWB gathering at one of two maternity caves in early spring, after 'migration' from overwintering caves, via transition caves.
- SBWB giving birth and staying in maternity caves until autumn, when they would 'migrate' back to overwintering caves (via transition caves).
- SBWB going into periods of torpor for several weeks at a time during winter. It was understood that SBWB would stay at the same cave over the winter period.
- SBWB generally being radial foragers. To conserve energy, it is considered that SBWB tend to focus their foraging activity in areas close to their base roost location.

More recent research has revealed a more diverse pattern of roosting activity. Rather than having a strict migration pattern and travel routes, SBWB disperse from key maternity caves to a wide range of locations and may move between roosts across the year, particularly during the non-breeding season.

It is now known that SBWB (and Eastern Bent-wing Bats) can fly very quickly and cover long distances in a single night.

- A survey at Bat Cave in South Australia traced an individual SBWB flying 45 kilometres from its cave, before returning to the cave over two consecutive nights. The flights followed a looping pattern rather than straight lines, and the 45 kilometre linear distance was travelled in approximately 2 hours (SWIFFT Conference Notes, July 2012).
- A survey of two bat caves 70 kilometres apart in South Australia found that a significant number of bats move between the caves in single night, with trips taking as little as 3 hours 32 minutes (Emmi Van Harten PhD data, Lindy Lumsden pers. comm.). Additionally, some individuals have been tracked as making the return (140km) journey in one night (TSSC 2021)
- Eastern Bent-wing Bats and closely related SBWB have been tracked making nightly forays of 50–60 kilometres from the roost (Mills and Pennay 2017).
- Eastern Bent-wing Bats are among the fastest bats in Australia and can fly at speeds of 40–50 kilometres/hour. They can fly 20–25 kilometres to the foraging site in 30–40 minutes (Mills and Pennay 2017).

It has also been documented that SBWB move between roosting sites through the year and sometimes for very short periods of time. They do not necessarily return each night to the same roost (Lindy Lumsden pers. comm.).

- A survey of bat movements between two caves used in winter in South Australia showed that a significant proportion of bats left the main cave for other roosts. One bat made four direct trips between the two caves 70 kilometres apart in one week (Emmi Van Harten PhD data, Lindy Lumsden pers. comm.).
- In South Australia during the maternity season, in some years, a large proportion of bats leave the maternity cave for other roosts for several weeks before returning and staying until late May, when the main dispersal begins (Kerr and Bonifacio 2009).

SBWB use a range of roost caves and may also roost in a range of other habitats:

- Monitoring and a comparison of numbers between the South Australian maternity cave and other known roosting caves has indicated that many bats are likely to disperse to unknown sites (potentially other landscape features) (Kerr and Bonifacio 2009).
- It has also been shown that SBWB are capable of travelling distances of 23–25 kilometres to and from the Bat Cave maternity site, and radio-tracked individuals have been recorded 35 kilometres from a roost site (Grant 2004, Bourne 2010). However, examples also show that individual's radio-tracked from the Naracoorte maternity cave predominantly foraged along a forested ridgeline within 3–4 kilometres of the cave (Grant 2004).

SBWB call activity has been identified through a range of wind farm assessments at significant distance from known SBWB roost caves. The Dundonnell Wind Farm study identified potential foraging activity approximately 53 kilometres from the closest known roost cave, and the Bulgana Wind Farm assessment identified potential foraging activity approximately 130 kilometres from the closest roost cave. As with the SBWB observations at MFWF project site, these detected observations may also be the result of small numbers of SBWB roosting at other features across the landscape. Alternatively, these detections may be associated with, or the result of, these larger length/scale movements.

The overall spatial pattern of all SBWB movements, including foraging activity, and the key factors that influence it are not known. Foraging areas include forested areas, volcanic plains, wetlands, coastal vegetation (including beaches), grazing and agricultural land, and urban areas. Primary habitat is predominantly woodlands near large natural wetlands, river basins and agricultural areas (Churchill 1998). Flight is usually fast, typically in open spaces (Dwyer 1969). Where there are trees, the species flies just above the canopy to many times the height of the canopy. However, in open country, flight may be 6 metres above the ground (Churchill 2008 cited in Kerr and Bonifacio 2009). The National Recovery Plan for the SBWB (DELWP 2020) does note that there is limited information available on foraging habitat used by the species.

6.2.4 Potential for the SBWB to access MFWF from known roosting sites

As described above, although there are documented long-distance movements of the SBWB, SBWB like other bats of the Microchiroptera suborder (i.e. microbats) have a large area of naked body surface on the wings, meaning they can lose large amounts of water quickly and are susceptible to dehydration.

Based on the available information as presented above, it is possible that individuals that roost at known non-breeding roost sites (e.g. Panmure, Grassmere) could forage out to within the distance of the MFWF site. The same could also be concluded for individuals that are roosting at the Starlight Cave maternity site; however, Starlight Cave is even further away than the nearest known non-breeding roosts. Based on the location of nearby roosts within the region, several of the closer locations are possible source roosts of the SBWB that have been recorded utilising the MFWF project site, as well as those recorded at other nearby sites such as Dundonnell Wind Farm and Mortlake South Wind Farm. As stated above, it is also reasonably likely/possible that the bat activity data recorded at these sites (Dundonnell, Mortlake South and Mt Fyans) is representative of the low numbers of bats roosting in other landscape features (as has been described above).

The consideration of influential factors is outlined in the following section.

It is likely that the presence of wetland and woodland habitats draw SBWB to forage in landscapes containing these features. Due to the highly disturbed farming nature of the MFWF project site and surrounding areas, there are few habitats of this type to support foraging activity and therefore few attraction factors to cause SBWB to access the area from roost sites.

Within the region of the MFWF project area, there are a range of potential roosting scenarios that could result in foraging activity. These include:

- The project area is within the nightly foraging distance of Warrnambool, Grassmere and Panmure caves. SBWB may possibly be both leaving and returning to these caves while foraging in the Mortlake/Mount Fyans area.
- SBWB in the project local area may be roosting in other habitat types in proximity to the site as well as roosting at major underground caves such as at Warrnambool, Grassmere or Panmure. SBWB may be arriving from or returning to these caves on different nights along with roosting in other locations, to the north of these caves, closer to the project area.
- There may be undiscovered roost sites in the wider region that provide opportunities for SBWB to forage on a wider basis than around the known roosts. This may cater for fewer than tens of SBWB (therefore not deemed 'significant roosts') used on annual and infrequent or opportunistic and irregular basis.

6.2.5 Evidence of foraging activity at the project site

Call activity analysis at Section 6.3 suggests that recorded activity is predominantly from smaller numbers of SBWB foraging around the detector area across the night. This is consistent with the foraging activity of the species as outlined in the National Recovery Plan for the SBWB (DELWP 2020), of individuals constantly in flight sometimes meandering between areas after 5–15 minutes of foraging or flying to a particular foraging area and remaining there for one or more hours. It is therefore possible for recorded activity to represent a single bat making multiple passes at a detector as it forages within the area over a short period of time.

In conclusion, there is a reasonable likelihood that bats leaving the maternity cave and/or significant regional roost sites could forage at locations within the wider region and could utilise smaller annual/opportunistic roosts to extend their foraging range.

Summary

- It is possible for SBWBs to forage at/ in the vicinity of the MFWF project site from known roost sites (distant from the site).
- SBWB are more likely to forage at locations near known roosting sites and at locations that provide habitat for their food sources, such as permanent wetlands, swamps, other bodies of water, possible waterways, and remnant woodlands. Ephemeral water bodies and wetlands together with non-native and native shelter belts may present additional opportunities for foraging (TSSC 2021).
- The MFWF site and immediate surrounds have been highly disturbed for the purposes of farming activities. There are no significant landscape scale features that are likely to provide a focal point for large numbers of foraging SBWBs. Regularly occurring landscape features such as farm dams, low-lying areas and paddock trees are present at the project site. Permanent-water locations ideal for foraging may be found to the south and north of MFWF project site.
- The recorded SBWB call activity at the project site is likely to be significantly influenced by the lack of known roost sites in close proximity as well as the lack of key foraging habitats.

6.3 Characterise SBWB activity within and near the project area including seasonal use of the site and use of different habitat types

Detection and identification of SBWB

Characterisation of SBWB activity within and near the MFWF project area has been conducted across several years, principally using acoustic survey techniques. Microbats utilise high-frequency sounds for echolocation, enabling them to examine their environment while flying (navigating) and targeting airborne prey. Microbats make

a range of vocalisation, including search phase calls while flying, and when foraging most species alter their calls to provide additional resolution and detail for targeting small insects.

Acoustic surveys involve use of high-frequency microphones and recording devices to detect and record bat calls within the range of the microphones. Most microbat species (including SBWB) have calls that are at a high frequency and cannot be detected/heard by the human ear, so the use of specialised recording equipment is required.

In some cases, these calls can be identified to species level, but this is a difficult process due to the natural variability in calls and the degree of overlap between other bat species occupying the same habitat areas. Unlike birds, which use vocalisations for social reasons and therefore generally make species-specific noises, bats use vocalisations for navigation and foraging. Species that fly in similar habitats and seek out similar prey are likely to have similar call characteristics, and it may not always be possible to distinguish between species based on call analysis.

Acoustic surveys provide an indication of bat activity levels, but the data cannot be used to determine the number of individuals, since the same individual may fly past the detector multiple times. Neither does the data provide direction of travel of individuals or other aspects of behaviour. Recordings are time-stamped, so provided the call can be identified, a recorded call provides information that an individual of the species was present at a particular time and location.

Microbats may be surveyed by other techniques, such as trapping with harp traps or mist nets, but these techniques are highly limited by availability of suitable trap sites where bat activity may be concentrated. Trapping is only effective at catching bats flying very close to the ground, up to a height of approximately 4 metres. Trapping with harp traps has been used to investigate if bats are flying out of cavities at Mondilibi Hill, but the technique has not been applicable elsewhere for the project.

Details of the acoustic detection surveys conducted for the MFWF project are outlined in the following section.

6.3.1 Acoustic detection surveys

Objectives of the studies

The acoustic detection surveys were completed to determine presence or absence of SBWB throughout the site and to provide a comparison of data from different years, seasons and habitat variation, and to compare proposed wind turbine areas to non-turbine areas.

All survey locations are shown in Table 6.2.

Survey locations and methods

Survey 1 (2016)

An acoustic detector (SM2 songmeter) was mounted on the (only) meteorological mast (met mast) located within the project area (Survey 1). The height of the met mast detector was 50 metres. A second detector was deployed at the mast base at one metre above ground level, to provide a potential comparative dataset. The met mast monitoring occurred for seven nights, spanning **25 February 2016 – 2 March 2016**. SM2 Songmeters were used to monitor for ultrasonic bat calls from sunset until sunrise, with calls recorded in zero-crossing format. This met mast was located in an open, heavily grazed paddock with very little wooded vegetation nearby or other features such as water bodies. The location is shown as 'MET Mast' in Figure 6.2. This monitoring offered the only practical opportunity to monitor for bat call activity within the lowest point of the potential rotor-swept area in a part of the site representative of the cleared and open areas where turbines are proposed.

Survey 2 (2017)

Following discussions with DEWLP, a site-wide acoustic survey (Survey 2) was completed using ground-based detectors. A 14-night study was conducted on **30 March 2017 – 12 April 2017**, with detectors operating from sunset until sunrise. SM4 Songmeters were used for this deployment and calls were recorded in zero-crossing format.

Eight sites were chosen to represent the range of different habitats present throughout the landscape and included open paddocks, planted trees/wind rows and dams/ephemeral wetlands. The survey locations are shown in Figure 6.2. Sites 1, 7 & 8 are representative of open habitats in which turbines will be located.

- Donaldson House (Site 1) is located near Blind Creek, an occasional watercourse, and is representative of open habitat in which turbines are located, although it is outside of the Project Area.
- Stradbroke Laneway (Site 7) is representative of open habitat in which turbines are located and it is located within the turbine layout.
- Stradbroke Shed (Site 8) is representative of open habitat in which turbines are located although it is outside the turbine layout.
-

DELWP requested assessment of wetlands that might provide suitable foraging habitat for SBWB, and two recording sites were found close to wetlands that were considered to be suitable habitat for buffering from turbine locations. These consist of:

- Donaldson Laneway (Site 2), located 200 metres from a large (over 200 hectares), DELWP-mapped wetland, a portion of which holds water for a large part of the year according to GeoScience data.
- Stirling Draffen (Site 5), located 100 metres from an ephemeral, low-lying area in the adjacent paddock which periodically holds water.

Sites 3, 4 & 6 are specific habitats outside of the turbine layout. These consist of:

- Down Ampney Mondilibi Hill (Site 3), a remnant scoria cone woodland (the only remnant woodland on the Project Site).
- Down Ampney Laneway Paddock (Site 4), an endemic aquatic herbland (the only wetland of this type on the Project Site).
- Walmsley Dam (Site 6), a large water body of approximately 10 hectares which is outside the Project Site.

Sites 2, 3, 4, 5 and 6 are categorised separately to sites that are considered to be within turbine-representative habitat and are depicted as either ‘Specific Habitat’ or ‘Wetland’.

Survey 3 (2018)

Following consultation with DELWP regarding SBWB during 2018, it was agreed that the 2017 survey should be repeated for a longer duration. Survey 3 used the same survey locations and equipment that were used in 2017 (Survey 2). Calls were again recorded in zero-crossing format. The survey was carried out for 35 nights, spanning **19 April 2018 – 8 June 2018**.

Survey 4 (2019)

Through ongoing discussions with DELWP regarding the results of the 2017 and 2018 surveys (i.e. Survey 2 and Survey 3 respectively), further survey information was requested to capture the spring and summer periods of 2019 (Survey 4). This survey was separated into two periods, each of three weeks' duration. The first period, for 24 nights total and spanning **22 October 2019 – 15 November 2019,** captured data at the original eight locations from the initial survey. The second survey period, over 21 nights total and spanning **15 November 2019 – 6 December 2019** took in eight new potential foraging locations (as suggested by DEWLP) across the broader region. The overall survey was completed in this way to allow three weeks of monitoring across all sites using the maximum number of available bat detectors (i.e. Biosis could only access 8 detectors for the study).

The inclusion of eight new potential foraging locations was at the express request of DELWP who wished to check the level of bat activity on the project site with levels of bat activity at sites either adjacent to the project site, or within the project site at locations where SBWB may be detected.

The eight new locations included an additional site at both Mondilibi Hill and Walmsley Dam, two new sites inside the turbine layout, and four sites at water bodies or specific habitats remote from the site:

- Down Ampney Reveg (Site 9). This site is within the turbine layout and is located within a young shelterbelt revegetation plantation.
- North Road Cattle Underpass (Site 10). This site is within the turbine layout and was chosen to detect any SBWB that may choose the underpass as an opportunistic roost.
- Hopkins River (Site 12). This is a publicly accessible location close to the Hopkins River, outside and to the west of the Project Site, approximately 9.5kms from the closest turbine.
- Cobra Killuc (Site 14). This site is within a large area of Sugar Gum plantation, outside and to the northwest of the Project Site, approximately 5.5kms from the closest turbine.
- Barnie Bolac (Site 15). This is a large wetland outside and to the east of the Project Site, approximately 6kms from the closest turbine.
- Anders Salt Creek (Site 16). This site is within farmland on the banks of Salt Creek, near the Hamilton Highway and is within the Project Site but outside the turbine layout. This location is approximately 800m from the closest turbine.

The survey locations are shown in Figure 6.3.

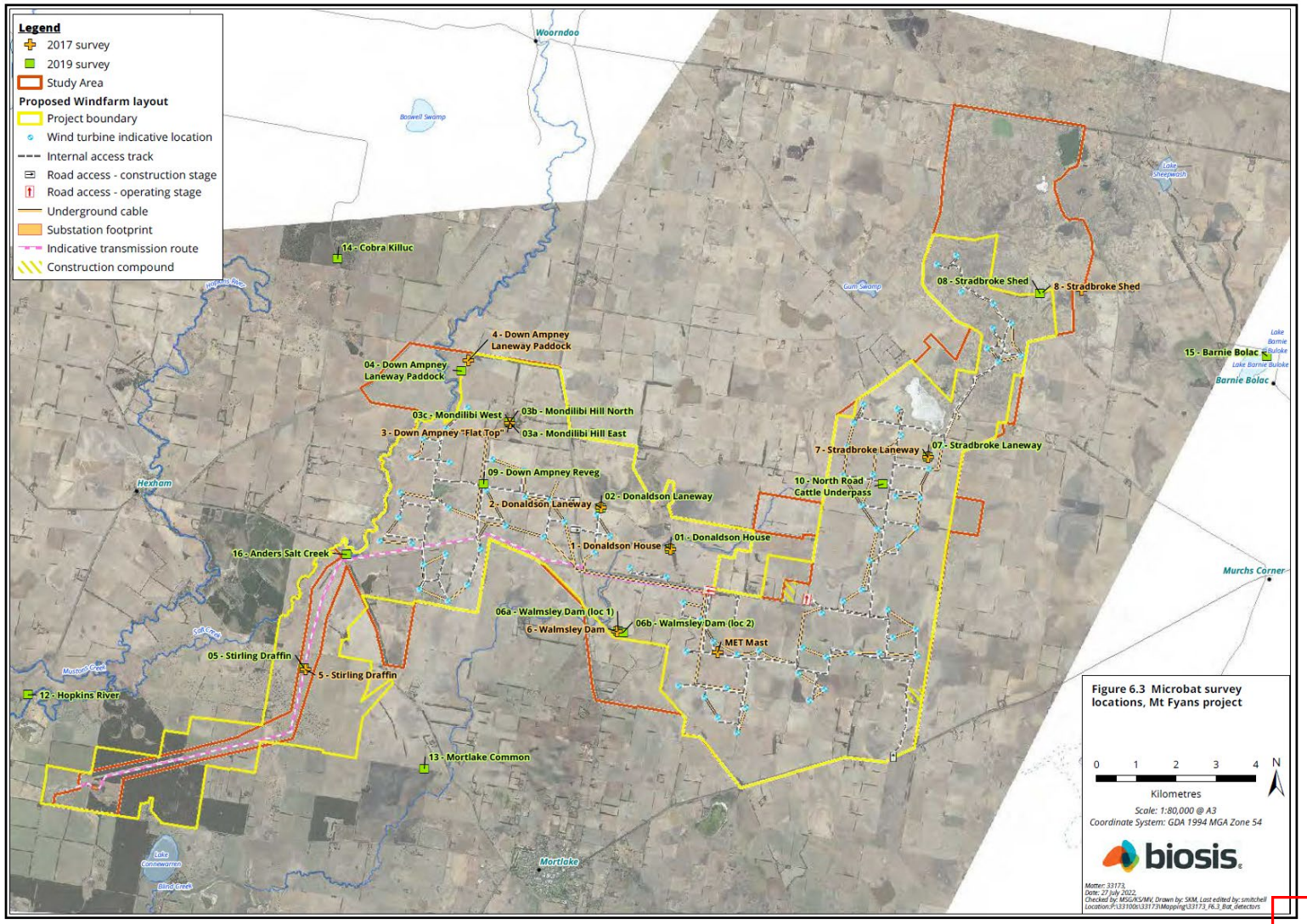


Figure 6-3 Microbat survey locations Mt Fyans project

Acoustic survey data management

Call identification for the 2017 and 2018 data was completed using Anascheme automated software and analysis with the southwest Victorian microbat identification key (20 June 2011) supplied by Lindy Lumsden, DELWP Arthur Rylah Institute for Environmental Research (ARI). The software allocates calls that meet the confirmed SBWB criteria to the species. Other calls that it allocates to 'Unknown SBWB' were subsequently assessed visually in AnalookW software (Chris Corben 2010) and separated into categories as specified in Table 6.3. This analysis was undertaken by Felicity Williams of Biosis.

The 2019 acoustic survey was conducted using Anabat Swift Detectors (Titley Electronics) in zero crossing (ZC) mode. These detectors produced ZC files that were unable to be processed by Anascheme due to a file format incompatibility. Due to this incompatibility, the call analysis was undertaken using the Anabat Insight software (Titley Electronics). Likely SBWB calls were identified using a combination of Anabat Insight filters and manual checking, using the following process:

- All call files were processed through Insight using a filter to distinguish between valid bat calls and other noise (other ultrasonic sounds and interference). Files containing only noise were excluded from further analysis.
- An Insight filter was used to flag all calls with an average characteristic frequency (FC) of 45–50 kHz.
- Each of the flagged calls was visually inspected within the Insight software to determine if it satisfied the 'possible SBWB' criteria presented in Table 6.3. This was completed by Matt Gibson of Biosis.

Table 6.3 Call categorisation criteria applied to SBWB call files

Status	Criteria for categorisation
Confirmed SBWB	Call identified as SBWB by the key for the bats of southwest Victoria.
Possible SBWB	• Majority of pulses in the sequence are within the target frequency range of 45–50khz AND show at least one of the following diagnostic features: • Pulses show some flattening/opening rather than long/steep downsweeps • Pulses show angular knee/heel • If 'hooks' are present, they are not cup-shaped (like *V. vulturnus*) and the downsweep is not as straight • If 'droop' is present, it is not just an 'afterthought' (like *C. morio*).

Acoustic survey results and discussion

Document note:

The tables listing data of acoustic calls are coloured as follows for ease of reference:

Data from the MFWF project site outside the turbine layout, focused on wetland and specific habitat suitable for SBWB foraging.

Data from the MFWF project site either representative of, or within, the turbine layout.

Data from Regional locations at distance from the MFWF project site.

The survey conducted from the met mast in summer 2016 (Survey 1) recorded no SBWB calls at the 50-metre-high detector. The ground-based detector recorded no SBWB calls either.

Detectors deployed for Survey 2, spanning **30 March 2017 – 12 April 2017** (early autumn) over 14 nights, recorded a total of 413 calls of SBWB. Of these calls, 220 (53%) were assigned to 'Confirmed SBWB' and while 193 (47%) were assigned to 'Possible SBWB' as defined per Table 6.3. Table 6.4 shows a summary of these results.

Table 6.4 Deployment summary results for SBWB call activity – 2017

Site		Confirmed SBWB	Average calls/night	Possible SBWB	Average calls/night
1	Donaldson House	5	0.36	7	0.5
2	Donaldson Laneway	9	0.64	2	0.14
3	Down Ampney Mondilibi Hill	44	3.14	45	3.21
4	Down Ampney Laneway Paddock	31	2.21	27	1.93
5	Stirling Draffen	2	0.14	0	0
6	Walmsley Dam	124	8.86	99	7.07
7	Stradbroke Laneway	3	0.21	4	0.29
8	Stradbroke Shed	2	0.14	9	0.64
	Total	**220**	**1.96**	**193**	**1.72**

Detectors deployed for Survey 3, spanning **19 April 2018 – 8 June 2018** (late autumn to winter) over 35 nights, recorded a total of 811 calls of SBWB. Of these calls 463 (57%) were assigned to 'Confirmed SBWB' and 348 (43%) to 'Possible SBWB' as defined per Table 6.3. Table 6.5 shows a summary of these results.

Table 6.5 Deployment summary results for SBWB call activity – 2018

Site		Confirmed SBWB	Average calls/night	Possible SBWB	Average calls/night
1	Donaldson House	7	0.2	0	0
2	Donaldson Laneway	24	0.69	15	0.43
3	Down Ampney Mondilibi Hill	78	2.23	128	3.66
4	Down Ampney Laneway Paddock	60	1.71	99	2.83
5	Stirling Draffen	5	0.14	3	0.09
6	Walmsley Dam	268	7.66	93	2.66
7	Stradbroke Laneway	18	0.51	8	0.23
8	Stradbroke Shed	3	0.09	2	0.06
	Total	**463**	**1.65**	**348**	**1**.24

The 2018 survey (Survey 3) found that of the 463 confirmed calls recorded over 35 nights, 406 of these (88%) were at the specific habitats of Sites 3, 4 and 6, targeted due to the presence of potential bat habitat. Results of the 2017 survey (Survey 2) show that of the 220 confirmed calls over 14 nights, 199 of these (90%) were also from the specific habitats of Sites 3, 4 and 6.

Detectors deployed for Survey 4, spanning **22 October 2019 – 6 December 2019** (spring to early summer) over a total of 44 nights in two phases, gave results as outlined in Table 6.6. The survey recorded a total of 678 'Likely SBWB' calls as defined per Table 6.3. Table 6.6 below shows a summary of these results.

Table 6.6 Deployment summary results for SBWB call activity – 2019

Site		Likely SBWB	Average calls/night
1	Donaldson House	44	2.00
2	Donaldson Laneway	63	2.86
3a	Down Ampney Mondilibi Hill East	183	5.72
3b	Down Ampney Mondilibi Hill North	73	3.04
3d	Down Ampney Mondilibi West	9	4.50
4	Down Ampney Laneway Paddock	39	1.63
5	Stirling Draffen	104	4.33
6a	Walmsley Dam (Loc 1)	10	0.43
6b	Walmsley Dam (Loc 2)	37	1.76
7	Stradbroke Laneway	56	2.43
8	Stradbroke Shed	15	0.65
9	Down Ampney Reveg	1	0.05
10	North Road Cattle Underpass	2	0.10
12	Hopkins River	30	1.43
14	Cobra Killuc	2	0.10
15	Barnie Bolac	1	0.05
16	Anders Salt Creek	9	0.43
	Total	**678**	**1.85**

The 2019 survey found that overall, the specific habitat and wetland sites were twice as likely to record bat calls than the turbine-representative areas. Given the different call identification methods used for the 2017 and 2018 acoustic survey periods as compared with the 2019 period, it is problematic to compare all three periods together. However, the average calls per night can be reviewed separately for each survey and this provides an indication of recorded call activity.

These results show that a high level of call activity during the 2017 and 2018 monitoring periods was recorded from the Walmsley Dam (Site 6), with a lesser activity recorded at the same site in 2019. This is a large dam with a significant water surface area and presumably increased insect numbers (relative to the surrounding landscape) on which microbats would feed. As a result, this site may be a focal point for foraging bats, and in this case SBWB.

Down Ampney Laneway Paddock and Down Ampney Mondilibi Hill and are also sites with a higher call activity rate during all monitoring sessions. Down Ampney Laneway Paddock is adjacent to a low-lying paddock with an ephemeral wetland and Salt Creek. Both water bodies may attract bats due to increased insect numbers and activity (relative to the surrounding landscape). The Mondilibi Hill landform has some sparse woodland habitats which may also result in increased insect numbers for foraging SBWB. The higher call activity rates (than detected in the surrounding landscape) in combination with the landform type could have provided the potential conditions for the scoria cone to be used as a roost site. However, the results of the extensive ground surveys in the area, discussed above at Section 6.1, provided no support for such a hypothesis.

It is notable (although not understood) that SBWB call activity was greatest at sites that are geographically closest to each other, including Walmsley Dam, Down Ampney Mondilibi Hill, Down Ampney Laneway Paddock and Donaldson Laneway. Apart from standing water at Walmsley Dam and Down Ampney Laneway Paddock, the remaining sites do not appear to support notable landscape features or habitats that would attract bats. Donaldson Laneway is adjacent to a large, ephemeral low-lying area which has been drained for agriculture. This area holds water for relatively short periods after high rainfall during winter. Down Ampney Mondilibi Hill does support some woodland features which may attract foraging bats, particularly if they are moving through the landscape.

Appendix 6 shows the number of SBWB calls recorded on each night at each site for the duration of each of the 2017, 2018 and 2019 surveys. Between the years/seasons of survey there was low variability in call rates with 2019 recording and average of 1.85 likely calls per night, 2018 recording 1.65 confirmed calls per night and 2017 recording 1.72 confirmed calls per night. It is difficult to ascribe any firm pattern of utlisation from these results, other than to state that the areas of highest call activity often occurred on several consecutive nights, with higher call activity interspersed with periods of little to no call activity. Over the 2017 monitoring period, Walmsley Dam recorded call activity every night and during the longer monitoring duration in 2018, call activity dropped off at this location during the latter half of the survey. This could indicate SBWB reducing activity onsite, and/or individuals having previously foraged subsequently moving on to a winter roost and/or reducing activity.

The call activity per night over all monitoring periods at Down Ampney Mondilibi Hill demonstrates that the site is utilised by SBWB; however, call activity was not high during the 2017 monitoring period. Call activity occurred at a higher rate over the first five nights of the 2018 survey, with lower activity rates recorded for the duration of the remaining survey. Nearby sites such as Walmsley Dam and Down Ampney Laneway continued to record higher nightly call activity over the same time period.

As demonstrated in Table 6.7 below, monitoring sites located near specific habitat or wetland areas had a much higher SBWB activity level in comparison to habitats where turbines will be located, to the ratio of 4.5:1.

Table 6.7 Call activity by habitat type

	Specific habitat sites			Wetland sites			Turbine-representative habitat			Regional sites		
	(3, 4, 6)			(2, 5)			(1, 7, 8)			(9, 10, 12, 14, 15, 16)		
Survey period	2017 (14 days)	2018 (35 days)	2019 (22 Oct. 2019 – 6 Dec. 2019; 45 days)	2017 (14 days)	2018 (35 days)	2019 (22 Oct. 2019 – 15 Nov. 2019)	2017 (14 days)	2018 (35 days)	2019 (22 Oct. 2019 – 15 Nov. 2019)	2017 (14 days)	2018 (35 days)	2019 (15 Nov. 2019 – 6 Dec. 2019)
Average confirmed calls/site/ night	4.74	3.87		0.39	0.36		0.24	0.27				
Average potential calls/site/ night	4.07	3.05		0.07	0.26		0.48	0.1				
Average likely calls/site/ night			2.85			3.6			1.7			0.36
Average calls per habitat	2.30						0.51			0.36		

Overall results, across all surveys, indicate that at specific habitat and wetland sites the average calls per night detected were the highest. SBWB calls from detectors in habitat that is representative of turbine locations (within the turbine layout) recorded a much lower average of calls per night. The results from these detectors, in both the 2017 and 2018 surveys, had an average nightly call rate of <0.5 confirmed calls and <0.5 potential calls (combined average of <1 call per night). In 2019, as described above, the nightly call rate could not be defined with the same level of confidence. The trend, however, was similar with over 50% fewer calls/night detected in turbine-representative areas compared with specific habitat/wetland sites. These average call rates in turbine representative habitat at Mt Fyans, are considered very low compared with sites located closer to known roosting sites or significant habitats. For example, nightly call rates at Portland Wind Farm which is at close proximity to a known roost site (Bats Ridge Wildlife Reserve) were found to be 4.5 confirmed calls per night during survey carried out during 2018 (Biosis unpublished data). The primary mitigation of avoidance, by locating turbines away from potential habitat, will provide effective mitigation of impact on the species (see Section 7).

Summary

- SBWB may be found within the MFWF site around habitat that supports foraging activity, such as specific habitat and wetlands.
- SBWB are five times more likely to be present/have some level of activity in foraging habitats than in open farmland representative of the turbine layout.

6.3.2 Foraging habitat and patterns of activity

The National Recovery Plan for the SBWB (DELWP 2020) describes:

- The characteristic foraging habitat of SBWBs as 'swamps with terrestrial vegetation occurring around the fringes and aquatic vegetation within the swamp itself'
- The typical foraging strategy as involving individuals constantly in flight sometimes meandering between areas after 5–15 minutes of foraging or flying to a particular foraging area and remaining there for one or more hours.

Recent radiotracking data also shows foraging in forested areas and in strips of planted vegetation in farmland.

The call activity of SBWB at foraging sites at MFWF demonstrates two clear patterns:

- A higher level of activity occurred on a relatively small number of nights
- Within nights with a higher level of activity, a large proportion of calls occurred within short bursts of 3–7 minutes.

These patterns indicate that utilisation is not continuous and is of short duration at MFWF.

While the level (number of calls) and duration of the call activity cannot be used to determine the actual number of SBWB associated with foraging sites, it is considered valid to assume that, at a location remote from a known roost site, multiple calls recorded over short periods are more likely to represent a smaller number of SBWB rather than a large number of SBWB moving through a site. At a location closer to a roost site, we would expect that call activity would be more continuous, representing a larger number of bats emerging after sunset.

To further investigate SBWB call activity at foraging habitats throughout the night, an analysis of the timing of calls has been undertaken. Individual calls were recorded at all stages across the night; however, most of the calls were recorded during short blocks of time over consecutive minutes.

During the 2017 acoustic survey period (Survey 2), the highest number of confirmed calls was recorded at Down Ampney Mondilibi Hill on 6 April, with 46 confirmed calls recorded across the night from 7:48 pm to 11:21 pm. Thirty-one of these calls occurred during short blocks of time (8 calls in 6 minutes, 4 calls in 4 minutes, 13 calls in 7 minutes and 6 calls in 3 minutes), totaling just 20 minutes during the night. This resulted in 67% of calls occurring in just 3% of the total time that all calls were recorded on that night. During the 2018 acoustic survey period (Survey 3) at Walmsley Dam, calls were recorded across the night from 6:29 pm on 1 May to 6:03 am on 2 May. Eighty-five per cent of these calls occurred during short blocks of time (5 calls in 4 minutes, 48 calls in 20 minutes, 31 calls in 25 minutes, 7 calls in 3 minutes, 17 calls in 13 minutes and 21 calls in 15 minutes), totaling just 80 minutes of the night. This resulted in 85% of calls occurring in just 11% of the total time that all calls were recorded on that night. Other nights where a higher level of activity was observed show a very similar pattern. This provides evidence that across the nights of recorded call activity, calls were conducted over short durations, not in extended calling events. This aligns with the observation of foraging outlined in the National Recovery Plan for the SBWB (DELWP 2020).

For the 2019 survey period (Survey 4), the two sites with the highest number of calls were:

- Mondilibi East: 184 likely calls over 34 nights
- Stirling Draffen: 104 likely calls over 24 nights.

Mondilibi East displayed a high level of activity in a few peak periods. One hundred and thirty-four calls (73%) were recoded over two consecutive nights (6% of nights). Within these nights, there were also clear peaks of activity:

- Of the 84 calls on 23 November, 60 calls (71%) were over a one-hour period from 10:24 pm
- Of the 50 calls on 24 November, 25 calls (50%) were over a one-hour period from 12:40 am.

Over the 34 nights of recording at Mondilibi East, 85 calls (46%) occurred over this two-hour period. There were 23 nights (67%) during which there were no SBWB calls recorded at Mondilibi East.

SBWB calls were distributed more evenly at the Stirling Draffen site:

- At least 1 call was recorded on each of 21 nights
- 4 or more SBWB calls were recorded on 13 nights
- The largest number of calls on a single night was 16.

Another notable event was at Site 2 (Donaldson Laneway), where across the 22 nights of recording, 43 calls (68% of all calls) occurred on a single night, with 37 of these occurring over an 18-minute period from 1:18 am.

This activity suggests that recorded activity at these sites is predominantly from single or smaller numbers of SBWB foraging around the detector area across the night. This is consistent with the foraging activity of the species as outlined in the National Recovery Plan for the SBWB (DELWP 2020), of individuals constantly in flight sometimes meandering between areas after 5–15 minutes of foraging, or flying to a particular foraging area and remaining there for one or more hours. There is therefore potential for recorded activity to represent a single bat making multiple passes at a detector as it forages within the area over a short period. Conversely, it is likely that total activity recorded at foraging sites over-represents the number of SBWB using these sites.

Summary

The data does provide a sound basis to infer the following:

- Foraging habitats are used sporadically on an intensive basis.
- Most activity recorded at foraging sites occurs during very short blocks of time, suggesting foraging behaviour by individual or small numbers of SBWB making repeated passes.
- Foraging activity is closely aligned to foraging habitats (rather than to turbine-representative areas).
- Foraging habitats have been avoided and buffered during the MFWF layout development.

6.3.3 Emergence of bats

At the request of DELWP, analysis has been undertaken to better understand the timing of SBWB calls across the site. The objective of the analysis is to determine whether the detected bats are likely to be arriving at the study area (MFWF project area) from roosting sites located within close proximity or more regionally. The timing of calls following sunset at all acoustic detectors is presented in Graph 6.1 for 2017–2018 and Graph 6.2 for 2019 below. The timing of sunset has been obtained from Geoscience Australia data and is taken as 'the instant in the evening

under ideal meteorological conditions, with standard refraction of the sun's rays, when the upper edge of the sun's disk is coincident with an ideal horizon' (http://www.ga.gov.au/scientific-topics/astronomical/astronomical-definitions#heading-1). The timing of recordings and sunset has been correlated to Australian Eastern Standard Time (AEST) for comparison across survey periods, with adjustments made to raw data as needed to address time difference resulting from Daylight Savings Time recordings.

Graph 6.1 and Graph 6.2 show the number of SBWB calls recorded within one-hour blocks following sunset.

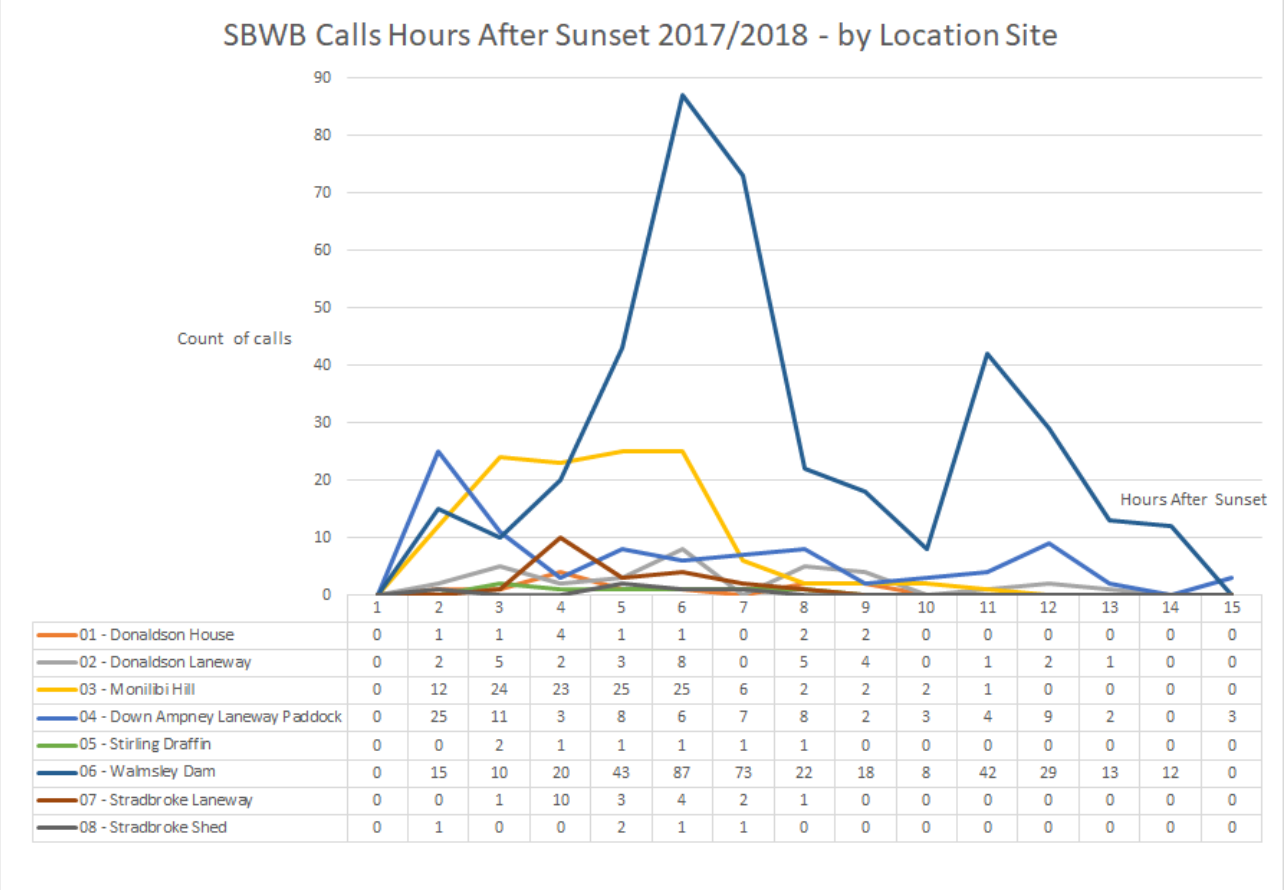
The timing of the dispersal of bats from roosts may vary nightly depending on conditions; however, generally the majority of bats are thought to exit roosts (not long) after sunset. Mills and Pennay (2017) found that Eastern Bent-wing Bats may travel 20–25 kilometres in 30–40 minutes to reach foraging sites. The assessment will therefore focus on the number of calls in 0–30 minutes and 0–60 minutes from sunset to capture potential SBWB arrivals at the MFWF site from the closest known roost sites at Grassmere and Panmure, which are within 35 kilometres of the MFWF site, or alternatively from an unknown roost site closer to the MFWF project area.

All confirmed and potential SBWB calls from across the 2017 and 2018 acoustic survey periods are included in Graph 6.1 at the time following sunset and site in which they were recorded. As mentioned above in Section 6.2.4, movement of SBWB between non-breeding roost sites is largely unknown and a range of potential roosting scenarios are possible.

No calls were recorded before or at sunset (0 hours after sunset), with the earliest call being recorded at Site 4 (Down Ampney Laneway Paddock) 26 minutes after sunset on 7 June 2018. This was the only confirmed call recorded on that survey night across all 8 acoustic detector locations.

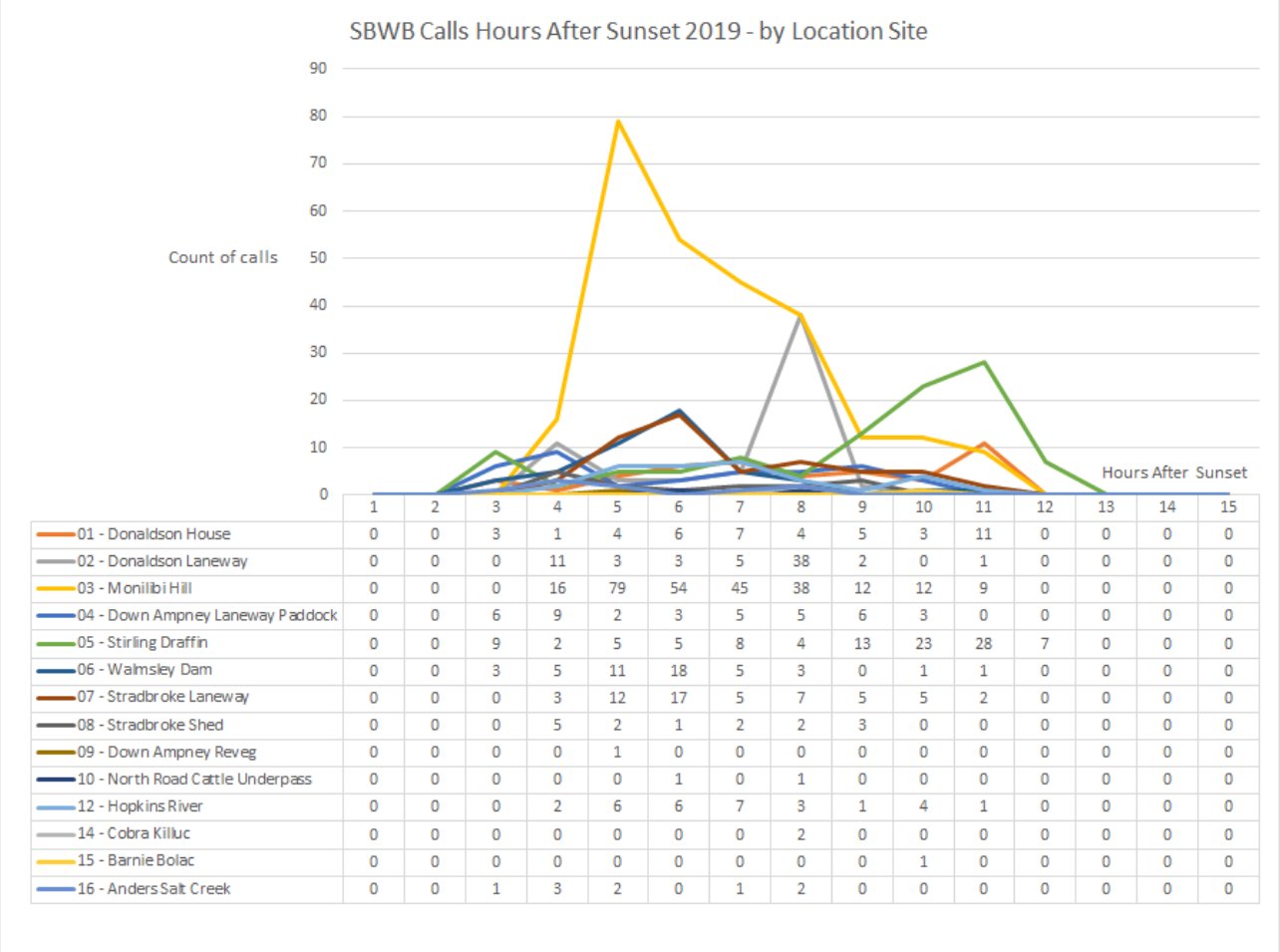
Analysis was also undertaken for the timing of calls following sunset and the sites at which they were recorded based on 'Likely SBWB' calls gathered during the 2019 acoustic survey. This survey program included sites across the region and results are included in Graph 6.2. For the 2019 analysis, numbers of calls have been standardised to compensate for unequal survey periods, and the use of multiple detectors at some sites. Counts of calls are expressed as calls per 21 nights of survey. In the 2019 dataset, no SBWB calls were recorded within the first hour following sunset. At three of the sites (9, 14 and 15), SBWB were only recorded within a single one-hour block, resulting in single peaks in the graph for these sites.

It is important to note that no comparison between the 2017–2018 and 2019 periods is possible, as the two datasets represent different times of year, two separate call analysis techniques and a varying number of sampling nights (survey effort). The data represented on each graph (Graph 6.1 and Graph 6.2) can be compared.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
01 - Donaldson House	0	1	1	4	1	1	0	2	2	0	0	0	0	0	0
02 - Donaldson Laneway	0	2	5	2	3	8	0	5	4	0	1	2	1	0	0
03 - Monilibi Hill	0	12	24	23	25	25	6	2	2	2	1	0	0	0	0
04 - Down Ampney Laneway Paddock	0	25	11	3	8	6	7	8	2	3	4	9	2	0	3
05 - Stirling Draffin	0	0	2	1	1	1	1	1	0	0	0	0	0	0	0
06 - Walmsley Dam	0	15	10	20	43	87	73	22	18	8	42	29	13	12	0
07 - Stradbroke Laneway	0	0	1	10	3	4	2	1	0	0	0	0	0	0	0
08 - Stradbroke Shed	0	1	0	0	2	1	1	0	0	0	0	0	0	0	0

Graph 6.1 Timing of confirmed SBWB calls at all sites following sunset 2017–2018 survey periods



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
01 - Donaldson House	0	0	3	1	4	6	7	4	5	3	11	0	0	0	0
02 - Donaldson Laneway	0	0	0	11	3	3	5	38	2	0	1	0	0	0	0
03 - Monilibi Hill	0	0	0	16	79	54	45	38	12	12	9	0	0	0	0
04 - Down Ampney Laneway Paddock	0	0	6	9	2	3	5	5	6	3	0	0	0	0	0
05 - Stirling Draffin	0	0	9	2	5	5	8	4	13	23	28	7	0	0	0
06 - Walmsley Dam	0	0	3	5	11	18	5	3	0	1	1	0	0	0	0
07 - Stradbroke Laneway	0	0	0	3	12	17	5	7	5	5	2	0	0	0	0
08 - Stradbroke Shed	0	0	0	5	2	1	2	2	3	0	0	0	0	0	0
09 - Down Ampney Reveg	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
10 - North Road Cattle Underpass	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
12 - Hopkins River	0	0	0	2	6	6	7	3	1	4	1	0	0	0	0
14 - Cobra Killuc	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
15 - Barnie Bolac	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
16 - Anders Salt Creek	0	0	1	3	2	0	1	2	0	0	0	0	0	0	0

Graph 6.2 Timing of likely SBWB calls at all sites following sunset 2019 survey

Again, a higher number of calls were recorded at foraging sites compared with open farmland. The number of calls recorded at wetland sites were also noticeably higher than at open farmland sites. For all sites, calls occurred across the night. There were very few calls at regional sites. No calls were recorded before sunset or within 1 hour of sunset, with the earliest call being recorded at Site 6 (Walmsley Dam) 97 minutes after sunset on 22 November 2019.

Further focus on the sunset period for the 2017–2018 surveys is presented in Table 6.8. Since no calls occurred less than 1 hour after sunset in 2019, there is insufficient data to make any representation, therefore no table for 2019 is provided.

Table 6.8 Sunset analysis of calls 2017–2018 survey periods

	Turbine-representative habitat			Wetland sites		Foraging sites				
Site	1 Donald-son House	7 Strad-broke Laneway	8 Strad-broke Shed	2 Donald-son Laneway	5 Stirling Draffen	3 Down Ampney Mondilibi Hill	4 Down Ampney Laneway Paddock	6 Walm-sley Dam	**Turbine-representative habitat (all)**	**Wetland and specific habitat foraging sites (all)**
Calls 0.5 hours after sunset	0	0	0	0	0	2	1	0	0	3
% of total calls 0–0.5 hours after sunset	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	1.1%	0.0%	0%	0.5%
Calls 1 hour after sunset	1	0	1	2	0	12	25	15	2	54
% of total calls 0–1 hours after sunset	8.3%	0.0%	20.0%	6.1%	0.0%	9.8%	27.5 %	3.8%	5.3%	8.4%

SBWB acoustic detection calls that were recorded across the 2017, 2018 and 2019 survey periods were analysed to determine the number of calls that occurred shortly after sunset. The following was found:

- No calls in open farmland and 3 calls in foraging habitat and wetland sites within 30 minutes of sunset across the 2017–2018 survey periods.
- Total of 2 calls in open farmland and 54 calls in foraging habitat and wetland sites within 1 hour of sunset across the 2017–2018 survey periods.
- No calls were recorded within 1 hour of sunset at any site across the 2019 survey period.

For the 2017–2018 survey periods, there was a very low count of calls within the first 30 minutes following sunset, with no calls recorded in open farmland and wetland sites across both survey periods and only 3 calls at foraging sites (total of 0.7% of all calls recorded) with 1 call at Down Ampney Laneway Paddock and 2 calls at Down

Ampney Mondilibi Hill. Twenty-five calls were recorded within 1 hour of sunset at Down Ampney Laneway Paddock. These calls were recorded on 7 separate nights, with 21 or 81% of these calls occurring on 3 nights during very short periods of time. These 3 events are as follows:

- 10 calls occurred within 5 minutes on 19 April 2018. The first of these calls occurred 47 minutes after sunset. This event represents 40% of all calls recorded within 1 hour of sunset at Down Ampney Laneway Paddock.
- 7 calls occurred on 26 May 2018, with 6 of those calls occurring in 4 minutes. The first of these calls occurred 53 minutes after sunset.
- 4 calls occurred in 2 minutes on 2 June 2018. The first of these calls occurred 51 minutes after sunset.

A similar pattern of activity was observed at Down Ampney Mondilibi Hill where 15 calls were recorded within 1 hour of sunset on 5 separate nights, and at Walmsley Dam where 7 calls were recorded within 1 hour of sunset on 2 separate nights.

For the 2019 survey period, no calls were recorded within 1.5 hours after sunset at any location surveyed, with the earliest call occurring 97 minutes after sunset at Walmsley Dam.

Summary

- Data clearly indicates a very low presence of SBWB in open farmland that is representative of wind turbine locations.
- Call activity data collected in 2017 and 2018 indicates it is possible that a roost may have existed within the vicinity of the project site at that time. This is unlikely to be a roost containing significant numbers of SBWB.
- In 2019 time of calls after sunset would indicate that bats are arriving at the MFWF project/study area from regional sites rather than emerging from roosting caves onsite at sunset or shortly thereafter.
- Foraging habitats are used sporadically on an intensive basis.
- Most activity recorded at foraging sites occurs during very short blocks of time, suggesting foraging behaviour by individual or small numbers of SBWB making repeated passes.
- SBWB are four to thirty times more likely to be present/have some level of activity in foraging habitats than in open farmland.
- The timing of the calls detected supports the documented foraging strategy, i.e. 'individuals constantly in flight sometimes meandering between areas after 5–15 minutes of foraging, or flying to a particular foraging area and remaining there for one or more hours'. (National Recovery Plan for the SBWB (DELWP 2020)
- The data indicates low levels of activity across the entire night-time hours. There do not appear to be any visual trends or indications of trends in either datasets (2017–2018 and 2019 survey years).

6.3.4 Comparative call activity at other and nearby sites in the region

SBWB activity levels across the MFWF turbine-representative habitat are very low. Average call activity was 5–25 times higher at sites of specific potential foraging habitat types, such as an irrigation dam, or aquatic herbland/ wetland and the scoria cone woodland on Down Ampney Mondilibi Hill.

A similar pattern of activity has been reported as part of SBWB assessments at other wind energy sites with similar landscape features and habitats that have compared acoustic survey results from turbine-representative habitats and reference sites of likely foraging habitat types.

A direct, detailed comparison of surveyed SBWB call activity between wind farms is not always possible, for the following reasons:

- Difficulty in comparing automated with manual call analysis/identification processes
- Some call analysis methods including SBWB calls within a broader species complex
- Differences in recording technology used and changes in technology employed over time
- Some assessment reports undertaking recording only in turbine-representative areas, while other assessments including potential foraging habitat outside the area of planned turbines.

Table 6.9 below provides information about SBWB surveys that were undertaken in locations/areas that were representative of proposed turbine sites for southwest Victoria wind farms that have received planning approval. Survey data from foraging areas at specific habitat types away from the location of proposed turbines is not included in Table 6.9 data. Comparison is also given to sample size and methodology used at the different wind farm site.

Table 6.9 Southwest Victoria wind farm projects – comparison of average calls/night in turbine-representative habitat

Project	Turbine-representative habitat average calls/detector nights	Survey nights and timing	Turbine-representative survey locations	Method
Dundonnell **70 kilometres north of the Starlight Cave maternity site**	0 confirmed 0 confirmed and potential	28 detector nights, 16 – 23 Nov. 2009	4	Anabat bat detectors (Titley Electronics). Analysed by Greg Richards.
	0.15 confirmed 0.60 confirmed and potential	116 detector nights, 1 – 29 March 2011	13	
	0.009 confirmed 0.11 confirmed and potential	532 detector nights, 18 Feb. – 30 April 2013	23	
	0 confirmed 0.04 confirmed and potential	135 nights, 817 detector nights	4 (excludes Sites 3 & 8 next to swamp) autumn, summer and spring	

Project	Turbine-representative habitat average calls/detector nights	Survey nights and timing	Turbine-representative survey locations	Method
	Total: 0.03 confirmed 0.16 confirmed and potential			
Bulgana **140 kilometres north of the Starlight Cave maternity site**	0.03 confirmed 0.22 confirmed and potential	126 detector nights, 27 Nov. – 26 Dec. 2013	9 (includes Site 10, 120 metres from turbine)	Anabat detectors (Titley Electronic, Billina, NSW) and SongMeter SM2BAT detectors (Wildlife Acoustics Inc., USA). Analysed by Greg Richards and Rob Gration.
	0.17 confirmed 0.19 confirmed and potential	104 detector nights, 28 Jan. – 11 Feb. 2014		
	Total: 0.10 confirmed 0.21 confirmed and potential	28 nights, 230 detector nights		
Mortlake South **40 kilometres north of the Starlight Cave maternity site**	0.25 confirmed 0.30 confirmed and potential	10 nights, 20 detector nights, Nov. – Dec. 2007	2	Anabat (R) Ultrasound detectors. Analysis of bat calls undertaken by Lindy Lumsden
Mortlake (East and South) **45 kilometres northeast of the Startlight Cave maternity site**	0.07 confirmed 0.5 confirmed and potential	14 nights 28 detector nights, 25 Oct. – 8 Nov. 2007	4	Anabat (R) Ultrasound detectors. Analysis of bat calls undertaken by Lindy Lumsden
	Total: 0.15 confirmed 0.42 confirmed and potential	24 nights, 48 detector nights		
Mt Fyans **45 kilometres**	0.24 confirmed 0.72 confirmed and potential	14 nights, 42 detector nights, 30 Mar. – 12 April 2017	3	Anabat (R) Ultrasound detectors. Analysis of bat calls

Project	Turbine-representative habitat average calls/detector nights	Survey nights and timing	Turbine-representative survey locations	Method
north of the Starlight Cave maternity site	0.27 confirmed 0.37 confirmed and potential	35 nights, 105 detector nights, 19 April – 8 June 2018	3	undertaken by Lindy Lumsden
	1.7 likely	46 nights, 115 detector nights, 22 Oct. – 6 Dec. 2019	3	Titley Anabat Swift detectors Analysed using Anabat insight with manual checking of potential SBWB calls.
	Total: 0.26 confirmed 0.55 confirmed and potential 1.7 likely	95 nights, 262 detector nights	(excludes 14 night met mast recordings, 0 calls)	
Ryan's Corner **40 kilometres east of the Starlight Cave maternity site**	0.50 – 1.10 confirmed (pg. 58 EES panel report)	Surveys across 36 nights, 5 – 29 March 2007 & summer 2007	Unclear (6 sites recorded overall)	Three reports prepared by Dr Richards and submitted to Inquiry
Macarthur **50 kilometres northwest of the Starlight Cave maternity site**	0.34 confirmed	41 detector nights, 7 Feb. – 10 Mar. 2005	5	Anabat ultrasonic bat detectors and analysed by Dr Greg Richards
	4.17 confirmed	12 detector nights, 16 – 21 April 2005	2 (excludes met mast recordings, 5 calls)	
	Total: 1.21 confirmed	53 detector nights		

As shown in the table above (Table 6.9), the level of call activity within open farmland landscapes (with scattered planted wind breaks) at the MFWF site and at other wind farm sites is very low. The most comparable project to MFWF is the Mortlake South Wind Farm, which used the Anascheme call analysis software for assessing species and call numbers. This site contains a volcanic plains landscape character and habitat that is most comparable to that of the MFWF site. Comparison of average call activity in turbine-representative habitat at MFWF site (0.26

confirmed calls/night) is very similar to the average level of activity that was reported as part of the Mortlake South Wind Farm Assessment (0.25 confirmed calls/night).

While comparison with other wind farms is problematic and only possible at a generalised level, Table 6.9 shows that recorded average calls/night in turbine-representative habitat at MFWF site is mid-range when compared with the previously approved wind farm projects in southwest Victoria presented above. For all wind farm projects presented in Table 6.9, SBWB activity at turbine-representative habitat is very low and this is especially the case for open pastoral and cropping landscapes with small sections of exotic vegetation, such as at MFWF.

Table 6.10 shows the level of call activity within the three specific foraging habitats at the MFWF project site in comparison to call activity data at potential foraging areas within or close to other wind farm project sites.

Table 6.10 Southwest Victoria wind farm projects – comparison of average calls/night at specific habitat feature types

Project	Approximate location from Starlight maternity cave	Specific habitat feature type: Call activity is likely to be foraging behaviour	Specific habitat feature: Average calls/night	Detector nights
Mt Fyans	45 kilometres north	Remnant woodland Mondilibi Hill, 1-hectare scoria cone woodland	2.69 confirmed	49 detector nights (at each site)
		Walmsley Dam, 10-hectare irrigation dam	8.26 confirmed 13.13 confirmed and potential	
		Aquatic herbland/wetland, adjacent to Salt Creek 7 hectares	1.96 confirmed 4.34 confirmed and potential	
Ryan's Corner	40 kilometres east	Large eucalypt plantation	8.90 confirmed	Unclear
Macarthur	50 kilometres northwest	Large irrigation dam (approx. 55 hectares)	7.22 confirmed and potential	9 (dam site)

Project	Approximate location from Starlight maternity cave	Specific habitat feature type: Call activity is likely to be foraging behaviour	Specific habitat feature: Average calls/night	Detector nights
Dundonnell	70 kilometres north	Large ephemeral water body swamp next to row of pine trees and large native remnant eucalypts (approx. 50 hectares)	Autumn survey 2011 1.80 confirmed 4.0 confirmed and potential	8 detector nights, 1 – 29 Mar. 2011 (Site 8)
Hawksdale	35 kilometres northwest	Creek line with swamps	2.00 confirmed	11 detector nights, 14 – 24 Feb. 2007
Bulgana	140 kilometres north	Remnant eucalyptus woodland, 4 hectares on ridge (120 metres from turbine)	0.79 confirmed	14 detector nights, 27 Nov. – 26 Dec. 2013 14 detector nights, 28 Jan. – 11 Feb. 2014 (Site 10) Total: 28 detector nights

As can be seen from Table 6.10 above, extensive surveys were carried out at three specific habitat locations on the MFWF site for a total of 49 detector nights in 2017 and 2018. Across the three surveys, 605 out of 683 (89%) confirmed SBWB calls were taken from these specific habitat types.

Comparatively higher activity associated with foraging activity at specific habitats has been found at all approved wind farm projects in southwest Victoria where such recordings have been undertaken. In this context, the activity levels associated with the three specific habitat types at MFWF is not exceptional and is representative of the concentration of foraging activity at these sites in comparison to open pastoral, turbine-representative habitat. For other approved wind farms in southwest Victoria, higher activity at these specific habitat types related to foraging would be expected in comparison to turbine-representative habitat. For example, the Mortlake East Wind Farm site included a large, 10-hectare irrigation dam close to proposed turbines. However, the closest recording device was 1.7 kilometres from this dam.

Comparison of Table 6.9 and Table 6.10 shows a clear distinction between confirmed and potential SBWB activity at turbine-representative habitat (0.46 calls/night) and activity associated with foraging at specific habitat types,

including a large permanent water body (13.13 calls/night), remnant woodland (6.13 calls/night) and aquatic herbland (4.34 calls/night).

Mills and Pennay (2017) have recently concluded that call activity in the closely related Eastern Bent-wing Bat was seven times greater at forested sites (2.99 passes per night) compared to cleared sites (0.43 passes per night) in New South Wales.

6.3.5 Relationships between wind speed and levels of activity

To assist in the characterisation of SBWB activity at the MFWF project site and at rotor-swept height, an additional assessment was conducted to compare bat activity and wind speed. Based on the ground detector results (activity) and wind speed analysis, an examination of the long-term wind data was conducted to assess the effects of wind speed on bat movements (using calls as a proxy) and whether levels of activity within the rotor-swept area were likely to be effected by increasing wind speed at height.

Moloney et al. (2019) investigated post-construction mortality monitoring at several Victorian wind farm sites and found a small number of mortality records for the SBWB, indicating that SBWB do fly at rotor-swept height. As demonstrated by acoustic surveys at wind farms across Victoria and New South Wales in Section 6.4, Bent-wing Bat recorded activity levels have been shown to decrease with higher altitudes. In summary, there is documented evidence of rotor-swept area activity. There is limited documented commentary about the impacts of wind speed on bat movements in Australia (or any other environmental variables, such as temperature or rain).

It is likely that SBWB forage closer to ground level at specific habitat types due to the higher concentrations of insects and the lower energy costs required to forage at ground level (where exposure to windy conditions is less). For the same reasons, it is logical that insect numbers decrease as height above ground level increases. However, as has been established, SBWB mortalities at wind farms have been recorded as have long-distance flights in order to reach foraging habitat. Little is known about the flight activity of SBWB at heights, including when moving across the landscape to foraging locations, or when foraging closer to the ground.

As outlined above, in attempt to characterise activity and behaviour of the SBWB in different wind speed conditions, an assessment of the acoustic detector (collected at the MFWF project area) compared with the site's long-term wind dataset has been compiled.

For background purposes, when considering the possible effects of wind speed, there are two important concepts. The relationship between wind speed and the power of the wind (kinetic energy) is such that:

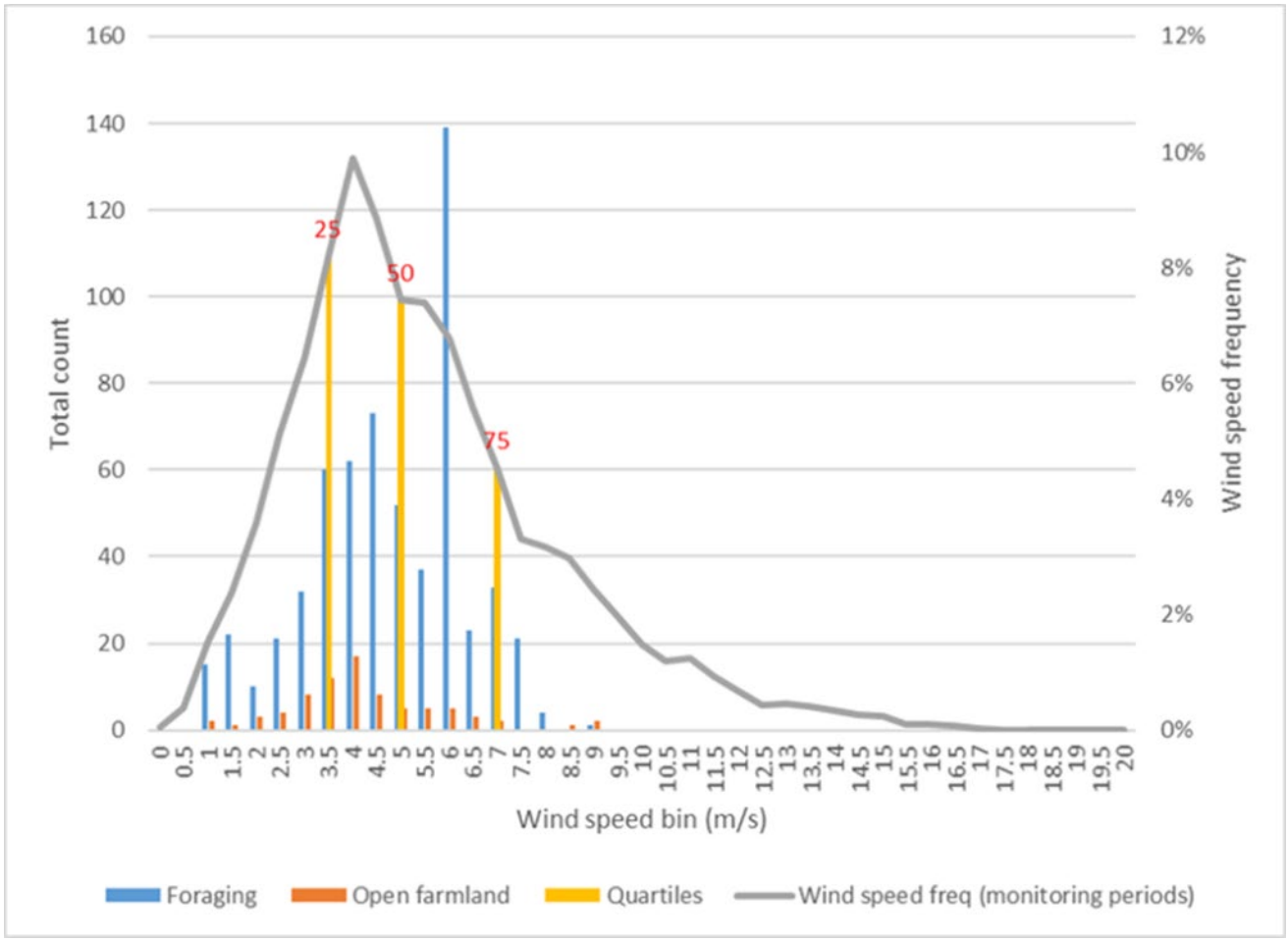
- The power of the wind at a speed of 10 metres per second (m/s) will be twice the power at 7 m/s.
- The power of the wind at 14 m/s will be four times greater than the level of the power at 7 m/s.

Increasing wind speed with height is described as a process called 'wind shear'; 'vertical wind shear' is used to describe the relationship between the changes in wind speed with the change in altitude. In open farmland landscapes such as at the MFWF site, the profile of wind shear from the ground surface layer to the height of the rotor-swept area (with the latter being the area through which the rotor blades of a wind turbine spin) is generally logarithmic in nature. This means that as height increases per metre from ground level, wind speed increases by a disproportionately increasing amount (wind velocity). For example, where the wind speed is 7 m/s at a height of 10 metres above the ground level (AGL), it is likely to be around 9.5 m/s at 40 metres AGL and 11 m/s at 80 metres AGL (Hydro Tasmania data). Therefore, small increases in wind speed or flight height (where wind shear occurs) result in a significantly greater level of kinetic energy.

Under a normal movement scenario, we would expect that the SBWB would aim to conserve energy where possible and therefore we reasonably assume that the species would be most active in lower wind speed

conditions and at heights that minimise their exposure to high levels of wind and kinetic energy. The open landscape characteristics around the MFWF site are likely to provide pockets of shelter but generally vast expanses of exposed areas. The landscape is generally free of obstructions that would require flight height changes and therefore bats could move through the landscape or forage without interruption.

Graph 6.3 demonstrates the relationship between SBWB activity at foraging and open habitat types and wind speed. Wind speed data was recorded at 30 metres above ground level from a met mast located in the center of the site. Time-stamped SBWB calls recorded during acoustic detector surveys undertaken in 2017 and 2018 were matched with wind speed at 0.5 m/s increments recorded over the same period. The wind mast was decommissioned prior to the 2019 acoustic survey program.



Graph 6.3 Comparison of SBWB recorded call activity 2017–2018 survey periods vs wind speed

Graph 6.3 shows the relationship between wind speed and SBWB activity levels (by total calls) across all wind speeds, up to 20 m/s. The graph demonstrates that SBWB activity is not significantly influenced by wind speed up until 7.0 m/s, and this is at both foraging and open farmland sites. The graph demonstrates the quartiles of wind speed measurement such that for 75% of the time the wind speed is less than 7m/s.

Of particular note:

- 38% of all calls were detected in wind speeds less than 3.5 m/s. (The importance of 3.5 m/s is discussed in Section 6.4.4.)
- 96% of all calls were detected in wind speed conditions below 7 m/s.
- After 7.0 m/s there is a major decline in total calls, with no activity recorded above wind speeds 9.5 m/s.

The results of this assessment (call counts vs wind speed) can be used to inform how changes in wind speed affect collision risk within the rotor swept area. This is addressed in the following section.

Summary

- SBWB are detected flying in low wind speed conditions more often than flying in high wind speed conditions. There is insufficient data to make strong deductions from this observation; however, it is likely that SBWB avoid flying in high wind speed conditions which become more prevalent with increase in height above ground level.

6.4 Characterise SBWB activity within rotor-swept area and assess the likely SBWB impacts through turbine collision and/or barotrauma

6.4.1 Turbine collision and barotrauma

Microchiropteran bats are known to collide with wind turbines causing fatalities (Arnett et al. 2008). This has been well documented internationally and more recently in Australia as bird and bat mortality monitoring and appraisal of data is carried out (Hull and Cawthen 2013).

In terms of distinguishing mortality source at wind energy facilities, all bat carcasses detected during monitoring should be considered to have arisen as the result of a collision with a wind turbine (or tower). Barotrauma has not been diagnosed as a cause of death in bats at Victorian wind energy facilities (Moloney et al. 2019). Barotrauma was described by Baerwald et al. (2008) as a potential effect of rapid changes in air pressure close to rotating wind turbine blades. Since this work was published, there has been doubt over whether it is a real effect due to difficulty in accurately diagnosing cause of death in bat carcasses (Rollins et al. 2012).

6.4.2 Measurements within rotor-swept area – techniques and constraints

There have been attempts in Australia to record bat call activity within the rotor-swept area, mostly conducted pre-construction via attachment of acoustic detectors to meteorological masts. These surveys have had varying success and, as is the case with ground-level survey, only provide an indication of species presence or absence.

Limitations for surveying SBWB at the height of wind turbine blades (rotor-swept area) are well known and documented and are summarised below. There is no proven technique for collecting information on SBWB at height and considerable distances from known roosts. The detection of bat activity both at height and ground level at a pre-construction stage has also been shown to provide a poor indication of fatality levels post-construction (Hein et al. 2013). Other than establishing that SBWB do fly at blade height at the MFWF site, the 'at height' data will not provide a means of estimating absolute fatality rates or risk level. This is because the 'at height' data provides only call presence/absence information; it provides no basis for estimating numbers of individuals or flight behaviour information.

Three techniques to gather 'at height' data relating to both the SBWB and the Eastern Bent-wing Bat at wind farms across Victoria and New South Wales have been deployed:

- Acoustic bat detector attached to wind monitoring mast.
- Acoustic bat detector at height using tethered helium balloon.
- Radar detection.

Most survey efforts at wind farms to date have focused on the use of acoustic bat detectors attached to wind-monitoring masts, often at heights of approximately 80 metres. The limitations of acoustic call identification are well known – especially when surveying for SBWB, which have overlapping call characteristics with other species.

Accepted limitations of call recording using acoustic detectors include variation in call intensity of SBWB depending on distance from the detector, and weather conditions, with exposure of the detector to winds, rain and associated environmental noise (which are increased when the detector is located 80 metres above ground) making it difficult to discern SBWB calls from interference. There are also limitation factors arising from sensitivity of the model of detector used, the placement of detectors in habitat locations or at heights where low activity is likely to occur, and the technical competence of the operator. As outlined by Gration (2011, pg. 187), 'a bat detector can only provide a measure of activity and does not provide evidence of the number of individual bats present or their movement across the landscape. In many instances, the quality and length of the bat call may not provide the diagnostic features required to identify to species level.'

Limitations with 'at height' survey methods, and specifically the limitations of acoustic detection methods, were discussed with DELWP at a meeting on 9 February 2018. Following this discussion, Biosis provided DELWP with information on the survey efforts to gather 'at height' data using acoustic detectors mounted on wind masts at the proposed Penshurst Wind Farm in Victoria. The Penshurst survey involved six masts that were erected to enable two detector units to be installed, one 50 metres above the ground, within rotor-swept height, and the other at 1.2 metres above ground level. Four SMX-US microphones were installed at each mast. One microphone mounted at 1.2 metres above ground level was pointing up at a 45-degree angle; the remaining three microphones were mounted at 50 metres, with two facing upwards in opposite directions at a 45 degree angle and a third pointing downwards at a 45 degree angle. Data acquired over the approximately eight-month period for this study failed to provide any clear evidence that could inform the assessment – other than that very little bat activity and very little SBWB activity was detected.

The use of a tethered helium balloon provides a mobile alternative in a situation where a wind-monitoring mast is not available; however, this technique incurs the same limitations as 'at height' surveying using wind-monitoring masts, as reliance is still on ultrasonic bat detection equipment. This technique was sampled by Mills and Pennay (2017) to record Eastern Bent-wing Bats using a tethered helium balloon ('helikite') at the Wee Jasper Cave maternity site in New South Wales and at six locations 20 kilometres away from a proposed wind farm at Parsons Creek. Six sites were sampled at Parsons Creek over 19 nights using this technique, and one site was sampled near Wee Jasper for 6 nights to provide a regional context. One detector was placed close to ground level and recorded up to approximately 20–30 metres above ground level, and a second detector was attached to the helikite and flown approximately 100 metres above ground level to attempt to record the echolocation calls of any bats flying around 70–130 metres in elevation. The helikite detector was able to survey the area both below and above its mounted position and was therefore able to cover a greater area than the detector placed close to ground level.

Balloon-mounted detection was not believed to accurately record Bent-wing Bat activity, due to 'greater sound attenuation in the higher winds speed at 100 metres above the ground and interference to the recordings caused by wind-generated noises on the balloon apparatus. This is supported by the very high number of noise files and low ratio of identifiable calls recorded from balloon detectors' (Mills and Pennay 2017, pg. 19). The relatively low

proportion of identifiable calls recorded on the balloon-mounted detectors, in comparison to the proportion recorded on the ground, suggests that conditions affected detectability. At the Parsons Creek Wind Farm site itself, the balloon-mounted detectors did not identify any bat calls (Mills and Pennay 2017, pg. 23).

Mills and Pennay (2017) trialled marine radar object tracking to image free-flying bats while simultaneously using an acoustic detector on a helikite at heights of approximately 100 metres above ground level at the entrance of the Wee Jasper maternity cave. Comparison of detector calls found that Eastern Bent-wing Bats were 9.3 times more likely to be recorded closer to ground level on the nights that they were recorded (Mills and Pennay 2017, pg. 3). From this work, they concluded that this species was recorded flying at 100 metres only occasionally and was recorded more regularly flying closer to the ground. However, it is not clear if the results from close to the entrance of a maternity cave are representative of the type of flight behaviour that occurs in open/forested farmland at the wind farm site. What is noted by these authors is that flights at height appear to be recorded more commonly closer to the maternity cave.

6.4.3 Radar

Advances in radar object tracking have given some optimism for the use of this technology; however, to date there is no proven technique for gaining reliable 'at height' survey data on SBWB site utilisation and no example of where this has been used.

Gration (2011) examined the use of radar technology to overcome the limitations of acoustic bat detection surveys for SBWB at wind farm rotor-swept height. He found that radar technology can provide 'statistically powerful datasets suitable for long-term monitoring, sample large volumes of space, record flight direction and height, and correlate activity to temporal variations and prey availability' (Gration 2011, pg. 192). However, there is no viable method that would enable radar technology to positively differentiate SBWB at wind farm sites where a wide range of different bat species are present.

The SBWB has a call which can be very similar to that of the Chocolate Wattled Bat *Chalinolobus morio* and Little Forest Bat *Vespadelus vulturnus*.. In the absence of a library of wingbeat vouchers to confidently identify bats to a species level, the use of radar is not suitable to determine utilisation of an airspace by SBWB (Kelly et al. 2007, in Gration 2011).

As discussed, Mills and Pennay (2017) carried out marine radar object tracking for free-flying bats at ground level and at 100 metres above ground using a helikite. This was a novel method that involved surveying close to an Eastern Bent-wing Bat maternity cave. The flight behaviour observed was not translated to the wind farm site. In this scenario, they found that radar was capable of recording a higher level of activity at rotor-swept height than acoustic detectors; however, individual bat species were unable to be discerned from all other tracked radar objects (Bruderer and Popa-Lisseanu 2005, in Mills and Pennay 2017, pg. 19). Radar was unable to determine with certainty if tracked objects were bats or other flying objects (e.g. large moths, insects, small nocturnal birds). They found no correlation between the balloon detector and number of radar-tracked objects at 100 metres elevation. The radar consistently tracked 9–15 objects per minute (10th – 90th percentiles) but the balloon detectors only recorded three bat calls during the same time. They concluded that the balloon-mounted detector under-sampled bat calls because of greater sound attenuation in the higher wind speeds at 100 metres above the ground and interference to the recordings caused by wind-generated noises on the balloon apparatus. This suggests that conditions adversely affect detectability.

There is a high level of ineffectiveness in the current technology when it is applied to estimating collision risk. Acoustic detectors are designed for recording bats calling in optimal conditions. Deploying detectors at height exposes the equipment to a range of adverse conditions that greatly impede the capacity to make good bat call recordings. Further, such recordings only indicate presence/absence at height and the data cannot be used to

estimate collision risk and therefore fatality rates. Attempts to utilise marine radar have shown some useful results but retain the limitation of difficulty in identifying the target species.

6.4.4 Call activity at height observations for MFWF project area

MFWF study 2016

In 2016, a seven-night acoustic survey using the onsite (MFWF) meteorological mast recorded no SBWB calls from within rotor-swept height from a detector placed 50 metres above the ground that was capable of detecting bats flying at heights of approximately 50–80 metres. A very low call rate (no SBWB calls) was recorded from detectors at ground level from the same site (average of 0.03 – 0.04 calls per night).

MFWF predicted activity at rotor-swept height based on wind speed

As described above (Section 6.3.5), the results of SBWB call counts vs wind speed can be used to inform collision risk. Using the available information of call counts and wind speed, an assessment of the wind speed data (using 10-minute interval, 50-metre meteorological mast data – from 2010 to 2018) has been conducted to provide a time-based estimate of when wind speeds are likely to be favourable/unfavourable for SBWB to be active at rotor-swept height.

For background, most modern wind turbines commence rotation of the blades only once the wind speed reaches an average of above 3.5 metres per second (m/s). The rotation (RPM) is relatively constant but as wind speed increases, the RPM also increases (marginally) until a wind speed of approximately 11 m/s. Above 11 m/s, the RPM is then constant until blade rotation ceases at approximately 25 m/s.

Based on the SBWB activity, wind speed assessment and wind turbine operation parameters, it is clear that the risk of impact to the SBWB from operating turbines is not always present. Our assessment indicates that it is limited to the wind speed band of 3.5 m/s – 7 m/s, on the basis that wind turbines do not operate in wind speeds <3.5 m/s while at wind speeds over 7 m/s there is significant decline in call activity – indicating very low levels of activity (no calls in wind speeds above 9 m/s).

The MFWF wind dataset was analysed to estimate the proportion of time between sunset and sunrise that wind speed was <3.5 m/s, within the 3.5 m/s – 7 m/s band, and >7 m/s. Wind speed is a highly fluctuating variable and for the assessment it was necessary to assume that periods of time were counted only when the wind speed dropped below 7 m/s for periods greater than 60 minutes. The wind analysis showed that the average wind conditions were below 3.5 m/s for 8.3% of time, and above 7 m/s for 26% of time. Therefore, potential risk of impact to the SBWB is reduced to 65.7% on a time basis.

In summary, the data provides for some insights about the risk of potential impacts. Based on the information available, it is reasonable to conclude that significant impacts to SBWB is unlikely

6.4.5 Call activity at height observations – other surveys

Parsons Creek, New South Wales

Mills and Pennay (2017) carried out 'at height' surveying for EBWB in New South Wales at a location just over 5 kilometres from a maternity site and at six locations at the study area of the proposed Parsons Creek Wind Farm which is over 20 kilometres from the maternity site. EBWB were recorded as flying at heights of 70–130 metres (within rotor-swept height for modern wind turbines), at the site just over 5 kilometres from the maternity site on three of six nights. At ground level at the same recording site (and time), EBWB were recorded on all six nights

and were found to be 9.3 times more likely to be recorded at ground level (0–30 metres) than within 70–130 metres at this site.

The concentration of EBWB recorded at Parsons Creek over 20 kilometres from the maternity site was found to be much lower than at the location just over 5 kilometres from the maternity site. No bats of this species were detected flying at 70–130 metres elevation at any of the six sites surveyed at Parsons Creek across the 19 nights of sampling. EBWB were recorded flying at ground level between 0–30 metres on six of 19 nights across these six sites surveyed.

Given the limitations of the surveying method, the authors were unable to determine if the records acquired at height are the result of very low activity at altitudes of 70–130 metres or whether calls are being masked by high winds and associated noise. All calls at height were recorded from the location just over 5 kilometres from the maternity site at a low level (0.26 passes per hour). The location closest to the maternity site also had much higher recordings of EBWB at ground level (2.46 passes per hour) compared with the six locations at the study area at a low level (0.23 passes per hour). Bat activity was not recorded at heights above 130 metres; however, given the low level of activity recorded at heights of 70–130 metres at the study area, it is anticipated that the higher wind speed conditions and kinetic energy required to navigate the airspace would result in an increasingly lower level of bat activity.

Penhurst Wind Farm, Victoria

A focus of SBWB acoustic surveying undertaken by Biosis at the proposed Penshurst Wind Farm was to assess SBWB activity at rotor-swept height across the wind farm study area during the period where there was a maximum number of SBWB present at the Byaduk Cave roost site approximately 16 kilometres away. Comparison of activity between rotor-swept height and ground level at wind masts erected at six randomly generated points within the study area demonstrates a similar pattern of activity to the Eastern Bent-wing Bats that was observed by Mills and Pennay (2017).

‘At height’ surveying was carried out at the six mast sites over the period 27 September 2012 – 27 May 2013. All masts were located in open, cleared stony rise grazing areas at considerable distances (>2 kilometres) from major water bodies. Across the survey period, the total number of confirmed and potential calls at ground level and at height was 21, with 1 confirmed call and 20 possible calls. There were 18 calls (1 confirmed, 17 potential) from detectors at ground level below rotor-swept height and three calls (three potential) from detectors surveying at rotor-swept height. The ratio of 6:1 ground to height calls was similar to that found by Mills and Pennay (2017) in New South Wales, at 9.3:1.

Other wind farm sites in Victoria have recorded a similar level of activity at height to that recorded at the Penshurst site (Authors’ pers. obs.). All available ‘at height’ data that has been gathered for wind farms in Victoria to inform activity at rotor-swept area demonstrates a similarly low level of call activity at height.

Conclusion

In conclusion, there is no reliable method to characterise SBWB activity within the rotor-swept area and therefore no capacity to assess the likely SBWB impacts through turbine collision and/or barotrauma. There are only the patterns of call activity demonstrated in the work presented here and the work from other authors such as Mills and Pennay (2017) that shows that call activity for cave-roosting species such as Eastern Bent-wing Bats and SBWB is likely to be higher in closer proximity to roost sites and that while call activity can be detected at rotor-swept height, it is likely to be much lower than call activity detected closer to the ground. On this basis, the possibility of impacts from turbine collision and barotrauma at the MFWF project site is likely to be low for SBWB.

From a wind farm operational point of view, there are two factors that influence the activity levels of SBWB within the rotor swept area:

1. the risk of impacts to SBWB is directly related to a combination of the number of SBWB present and the duration of activity. There is inherently less risk to the SBWB from the MFWF project on the basis that areas of higher activity such as foraging sites have been avoided (and buffered) during the wind farm layout development. As demonstrated by the results of acoustic surveys, very little ground-level activity has been recorded in the turbine-representative habitats and it is reasonably concluded that there would be an even lower level of activity at height.
2. As stated in Section 6.3.4, SBWB are detected flying more often in low wind speed conditions. The effect of wind shear where wind speed increases with height above the ground results in conditions within the rotor swept area that SBWB may avoid.

Summary

- Accurate and reliable measurement of SBWB presence at rotor-swept height is not supported by the technology and methods currently available.
- Data from other surveys suggests a ratio of bats at foraging height vs bats at rotor-swept height of 9.3:1.
- For the MFWF project, a staged process of ground-based surveys has revealed such a low level of activity that a further assessment of bat utilisation at height is not warranted.
- The avoidance of areas with higher call volumes has been incorporated into the site design to minimise collision risk at rotor-swept height.
- SBWB are detected flying in low wind speed conditions more often than flying in high wind speed conditions. There is insufficient data to make strong deductions from this observation; however, it is likely that SBWB avoid flying in high wind speed conditions which become more prevalent with increase in height above ground level and are typically the conditions in the rotor swept area.

6.5 Potential cumulative effects on SBWB from the project in combination with other wind farms

Traditionally, environmental impact assessments have focused on the potential impacts of individual wind energy projects; however, this fails to recognise that cumulative effects may occur where mortalities of a species occur at more than one facility. While a species may be subject to the effects of many cumulative impacts, cumulative impact in the context of this report refers only to the combined effect of multiple wind farms.

Scottish Natural Heritage (2012) lists the following ways in which cumulative impacts may function:

- The effects of different wind farms may be additive (i.e. A multiple independent additive model).
- The effects of different wind farms may interact in ways that are antagonistic (i.e. The sum of impacts are less than in a multiple independent additive model).
- The effects of different wind farms may be synergistic (i.e. The cumulative impact is greater than the sum of the multiple individual effects).

In addition, for some species, routine migration passage or nomadic movements might expose them to multiple wind farms in a sequence, so that the cumulative risk may be a function of the probability of surviving one wind farm after another (Smales et al. 2006).

As noted by Scottish Natural Heritage (2012), it may be difficult to demonstrate antagonistic or synergistic effects, and it may be simpler, at least initially, to concentrate on the concepts of additive effects or those associated with movements that interact with one wind farm after another.

Moloney et al. 2019 note: 'The majority of the publications about cumulative impacts include discussion of conceptual approaches, but it is worth noting that no published examples have been found of jurisdictions in which a program is in operation to determine the cumulative effects of mortalities at operating wind farms.'

Moloney et al. (2019) have determined that currently it is very difficult to obtain accurate estimates of the total number of turbine collision mortalities for any species. Moloney et al. (2019) conclude that this is mostly due to the wide level of variation employed by mortality monitoring programs of time and between wind farms, with there being key differences in the objectives, design, intensity, frequency and duration of monitoring regimes. Mortality monitoring has now been undertaken in Victoria for a number of years and still there is little clarity on whether turbine collisions are having a significant impact on fauna populations, including the SBWB. The potential for cumulative effects from multiple wind farms has been recognised and is now regularly required as part of the regulatory processes; however, the methodology of how to assess or estimate potential cumulative impacts has not yet been established (Moloney et al 2019).

In reference to the purpose of mortality monitoring, Moloney et al. (2019) state: 'The overarching purpose of monitoring fauna collisions is to determine whether the mortalities that occur are sufficient to result in a negative impact on the functioning of the Victorian population of any species of conservation concern, either as a result of the total number of mortalities occurring at the particular wind farm alone or in combination with other wind farms.'

The above has not been achievable for SBWB, largely due to a lack of adequate turbine collision mortality data on which to base a significant impact assessment. Biosis staff are aware of eight recorded turbine collision mortalities in Victoria for SBWB and note that one wind farm which had sufficient data for further analysis recorded one SBWB mortality. When this one identified mortality was corrected for an annual mortality estimation, it provided an annual mortality rate of 14 individuals (CL/range 0–70) at that site (Moloney et al. 2019). This demonstrates a high level of uncertainty.

In order for methods of assessing cumulative impacts to be developed, a number of constraints need to be resolved. As Moloney et al. (2019) suggest: 'These include (i) the need for reduced uncertainties in the mortality estimates from individual wind farms, (ii) the need for all assessments to be undertaken using an agreed set of standards, (iii) the need for mortality estimates to be undertaken over the entire lifetime of a wind farm, (iv) the need for greater understanding of the impact of other anthropogenic causes of declines in populations, and (v) the need for the effects of all existing wind farms to be available before the likely effects of a new one can be predicted, which requires a centralised coordinated repository for all relevant information.'

National SBWB Recovery team have recently carried out Population Viability Analyses for the SBWB population (TSSC 2021). A PVA model will be used to determine the impact threshold level that the MFWF wind farm must be operated within to minimise extinction risks to the species as far as is practicable. The impact of wind energy on population viability was not considered in the National SBWB Recovery Team run model (TSSC 2021) as there are limited wind energy mortality data inputs available. In time, PVA may inform methods to assess cumulative impacts on the species, from environmental, anthropogenic (including wind energy facilities) and climatic factors.

In conclusion, the data does not exist on which to base an assessment of the potential cumulative effects on SBWB from the MFWF project in combination with other wind farms. What can be concluded from other sections of our responses to the scoping requirements is that the proximity of the proposed wind farm to important roost sites is such that SBWB call activity recorded onsite are most likely to be foraging individuals utilising the broader landscape surrounding these roosts. Other elements of our responses relating to the timing of call activity after

sunset and the timing of call activity during the night also support this conclusion. In that regard, while we cannot assess the potential cumulative effects on SBWB in combination with other wind farms, we can assess that MFWF project represents a low to Unlikely likelihood of significant impacts to the status of the species.

7. Proposed Avoidance and Mitigation Measures

Mount Fyans Wind Farm Pty Ltd commits to implementing avoidance and mitigation measures to ensure that operations of the wind farm do not result in net significant or lasting impacts on the viability or conservation status of the Victorian SBWB population. Many of the specific site-based avoidance measures have been discussed already in the sections above. This section reiterates MFWF's commitments. Overall, the approach (avoidance and mitigation measures) will be commensurate to likely risk of impact to the species from the MFWF project.

7.1 Avoidance

Avoidance of potential impacts through broadscale spatial planning and site design is considered the most effective primary means of achieving ecological outcomes. Minimising impacts at the site design level by avoiding areas with a higher level of risk is a secondary measure. The avoidance considerations taken during the development of the MFWF project are set out below.

7.1.1 Broadscale avoidance (collision impacts)

The National Recovery Plan for the SBWB (DELWP 2020) for the SBWB recognises that:

- It is possible that a wind farm built close to a significant roosting site could have a major impact on that population.
- The risk increases the closer the wind farm is to an important site, particularly a maternity site or migration path.

The latest Conservation Advice for the SBWB (TSSC 2021) states it is important to avoid positioning wind turbines near important roost and foraging sites or potential flight routes.

In southwest Victoria, the majority of non-maternity roosting caves are along the coast in limestone caves. There are also major roost sites in lava tube caves. This is illustrated in Figure 6.1 and Table 6.2. The MFWF site is approximately 35 kilometres north of the closest non-maternity roost sites at Panmure and Grassmere and 50 kilometres north of the Starlight Cave maternity site.

In terms of broadscale avoidance (regional spatial level), the location of the MFWF project has avoided many of the risks associated with proximity to major roost and maternity sites and their likely associated flight paths. In relation to the location of maternity and non-maternity major roost sites, this results in a very low / Unlikely risk of the site being within:

- Migration paths associated with annual movements to and from the maternity roost, and
- Travel paths associated with movements between non-maternity roost sites.

7.1.2 Site-specific avoidance (collision impacts)

As has been described in Section 4, a considerable number of studies have been conducted to provide an informed view regarding the areas of the MFWF site utilised by SBWB. The analysis of the data concluded that the level of SBWB call activity throughout the turbine layout (open areas of grazing and cropping farmland) is very low. Specific habitats are currently buffered or avoided by the proposed wind farm layout and these include large permanent water bodies, swamps with aquatic vegetation and remnant woodlands indicative of higher (but still low) levels of call activity. Avoidance has been applied to these areas as described below.

- The northern section of the site, in the newer volcanic landscape, contains a high density of permanent and seasonally inundated wetlands. Based on the available knowledge of the species, this area has the greatest potential for use for foraging by SBWB. ***This area has been avoided***.
- The central and southern area of the site contain a number of large shallow wetlands that are drained and used for cropping and improved pasture. Many of the natural wetlands in this area hold water for a very short period of time, do not hold water each year and do not have aquatic vegetation. ***Buffers (ranging between 2,275 metres and 5,000 metres) have been applied to these areas.***
- ***A significant buffer*** (800 metres – 1.2 kilometres) has been applied to the three key SBWB foraging areas: the scoria woodland (Mondilibi Hill), Walmsley Dam and the aquatic herbland (Down Ampney Laneway Paddock).

At Section 6.2.2 of the SBWB Adaptive Management Plan is a description of studies to identify areas of surface water including farm dams and ephemeral wetlands. It is proposed to consider that all bodies of water should be buffered if they have a frequency of surface water greater than 30% of the time during the total winter period of records over period 1987-2019 and an area greater than 1ha. This represents a conservative approach to identifying potential SBWB wetland foraging habitat.

It is proposed that a buffering concept to be applied would adhere to the following parameters:

- All wetlands that meet the criteria for having retained surface water for greater than 30% of the time during the total winter period of records over period 1987-2019 and an area greater than 1ha, are to be buffered by exclusion of turbines from within 200 metres of the extents of the surface water areas observed.
- If this principle of buffering is accepted as a condition of the awarded planning permit, the proponent will alter the site design to accommodate this proposal.

A map showing examples of the site-specific avoidance is included below in Table 7.1.

7.1.3 Site-specific avoidance (habitat loss impacts)

The development of the MFWF will not require any loss, modification or otherwise to any important (known or likely) habitats. Therefore, there will be no direct habitat impacts for SBWB from the proposed wind farm development.

7.1.4 Avoidance conclusions

As the location of the proposed MFWF is a significant distance away from all major known roost sites in southern Victoria (and does not appear to be a focal site for SBWB), a range of avoidance considerations (including large buffers) have been applied to the proposal and site-based habitat will not be impacted. It is concluded that the MFWF proposal is unlikely to pose a significant risk to the SBWB species.

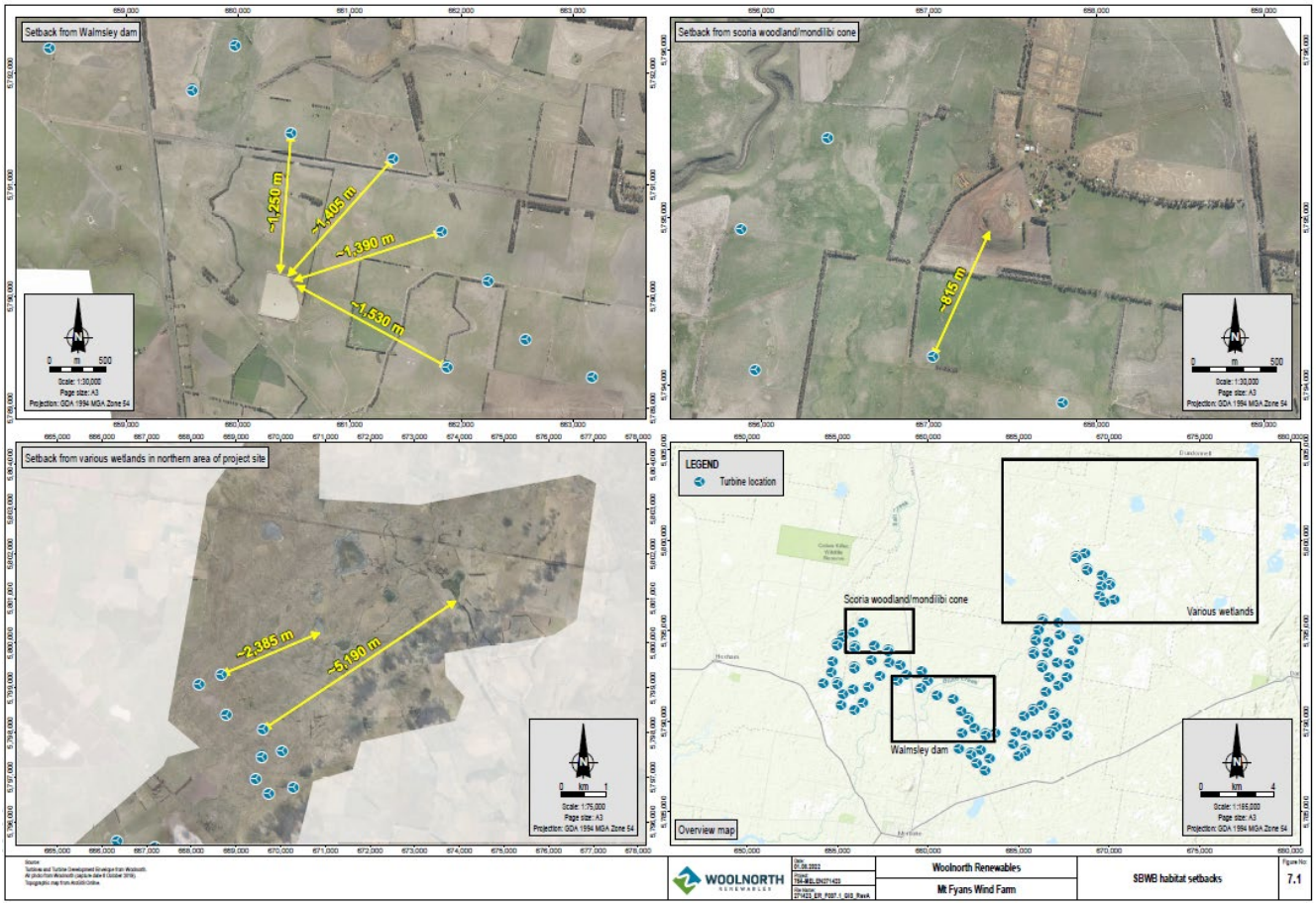


Figure 7-1 Site-specific avoidance measures taken at MFWF project site

7.2 Mitigation measures

7.2.1 Construction mitigation measures

No mitigation measures are relevant to the construction phase of the project. A general bird/bat mortality monitoring program and a SBWB Adaptive Management Plan will be implemented to ensure that impacts can be detected following the erection of wind turbines (prior to commissioning).

7.2.2 Operational mitigation

A range of mitigation approaches exist that have the potential to minimise impacts of MFWF on avifauna and bats. Many of these approaches have been implemented at operational wind farms sites but there is no one approach that is solely completely effective (reduces mortalities to zero). It is clear that existing techniques are continuing to be improved and new techniques are being trialled.

MFWF commits to implementing a SBWB Adaptive Management Plan which would implement a survey regime, monitor and adapt the operation and configuration of the wind farm both in response to risks to the species and proactively to mitigate evident risks. The plan would be prepared in advance of wind farm commissioning and seek to reduce the potential for collision impacts to the species via adaptive measures, pro-active deterrents, and indirect offsets (research fund). A substantive draft is included with this suite of documentation at Appendix 8. Approval by the Responsible Authority will be required for the Adaptive Management Plan to be adopted.

The techniques currently trialled or implemented at operational wind farms are summarised below and the final SBWB Adaptive Management Plan will assess whether these current options are still applicable prior to commencing operations of wind turbines. The document describes the process to determine the most appropriate mitigation methods in response to impacts to the species and as pro-active measures that will be implemented to prevent net significant or lasting impacts on the viability or conservation status of the Victorian SBWB population.

Turbine cut-in wind speed

A number of investigations overseas have demonstrated that small species of bats prefer to fly when wind speeds are relatively low. Consequently, some studies have investigated whether a reduction in bat fatalities due to turbine collision can be achieved by the relatively simple measure of programming night-time operation of turbines so that they cut in (begin operating) only after a designated wind speed is reached. The option is generally termed 'low wind speed turbine curtailment'. Designated wind speeds are determined by utilisation and flight behaviour of the specific species and, for the SBWB, additional utilisation data would be needed to establish whether the strategy would be effective (e.g. more detail on SBWB activity and wind speed). The technique, unrefined, is a relatively broad and blunt approach and likely to lead to significant energy-generation losses. This is on the basis that the risk control is implemented without knowledge of the target species being present.

Low wind speed turbine curtailment has been demonstrated to be an effective operational measure to reduce fatalities of migratory, tree-roosting bat species, including the Hoary Bat *Lasiurus cinereus*, at wind farms on mainland USA and in Canada (Arnett et al. 2009, 2010; Baerwald et al. 2009; Good et al. 2012; Young et al. 2011). These studies have compared numbers of bat collision fatalities found under turbines with and without low wind speed curtailment. By way of example, Arnett et al. (2009) found that the estimated total bat fatalities per turbine (i.e. all carcasses found and corrected for field bias) were 1.23 – 4.68 times greater (mean = 2.34) at non-curtailed turbines relative to turbines where cut-in wind speeds were 5.0 metres/second (m/s) or 6.5 m/s.

More recently, Forcey et al. (2016) conducted a two-year study at Raleigh Wind Energy Centre in southwest Ontario. This study identified that a 3.5 m/s cut-in speed resulted in significantly higher mortalities than turbines curtailed at 4.5 m/s across all species ($P = 0.001$). The study did not show significant differences in estimated bat mortality between 4.5 m/s and 4.0 m/s cut-in speeds.

Some recent investigations have achieved refinements to the simple blanket measure of a low wind speed turbine curtailment at a particular wind speed. For example, at two wind farms in Hawaii, Snetsinger et al. (2016) found that low wind speed turbine curtailment only seasonally coincided with reduced mortality of Hoary Bats. Sutter et al. (2016) used real-time measures of bat activity (Blue Sky Green Field wind facility near Fond du lac, Wisconsin) in combination with weather conditions as an appropriate trigger for curtailment. The approach showed an 83% reduction in overall bat fatalities compared to the normally operating turbines.

Appendix 8, SBWB Adaptive Management Plan makes firm commitments to implement low-wind speed curtailment both in response to detected SBWB mortalities and as a proactive action. Section 6.3.5 and Section 6.4.4 outline the current knowledge base regarding SBWB activity and wind speed at MFWF. For the mitigation option to be effectively tested, a stronger correlation between activity and wind speed would need to be determined and this requires the collection of a larger dataset. The Trigger Level 1 and Trigger Level 2 Incident Investigations specified in the SBWB Adaptive Management Plan may provide an opportunity to collect such data

Ultrasonic Acoustic Deterrents

Ultrasonic Acoustic Deterrent (UAD) technology is in the early phases of research and development. UAD are devices that emit a loud, high-frequency noise (inaudible to the human ear) that bats will avoid. It is hypothesised that placing UAD devices on wind turbines may allow wind energy facilities to operate normally while decreasing

bat fatalities. A number of studies at operational wind farms in Northern America have produced results suggesting that some species of bat avoid turbines fitted with UAD technology. Literature reviewed include:

- Weaver et al. (2019) Weaver, S., Castro-Arellano, I., Simpson, T. and Hein, C. 2019. Testing Ultrasonic Acoustic Deterrents for Reducing Bat Fatalities at Wind Turbines in South Texas. (Abstract). American Wind Wildlife Research Institute (AWWI), Wind Wildlife Research Meeting XII 2019, St Paul, Minnesota, USA.
- Romano et al. (2019) Romano, B., Skalski, J., Townsend, R., Kinzie, K., Coppinger, K. and Miller, M. 2019. Evaluation of an Acoustic Deterrent to Reduce Mortalities at an Illinois Wind Farm. Wildlife Society Bulletin: 1–11.
- Arnett et al. (2013) Evaluating the Effectiveness of an Ultrasonic Acoustic Deterrent for Reducing Bat Fatalities at Wind Turbines. PLoS ONE 8 (6): e65794. doi:10.1371/journal.pone.0065794 [and published correction. PLoS ONE 8 (9): 10.1371/annotation/a81f59cb-0f82-4c84-a743-895acb4b2794. doi:10.1371/annotation/a81f59cb-0f82-4c84-a743-895acb4b279].
- Gorresen et al. (2015) Gorresen, P.M., Cryan, P.M., Dalton, D.C., Wolf, S., Johnson, J., Todd, C. and Bonaccorso, F.J. 2015. Dim Ultraviolet Light as a Means of Deterring Activity by the Hawaiian Hoary Bat *Lasiurus cinereus semotus*. Endangered Species Research 28: 249–257.

The use of ultrasonic noise is not a proven reliable deterrent of microbats and is not likely suitable to reduce the risk of turbine collisions for SBWB at Mt Fyans Wind Farm.

. It is likely that global research and development of UAD technology will continue and the effectiveness of the technology will become more clearly known in future years. Appendix 8, SBWB Adaptive Management Plan undertakes to review the development of techniques such as UAD technology.

Bat detection and shutdown techniques

A range of additional techniques could also be investigated as potential mitigation options. An obvious method of risk reduction for avian-based species at wind farms is turbine shutdowns. Blanket turbine shutdowns (such as low wind cut-in speeds or those based on environmental conditions) are blunt approaches to reducing short-duration risk. Blanket shutdowns are an effective option for large movements of migratory birds. For mitigating risk to resident species or species continuously present at a site (including those absent for long periods of time but present for short periods of time, such as the SBWB at the MFWF site), the downside to broad brush or blanket mitigation rules is significant lost energy production. As outlined above, control could be implemented without a risk being present.

Several techniques/systems have the future potential to detect objects like the SBWB. Through integration of the detection systems to the wind farm operating system, it may be possible to automate shutdowns to specific wind turbines at specific times. Such systems have been developed for various species of concern (Identiflight, Robin Radar, DT Bird). Such systems use camera technology, radar and infrared. Automating a system based on ultrasonic bat detectors may also be a future possibility.

A key issue associated with camera-based, radar and infrared systems is the inability to distinguish between species. This is, of course, even more difficult for cryptic (and nocturnal) species such as the SBWB. It is worth noting here that this may not be an issue at particular sites (depending on the level of utilisation observed), because the number of additional shutdowns for non-target species may be immaterial.

The use of automated bat detection and turbine shutdown techniques are not currently a proven reliable deterrent of microbats and is not likely suitable to reduce the risk of turbine collisions for SBWB at Mt Fyans Wind Farm.

It is likely that global research and development of this type of technology will continue, and the effectiveness of the technology will become more clearly known in future years. Appendix 8, SBWB Adaptive Management Plan undertakes to review the development of these methods Effectiveness of mitigation measures

Inherent in the adaptive management approach would be to evaluate the effectiveness of a mitigation solution. Based on the results of the studies on the mitigation options discussed above, it could be reasonable to assume that some benefit is likely to arise from their applications. Caution is required, however, in the application of results from one site to another and from one species to another. In particular, some of the cited studies have reported different responses to mitigation options between species. Site uniqueness and conditions may also be an important consideration.

Appendix 8, SBWB Adaptive Management Plan undertakes to implement low wind speed curtailment in response to bat mortalities and also as part of proactive actions to protect the species.

The SBWB Adaptative Management Plan undertakes to monitor approaches and evidenced-based measures to validate (statistically significant where possible) the effectiveness of alternative mitigation measure/s that are currently in development.

7.3 Mitigation conclusions

In conclusion, low wind speed curtailment will be implemented in response to bat mortalities and as part of a proactive actions to protect the SBWB species.

A range of developing measures will be monitored by literature review annually to determine their potential in reducing collision risk for SBWB at MFWF. Technologies and techniques that are under development may provide solutions in the future. As outlined above, the Mt Fyans Wind Farm SBWB Adaptive Management Plan sets out the survey regime, adaptive management approach and the available techniques to be employed and potential techniques to be monitored.

7.4 Alternatives

Alternative locations for wind turbines were considered in the design of the project and the project design has incorporated broad scale and localised alternative turbine locations to reduce risk to the species

7.5 SBWB Significant Impact Criteria

The significant impact criteria for critically endangered and endangered species (DEWHA 2013) is given below. An action is likely to have a significant impact on a critically endangered species if there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of a population
- Reduce the area of occupancy of the species
- Fragment an existing population into two or more populations
- Adversely affect habitat critical to the survival of a species
- Disrupt the breeding cycle of a population
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

- Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
- Introduce disease that may cause the species to decline, or
- Interfere with the recovery of the species.

The Wind Farm Industry EPBC Act Policy Statement 2.3 (DEWHA 2009) provides additional information on how to apply the EPBC Act significant criteria to wind farm projects. Certain attributes of listed threatened species and site characteristics increase the likelihood that a wind farm development will impact on a listed threatened species or ecological community.

The Policy recognises different categories of threat for listed species and ecological communities, reflecting different levels of risk of extinction. It recognises that for a community and/or species with low population numbers nationally, limited distribution or habitat, or habitat of particular importance, actions could have a significant impact:

"An activity that affects, or is likely to affect, a small number of individuals usually would not be expected to have a significant impact on the species as a whole. However, when a species or community is in small numbers nationally, or its distribution or habitat is limited, or if the habitat has particular importance for the species, the activity could have a significant impact. In general, this would apply to species or communities that are most at risk of extinction and are, as such, listed as critically endangered or endangered." (EPBC Act Policy Statement 2.3 p. 10).

The Policy Statement recognises the importance of movement routes for species such as Southern Bent-wing Bat that undertake seasonal migration:

"The southern bent-wing bat (*Miniopterus schreibersii basanii*) migrates to maternity roosts over long distances, generally at faster speeds and at different heights from normal foraging flight. Topographical features, feeding and roosting resources are some of the factors influencing the route taken. Flight corridors for these movements may be narrow at:

- prominent headlands or peninsulas where migrating species depart or make landfall
- near approaches to wetlands or bat caves
- along ridges, rivers and vegetated corridors, and
- through gaps between habitat patches." (EPBC Act Policy Statement 2.3 p. 11).

It also recognises consideration of the suitability of the site, its vegetation and features for use by listed threatened species for roosting, feeding or breeding:

"Where a wind farm development is on or near habitat which is important to listed threatened or listed migratory species, an impact might be expected. Such habitat includes:

- Roosts of communally roosting species, such as certain bats
- Breeding grounds of species which gather en-masse in a very restricted area, such as seabird island or promontory, or a bat nursery cave…" (EPBC Act Policy Statement 2.3 p. 11).

The above is given consideration in the assessment below.

7.6 SBWB Significant Impact Assessment

The National Recovery Plan for the SBWB (DELWP 2020) states that the most significant limitation on the SBWB population appears to be the species reliance on just two regularly used breeding sites/caves. A number of other factors are implicated in the rapid decline of the population including loss and modification of roosting and foraging habitat, human disturbance, pesticides, disease, and drought and climate change affecting food availability. However, there is little empirical evidence to identify the main cause/s of the current decline.

The National Recovery Plan for the SBWB (DELWP 2020) states that:

- it is possible that a wind farm built close to a significant roosting site could have a major impact on that population
- the risk increases the closer the wind farm is to an important site, particularly a maternity site or migration path.

The proposed Mt Fyans wind farm site is approximately 35 kilometres north of the closest non-maternity roost site at Panmure/Grassmere and 50 kilometres north of the Starlight maternity cave, with the remainder of roosting caves being located further west and south – west within basalt lava flows and limestone caves closer to the coast.

An assessment of the proposed wind farm against the significant impact criteria relevant to SBWB is provided below in Table 7.1.

The location of the Mt Fyans site in relation to the maternity and non-maternity key roost sites results in a Unlikely risk of the site being within:

- migration paths associated with annual movements to and from the maternity roost
- travel paths associated with movements between non-maternity roost sites.

There will be no direct habitat impacts for SBWB from the proposed wind farm. As with any wind energy facility in south-west Victoria there may be some residual operational collision risk to individual SBWB foraging and moving through the site. However, in common with a broad range of similar environments across SW Victoria, the location of the proposed Mt Fyans Wind Farm does not appear to be a key focal site for SBWB and is unlikely to pose a significant risk for the species.

There will be no foraging habitat impacts for SBWB from the proposed wind farm. As with any wind energy facility in south-west Victoria there is a high focus on protection of waterways, wetlands and farm dams and protection of resident fauna. There is no planned drainage of wetlands, and no removal of native vegetation from the wind farm site that will cause foraging habitat loss for SBWB.

The SBWB Adaptive Management Plan for Mt Fyans Wind Farm has been prepared with the aim to address any residual operational collision risk to below acceptable threshold level – refer to the document for details. Feedback has been received from the National SBWB Recovery team and Mount Fyans Wind Farm Pty Ltd wishes to maintain the consultation with that body.

Table 7.1 Assessment of Southern Bent-wing Bat (listed Critically Endangered species) in relation to Significant Impact Criteria for Critically endangered and endangered species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of a population	Unlikely – to be confirmed by PVA modelling and the SBWB Adaptive Management Plan and SBWB Monitoring Program	As the proposed site is not within close proximity to a maternity site or a known major roost site and there is a general lack of other habitats that would provide significant foraging resources, it is not expected that the site would attract SBWB in numbers that constitute a significant proportion of the population. There are no known roosting resources nearby that would lead the species to 'migrate' through the site during movements from and to maternity sites and non-breeding sites, and there is also no known roosting habitat to the north of the site. The majority of the site is cleared agricultural land, devoid of remnant woodland with completely altered hydrological regimes that results from agricultural drainage of the plains. Due to the above factors combined with the relatively low call rates recorded onsite, it is considered unlikely the proposed action would lead to a long-term decrease in the size of the population.
Reduce the area of occupancy of the species	Unlikely	The numbers of confirmed SBWB calls recorded in the site surveys and lack of roosting habitat indicates that it is unlikely that a significant number of SBWB individuals migrate through or utilise the area regularly. Buffering of wetland habitats (dams) and woodland areas where higher call activity was recorded at times, will reduce residual collision risk. The area of occupancy of the species will not be reduced.
Fragment an existing population into two or more populations	Unlikely	The site does not support significant numbers of this species and it is not within close proximity to roost sites with large congregations. Fragmentation of the population into two or more populations will not occur.
Adversely affect habitat critical to the survival of a species	Unlikely	There is no declared critical habitat for the species. Critical habitat would likely include the maternity sites in Warrnambool and South Australia, non-breeding roosts across the species' range and foraging habitat associated with these locations (DELWP 2020). The site does not contain habitat critical to the survival of the species.

Significant Impact Criteria	Likelihood of significant impact	Notes
Disrupt the breeding cycle of a population	Unlikely	The site is located 50 km to the north of the Victorian maternity site. The site is not located within what could be considered to be a migration route between known maternity and non-breeding roost habitats. TSSC (2021) states there are examples of individual bats flying between a particular maternity and a particular non-maternity cave and sometimes returning on the same night – journey of 70km or 140km return. TSSC (2021) also states: "*Comparatively little is known about preferred foraging habitats and locations.*"
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The construction and operation of the proposed wind farm will not result in a decrease in habitat that will have any measurable effect on viability of the species.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat	Unlikely	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.
Introduce disease that may cause the species to decline	Unlikely	As per previous response. No impact.

Significant Impact Criteria	Likelihood of significant impact	Notes
Interfere with the recovery of the species	Unlikely	The National Recovery Plan for the SBWB (DELWP 2020) DELWP 2020 notes nine objectives for recovery of the species: 1. Develop techniques to accurately estimate the population size at the maternity sites and undertake regular assessments of population numbers to thoroughly document population trends. 2. Determine the main cause/s of the recent decline in numbers of Southern Bent-wing Bats, and develop targeted, rapid management responses. 3. Protect the maternity sites and other key non-breeding sites. 4. Protect and enhance foraging habitat around the maternity sites and key non-breeding sites. 5. Clarify the taxonomic status, distribution and population structure of the Southern Bent-wing Bat. 6. Compile and maintain databases to aid in the management of the subspecies. 7. Establish a long-term monitoring program for the Southern Bent-wing Bat. 8. Facilitate and promote community interest, understanding and participation. 9. Provide direction and guidance to the recovery of the Southern Bent-wing Bat and review the success of this Recovery Plan. As the proposed site will have no impact on a breeding site and/or key non-breeding site, the proposed action will not interfere with the recovery of the species. This will be confirmed by the use of PVA analysis and controlled mitigations as described in the Mt Fyans SBWB Adaptive Management Plan.

8. Residual Impacts / Offsets

8.1 Residual impacts

As described in Section 6.3, the numerous site-based studies conducted at MFWF site have concluded that SBWB call activity is low. As bat call activity data does not provide an indication of the number of individuals or flight observational data, collision risk modelling cannot be conducted. Collision risk modelling is considered a pre-construction risk assessment tool that can be useful in predicting the level of impact of a project to a particular species or group of species. Commonly, however, it cannot be completed because of insufficient data. No collision risk modelling has been completed for SBWB for any other wind development project. As has been described (Section 6), the various campaigns to collect utilisation data on the SBWB at the MFWF project site have been extensive. On the basis that low call activity has been recorded across the project site, in both areas of high and low potential risk (as determined by specialist ecologists), there is no basis for further data to be collected and any such data would still not facilitate the undertaking of collision risk modelling.

With respect to residual impacts, as has been described in Section 7 of this document, determining the effectiveness of the available mitigation options will rely on the implementation of an adaptive management approach (SBWB Mitigation Plan). The approach will be developed as a part of the SBWB Mitigation Plan, including measuring the effectiveness of mitigation approaches.

Based on low levels of SBWB call activity across the site, particularly in areas proposed for wind turbines, and the various mitigation options that could be trialed as a part of the SBWB Mitigation Plan, there is unlikely to be a residual risk. The SBWB Mitigation Plan will clearly set out the process for continually addressing identified risks through the adaptive management framework. Residual impacts identified will be managed through the implementation of offsets as described in the following section.

8.2 Offset strategy and management plan

Offsets are a measure to provide environmental benefits after the implementation of all possible avoidance and mitigation measures has been considered. As stated in EPBC Act Environmental Offsets Policy October 2012 (https://www.environment.gov.au/system/files/resources/12630bb4-2c10-4c8e-815f-2d7862bf87e7/files/offsets-policy_2.pdf), offsets should not be considered until all reasonable avoidance and mitigation measures have been deployed, or acceptable reasons have been provided as to why avoidance or mitigation of impacts is not reasonably achievable. Where there are significant difficulties in quantifying the effectiveness of expensive and logistically difficult mitigation options, it may be more suitable to consider offsets that have certainty in providing a real and tangible benefit to the species.

There are no SBWB-specific offset guidelines available.

The Federal Government Department of Agriculture, Water and the Environment (DAWE) provide the EPBC Act Offsets assessment guide to determine suitable species-specific offsets and this is suitable for use on listed flora and species of fauna that are tightly linked to a habitat type. For SBWB and other fauna species that do not rely on a specific habitat type that is being removed or is no longer useable, there is difficulty in quantifying benefits to protected, improved or restored habitat. For SBWB, it is acknowledged that making informed decisions about the benefit of offsets to the species is difficult. Discussions with DEWLP (March 2020) concluded that it was unclear what could be considered a suitable SBWB offset. The development of suitable offset projects would therefore be required in close collaboration with relevant technical specialists and government departments.

For offsets to be suitable, the EPBC Act 1999 Environmental Offset Policy states that they 'should align with conservation priorities for the impacted protected matter and be tailored specifically to the attribute of the protected matter that is impacted in order to deliver a conservation gain'. The National Recovery Plan for the SBWB (DELWP 2020) is the most relevant document and includes recovery actions focused on protecting the maternity sites, developing survey techniques, undertaking research, developing monitoring programs to better understand the behaviour of the species and increasing community awareness. Zoos Victoria has also released a Wildlife Conservation Master Plan 2019–2024 that is dedicated to the recovery of 27 threatened native species including the SBWB. The plan includes a range of direct actions and research measures with budget to protect the species, including:

- Protecting Victoria's main SBWB maternity site,
- Understanding the population dynamics of the species,
- Contributing to an Australian Research Council (ARC)-funded study of white-nose syndrome,
- Habitat restoration of maternity cave surrounds, and
- Investigating threats facing SBWB habitat.

In southwest Victoria, the only other project that has been given an EPBC Act permit condition relating to SBWB was the Mortlake South Wind Farm. The condition required the proponent to develop a Habitat Enhancement Plan that contained measures to enhance habitat for SBWB.

Mount Fyans Wind Farm Pty Ltd acknowledges that it will be difficult to establish the extent of the offset required. This is principally on the basis that there is uncertainty as to whether or not there will be an impact from the MFWF project. As previously highlighted, the low levels of utilisation across the site and the implementation of an adaptive management approach are expected to result a residual impact that is unlikely to impact the species. However, on the basis of this uncertainty, WNR has developed an adaptive management plan for this species. The Southern Bent-wing Bat Adaptive Management Plan for Mt Fyans Wind Farm has been prepared in consultation with the National SBWB Recovery team and this consultation is ongoing.

This plan:

- Provides explanatory information and the rationale underpinning design and management of Mt Fyans Wind Farm that are intended to avoid and minimise effects on the SBWB,
- Sets out a framework of adaptive measures from project siting and design through to the operational functioning of the planned wind farm, to which Mount Fyans Wind Farm Pty Ltd is committed to ensure the proposed wind farm has minimal effect on the SBWB,
- Proposes a Southern Bent-wing Bat Offset Research Fund to support high quality ecological or other relevant scientific research on the SBWB, or management activities, the results of which will assist with the management and protection of the species. Support will be given to research that is scientifically rigorous, conducted by suitably qualified, knowledgeable and experienced scientists, and which is consistent with the objectives of the National Recovery Plan for the SBWB (DELWP 2020), or any subsequent Southern Bent-wing Bat Recovery Plan.

9. Natural Temperate Grassland of the Victorian Volcanic Plain

9.1 Description

Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) is listed as critically endangered under the EPBC Act.

There is no adopted national recovery plan for this community. DAWE provide a range of relevant documents for this community, including:

- approved conservation advice (TSSC 2018),
- Commonwealth listing advice (TSSC 2008), and
- information sheets and guidelines (DSEWPC 2011a, DEWHA 2009a, DSEWPC 2012).

NTGVVP is dominated by tussock grasses, including Kangaroo Grass *Themeda triandra*, wallaby grasses *Rytidosperma* spp., spear grasses *Austrostipa* spp. or tussock grasses *Poa* spp. A range of other graminoid species and herbs may also be present.

The community corresponds closely with several Ecological Vegetation Classes (EVC), including EVC 132 Plains Grassland, EVC 654 Creekline Tussock Grassland and open areas within EVC 55_61 Plains Grassy Woodland. Some occurrences of EVC 649 Stony Knoll Shrubland and EVC 125 Plains Grassy Wetland may also correspond with the definition of NTGVVP.

To qualify for protection as this community, native vegetation patches must meet a range of condition and size criteria, including:

- size: minimum patch size of 0.05 hectares, and
- condition:
  - dominant native species must represent at least 50% of the native species and the perennial tussock cover, or
  - non-grass weeds comprise less than 30% of ground cover, or
  - native forbs comprise at least 50% of total vegetation cover during spring and summer.

A detailed flowchart for assessing individual patches is provided in DSEWPC (2011b). It is possible for relatively degraded examples of the community to qualify for protection under the EPBC Act, provided native grass cover exceeds the cover of introduced perennial tussock grasses, and non-grass weed cover is less than 30%. For example, paddocks dominated by introduced annual grasses, but with scattered occurrences of a single native perennial grass such as Common Tussock-grass *Poa labillardeiri*, would qualify for protection.

This NTGVVP community has affinities with other nationally listed communities, including:

- Grassy Eucalypt Woodland of the Victorian Volcanic Plain
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains.

NTGVVP also corresponds with the FFG Act listed Western (Basalt) Plains Grasslands Community.

9.1.1 Occurrences within the MFWF project area

The EPBC Act Protected Matters Search Tool (PMST) predicts that NTGVVP is likely to occur within the MFWF Project site. Field assessments confirmed that this community is present within sections of Heavier-soils Plains Grassland EVC; Plains Grassy Wetland and Stony Knoll Shrubland within the MFWF study area and along roadsides.

The mapped distribution of this community is shown in Appendix 7. Surveys undertaken onsite to document EPBC Act listed flora and communities are described in Section 3 of the targeted surveys report (Biosis 2022b).

Within the northern section of the MFWF study area (between Woorndoo–Darlington Road and Woorndoo–Dundonnell Road), NTGVVP exists on private land and road reserves as occurrences of EVC 649 Stony Knoll Shrubland, EVC 125 Plains Grassy Wetland and EVC 132_61 Heavier-soils Plains Grassland. High-quality examples of NTGVVP are present along Woorndoo–Dundonnell Road.

To the south of Woorndoo–Darlington Road, the landscape is generally flatter (older volcanics) and has been subject to higher levels of pasture improvement and cultivation. Within this area, NTGVVP is generally limited to road reserves, although there are some patches of EVC 125 Plains Grassy Wetland, supporting Common Tussock-grass, which meet the definition of this community. Road reserves supporting EVC 132_61 Heavier-soils Plains Grassland include the Hamilton Highway, South Road, Mortlake–Ararat Road and Castle–Carey Road.

This community is likely to have been considerably more widespread in the study area in the past. The community has been impacted by agricultural practices including land clearing, pasture improvement, grazing and cropping.

The proponent undertook further investigations for alternative site access, including the use of South Road and an alternative construction compound, in 2021. Flora and fauna surveys were undertaken along South Road in March 2021, in anticipation of likely requirements to upgrade the road, which may involve road widening. The South Road reserve supports areas of Plains Grassland, interspersed with areas dominated by introduced grasses, particularly Toowoomba Canary-grass *Phalaris aquatica*. Some of the patches of Plains Grassland are of sufficient size and condition to qualify for protection as NTGVVP.

9.2 Potential for impact

There are two NTGVVP communities where development is proposed closer than 200m from the edge of the community. These areas are referred to as the ‘northern’ grassland, and the ‘southern’ grassland.

The northern grassland has an area of 2.9ha and is in an area where surface and subsurface Aboriginal heritage artefacts were located on pronounced stony rises. As shown in Figure 9-1, there are wind turbines near the grassland as well as an access track and underground cable to the north.

The southern grassland covers an area of approximately 100ha, the condition and quality of the NTGVVP communities varies considerably across the area and specifically close to the outer edges of the paddock. The mapped extent of the community has been taken as corresponding with paddock boundaries and the Work Exclusion Area has been applied to this area. A planted shelterbelt exists across the majority of the western extent of the NTGVVP community, as shown in Figure 9-2.

The significant impact guidelines for these two communities are addressed in Table 9.1.

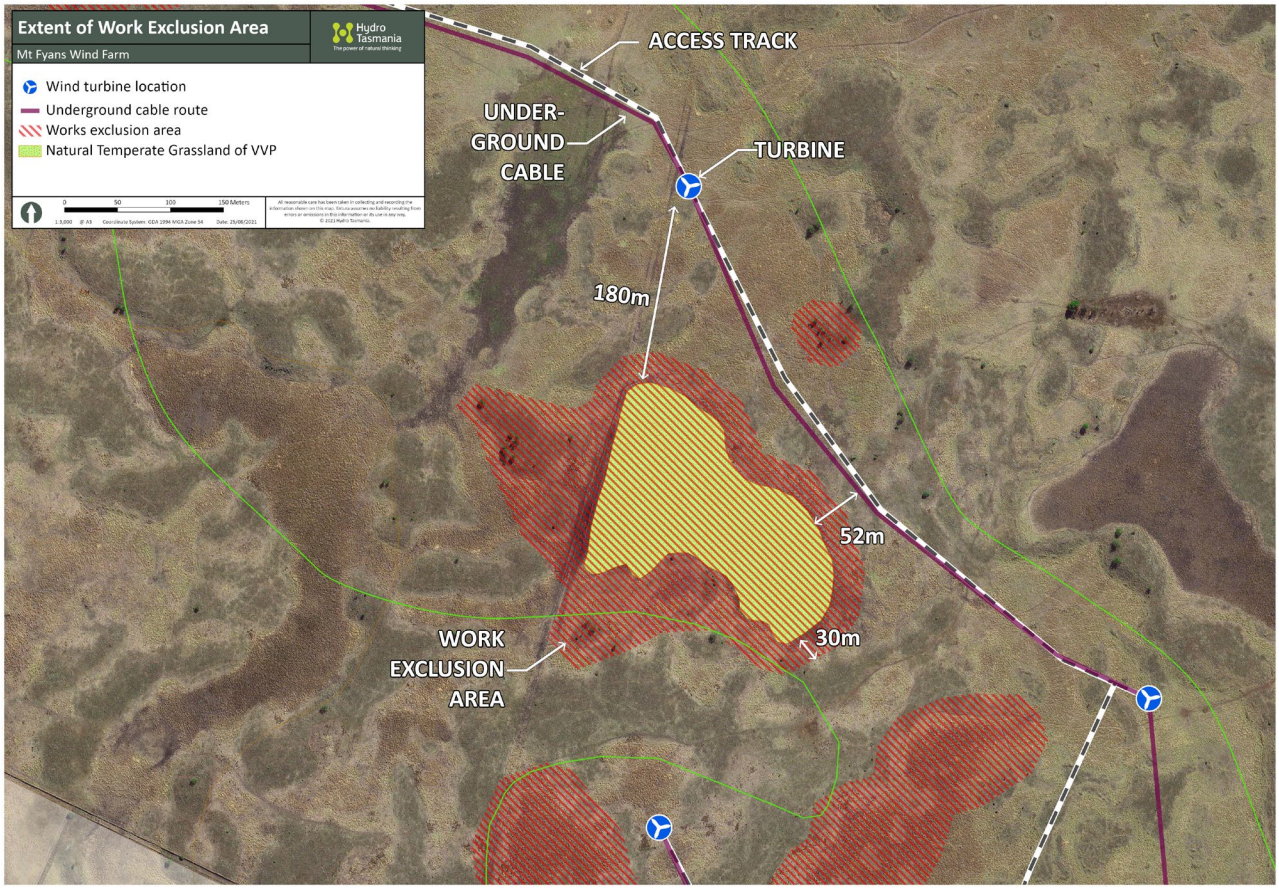


Figure 9-1 Extent of NTGVVP and Work Exclusion Area in the northern area of project site

Figure 9-2 Extent of NTGVVP and Work Exclusion Area in the southern area of project site

Table 9.1 Assessment of Natural Temperate Grassland of the Victorian Volcanic Plain (listed critically endangered community) in relation to *Significant Impact Criteria* for critically endangered and endangered communities

Significant Impact Criteria	Likelihood of significant impact	Notes
Reduce the extent of an ecological community	Likely	With the exception of the impact area required for the South Road upgrade, all mapped patches have been included within specified 'Work Exclusion Areas' and the extents of those communities will not be impacted. The planned South Road upgrade will involve removal of 0.41 ha of the community.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	Unlikely	With the exception of the impact area required for the South Road upgrade, all mapped patches have been included within specified 'Work Exclusion Areas'. The planned South Road upgrade works will involve minor removal of portions of the community adjacent to the road. This will not lead to additional fragmentation.

Significant Impact Criteria	Likelihood of significant impact	Notes
Adversely affect habitat critical to the survival of an ecological community	Unlikely	The occurrence of this community along South Road is in relatively poor condition and is likely to be invaded by Toowoomba Canary-grass, and other introduced grasses, if the current management regime continues.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	Unlikely	With the exception of the impact area required for the South Road upgrade, all mapped patches have been included within specified 'Work Exclusion Areas'. Indirect impacts due to hydrological changes are highly unlikely.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	Unlikely	The project will not lead to a substantial change to the primary land uses of the properties involved. Existing land uses and land management activities, such as grazing and cropping, will continue.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: – assisting invasive species, that are harmful to the listed ecological community, to become established, or – causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community	Unlikely	The project will not lead to a substantial change to the primary land uses of the properties involved. Existing land uses and land management activities, such as grazing and cropping, will continue. The risk of introduction of weeds or pathogens will be managed through vehicle hygiene and biosecurity protocols during construction and operation of the facility.

Significant Impact Criteria	Likelihood of significant impact	Notes
Interfere with the recovery of an ecological community.	Unlikely	There is no adopted recovery plan for the community. Agricultural practices and management of road reserves remain the primary factors inhibiting recovery of the community within the area. The development of the project is not likely to interfere with recovery provided individual patches of the community are avoided. The availability of an additional income stream for landholders could lead to opportunities for farmers to reduce impacts and undertake rehabilitation actions.

9.3 Proposed alternatives, avoidance and mitigation measures

Through the establishment of WEA and design measures, most of the potential impacts on the NTGVVP have been avoided.

For the northern areas of NTGVVP, potential impact has been avoided by the establishment of a WEA to protect the EPBC Act listed community as well as the stony rise landform. As shown in Figure 9-1, the WEA extends beyond the extent of the grassland community by 30m. Potential impact arising from the proposed underground cable route and access track is avoided with the infrastructure situated a minimum 52m away from the community.

For the southern areas of the NTGVVP, potential impact has been avoided with the establishment of a WEA encompassing all of the areas of the threatened community as shown in Figure 9-2. The nearest wind turbine is approximately 90m from the community, while the proposed access track will be situated along the western length of the NTGVVP community, on the far side of the shelterbelt approximately 20m away from the NTGVVP community. Furthermore, potential impacts because of the proximity of the access track to the community and subsequent stormwater runoff will be minimised with the proposed installation of a drainage channel that avoids runoff / and sedimentation entering the grassland.

However, impact on up to 0.41 ha of NTGVVP in the road reserve of the Moyne Shire Council-owned South Road could not be avoided. The upgrade scenario on which this application is based assumes a maximum road works width of 19 to 20m, For the western section of the road it is assumed that all works occur to the north of the road, and for the eastern section of the road it is assumed that the road is widened by up to 5m on either side, as shown in Figure 9-3 and the inset map. The assumptions around both the maximum width of the road works and location of the works result in a worst-case scenario for potential impact to the NTGVVP communities.

There are opportunities to work with the Moyne Council to meet their road design requirements while minimising direct impacts to NTGVVP. Mount Fyans Wind Farm Pty Ltd is committed to working with the Moyne Council to design the road work to both minimise its width and to locate the works to avoid the NTGVVP community as far as practicable.

Appropriate mitigation measures will also be established to ensure areas of NTGVVP which have been avoided from upgrade works will be treated as protected areas within WEA. This will ensure that ancillary construction activities such as materials storage and vehicle/machinery parking will avoid these areas.

The access track to the onsite substation will also include the trench for underground cables. The access track impacts an area of NTGVVP. The option of relocating the access track to the southern side of the substation was

assessed. This was found to be unviable as it would create a safety hazard with large and heavy vehicles crossing under the high voltage overhead line.

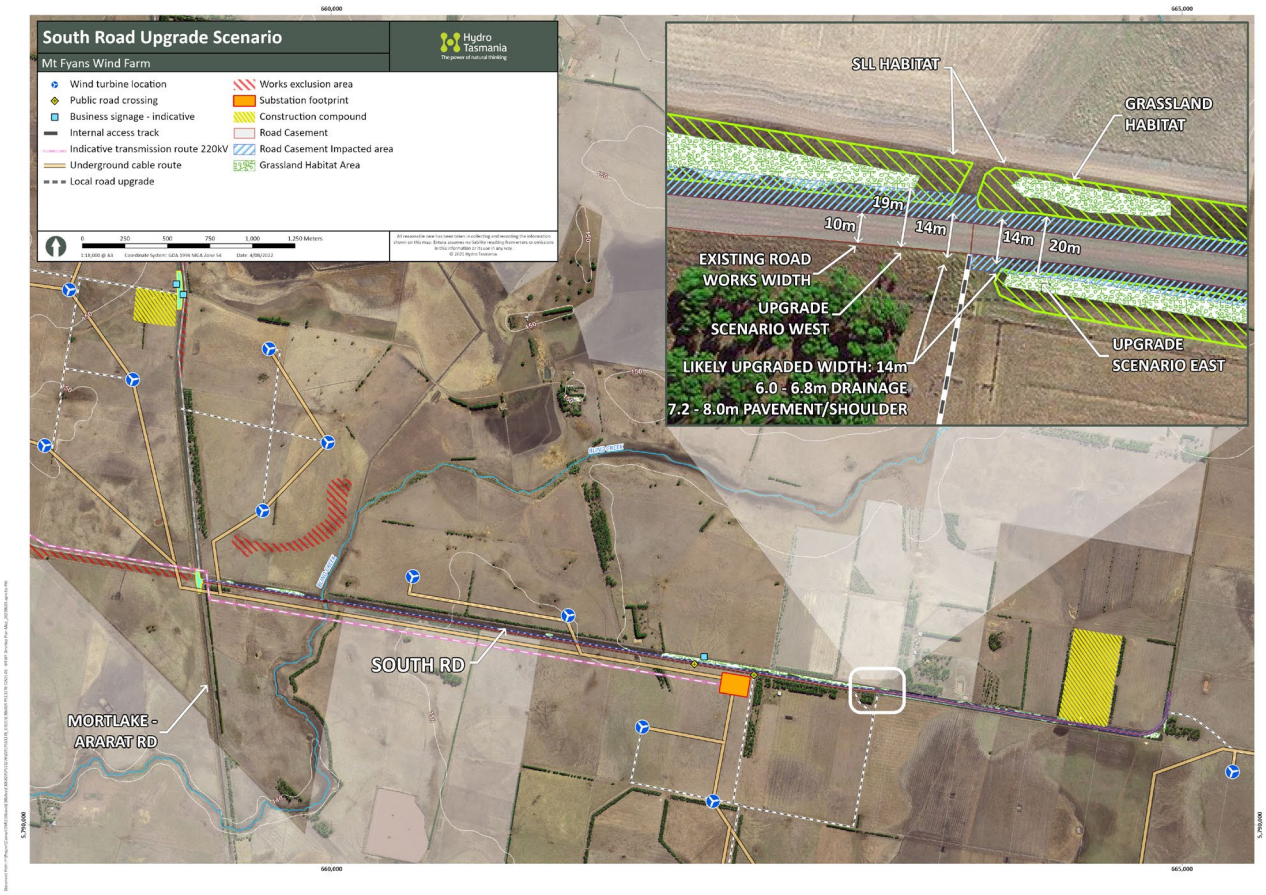


Figure 9-3 NTGVVP along South Road

9.4 Residual impacts and offsets

The planned works will involve disturbance to 0.41 ha of Plains Grassland, and 0.41 ha of NTGVVP (Refer to Biosis 2022b, Figure 7 and Appendix 3).

The residual impact on the NTGVVP is up to 0.41 ha, which relates to the maximum area of disturbance for the upgrade of South Road. This area assumes that the widening and realignment will disturb all areas of NTGVVP within the road reserve of the upgraded section of South Road. However, it is noted that the upgrade works is highly unlikely to disturb the maximum area.

Offsetting a loss of 0.41 ha of NTGVVP will require an offset area of approximately 2 ha, depending on the current quality of the offset site. A suitable offset site has not yet been identified, however given the level of residential development on the Victorian Volcanic Plain to the west of Melbourne, it is understood that there is a well-established offset market for this community. Subsequently it is expected that offsets will be able to be secured. The intent is that the offset site of NTGVVP will be co-located with a habitat offset for Striped Legless Lizard.

Residual impacts to the community will be avoided post-construction by the design of the construction works to no hinder the natural flow of surface water servicing the wetland areas. Culverts and drains around the construction works will be specified during the design phase and installed to permit the natural flows to continue and be sized in accordance with civil engineering design requirements. These design elements will be installed and configured in such a way to also mitigate soil erosion.

10. Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains

10.1 Description

Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains (SHWTLP) are listed as critically endangered under the EPBC Act.

There is no adopted national recovery plan for this community. DAWE provide a range of relevant documents for this community, including:

- Approved conservation advice (DSEWPC 2012)
- Commonwealth listing advice (TSSC 2012a).

The SHWTLP ecological community protects temporary freshwater wetlands that are inundated on a seasonal basis, within Victoria, southeast South Australia and southern New South Wales. It occurs on bioregions associated with lowland plains, including the Victorian Volcanic Plain. The vegetation is generally treeless, and dominated by a herbaceous ground layer, including a high cover of graminoids such as grasses and sedges. The community does not include tall marshlands dominated by Cumbungi *Typha* spp., Common Reed *Phragmites australis* or spike-rushes *Eleocharis* spp. These species are typically indicators of more permanent inundation. Other wetland types not included in this community include saline or brackish wetlands, tidal or estuarine wetlands, deep limestone wetlands, wetlands connected to riparian or riverine systems and groundwater-dependent shallow wetlands such as fens, peat bogs and springs.

The Commonwealth list advice (TSSC 2012b) specifies key diagnostic characteristics and condition thresholds for both dry and wet conditions. Condition thresholds relate to species composition, topography, past disturbance and surrounding native vegetation. Wetlands that meet the diagnostic characteristics and condition thresholds are included in the national listing as MNES.

During typical wet cycles, at least 50% of the total cover of plans in the ground layer of the wetland must be provided by native species characteristic of the community. A list of characteristic species is provided in Appendix A of the Commonwealth list advice (TSSC 2012b).

As characteristic species may not be evident during dry conditions (including drought), the presence of SHWTLP wetlands is determined by the landscape position, signs of past disturbances (including drainage) and the nature of vegetation surrounding the wetland. Information collected during past wet conditions, including past surveys or maps, may also be used as evidence that the wetland is likely to support characteristic species when wet.

For wetlands consistent with the key diagnostic features and condition thresholds, there are also size threshold requirements to be included in the national listing. Wetlands must be either:

- isolated wetlands with a minimum size of 0.5 hectares, or
- a cluster of smaller wetlands with a cumulative area of at least 0.5 hectares within a 5-hectare area, or
- isolated wetlands within an area of native vegetation, where the wetland is at least 0.1 hectares, and the combined area of the wetland and surrounding native vegetation is at least 1.0 hectare.

10.1.1 Occurrences within the MFWF project area

Surveys undertaken onsite to document EPBC Act listed flora and communities are described in Section 3 of the targeted surveys report (Biosis 2022b). The EPBC Act Protected Matters Search Tool (PMST) predicts that SHWTLP is likely to occur within the MFWF project area. The following Ecological Vegetation Classes (EVC) within the project area are likely to correspond with the definition of this community:

- EVC 125 Plains Grassy Wetland
- EVC 653 Aquatic Herbland.

Additionally, some wetlands mapped within the Victorian Wetland Inventory (current) map layer may also meet the community definition:

- Freshwater meadow
- Shallow freshwater marsh.

These EVCs and wetlands are shown in Appendix 7.

Determining the listing status of individual occurrences of these EVC and wetlands would require assessment against the diagnostic characteristics and condition thresholds specified in TSSC (2012b). Direct impacts to any mapped remnant vegetation patches or wetlands potentially corresponding with this community have been avoided during the MFWF project design phase. These areas have been included in Work Exclusion Areas for avoidance of any wind farm infrastructure or construction activity and to allow environmental management controls to be effectively initiated and maintained.

10.2 Potential for impact

Commensurate with the priority for mitigation being Avoidance, direct impacts to SHWTLP have been avoided through the design process as follows:

- All mapped occurrences of EVC 125, EVC 653 or wetlands on the current wetland layer have been included within Work Exclusion Areas to avoid direct impacts to this community. These Work Exclusion Areas will be managed during pre-construction, construction and operational phases of the project.
- Entry points to the site from public road reserves have been micro-sited to avoid direct impacts to this community. Changes or modifications of these locations will take into consideration the presence of SHWTLP.

The *Significant Impact Criteria* are addressed in Table 10.1.

Table 10.1 Assessment of Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains (listed critically endangered community) in relation to Significant Impact Criteria for critically endangered and endangered communities

Significant Impact Criteria	Likelihood of significant impact	Notes
Reduce the extent of an ecological community	Unlikely	The project design has avoided direct impacts to EVCs and wetlands that may correspond with this community. All areas have been included within specified 'Work Exclusion Areas'.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	Unlikely	The project design has avoided direct impacts to EVCs and wetlands that may correspond with this community. All areas have been included within specified 'Work Exclusion Areas'.
Adversely affect habitat critical to the survival of an ecological community	Unlikely	The project design has avoided direct impacts to EVCs and wetlands that may correspond with this community. All areas have been included within specified 'Work Exclusion Areas'.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	Unlikely	The project is not expected to impact upon groundwater or surface drainage.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	Unlikely	Land uses within the study area, including grazing and cropping, will continue. The project will not result in a change to the locations, methods or extent of current land uses.

Significant Impact Criteria	Likelihood of significant impact	Notes
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: – assisting invasive species, that are harmful to the listed ecological community, to become established, or – causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community	Unlikely	The project will not lead to a substantial change to the primary land uses of the properties involved. Existing land uses and land management activities, such as grazing and cropping, will continue. The risk of introduction of weeds or pathogens will be managed through vehicle hygiene and biosecurity protocols during construction and operation of the facility.
Interfere with the recovery of an ecological community.	Unlikely	There is no adopted recovery plan for the community. Agricultural practices, particularly construction of drains within low-lying areas, are the primary factors inhibiting recovery of the community within the area. The development of the project is not likely to interfere with recovery provided individual patches of the community are avoided. The availability of an additional income stream for landholders could lead to opportunities for farmers to reduce impacts and undertake rehabilitation actions.

10.3 Proposed alternatives, avoidance and mitigation measures

All mapped occurrences of EVC 125, EVC 653 or wetlands on the current wetland layer have been included within Work Exclusion Areas to avoid direct impacts to this community.

Entry points to the site from public road reserves have been micro-sited to avoid direct impacts to this community. Changes or modifications of these locations will take into consideration the presence of SHWTLP.

Indirect impacts will be managed by implementing a range of measures across all phases of the project to ensure that areas of SHWTLP are not impacted by general construction/operational works, including but not limited to weed and disease controls, dust controls, turbid water run-off controls, no significant alteration of surface water flows, wildfire prevention or any work on adjacent lands likely to cause an impact.

General construction and operational controls will be implemented and maintained via specific documentation under Construction Environment Management Plan that will be developed in response to planning permit conditions.

10.4 Residual impacts and offsets

Residual impacts to the community will be avoided post-construction by the design of the construction works to no hinder the natural flow of surface water servicing the wetland areas. Culverts and drains around the construction works will be specified during the design phase and installed to permit the natural flows to continue and be sized in accordance with civil engineering design requirements. These design elements will be installed and configured in such a way to also mitigate soil erosion.

11. Striped Legless Lizard

11.1 Description

The Striped Legless Lizard (*Delma impar*) is listed as Vulnerable under the EBPC Act and has a patchy distribution throughout south-eastern NSW, ACT, north-eastern, central and south-western Victoria, and south-eastern South Australia. It is a grassland specialist, found only in areas of native grassland and nearby grassy woodland and exotic pasture. The lizard's primary habitat in south-western Victoria is encompassed by two nationally threatened ecological communities including NTGVVP and Grassy Eucalypt Woodland of the Victorian Volcanic Plain. Loss, modification, degradation, and fragmentation of habitat including urban development, high intensity grazing and ploughing and pasture improvement are identified threats to the species. The species is also listed as endangered under the FFG Act.

11.1.1 Occurrences within the MFWF project area

Suitable striped legless lizard habitat at MFWF site is restricted to linear strips of remnant and mixed exotic grassland along roadsides and in road reserves containing loose and lightly embedded rock and cracking clay soils. Potential impacts to habitat may occur on Castle Carey Road, South Road and Mortlake-Ararat Road.

All patches of Plains Grassland and potential Striped Legless Lizard habitat identified in Biosis (2022a) were surveyed either by non-destructive rock rolling or roof tile survey. Surveys were undertaken during October and November 2013 (Biosis 2022b). Striped Legless Lizards were recorded on three occasions from only one of the tile grids which was located on the road reserve at the western end of Castle Carey Road, adjacent to the Hamilton Highway within the Project site. Striped Legless Lizard was not recorded from any other location within the Project site during the targeted surveys involving rock rolling. The remaining areas surveyed still constitute suitable habitat and the Castle Carey Road/Mortlake-Ararat Road population would likely inhabit the remaining other portions of the road reserve despite not being detected there during surveys (Appendix 7).

The upgrading of South Road was proposed in March 2021 and as such a targeted survey has subsequently been completed in the later half of 2021 (Biosis 2022b). The species was recorded at one tile grid on several occasions during the targeted survey.

11.2 Potential for impact

Impact on potential striped legless lizard habitat may occur due to widening and upgrade of South Road including construction of two crossings, as well as construction of two crossings and a cable trench on Castle Carey Road and two site entrances on Mortlake-Ararat Road. Upgrading of the existing roadway will impact up to 3.6ha of lizard habitat on South Road,up to 0.054ha of lizard habitat on Castle Carey Road and up to 0.095ha of lizard habitat on Mortlake-Ararat Road. Total extent of impact is 3.773ha. These locations are described at Appendix 3.1 and shown in Figure 8 of Biosis (2022b).

An assessment of impacts to the striped legless lizard against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 11.1 below. The methods and results of assessments undertaken for this species is included at Section 4.3 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 11.1 Assessment of Striped Legless Lizard (listed vulnerable species) in relation to *Significant Impact Criteria* for vulnerable species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of an important population	Unlikely	Targeted surveys using roof tiles in accordance with the *Survey Guidelines for Australia's Threatened Reptiles* (DEWHA 2011) detected Striped Legless Lizard within the Castle–Carey Road reserve and South Road Reserve within the MFWF project area. Under the EPBC Act, an important population is one that is necessary for a species' long-term survival and recovery. Due to the cryptic nature of the species and lack of evidence to suggest the population identified is genetically impoverished, it must be assumed that the local population identified within the project area is viable, and consequently, one that is important. It is unlikely that the proposed action will result in a long-term decrease in an important population of Striped Legless Lizard. With the exception of recently proposed impacts to the species habitat on South Road, all other areas of native grasslands and woodland within the MFWF project area have been excluded by design to ensure that no temporary or permanent ground disturbance will occur to the species. This will be implemented through a detailed CEMP that ensures areas of known/potential habitat are fenced off and signed as 'Exclusion Areas, with access intercepting habitat along Castle–Carey Road and Mortlake-Ararat Road reserves and South Road to use existing road access locations where feasible. The impact along South Road will be minimised to only extend as little as possible into adjacent habitat from the existing road surface. A total of 3.7 ha of suitable habitat is proposed to be impacted on South Road. At this stage presence has been confirmed, in accordance with the EPBC Act policy statement for this species (DSEWPC 2011b). As the site supports Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP)/ removal or modification of 0.5 hectares or more of known habitat is proposed, or the habitat has a moderate to high potential to support the species, there is a risk of significant impacts. Road reserve crossings on and cable trenches Castle Carey Road and Mortlake-Ararat Road will impact 0.0054 ha and 0.095 ha of habitat respectively.

Significant Impact Criteria	Likelihood of significant impact	Notes
Reduce the area of occupancy of an important population	Likely	The Striped Legless Lizard inhabits remnant grassland or woodland with grassy ground cover on rocky areas within Victoria's volcanic plain and adjacent bioregions (DSEWPC 2011b). It is possible that the proposed action will reduce the area of occupancy of the species where suitable habitat is proposed for removal along South Road and Castle Carey Road.
Fragment an existing population into two or more populations	Unlikely	It is unlikely for the proposed action to fragment an existing population into two or more populations. It is likely that little interaction occurs between individuals located in geographically isolated populations such as those in south-western Victoria's roadsides. For instance, individuals known from Castle Carey Road in the west of the study area are already isolated from habitat on South Road.
Adversely affect habitat critical to the survival of a species	Unlikely	It is unlikely that the proposed action would adversely affect habitat deemed critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely	The life history of the Striped Legless Lizard is poorly known. However, it is believed that females deposit up to two eggs every year within a soil cavity or under rocks in communal nests. The proposed action is not expected to disrupt the breeding cycle of the species.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	It is unlikely that the proposed action would modify or isolate the species' habitat such that measurable effect occurred on the viability of the species.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the vulnerable species' habitat	Unlikely	The proposed action does not include any known mechanism that would result in the establishment of invasive species harmful to Striped Legless Lizard that are not already present in the local area.
Introduce disease that may cause the species to decline	Unlikely	The proposed action does not include any known mechanism that would result in the introduction of a disease that is not already present in the local area.
Interfere with the recovery of the species	Unlikely	The proposed action will not interfere with the recovery of the species in respect to the specific objectives for recovery outlined in the in the National Recovery Plan for Striped Legless Lizard (Smith and Robertson 1999).

11.3 Proposed alternatives, avoidance and mitigation measures

Impact on potential striped legless lizard habitat has been mostly avoided through the design process by the establishment of WEA, as discussed in Section 2.2.4.

With the exception of some areas of South Road and Castle Carey Road, areas potentially suitable for the lizard have been included in Work Exclusion Areas to manage impacts arising during the pre-construction, construction, and post-construction/operational phases of the project. Crossings that intercept habitat along Castle Carey Road reserve and South Road will also use existing road access locations where possible.

The assessed maximum impact on up to 3.624 ha of habitat in the road reserve of the Moyne Shire Council-owned South Road could not be avoided. The upgrade scenario assumes the entire road casement of 19m- 20m is impacted. For the western section of the road it is assumed that all works occur to the north of the road, and for the eastern section of the road it is assumed that the road is widened by up to 5m on either side, as shown in Figure 9-3 and the inset map. The assumptions around the width of works and the location of these works result in a worst-case scenario for impacts to Striped Legless Lizard habitat.

There are opportunities to work with the Moyne Council to meet their road design requirements while minimising direct impacts to Striped Legless Lizard habitat. Mount Fyans Wind Farm Pty Ltd is committed to working with the Moyne Council to design the road work to both minimise width and to locate the works to avoid the NTGVVP community and Striped Legless Lizard habitat as far as practicable.

Appropriate mitigation measures will also be established to ensure areas of Striped Legless Lizard habitat which have been avoided from upgrade works will be treated as protected areas within Work Exclusion Areas. This will ensure that ancillary construction activities such as materials storage and vehicle/machinery parking will avoid these areas.

11.4 Residual impacts and offsets

The project has sought to avoid all possible potential habitat through mapping as Work Exclusion Areas. Where these areas are close to project works, such as along South Road and Castle Carey Road, no-go exclusion fencing will be used. Additionally, a range of measures will be implemented across all phases of the project to ensure that areas of NTGVVP and suitable Striped Legless Lizard habitat will not be impacted by general construction/operational works, including but not limited to weed and disease controls, dust controls, turbid water run-off controls, no significant alteration of surface water flows, wildfire prevention or any work on adjacent lands likely to cause an impact.

The residual impact on the Striped Legless Lizard and suitable habitat as a result of the assumed maximum road widening scenario and crossing points will involve a maximum disturbance of 3.6ha on South Road, 0.054ha on Castle Carey Road and 0.95ha on Mortlake-Ararat Road. A targeted survey for Striped Legless Lizard was undertaken in the second half of 2021 to determine the resident population and therefore enable the calculation of the required offsets. The required offset will be calculated when a final road upgrade design is available and is expected to be included as a condition of approval for the project.

12. Significant Impact Assessment for EPBC Matters Other Than SBWB, NTGVVP, SHWTLP, SLL

12.1 Curlew Sandpiper

An assessment of impacts to Curlew Sandpiper *Calidris ferruginea* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.1 below. The methods and results of assessments undertaken for migratory shorebirds is included at Section 4.1 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.1 Assessment of Curlew Sandpiper (listed critically endangered species) in relation to *Significant Impact Criteria* for critically endangered and endangered species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of a population	Unlikely	Habitat potentially suitable for Curlew Sandpiper is located north of the MFWF project site and outside the turbine layout area and are excluded by design from the wind farm. Small numbers of Curlew Sandpipers may occasionally visit the habitat located outside the wind farm. If any individual birds pass through the wind farm, there would be a potential risk of turbine collision. The likelihood of that occurrence is considered to be low. Any loss of individuals would not result in a long-term decrease in the size of the species population. It is unlikely for indirect impacts of sedimentation or pollutant runoff to impact on the species' habitats or food resources in areas within or downstream of the MFWF project area. All Environment Protection Authority (EPA) construction standards for sediment/pollutant runoff will be implemented through a detailed Construction Environmental Management Plan (CEMP). It is noted that the habitat for the Curlew Sandpipers is located upstream from the project site. It is unlikely for the proposed action to result in long-term decrease in the size of the Curlew Sandpiper population.
Reduce the area of occupancy of the species	Unlikely	The proposed action will not reduce the area of occupancy of the species, as all areas of suitable habitat, including low-lying areas subject to inundation, within the MFWF project area will be avoided and remain intact.
Fragment an existing population into two or more	Unlikely	The proposed action will not fragment an existing population into two or more populations, as the Curlew Sandpiper exists as part of a global population (DoE

Significant Impact Criteria	Likelihood of significant impact	Notes
populations		2015).
Adversely affect habitat critical to the survival of a species	Unlikely	The proposed action will not adversely affect terrestrial habitat critical to the survival of the species, as all wetland environments that support habitat for the species have been excluded from the MFWF project area by design. It is unlikely for indirect impacts of sedimentation or pollutant runoff to impact on the species' habitats or food resources in areas within or downstream of the MFWF project area, as all EPA construction standards for sediment/pollutant runoff will be implemented through a detailed CEMP.
Disrupt the breeding cycle of a population	Unlikely	The proposed action will not disrupt the breeding cycle of the Curlew Sandpiper, as the species is a non-breeding migrant in Australia, nesting in Siberia during the months of June and July (DoE 2015).
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The proposed action will not have any measurable effect on the species viability as a result of the modification or removal of habitat, as all wetland environments that support suitable habitat for the species have been excluded from the MFWF project area by design. It is unlikely for indirect impacts of sedimentation or pollutant runoff to impact on the species habitats or food resources in areas within or downstream of the greater MFWF project area, as all EPA construction standards for sediment/pollutant runoff will be implemented through a detailed CEMP.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered species' habitat	Unlikely	The proposed action does not include any known mechanism that would result in the establishment of invasive species that are not already present in the Hopkins River catchment.
Introduce disease that may cause the species to decline	Unlikely	The proposed action does not include any known mechanism that would result in the introduction of a disease that is not already present in the relevant environment.
Interfere with the recovery of the species	Unlikely	The proposed action will not interfere with the species recovery actions as the species does not have a national recovery plan.

12.2 Little Galaxias (Dwarf Galaxias)

Note: MFWF project (EPBC 2019/8589) – Specific MNES document calls for assessment of Dwarf Galaxias *Galaxiella pusilla*. Studies of morphology and genetics using multiple nuclear and mitochondrial DNA markers have found substantial differences between populations of that taxon occurring in western Victoria and South Australia compared to eastern Victoria, Flinders Island and Tasmania (Coleman, Hoffman and Raadik 2015). Following examination of the diagnostic differences between eastern and western region specimens, western region populations were described as a new species, Little Galaxias *Galaxiella toourtkoourt* (Coleman, Hoffman and Raadik 2015). The taxon Little Galaxias *Galaxiella toourtkoourt* is thus relevant to the MFWF project area rather than Dwarf Galaxias *Galaxiella pusilla*. However, assessment for Dwarf Galaxias under provisions of the EPBC Act remains relevant. The *National Recovery Plan for Dwarf Galaxias* does not identify important populations (Saddlier, Jackson and Hammer 2010). A population downstream of the MFWF project area would be towards the species' eastern range within Australia, and therefore may be considered an important population in this regard.

An assessment of impacts to Little Galaxias against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.2 below. The methods and results of assessments undertaken for this species is included at Section 4.7 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.2 Assessment of Little Galaxias *Galaxiella toourtkoourt* (listed vulnerable species) in relation to *Significant Impact Criteria* for vulnerable species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of an important population	Unlikely	It is unlikely that the proposed action would result in a decrease in the size of an important population of Little Galaxias within or downstream of the greater MFWF project area. All suitable environments supporting habitat (including Salt Creek and Blind Creek) and associated low-lying areas identified to support a known population / suitable habitat of the species have been purposely excluded in the project design, with all pre-existing crossings of waterways within the project area to also be used. It is unlikely that the proposed action would result in any indirect impacts downstream of the MFWF project area that would compromise water quality, in turn, the habitat and food resources of an important population of Little Galaxias. A detailed CEMP will be implemented to ensure that all EPA-approved measures are applied throughout the construction phase in order to effectively manage sediments and pollutants produced on site.
Reduce the area of occupancy of an important population	Unlikely	The proposed action will not reduce the area of occupancy of an important population of Little Galaxias within any of the MFWF project development areas, as all suitable aquatic habitats for the species and associated low-lying areas have been identified and excluded by the project design.

Significant Impact Criteria	Likelihood of significant impact	Notes
Fragment an existing population into two or more populations	Unlikely	The proposed action will not fragment an existing population into two or more populations as all suitable aquatic habitats for the species and associated low-lying areas have been identified and excluded by the project design.
Adversely affect habitat critical to the survival of a species	Unlikely	Flow regimes that regularly replenish shallow freshwater habitats are essential for the survival of Dwarf Galaxias (Little Galaxias), with the connectivity of more permanent waterways with off-stream water bodies considered vital to the species' long-term survival (Saddlier, Jackson and Hammer 2010). It is considered unlikely that the proposed action would impact on the hydrological regime as a result of an increase in impervious surfaces to the extent that permanent waterways downstream of the MFWF project area would become disconnected from their associated off-channel habitats.
Disrupt the breeding cycle of an important population	Unlikely	Dwarf Galaxias (Little Galaxias) are known to spawn in late winter–spring, with females laying 65–250 adhesive eggs on the underside of aquatic vegetation or a hard surface such as rock or woody debris (Ryan, Stuart and Saddlier 2010). It is considered unlikely that the proposed action would result in a decline in water quality downstream of the MFWF project area that would disrupt the breeding cycle of the species. A detailed CEMP will be implemented that contains all EPA-approved measures to minimise indirect impacts associated with the project's construction (i.e. sediments, pollutants, etc.).
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The proposed action will not decrease the quality of the water downstream of the MFWF project area during the construction phase in a way that would have any measurable effect on the viability of the species.

Significant Impact Criteria	Likelihood of significant impact	Notes
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the vulnerable species' habitat	Unlikely	The proposed action does not include any known mechanism that would result in the establishment of invasive species harmful to Little Galaxias that are not already present in the Hopkins River catchment.
Introduce disease that may cause the species to decline	Unlikely	The proposed action does not include any known mechanism that would result in the introduction of a disease that is not already present in the Hopkins River catchment. It is considered unlikely that the proposed action would compromise quality of the water downstream within or downstream of the MFWF project area leading to an increase in the species' susceptibility to pre-existing diseases within the catchment. A detailed CEMP will be implemented to ensure that all EPA-approved measures are applied throughout the construction phase to effectively manage sedimentation and pollutants on site.
Interfere with the recovery of the species	Unlikely	The proposed action will not interfere with the recovery of the species in respect to the specific objectives for recovery outlined in the in the National Recovery Plan for Dwarf Galaxias (Saddlier Jackson and Hammer 2010).

12.3 Yarra Pygmy Perch

An assessment of impacts to Yarra Pygmy Perch *Nannoperca obscura* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.3 below. The methods and results of assessments undertaken for this species is included at Section 4.7 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.3 Assessment of Yarra Pygmy Perch (listed vulnerable species) in relation to *Significant Impact Criteria* for vulnerable species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of an important population	Unlikely	Important populations of the Yarra Pygmy Perch remain undefined by the National Recovery Plan for the species (Saddlier and Hammer 2010). Within its range, its distribution is patchy and highly fragmented, making it extremely vulnerable to local extinctions (Saddlier and Hammer 2010). A population downstream of the MFWF project area would be in an area typically known for small, isolated populations, with major Victorian populations predominantly occurring in systems flowing to the coast between the Barwon River and the South Australia border. A population downstream of the project area would also be towards the northern end of the species' range within Victoria, and therefore may be considered as an important population in this regard. It is unlikely that the proposed action would result in a decrease in the size of an important population of Yarra Pygmy Perch. All suitable environments supporting habitat (including Salt Creek and Blind Creek) and associated low-lying areas identified to support a known population/suitable habitat of the species have been purposely excluded in the MFWF project design, with all pre-existing crossings of waterways within the project area to also be used. It is unlikely that the proposed action would result in any indirect impacts downstream of the MFWF project area that would compromise water quality, in turn, the habitat and food resources of an important population of Yarra Pygmy Perch. A detailed CEMP will be implemented to ensure that all EPA-approved measures are applied throughout the construction phase in order to effectively manage sediments and pollutants produced onsite.

Significant Impact Criteria	Likelihood of significant impact	Notes
Reduce the area of occupancy of an important population	Unlikely	The proposed action will not reduce the area of occupancy of an important population of Yarra Pygmy Perch, as all suitable wetland environments and associated low-lying areas have been identified and excluded by the MFWF project's design.
Fragment an existing population into two or more populations	Unlikely	It is unlikely for the proposed action to fragment an existing population into two or more populations, as this species is more widely believed to exist at the catchment level (Brauer et al. 2013). Nevertheless, all suitable environments supporting habitat (including Salt Creek and Blind Creek) and associated low-lying areas identified to support a known population/suitable habitat of the species have also been purposely excluded in the MFWF's project design, with all pre-existing crossings of waterways within the project area to also be used.
Adversely affect habitat critical to the survival of a species	Unlikely	Habitat critical to the survival of the Yarra Pygmy Perch remains poorly defined within the National Recovery Plan for the species (Saddlier and Hammer 2010). However, given its poor dispersal abilities, it may be considered that any habitat that the species is known/considered to be present in is likely to be critical to its survival (Saddlier and Hammer 2010). It is unlikely that the proposed action would affect habitat critical to the survival of Yarra Pygmy Perch within the MFWF project area. All suitable environments supporting habitat (including Salt Creek and Blind Creek) and associated low-lying areas identified to support a known population/suitable habitat of the species have been purposely excluded in the project's design, with all pre-existing crossings of waterways within the project area to also be used.
Disrupt the breeding cycle of an important population	Unlikely	Very little is known of the breeding biology of this species, although it is assumed that breeding behaviour is similar to the closely related Southern Pygmy Perch, which lays demersal, non-adhesive eggs, over aquatic vegetation and the substrate during the months of spring (Saddlier and Hammer 2010). It is unlikely that the proposed action would comprise water quality downstream of the MFWF project area disrupting the breeding cycle of an important population of the species. A detailed CEMP will be implemented that contains all EPA-approved measures to minimise indirect impacts associated with the project's construction (i.e. sediments, pollutants, etc.).

Significant Impact Criteria	Likelihood of significant impact	Notes
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	It is unlikely that the proposed action phase would decrease water quality downstream of the MFWF project area during the construction phase that would have any measurable effect on the viability of the species.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the vulnerable species' habitat	Unlikely	The proposed action does not include any known mechanism that would result in the establishment of invasive species harmful to Yarra Pygmy Perch that are not already present in the Hopkins River catchment.
Introduce disease that may cause the species to decline	Unlikely	The proposed action does not include any known mechanism that would result in the introduction of a disease that is not already present in the Hopkins River catchment. It is considered unlikely that the proposed action would compromise water quality water within or downstream of the MFWF project area leading to an increase in the species' susceptibility to pre-existing diseases within the catchment. A detailed CEMP will be implemented to ensure that all EPA-approved measures are applied throughout the construction phase to effectively manage sedimentation and pollutants on site.
Interfere with the recovery of the species	Unlikely	The proposed action will not interfere with the recovery of the species in respect to the specific objectives for recovery outlined in the National Recovery Plan for Yarra Pygmy Perch (Saddlier and Hammer 2010).

12.4 Growling Grass Frog

An assessment of impacts to Growling Grass Frog *Litoria raniformia* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.4 below. The methods and results of assessments undertaken for this species is included at Section 4.5 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.4 Assessment of Growling Grass Frog (listed vulnerable species) in relation to *Significant Impact Criteria* for vulnerable species

Significant impact criteria	Likelihood of significant impact	Notes
Significant Impact Criteria 1.1 (vulnerable species)		
Lead to a long-term decrease in the size of an important population	Unlikely	It is unlikely that the proposed action would lead to a long-term decrease in the size of an important population of Growling Grass Frog. Despite the presence of suitable habitat, the species was not detected during targeted surveys (undertaken in accordance with survey methodologies outlined in the *Significant Impact Guidelines for Growling Grass Frog*) within either the MFWF project area or at nearby reference sites. The species is highly mobile and thus a lack of empirical data from within the project area does not specifically exclude potential for the species to occur. As a result, all suitable aquatic habitat, and low-lying areas with potential for seasonal inundation have been buffered and excluded by design from development areas of the project area. All potential indirect impacts such as sediments and pollutants will also be managed to EPA-approved measures through a CEMP to ensure that the proposed action does not compromise surrounding water quality which, in turn, could impact on the species' habitat and food resources.
Reduce the area of occupancy of an important population	Unlikely	It is unlikely that the proposed action would reduce the area of occupancy for an important population of Growling Grass Frog as all suitable wetland habitat and low-lying areas with potential for seasonal inundation have been excluded from development areas by design. All indirect impacts such as sediments and pollutants will also be managed to EPA-approved measures through a CEMP to ensure that the proposed action does not compromise downstream water quality, including the species' habitat and food resources.

Significant impact criteria	Likelihood of significant impact	Notes
Fragment an existing population into two or more populations	Unlikely	The Growling Grass Frog is a highly mobile species that is dependent on the migration of adults between water bodies, and between breeding and non-breeding habitats (Clemann and Gillespie 2012). It is unlikely for the proposed action to fragment an existing population into two or more populations, as all suitable wetland habitat and low-lying areas with potential for seasonal inundation have been excluded from the MFWF project area by design and will remain intact.
Adversely affect habitat critical to the survival of a species	Unlikely	It is unlikely for the proposed action to adversely affect habitat critical to the survival of the species within the MFWF project area, as all suitable aquatic environments and associated low-lying areas that would support foraging, breeding, roosting and dispersal have been identified, buffered and purposely excluded in the project's design. It is also unlikely for indirect impacts of sedimentation or pollutant runoff to impact on the species' habitats or food resources, as all EPA-construction standards for sediment/pollutant runoff will be implemented through a detailed CEMP.
Disrupt the breeding cycle of an important population	Unlikely	The Growling Grass Frog is reliant on aquatic and riparian habitats for breeding and the subsequent development of the larval stage (Clemann and Gillespie 2012). It is unlikely for the proposed action to disrupt the breeding of an important population within the MFWF project area as all suitable wetland environments and associated low-lying areas have been identified and purposely excluded in the project's design. All indirect impacts such as sediments and pollutants will also be managed to EPA-approved measures through a CEMP to ensure the proposed action does not compromise downstream water quality, including the species' habitat and food resources.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	It is unlikely that the proposed action phase would decrease water quality downstream of the MFWF project area during either the construction or operational phase resulting in any measurable effect on the viability of the species.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the vulnerable species' habitat	Unlikely	The proposed action does not include any known mechanism that would result in the establishment of invasive species harmful to Growling Grass Frog that are not already present in the Hopkins River catchment.

Significant impact criteria	Likelihood of significant impact	Notes
Introduce disease that may cause the species to decline	Unlikely	The proposed action does not include any known mechanism that would result in the introduction of a disease that is harmful to the species that is not already present in the Hopkins River catchment.
Interfere with the recovery of the species	Unlikely	The proposed action will not interfere with the recovery of the species in respect to the specific objectives for recovery outlined in the in the *National Recovery Plan for Growling Grass Frog* (Clemann and Gillespie 2012).

A further assessment of impacts to Growling Grass Frog *Litoria raniformia*, against the *Significant Impact Guidelines* (Commonwealth of Australia 2009), is presented in Table 12.5 below.

Table 12.5 Assessment of Growling Grass Frog in relation to *Significant Impact Guidelines for the Vulnerable Growling Grass Frog* Litoria raniformis (Commonwealth of Australia 2009)

Significant impact criteria	Likelihood of significant impact	Notes
Significant Impact Guidelines for the Vulnerable Growling Grass Frog *Litoria raniformis*		
Will the works result in a net reduction in the number and/or diversity of water bodies available to an important population?	Unlikely	It is unlikely for the proposed action to result in a net reduction in the number and diversity of suitable wetland environments as all suitable habitats have been identified, buffered and purposely excluded in the project's design.
Will the works result in the permanent removal or degradation of terrestrial habitat (for example between ponds, drainage lines or other temporary/permanent habitat) within 200 m of a water body in temperate regions, or 350 m in semi-arid regions, that results in the loss of overwintering opportunities for an important population?	Unlikely	It is unlikely for the proposed action to result in the permanent removal or degradation of terrestrial habitat resulting in the loss of over-wintering opportunities, as all potential habitat has been identified, buffered (>350m) and purposely excluded in the project's design.
Will the works result in alterations to wetland hydrology, diversity and structure (for example any changes to timing, duration or frequency of flood events that leads to a decrease in habitat	Unlikely	It is unlikely that increases in impervious surfaces as a result of the proposed action would alter the current hydrological regime to the extent that it would significantly alter the timing and duration of wetting cycles required to maintain the species habitats and associated dispersal corridors.

Significant impact criteria	Likelihood of significant impact	Notes
quality?		
Will the works involve alteration of aquatic vegetation diversity or structure that leads to a decrease in habitat quality?	Unlikely	It is unlikely that in impervious surfaces as a result of the proposed action would alter the current hydrological regime to the extent that it would significantly alter the overall structure and ecological function of the species critical habitat.
Will works result in construction of physical barriers to movement between water bodies, such as roads or buildings?	Unlikely	It is unlikely that the proposed action would result in the construction of physical barrier to movement between water bodies as suitable wetland environments and associated low-lying areas have been identified, buffered, and purposely excluded in the project's design.
Will the works result in removal or alteration of terrestrial or aquatic habitat corridors (including alteration of connectivity during flood events)?	Unlikely	It is unlikely for the proposed action to impact on the surrounding landscape's hydrological regime. Any alterations as a result of the increase in impervious surfaces are considered unlikely to affect permanent waterways downstream of the Project area to the extent that they would become disconnected from their associated off-channel habitats during flood events, resulting in a subsequent decline in the structure and function of the species' habitat corridors.
Will the works result in introduction of predatory fish or disease agents?	Unlikely	The proposed action does not include any known mechanism that would result in the introduction of a disease or predatory fish that is harmful to the species that is not already present in the Hopkins River catchment.

12.5 Spiny Rice-flower

An assessment of impacts to Spiny Rice-flower *Pimelea spinescens* subsp. *spinescens* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.6 below. Surveys undertaken onsite to document EPBC Act listed flora and communities are described in Section 3 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.6 Assessment of Spiny Rice-flower (listed critically endangered species) in relation to *Significant Impact Criteria* for critically endangered and endangered species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of a population	Unlikely	Spiny Rice-flower was detected within the MFWF project area in the road reserves of Woorndoo–Dundonnell Road and Castle–Carey Road during targeted surveys of the species (in accordance with methodologies outlined in *Significant Impact Guidelines for Spiny Rice-flower* (DEWHA 2009b) within all areas of Plains Grassland. It is unlikely that the proposed action would result in the loss of any individuals of Spiny Rice-flower, as all known populations and potential habitat of the species have been identified, buffered and excluded by the project's design. The project will also make use of all pre-existing powerpoles to minimise the requirement for ground disturbance and, to a feasible extent, undertake works within and from areas of pre-existing disturbance. During the construction phase, a detailed CEMP for the project area will also be implemented to ensure that: all known populations and potential habitat are fenced and appropriately signed as 'No Go' zones all staff are inducted to understand the conservation values of native vegetation and threatened flora on site all earth moving vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds. Further targeted survey is required in 2021 to confirm that this species is not present within the area to be impacted for the proposed upgrades to South Road.

Significant Impact Criteria	Likelihood of significant impact	Notes
Reduce the area of occupancy of the species	Unlikely	Spiny Rice-flower occurs primarily in native grassland or exotic perennial grassland featuring a moderate diversity of native species and inter-tussock spaces (DEWHA 2009b). The proposed action is not expected to reduce the species' distributional extent as the majority of the MFWF project area does not support suitable habitat and all suitable habitat will be buffered and excluded from the project area, by both design and fencing signed as 'No Go' zones.
Fragment an existing population into two or more populations	Unlikely	Spiny Rice-flower is sensitive to development activities due to its restricted distribution, resulting in declining populations and low levels of recruitment (DEWHA 2009b). Connectivity is therefore considered important for maintaining gene flow for the species, given its limited dispersal capabilities (DEWHA 2009b). The proposed action is not expected to fragment or disturb an existing population of Spiny Rice-flower as the majority of the MFWF project area does not support suitable habitat and all suitable habitat will be buffered and excluded from the project area, by both design and fencing signed as 'No Go' zones.
Adversely affect habitat critical to the survival of a species	Unlikely	Habitat critical to the survival of the species is not defined within the *National Recovery Plan for the Spiny Rice-flower* (Carter and Walsh 2006a). However, given the species' fragmented distribution, declining populations and low levels of recruitment, it could be considered that all habitat where it is known or has the potential to occur is ecologically significant to the species' survival. The proposed action is not expected to impact upon on the species habitat given that the majority of the MFWF project area does not support suitable habitat and all suitable habitat will be buffered and excluded from the project area, by both design and fencing signed as 'No Go' zones.
Disrupt the breeding cycle of a population	Unlikely	Both male and female plants are required for reproduction, with germination thought to be triggered by fire followed by rain (DEWHA 2009b). The proposed action is not expected to disrupt the breeding cycle of a population of the species as the majority of the MFWF project area does not support suitable habitat and all suitable habitat will be buffered and excluded from the project area, by both design and fencing signed as 'No Go' zones.

Significant Impact Criteria	Likelihood of significant impact	Notes
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	It is unlikely that the proposed action would have any measurable effect on the viability of the species. All known populations and potential habitat have been buffered and excluded, by both design and fencing signed as 'No Go' zones. The project will also make use of all pre-existing powerpoles to minimise the requirement for ground disturbance and, to a feasible extent, undertake works within and from areas of pre-existing disturbance.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered species' habitat	Unlikely	It is unlikely for the proposed action to result in the establishment of invasive species that are not already present in the Hopkins River catchment. A detailed CEMP for the MFWF project area will ensure that all inductions highlighting the conservation value of native vegetation are undertaken prior to works and that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Introduce disease that may cause the species to decline	Unlikely	It is unlikely for the proposed action to result in the introduction of a disease that is not already present in the relevant environment. A detailed CEMP for the MFWF project area will ensure that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Interfere with the recovery of the species	Unlikely	It is unlikely that the proposed action will interfere with the recovery of the species in respect to the specific objectives for recovery outlined in the *National Recovery Plan for Spiny Rice-flower* or trigger impacts regarded a significant as outlined in the *Significant Impact Guidelines for Spiny Rice Flower* (Carter and Walsh 2006a, DEWHA 2009b). All individuals and potential habitat of the species will be retained through the MFWF project's design and protected during construction through use of fencing signed as 'No Go' zones and the implementation of a site-specific CEMP.

12.6 Basalt Rustyhood

An assessment of impacts to Basalt Rustyhood (also known as Basalt Greenhood) *Pterostylis basaltica* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.7 below. Surveys undertaken onsite to document this species are described in Section 3.3.3 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b.

Within the vicinity of the project site, the Basal Rustyhood is known to be found within the road verges of the Worndoo-Darlington Road. There are no other known or surveyed locations for the species.

The Worndoo-Darlington Road is not identified as a road transport route within the project Traffic Impact Assessment and no upgrade works are planned, nor will occur, along the Worndoo-Darlington Road. It is intended to take all reasonable steps to exclude project -related heavy transport from that road.

Table 12.7 Assessment of Basalt Rustyhood (listed endangered species) in relation to *Significant Impact Criteria* for critically endangered and endangered species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of a population	Unlikely	The proposed action will not lead to a long-term decrease in the size of a population of Basalt Rustyhood. The species was not detected during targeted surveys within the MFWF project area, in accordance with survey methodologies outlined in the *Draft Survey Guidelines for Australia's Threatened Orchids* (DoE 2013). Despite a lack of empirical data for the species presence within the project area, all areas of its suitable habitat – including Plains Grassland, stony rises dominated by grass and forb species and stony rises only partially dominated by Austral bracken or introduced flora – have been buffered and excluded by design. The project will also make use of all pre-existing powerpoles to minimise the requirement for ground disturbance and, to a feasible extent, undertake works within and from areas of pre-existing disturbance. During the construction phase, a detailed CEMP for the MFWF project area will also be implemented to ensure that: all potential habitat is fenced and appropriately signed as 'No Go' zones all staff are inducted to understand the conservation values of native vegetation and threatened flora on site all earth moving vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.

Significant Impact Criteria	Likelihood of significant impact	Notes
Reduce the area of occupancy of the species	Unlikely	Basalt Rustyhood is known from stony rises and areas of Plains Grassland supporting embedded surface rock. There are only two known populations of Basalt Rustyhood in Victoria, with both occurring in Dundonnell within the road reserve of Woorndoo–Dundonnell Road (n=1,000) and adjacent private property (n=20). It is considered to be unlikely that the proposed action would reduce the species' distributional extent as the majority of the MFWF project area does not support suitable habitat and all suitable habitat will be buffered and excluded from the project area, by both design and fencing signed as 'No Go' zones.
Fragment an existing population into two or more populations	Unlikely	The Basalt Rustyhood has only ever been known from the two sites at Dundonnell. It is therefore considered that the proposed action will not fragment an existing population into two or more populations, as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones).
Adversely affect habitat critical to the survival of a species	Unlikely	Habitat critical to the survival of the species has not been identified within the *National Recovery Plan for the Basalt Rustyhood* (Vicek and Pritchard 2010). However, given its severely restricted occurrence it may be considered that all suitable habitat is ecologically significant to the species in this regard. It is unlikely for the proposed action to adversely affect habitat critical to the survival of the species, as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).
Disrupt the breeding cycle of a population	Unlikely	Reproduction of the species is believed to be solely from seed. It is unlikely that the proposed action would disrupt the breeding cycle of a population of Basalt Rustyhood as the species was not detected within the MFWF project area and all suitable areas of habitat identified have been buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase) to ensure that no temporary or permanent ground disturbance could occur to its habitat.

Significant Impact Criteria	Likelihood of significant impact	Notes
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	It is unlikely that the proposed action would have any measurable effect on the viability of the species as the species was not detected within the MFWF project area and all suitable areas of habitat identified have been buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase) to ensure that no temporary or permanent ground disturbance could occur to its habitat.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered species' habitat	Unlikely	It is considered unlikely for the proposed action to result in the establishment of invasive species that are not already present in the Hopkins River catchment. A detailed CEMP for the MFWF project area will ensure that all inductions highlighting the conservation value of native vegetation are undertaken prior to works and that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Introduce disease that may cause the species to decline	Unlikely	It is unlikely for the proposed action to result in the introduction of a disease that is not already present in the relevant environment. A detailed CEMP for the MFWF project area will ensure that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Interfere with the recovery of the species	Unlikely	It is unlikely the proposed action would interfere with the recovery of the species in respect to the specific objectives for recovery outlined in the *National Recovery Plan for Basalt Rustyhood* (Vlcek and Pritchard 2010). All potential habitat of the species will be retained through the MFWF project's design and use of fencing signed as 'No Go' zones and the implementation of a site-specific CEMP.

12.7 Adamson's Blown-grass

An assessment of impacts to Adamson's Blown-grass *Lachnagrostis adamsonii* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.8 below. Surveys undertaken onsite to document EPBC Act listed flora and communities are described in Section 3 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.8 Assessment of Adamson's Blown-grass (listed endangered species) in relation to *Significant Impact Criteria* for critically endangered and endangered species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of a population	Unlikely	It is unlikely that the project would lead to a long-term decrease in the size of a population of Adamson's Blown-grass. The species was not detected during targeted surveys within the MFWF project area. Despite a lack of empirical data for the species presence within the project area, all areas of its suitable habitat have been buffered and excluded by design. The project will also make use of all pre-existing powerpoles to minimise the requirement for ground disturbance and, to a feasible extent, undertake works within and from areas of pre-existing disturbance. During the construction phase, a detailed CEMP for the project area will also be implemented to ensure that: • all potential habitat is fenced and appropriately signed as 'No Go' zones • all staff are inducted to understand the conservation values of native vegetation and threatened flora on site. • all earth moving vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds • all indirect impacts such as sediments and pollutants will be managed to EPA-approved measures to ensure that the proposed action does not compromise surrounding water quality which, in turn, could impact on the species habitat.
Reduce the area of occupancy of the species	Unlikely	Adamson's Blown-grass is known from low-lying, seasonally wet or swampy areas of plains communities. The species was not detected within the MFWF project area during targeted surveys. It is unlikely that the proposed action would reduce the area of occupancy of Adamson's Blown-grass as the majority of the project area does not support suitable habitat and all suitable

Significant Impact Criteria	Likelihood of significant impact	Notes
		habitat will be buffered and excluded from the project area, by both design and fencing signed as 'No Go' zones.
Fragment an existing population into two or more populations	Unlikely	The nearest record of the species is approximately 30 kilometres from the MFWF project area. It is unlikely that the proposed action would fragment an existing population into two or more populations as the species was not identified within the project area and as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones).
Adversely affect habitat critical to the survival of a species	Unlikely	Habitat critical to the survival of the species has not been identified within the *National Recovery Plan for Adamson's Blown-grass* (Murphy 2010). However, given its restricted occurrence to seasonally wet, low-lying areas that are increasingly threatened by changes in hydrological regimes as a result of changes in land use and climate variability, it may be considered that all suitable habitat is ecologically significant to the species in this regard. It is unlikely the proposed action would adversely affect habitat critical to the survival of the species as all areas of potential habitat has been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).
Disrupt the breeding cycle of a population	Unlikely	Adamson's Blown-grass flowers between November and February. the proposed action would impact on the breeding cycle of the species as it was not detected within the MFWF project area and all potential habitat has been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	It is unlikely that the proposed action would have any measurable effect on the viability of the species, as Adamson's Blown-grass was not detected within the MFWF project area and all suitable areas of habitat identified have been buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase) to ensure that no temporary or permanent ground disturbance could occur to its habitat.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established	Unlikely	It is considered a low likelihood for the proposed action to result in the establishment of invasive species that are not already present in the Hopkins River catchment. A detailed CEMP for the MFWF project area will ensure

Significant Impact Criteria	Likelihood of significant impact	Notes
in the critically endangered species' habitat		that all inductions highlighting the conservation value of native vegetation are undertaken prior to works and that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Introduce disease that may cause the species to decline	Unlikely	It is unlikely for the proposed action to result in the introduction of a disease that is not already present in the relevant environment. A detailed CEMP for the MFWF project area will ensure that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Interfere with the recovery of the species	Unlikely	The proposed action is unlikely to interfere with the recovery of the species in respect to the specific objectives for recovery outlined in the *National Recovery Plan for Adamson's Blown-grass* (Murphy 2010). All potential habitat of the species will be retained through the MFWF project's design, use of fencing signed as 'No Go' zones and the implementation of a site-specific CEMP.

12.8 Fragrant Leek-orchid

An assessment of impacts to Fragrant Leek-orchid *Prasophyllum suaveolens* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.9 below. Surveys undertaken onsite to document EPBC Act listed flora and communities are described in Section 3 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.9 Assessment of Fragrant Leek-orchid (listed endangered species) in relation to *Significant Impact Criteria* for critically endangered and endangered species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of a population	Unlikely	It is unlikely the proposed action would lead to a long-term decrease in the size of a population of Fragrant Leek-orchid. The species was not detected during targeted surveys within the MFWF project area, in accordance with survey methodologies outlined in the *Draft Survey Guidelines for Australia's Threatened Orchids* (DoE 2013). Despite a lack of empirical data for the species' presence within the project area, all areas of its suitable habitat including damp *Themeda* grasslands within Plains Grassland have been buffered and excluded by design. The project will also make use of all pre-existing powerpoles to minimise the requirement for ground disturbance and, to a feasible extent, undertake works within and from areas of pre-existing disturbance. During the construction phase, a detailed CEMP for the MFWF project area will also be implemented to ensure that: all potential habitat is fenced and appropriately signed as 'No Go' zones all staff are inducted to understand the conservation values of native vegetation and threatened flora on site all earth moving vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.

Reduce the area of occupancy of the species	Unlikely	The Fragrant Leek-orchid is endemic to the basalt plains of southwest Victoria, where it requires the presence of mychorrizal fungi for seed germination and nutrients to adult plants. The species was not detected within the MFWF project area during targeted surveys in potential habitat. It is unlikely the proposed action would reduce the area of occupancy of the Fragrant Leek-orchid as the majority of the project area does not support suitable habitat and all suitable habitat will be buffered and excluded from the project area, by both design and fencing signed as 'No Go' zones.
Fragment an existing population into two or more populations	Unlikely	The Fragrant Leek-orchid is endemic to the basalt plains of southwest Victoria, where it that has been recorded from within 10 kilometres of the MFWF project area where it has been recorded in predominantly native grass and forb species. It is unlikely the proposed action would fragment an existing population into two or more populations as the species was not identified within the project area and as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones).
Adversely affect habitat critical to the survival of a species	Unlikely	Habitat critical to the survival of the species has not been identified within the *Recovery Plan for Twenty-five Threatened Orchid Taxa of Victoria, South Australia and New South Wales 2003–2007* (Coates, Jeanes and Pritchard 2003). However, given the increasing risks of fire, weed invasion, grazing and development impacting habitat and its relationship with mycorrhizal fungi within its range, it may be considered that all suitable habitat is ecologically significant to the species in this regard. It is unlikely the proposed action would adversely affect habitat critical to the survival of the species as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).
Disrupt the breeding cycle of a population	Unlikely	The principal means of reproduction is sexual, with pollination mainly occurring by native bees. It is unlikely the proposed action would impact on the breeding cycle of the species as it was not detected within the MFWF project area and all potential habitat has been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).

Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	It is unlikely the proposed action would have any measurable effect on the viability of the species as the species was not detected within the MFWF project area and all suitable areas of habitat identified have been buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase) to ensure that no temporary or permanent ground disturbance could occur to its habitat.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered species' habitat	Unlikely	It is considered a low likelihood for the proposed action to result in the establishment of invasive species that are not already present in the Hopkins River catchment. A detailed CEMP for the MFWF project area will ensure that all inductions highlighting the conservation value of native vegetation are undertaken prior to works and that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Introduce disease that may cause the species to decline	Unlikely	It is unlikely for the proposed action resulting in the introduction of a disease that is not already present in the relevant environment. A detailed CEMP for the MFWF project area will ensure that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Interfere with the recovery of the species	Unlikely	The proposed action has a low likelihood of interfering with the recovery of the species in respect of the specific objectives for recovery outlined in the *Recovery Plan for Twenty-five Threatened Orchid Taxa of Victoria, South Australia and New South Wales 2003–2007* (Coates, Jeanes and Pritchard 2003). All potential habitat of the species will be retained through the MFWF project's design, use of fencing signed as 'No Go' zones and the implementation of a site-specific CEMP.

12.9 Small Golden Moths Orchid

An assessment of impacts to Small Golden Moths Orchid *Diuris basaltica* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.10 below. Surveys undertaken onsite to document EPBC Act listed flora and communities are described in Section 3 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.10 Assessment of Small Golden Moths Orchid (listed endangered species) in relation to *Significant Impact Criteria* for critically endangered and endangered species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of a population	Unlikely	It is unlikely the proposed action would lead to a long-term decrease in the size of a population of Small Golden Moths Orchid. The species was not detected during targeted surveys within the MFWF project area, in accordance with survey methodologies outlined in the *Draft Survey Guidelines for Australia's Threatened Orchids* (DoE 2013). Despite a lack of empirical data for the species' presence within the project area, all areas of its suitable habitat including grassland vegetation dominated by tussock-forming perennial grasses, often with embedded surface rock, has been excluded by design. The project will also make use of all pre-existing powerpoles to minimise the requirement for ground disturbance and, to a feasible extent, undertake works within and from areas of pre-existing disturbance. During the construction phase, a detailed CEMP for the MFWF project area will also be implemented to ensure that: all potential habitat is fenced and appropriately signed as 'No Go' zones all staff are inducted to understand the conservation values of native vegetation and threatened flora on site all earth moving vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.

Significant Impact Criteria	Likelihood of significant impact	Notes
Reduce the area of occupancy of the species	Unlikely	The Small Golden Moths Orchid was initially thought to be restricted to a small area immediately to the west of Melbourne; however, recent records have been found within three kilometres north of the MFWF project area within predominantly native grassland. The species was not detected within the MFWF project area during targeted surveys in potential habitat. The project will not reduce the area of occupancy of the Small Golden Moths orchid as the majority of the project area does not support suitable habitat and all suitable habitat will be buffered and excluded from the project area, by both design and fencing signed as 'No Go' zones.
Fragment an existing population into two or more populations	Unlikely	It is unlikely the proposed action would fragment an existing population into two or more populations as the species was not identified within the MFWF project area and as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones).
Adversely affect habitat critical to the survival of a species	Unlikely	Habitat critical to the survival of the species has not been identified within the *National Recovery Plan for the Small Golden Moths Orchid* (Backhouse and Lester 2010). However, given its severely restricted occurrence it may be considered that all suitable habitat is ecologically significant to the species in this regard. It is unlikely the proposed action would adversely affect habitat critical to the survival of the species, as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).
Disrupt the breeding cycle of a population	Unlikely	The species reproduces by seed or tuber multiplication. It is unlikely for the proposed action to adversely affect the breeding cycle of the species as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase) to avoid temporary and permanent ground disturbance.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	It is unlikely the proposed action would have any measurable effect on the viability of the species. The species was not detected within the MFWF project area and all suitable areas of habitat identified have been buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase) to ensure that no temporary or permanent ground disturbance could occur to its habitat.

Significant Impact Criteria	Likelihood of significant impact	Notes
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered species' habitat	Unlikely	It is considered a low likelihood for the proposed action to result in the establishment of invasive species that are not already present in the Hopkins River catchment. A detailed CEMP for the MFWF project area will ensure that all inductions highlighting the conservation value of native vegetation are undertaken prior to works and that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Introduce disease that may cause the species to decline	Unlikely	It is unlikely for the proposed action to result in the introduction of a disease that is not already present in the relevant environment. A detailed CEMP for the MFWF project area will ensure that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Interfere with the recovery of the species	Unlikely	The proposed action is unlikely to interfere with the recovery of the species in respect to the specific objectives for recovery outlined in the *National Recovery Plan for the Small Golden Moths Orchid* (Backhouse and Lester 2010). All potential habitat of the species will be retained through the MFWF project's design, use of fencing signed as 'No Go' zones and the implementation of a site-specific CEMP.

12.10 Hoary Sunray

An assessment of impacts to Hoary Sunray *Leucochrysum albicans* subsp. *tricolor* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.11 below. Surveys undertaken onsite to document EPBC Act listed flora and communities are described in Section 3 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.11 Assessment of Hoary Sunray (listed endangered species) in relation to *Significant Impact Criteria* for critically endangered and endangered species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of a population	Unlikely	It is unlikely the proposed action would lead to a long-term decrease in the size of a population of Hoary Sunray. The species was not detected during targeted surveys within the MFWF project area. Despite a lack of empirical data for the species presence within the project area, all areas of its suitable habitat have been buffered and excluded by design. The project will also make use of all pre-existing powerpoles to minimise the requirement for ground disturbance and, to a feasible extent, undertake works within and from areas of pre-existing disturbance. During the construction phase, a detailed CEMP for the project area will also be implemented to ensure that: all potential habitat is fenced and appropriately signed as 'No Go' zones all staff are inducted to understand the conservation values of native vegetation and threatened flora on site all earth moving vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Reduce the area of occupancy of the species	Unlikely	Hoary Sunray grows on the grasslands of the Victorian Volcanic Plain, which are primarily acidic clay soils derived from basalt, with occasional occurrences on adjacent sandy soils. The species was not detected within the MFWF project area during targeted surveys in potential habitat. It is unlikely the proposed action would reduce the area of occupancy of Hoary Sunray as the majority of the project area does not support suitable habitat and all suitable habitat will be buffered and excluded from the project area, by both design and fencing signed as 'No Go' zones.
Fragment an existing population into two or more	Unlikely	There are three records approximately within 10 kilometres of the MFWF project area. It is unlikely the

populations		proposed action would fragment an existing population into two or more populations as the species was not identified within the project area and all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones).
Adversely affect habitat critical to the survival of a species	Unlikely	Habitat critical to the survival of the species has not been identified within the *National Recovery Plan for the Hoary Sunray* (Sinclair 2011). However, given its increasing risk to fire, weed invasion, grazing and development, it may be considered that all suitable habitat is ecologically significant to the species in this regard. It is unlikely the proposed action would adversely affect habitat critical to the survival of the species, as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).
Disrupt the breeding cycle of a population	Unlikely	The Hoary Sunray is an obligate out-breeder that is entirely dependent on the transfer of pollen between individuals for successful reproduction. It is unlikely the proposed action would impact on the breeding cycle of the species as it was not detected within the MFWF project area and all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	It is unlikely the proposed action would have any measurable effect on the viability of the species as the Hoary Sunray was not detected within the MFWF project area and all suitable areas of habitat identified have been buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase) to ensure that no temporary or permanent ground disturbance occurs.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered species' habitat	Unlikely	It is considered unlikely that the proposed action will result in the establishment of invasive species that are not already present in the Hopkins River catchment. A detailed CEMP for the MFWF project area will ensure that all inductions highlighting the conservation value of native vegetation are undertaken prior to works and that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.

Introduce disease that may cause the species to decline	Unlikely	It is unlikely for the proposed action to result in the introduction of a disease that is not already present in the relevant environment. A detailed CEMP for the MFWF project area will ensure that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Interfere with the recovery of the species	Unlikely	The proposed action is unlikely to interfere with the recovery of the species in respect to the specific objectives for recovery outlined in the *National Recovery Plan for the Hoary Sunray* (Sinclair 2011). All potential habitat of the species will be retained through the MFWF project's design, use of fencing signed as 'No Go' zones and the implementation of a site-specific CEMP.

12.11 Spiny Pepper-cress

An assessment of impacts to Spiny Pepper-cress *Lepidium aschersonii* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.12 below. Surveys undertaken onsite to document EPBC Act listed flora and communities are described in Section 3 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.12 Assessment of Spiny Pepper-cress (listed vulnerable species) in relation to *Significant Impact Criteria* for vulnerable species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of an important population	Unlikely	The closest important population of Spiny Pepper-cress is located within a private property in nearby Mortlake. It is unlikely the proposed action would lead to a long-term decrease in the size of this population. The project will make use of all pre-existing powerpoles to minimise the requirement for ground disturbance and, to a feasible extent, undertake works within and from areas of pre-existing disturbance. During the construction phase, a detailed CEMP for the MFWF project area will also be implemented to ensure that: all potential habitat is fenced and appropriately signed as 'No Go' zones all staff are inducted to understand the conservation values of native vegetation and threatened flora on site all earth moving vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds all indirect impacts such as sediments and pollutants will be managed to EPA-approved measures to ensure the proposed action does not compromise surrounding water quality which, in turn, could impact on the species habitat.
Reduce the area of occupancy of an important population	Unlikely	Spiny Pepper-cress is known from periodically wet sites such as gilgai depressions and the margins of freshwater and saline marshes and shallow lakes, usually on heavy clay soil. It is unlikely the proposed action would reduce the area of occupancy of an important population of Spiny Pepper-cress as all suitable habitat will be buffered and excluded from the MFWF project area, by both design and fencing signed as 'No Go' zones.
Fragment an existing population into two or more	Unlikely	The nearest important population of 70 individuals is located 12 kilometres south at a private property at

populations		Mortlake. It is unlikely the proposed action would fragment this population or any other existing population as the species was not identified within the MFWF project area and as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones).
Adversely affect habitat critical to the survival of a species	Unlikely	Habitat critical to the survival of the species has not been identified within the *National Recovery Plan for Spiny Pepper-cress* (Carter 2010). However, given its restricted occurrence to seasonally wet, low-lying areas that are increasingly threatened by changes in hydrological regimes as a result of changes in land use and climate variability, it may be considered that all suitable habitat is ecologically significant to the species in this regard. It is unlikely the proposed action would adversely affect habitat critical to the survival of the species as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).
Disrupt the breeding cycle of an important population	Unlikely	The reproductive ecology of the species is not well known. The proposed action is not expected to impact on the breeding cycle of the species as it was not detected within the MFWF project area and all potential habitat has been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	It is unlikely the proposed action would have any measurable effect on the viability of the species as the Spiny Pepper-cress was not detected within the MFWF project area and all suitable areas of habitat identified have been buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase) to ensure that no temporary or permanent ground disturbance could occur to its habitat.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the vulnerable species' habitat	Unlikely	It is considered unlikely that the proposed action will result in the establishment of invasive species that are not already present in the Hopkins River catchment. A detailed CEMP for the MFWF project area will ensure that all inductions highlighting the conservation value of native vegetation are undertaken prior to works and that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.

Introduce disease that may cause the species to decline	Unlikely	It is unlikely for the proposed action to result in the introduction of a disease that is not already present in the relevant environment. A detailed CEMP for the MFWF project area will ensure that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Interfere with the recovery of the species	Unlikely	The proposed action is unlikely to interfere with the recovery of the species in respect to the specific objectives for recovery outlined in the *National Recovery Plan for Spiny Pepper-cress* (Carter 2010). All potential habitat of the species will be retained through the MFWF project's design, use of fencing signed as 'No Go' zones and the implementation of a site-specific CEMP.

12.12 Swamp Fireweed

An assessment of impacts to Swamp Fireweed *Senecio psilocarpus* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.13 below. Surveys undertaken onsite to document EPBC Act listed flora and communities are described in Section 3 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.13 Assessment of Swamp Fireweed (listed vulnerable species) in relation to Significant Impact Criteria for vulnerable species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of an important population	Unlikely	The proposed action is not expected to lead to a long-term decrease in the size of an important population of Swamp Fireweed. Commonwealth policy documents for the species do not identify important populations. A population, while not identified within the MFWF project area, would be within the core of its range, isolated and limited to very small areas of high-quality, herb-rich wetlands. A population that exists within the core of its range, isolated from other populations, is unlikely to be considered important in this regard. Despite a lack of empirical data for the species presence within the MFWF project area, all areas of its suitable habitat have been buffered and excluded by design. The project will also make use of all pre-existing powerpoles to minimise the requirement for ground disturbance and, to a feasible extent, undertake works within and from areas of pre-existing disturbance. During the construction phase, a detailed CEMP for the project area will also be implemented to ensure that: all potential habitat is fenced and appropriately signed as 'No Go' zones all staff are inducted to understand the conservation values of native vegetation and threatened flora on site all earth moving vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds all indirect impacts such as sediments and pollutants will be managed to EPA-approved measures to ensure that the proposed action does not compromise surrounding water quality which, in turn, could impact on the species habitat.
Reduce the area of occupancy of an important population	Unlikely	Swamp Fireweed is known from high-quality, herb-rich wetlands on plains. It is unlikely the proposed action

		would reduce the area of occupancy of Swamp Fireweed as all suitable habitats, including low-lying areas, have been buffered and excluded from the MFWF project area, by both design and fencing signed as 'No Go' zones.
Fragment an existing population into two or more populations	Unlikely	It is unlikely the proposed action would fragment an existing population into two or more populations as the species was not identified within the MFWF project area and all areas of low-lying, herb-rich habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones).
Adversely affect habitat critical to the survival of a species	Unlikely	Habitat critical to the survival of the species has not been identified within Commonwealth policy documents. However, given its restricted occurrence to seasonally wet, low-lying areas that are increasingly threatened by changes in hydrological regimes as a result of changes in land use and climate variability, it may be considered that all suitable habitat is ecologically significant to the species in this regard. It is unlikely the proposed action would adversely affect habitat critical to the survival of the species, as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).
Disrupt the breeding cycle of an important population	Unlikely	Within occupied sites, a hydrological regime is required which allows the retention of shallow and relatively still water during spring, so that pollination and seed dispersal can take place. It is unlikely the proposed action would impact on the breeding cycle of the species as it was not detected within the MFWF project area and all potential habitats has been identified, buffered, and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	It is unlikely the proposed action would have any measurable effect on the viability of the species as all suitable areas of habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase) to ensure that no temporary or permanent ground disturbance causes impacts to its habitat.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the vulnerable species' habitat	Unlikely	It is unlikely that the proposed action would result in the establishment of invasive species that are not already present in the Hopkins River catchment. A detailed CEMP for the MFWF project area will ensure that all inductions highlighting the conservation value of native vegetation are undertaken prior to works and that all

		vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Introduce disease that may cause the species to decline	Unlikely	It is unlikely for the proposed action to result in the introduction of a disease that is not already present in the relevant environment. A detailed CEMP for the MFWF project area will ensure that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Interfere with the recovery of the species	Unlikely	It is unlikely the proposed action would interfere with the recovery of the species as the species does not have a National Recovery Plan. All potential habitat of the species will be retained through the MFWF project's design, use of fencing signed as 'No Go' zones and the implementation of a site-specific CEMP.

12.13 Swamp Everlasting

An assessment of impacts to Swamp Everlasting *Xerochrysum palustre* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.14 below. Surveys undertaken onsite to document EPBC Act listed flora and communities are described in Section 3 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.14 Assessment of Swamp Everlasting (listed vulnerable species) in relation to *Significant Impact Criteria* for vulnerable species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of an important population	Unlikely	The proposed action would not lead to a long-term decrease in the size of an important population of Swamp Everlasting. The National Recovery Plan for the species lists important populations of the Swamp Everlasting, in the location of which the proposed action does not occur (Carter and Walsh 2011).
Reduce the area of occupancy of an important population	Unlikely	Swamp Everlasting is known from sedgeswamps and shallow freshwater marshes, often on heavy black clay soils. The proposed action would not lead to a long-term decrease in the size of an important population of the species as the action will not occur in the location of an important population.
Fragment an existing population into two or more populations	Unlikely	About 35 populations of Swamp Everlasting are known, constituting to ~10,000 plants. The proposed action would not lead to a long-term decrease in the size of an important population of Swamp Everlasting as the action will not occur in the location of the population.
Adversely affect habitat critical to the survival of a species	Unlikely	Habitat critical to the survival of the species has not been identified within the *National Recovery Plan for Swamp Everlasting* (Carter and Walsh 2011). However, given its restricted occurrence to seasonally wet, low-lying areas that are increasingly threatened by changes in hydrological regimes as a result of changes in land use and climate variability, it may be considered that all suitable habitat is ecologically significant to the species in this regard. The proposed action would not adversely affect habitat critical to the survival of the species, as all areas of potential habitat the species may occur in have been buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).
Disrupt the breeding cycle of an important population	Unlikely	Flowering for the species occurs from November to March. The proposed action would not lead to a long-

		term decrease in the size of an important population of Swamp Everlasting as the action would not occur in the location of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	It is unlikely the proposed action would have any measurable effect on the viability of the species as the species was not detected within the MFWF project area and all suitable areas of habitat identified have been buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase) to ensure that no temporary or permanent ground disturbance could occur to its habitat.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the vulnerable species' habitat	Unlikely	It is considered unlikely the proposed action would result in the establishment of invasive species that are not already present in the Hopkins River catchment. A detailed CEMP for the MFWF project area will ensure that all inductions highlighting the conservation value of native vegetation are undertaken prior to works and that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Introduce disease that may cause the species to decline	Unlikely	It is unlikely for the proposed action to result in the introduction of a disease that is not already present in the relevant environment. A detailed CEMP for the MFWF project area will ensure that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Interfere with the recovery of the species	Unlikely	The proposed action is unlikely to interfere with the recovery of the species in respect to the specific objectives for recovery outlined in the *National Recovery Plan for Swamp Everlasting* (Carter and Walsh 2011). All potential habitat of the species will be retained through the MFWF project's design, use of fencing signed as 'No Go' zones and the implementation of a site-specific CEMP.

12.14 Clover Glycine

An assessment of impacts to Clover Glycine *Glycine latrobeana* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.15 below. Surveys undertaken onsite to document EPBC Act listed flora and communities are described in Section 3 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.15Assessment of Clover Glycine (listed vulnerable species) in relation to *Significant Impact Criteria* for vulnerable species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of an important population	Unlikely	The proposed action would not lead to a long-term decrease in the size of an important population of the species. The *National Recovery Plan for Clover Glycine* does not identify important populations (Carter and Sutter 2010). A population, while not identified within the MFWF project area, would be within five kilometres of known populations existing within native grassland and graminoid sites. A population existing in proximity to other populations may therefore be considered important in this regard. Despite a lack of empirical data for the species presence within the MFWF project area, all areas of its suitable habitat have been buffered and excluded by design. The project will also make use of all pre-existing powerpoles to minimise the requirement for ground disturbance and, to a feasible extent, undertake works within and from areas of pre-existing disturbance. During the construction phase, a detailed CEMP for the project area will also be implemented to ensure that: all potential habitat is fenced and appropriately signed as 'No Go' zones all staff are inducted to understand the conservation values of native vegetation and threatened flora on site all earth moving vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Reduce the area of occupancy of an important population	Unlikely	Clover Glycine inhabits a range of soils within grassland and grassy woodland. The species was not detected within the MFWF project area during targeted surveys in areas of potential habitat. It is considered unlikely that the proposed action would reduce the area of occupancy of the species as the majority of the project area does not support suitable habitat and all suitable

Significant Impact Criteria	Likelihood of significant impact	Notes
		habitat will be buffered and excluded from the project area, by both design and fencing signed as 'No Go' zones.
Fragment an existing population into two or more populations	Unlikely	It is unlikely the proposed action would fragment an existing population into two or more populations as the species was not identified within the project area and as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones).
Adversely affect habitat critical to the survival of a species	Unlikely	Habitat critical to the survival of the species has not been identified within the *National Recovery Plan for Clover Glycine* (Carter and Sutter 2010). However, given its scattered distribution and increasing risk to fire, weed invasion, grazing and development, it may be considered that all suitable habitat is ecologically significant to the species in this regard. It is unlikely for the proposed action to adversely affect habitat critical to the survival of the species as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).
Disrupt the breeding cycle of an important population	Unlikely	The proposed action is not expected to impact on the breeding cycle of the species as it was not detected within the MFWF project area and all potential habitat has been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase).
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	It is unlikely the proposed action would have any measurable effect on the viability of the species as the species was not detected within the MFWF project area and all suitable areas of habitat identified have been buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase) to ensure that no temporary or permanent ground disturbance could occur to its habitat.
Result in invasive species that are harmful to a critically	Unlikely	It is considered unlikely that the proposed action would result in the establishment of invasive species that are

Significant Impact Criteria	Likelihood of significant impact	Notes
endangered or endangered species becoming established in the vulnerable species' habitat		not already present in the Hopkins River catchment. A detailed CEMP for the MFWF project area will ensure that all inductions highlighting the conservation value of native vegetation are undertaken prior to works and that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Introduce disease that may cause the species to decline	Unlikely	It is unlikely for the proposed action to result in the introduction of a disease that is not already present in the relevant environment. A detailed CEMP for the MFWF project area will ensure that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Interfere with the recovery of the species	Unlikely	The proposed action would not interfere with the recovery of the species in respect to the specific objectives for recovery outlined in the *National Recovery Plan for Clover Gylcine* (Carter and Sutter 2010). All potential habitat of the species will be retained through the MFWF project's design, use of fencing signed as 'No Go' zones and the implementation of a site-specific CEMP.

12.15 Salt-lake Tussock-grass

An assessment of impacts to Salt-lake Tussock-grass *Poa sallacustris* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.16 below. Surveys undertaken onsite to document EPBC Act listed flora and communities are described in Section 3 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.16Assessment of Salt-lake Tussock-grass (listed vulnerable species) in relation to *Significant Impact Criteria* for vulnerable species

Significant Impact Criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of an important population	Unlikely	The proposed action would not lead to a long-term decrease in the size of an important population of Salt-lake Tussock-grass. The National Recovery Plan for the species does not specifically list important populations, but it does state that most occur on land managed by Parks Victoria, suggesting that important populations of the species have been identified (Carter and Walsh 2006b).
Reduce the area of occupancy of an important population	Unlikely	Salt-lake Tussock-grass occurs in grassland/herbfields on flat to slightly elevated sites at the verges of slightly to strongly saline lakes. The species was not detected within the MFWF project area during targeted surveys in areas of suitable habitat. It is unlikely the proposed action would reduce the area of occupancy of the species as the majority of the MFWF project area does not support suitable habitat and all suitable habitat will be buffered and excluded from the project area, by both design and fencing signed as 'No Go' zones.
Fragment an existing population into two or more populations	Unlikely	It is unlikely the proposed action would fragment an existing population into two or more populations as the species was not identified within the project area and as all areas of potential habitat have been identified, buffered and excluded (either by design or by fencing signed as 'No Go' zones).
Adversely affect habitat critical to the survival of a species	Unlikely	Habitat critical to the survival of the species has not been identified within the *National Recovery Plan for the Salt-lake Tussock-grass* (Carter and Walsh 2006b). However, given its increasing risk to fire, weed invasion, grazing and development, it may be considered that all suitable habitat is ecologically significant to the species in this regard. It is unlikely the proposed action would adversely affect habitat critical to the survival of the species as all areas of potential habitat that the species may occur in have been buffered and excluded (either by design or by fencing

Significant Impact Criteria	Likelihood of significant impact	Notes
		signed as 'No Go' zones during the construction phase).
Disrupt the breeding cycle of an important population	Unlikely	It is unlikely the proposed action would impact on the breeding cycle of an important population of the species as the *National Recovery Plan for the Salt-lake Tussock-grass* suggests that important populations of the species have been identified, with most occurring on land managed by Parks Victoria (Carter and Walsh 2006b).
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	It is unlikely the proposed action would have any measurable effect on the viability of the species as the species was not detected within the MFWF project area and all suitable areas of habitat identified have been buffered and excluded (either by design or by fencing signed as 'No Go' zones during the construction phase) to ensure that no temporary or permanent ground disturbance could occur to its habitat.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the vulnerable species' habitat	Unlikely	It is considered unlikely that the proposed action would result in the establishment of invasive species that are not already present in the Hopkins River catchment. A detailed CEMP for the MFWF project area will ensure that all inductions highlighting the conservation value of native vegetation are undertaken prior to works and that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Introduce disease that may cause the species to decline	Unlikely	It is unlikely for the proposed action to result in the introduction of a disease that is not already present in the relevant environment. A detailed CEMP for the MFWF project area will ensure that all vehicles, machinery, equipment and PPE travelling on and off the site are washed and blown down to remove soil and invasive soil propagules to avoid the introduction and spread of new invasive weeds.
Interfere with the recovery of the species	Unlikely	The proposed action is unlikely to interfere with the recovery of the species in respect to the specific objectives for recovery outlined in the *National Recovery Plan for Salt-lake Tussock-grass* (Carter and Walsh 2006b). All potential habitat of the species will be retained through the MFWF project's design, use of fencing signed as 'No Go' zones and the implementation of a site-specific CEMP.

12.16 Grey-headed Flying-fox

An assessment of impacts to Grey-headed Flying-fox *Pteropus poliocephalus* against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.17.

Table 12.17 Assessment of Grey-headed Flying-fox (listed vulnerable species) in relation to Significant Impact Criteria for vulnerable species

Significant impact criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of an important population of a species	Unlikely	The National Flying-fox Monitoring Program (NFFMP) has undertaken regular counts throughout Australia since 2012 (Westcott et al. 2015). The February 2019 NFFMP counted 660,000 Grey-headed Flying-foxes across Queensland, New South Wales, Victoria, ACT and South Australia. An analysis of the data (CSIRO 2019) indicates that the Australian population of the Grey-headed Flying-fox is approximately 700,000. Welbergen et al (2020) provide empirical evidence that the entire Australian population functions as a widespread, highly mobile and fluid, single unit. As such, no 'important' population exists. The Australian Government sets out that a maximum of 1.5% of the lowest agreed national population estimate for the species may be culled under licence at commercial orchards in Queensland and NSW. In 2020/2021 permits may be issued for culling of up to a maximum of 1280 Grey-headed Flying-foxes (DES [Qld] 2020). In this context, turbine collision mortalities of tens, or potentially of hundreds, of Grey-headed Flying-foxes at Mt Fyans Wind Farm would not be likely to lead to a long-term decrease in the size of the population.
Reduce the area of occupancy of an important population	Unlikely	Grey-headed Flying-foxes may fly through Mt Fyans Wind Farm on passage to resources elsewhere but turbine collision mortalities or the presence of the wind farm have no capacity to reduce the area occupied by the species.
Fragment an existing important population into two or more populations	Unlikely	The Australian population of Grey-headed Flying-foxes functions as a widespread, highly mobile and fluid, single unit. Mt Fyans Wind Farm does not have

Significant impact criteria	Likelihood of significant impact	Notes
		potential to fragment the existing population.
Adversely affect habitat critical to the survival of a species	Unlikely	Grey-headed Flying-foxes may fly through Mount Fyans Wind Farm on passage to resources elsewhere but the wind farm will not remove or modify any habitat for the species. The project has no capacity to adversely affect any habitat for this species.
Disrupt the breeding cycle of an important population	Unlikely	Grey-headed Flying-foxes breed in roost camps at defined key sites. Welbergen et al (2020) identified 546 roost sites for the species. While breeding may not occur at all of them, the Mt Fyans Wind Farm site does not support any roost camp or any habitat suitable for one. The project has no capacity to disrupt the breeding cycle of the species.
Modify destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The project does not entail modification, destruction, removal, isolation or any decrease in availability or quality of habitat for the species. Hence, it has no capacity to result in alteration of habitat that could result in decline of the species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely	The project does not include any known mechanism that would result in establishment of invasive species that are not already present in the relevant environment.
Introduce disease that may cause the species to decline	Unlikely	The project does not include any known mechanism that would result in introduction of any disease that is not already present in the relevant environment.
Interfere substantially with the recovery of the species	Unlikely	As outlined in responses above, the project is not likely to interfere with the recovery of the species.

The assessment of likelihood of occurrence for this species was originally considered unlikely in the existing conditions report (Biosis 2022a), however this species has recently been recorded roosting in a pine plantation near Hexham to the south-west of the study area. There have also been recently recorded mortalities for this species at the nearby Salt Creek and Dundonnell Wind Farm sites. These recorded mortalities and potential to occur in the local area does not alter our assessment of the impact criteria above, however measures for the adaptive management of any detected impacts to this species will be included within the project Bird and Bat Management Plan.

12.17 White-throated Needletail

An assessment of impacts to White-throated Needletail *Hirundapus caudacutus* against *the Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.18.

Table 12.18 Assessment of White-throated Needletail (listed vulnerable species) in relation to Significant Impact Criteria for vulnerable species

Significant impact criteria	Likelihood of significant impact	Notes
Lead to a long-term decrease in the size of an important population of a species	Unlikely	There is no defined important population for this species and the total population is unknown (DAWE 2021). Given the widespread distribution and 'abundant' description applied to the species (DAWE 2021), it is considered unlikely that a long term decrease in the size of the population or any important population could occur from the operation of the Mt Fyans Wind Farm.
Reduce the area of occupancy of an important population	Unlikely	There is no defined important population for this species and the total population is unknown (DAWE 2021). Given the widespread distribution and 'abundant' description applied to the species (DAWE 2021), it is considered unlikely that a reduction in the area of occupancy of the population or of an important population could occur from operation of the Mt Fyans Wind Farm.
Fragment an existing important population into two or more populations	Unlikely	There is no defined important population for this species and the total population is unknown (DAWE 2021). The Mt Fyans Wind Farm will not fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	Unlikely	There is no habitat defined as critical to the survival of the species.
Disrupt the breeding cycle of an important population	Unlikely	There is no defined important population for this species and the total population is unknown (DAWE 2021).
Modify destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	Given the widespread distribution and 'abundant' description applied to the species (DAWE 2021), it is considered unlikely that the Mt Fyans Wind Farm will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established	Unlikely	This will not occur from the proposed project.

Significant impact criteria	Likelihood of significant impact	Notes
in the vulnerable species' habitat		
Introduce disease that may cause the species to decline	Unlikely	This will not occur from the proposed project.
Interfere substantially with the recovery of the species	Unlikely	This will not occur from the proposed project. Due to the limited nature of any threats to the species and its mobility, there are no threat abatement or recovery actions either underway or proposed (DAWE 2021).

12.18 Grassy Eucalypt Woodland of the Victorian Volcanic Plain

An assessment of impacts to Grassy Eucalypt Woodland of the Victorian Volcanic Plain (GEWVVP) against the *Significant Impact Criteria 1.1* (DoE 2013) is presented in Table 12.19 below. Surveys undertaken onsite to document EPBC Act listed flora and communities are described in Section 3 of the Mt Fyans Wind Farm: Targeted Surveys and Impact Assessment (Biosis 2022b).

Table 12.19 Assessment of Grassy Eucalypt Woodland of the Victorian Volcanic Plain (listed critically endangered community) in relation to *Significant Impact Criteria* for critically endangered and endangered communities

Significant Impact Criteria	Likelihood of significant impact	Notes
Reduce the extent of an ecological community	Unlikely	Diagnostic characteristics and condition thresholds for GEWVVP are provided in DSEWPC (2011b). This community is typically characterised by an overstorey of River Red-gum *Eucalyptus camaldulensis* but may be dominated by Swamp Gum *Eucalyptus ovata* or Manna Gum *Eucalyptus viminalis* in higher rainfall situations. As the majority of scattered trees recorded within the study area are River Red-gum, it is expected that stands of this community in the MFWF project area would be dominated by this species. To qualify for listing, patches of this community must also have ground vegetation dominated by native species and have a patch size exceeding 0.5 hectares. Vegetation studies have determined that this community is not present within the project area.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	Unlikely	GEWVVP is not present within the study area.
Adversely affect habitat critical to the survival of an ecological community	Unlikely	GEWVVP is not present within the study area.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	Unlikely	GEWVVP is not present within the study area.
Cause a substantial change in	Unlikely	GEWVVP is not present within the study area.

Significant Impact Criteria	Likelihood of significant impact	Notes
the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting		
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: – assisting invasive species, that are harmful to the listed ecological community, to become established, or – causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community	Unlikely	GEWVVP is not present within the study area.
Interfere with the recovery of an ecological community.	Unlikely	GEWVVP is not present within the study area.

13. Conclusion

Assessment of 21 matters of national environmental significance (MNES), including listed species and ecological communities was performed to satisfy the requirements of the Proponent Assessment Documentation under the EPBC Act Bilateral Agreement. The assessments determined likelihood of significant impacts to MNES. The overwhelming majority of the assessments concluded that significant impacts were Unlikely with only three exceptions:

Table 13.1 Summary Table: Assessments of Likely Significant Impact

Matters of National Environmental Significance	Significant Impact Assessment Category	Likelihood of Significant Impact	Mitigation Measures
Southern Bent-wing Bat – Critically Endangered species	Lead to a long-term decrease in the size of a population	Unlikely – to be confirmed by PVA modelling and the SBWB Adaptive Management Plan and SBWB Monitoring Program	The proponent has proposed a SBWB Adaptive Management Plan that contains binding operational controls and mitigation actions including a SBWB Monitoring Program and SBWB Research Fund of $750,000 as an indirect offset.
Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) – Critically Endangered community	Reduce the extent of an ecological community	Likely	Due to upgrading a local road to achieve lower road impact on other road users. The impact assessment is based upon a conservative estimate and can be mitigated by sympathetic road design and coordination with the local council. Direct offsets will be provided for any loss.
Striped Legless Lizard – Vulnerable species	Reduce the area of occupancy of an important population	Likely	Due to upgrading a local road to achieve lower road impact on other road users. The impact assessment is based upon a conservative estimate and can be mitigated by sympathetic road design and coordination with the local council. Direct offsets will be provided for any loss.

This development is consistent with and supports National Strategy for Ecologically Sustainable Development Objective 8.1: *to limit harmful emissions arising from energy production and distribution wherever economically efficient, and to promote alternative energy sources* (DoE 2013).

The Minister for Planning (Victoria) No-EES decision requirement for an assessment of the potential utilisation of the site by the SBWB and assessment for the presence of the Basalt Greenhood orchid has been satisfied. The proponent has conducted extensive surveys to determine SBWB is present on the site with overall utilisation levels similar to the surrounding environment ,and within the site the SBWB is found more often near foraging environment. The site location inherently avoids SBWB maternity and non-breeding roosts of significance, and the layout design favours areas of low foraging potential for the SBWB. The proponent has proposed, and is capable of delivering, a SBWB Adaptive Management Plan with binding operational controls and mitigation actions including a SBWB Monitoring Program and SBWB Research Fund of $750,000. Within the vicinity of the project site, the Basal Rustyhood is only found within the road verges of the Woorndoo-Darlington Road, which will not be utilised or impacted by the project.

The proponent proposes the following conditions of approval under the EPBC Act:

1. The approval holder must not cause impacts to more than:
    a. 3.7 ha of Striped Legless Lizard habitat.
    b. 0.41 ha of NTGVVP.
2. Prior to the commencement of the action, surveys must be undertaken to identify the extent, presence and quality of Striped Legless Lizard habitat and NTGVVP in South Road. Surveys must be conducted by suitable qualified persons in accordance with the most recently published version of the Department's survey guidelines.
3. The approval holder must submit for approval by the Minister an Offset Strategy to compensate for the significant residual impacts to Striped Legless Lizard (SLL) and NTGVVP identified in the surveys undertaken in accordance with condition [2]. The approval holder must not commence the action until the Offset Strategy has been approved by the Minister in writing. The approved Offset Strategy must be implemented and published. The Offset Strategy must:
    a. Demonstrate whether residual impacts to the SLL and NTGVVP are significant.
    b. Provide a written description and map that clearly defines the location and boundaries of the proposed offset area(s) for the SLL and NTGVVP.
    c. Demonstrate the presence of relevant SLL and NTGVVP in the proposed offset area(s) and quantify the area and quality of the SLL and NTGVVP and their habitat.
    d. Commit to ecological outcomes and offset completion criteria for SLL and NTGVVP and the timeframes in which these will be achieved.
    e. Demonstrate that the Offset Strategy meets the principles of the EPBC Act Environmental Offsets Policy.
    f. Include timelines and mechanisms for legally securing the proposed offset area(s).
    g. Include offset attributes and shapefiles that clearly define the location and boundaries of the proposed offset area(s).
    h. Include timebound performance and completion criteria for evaluating that ecological outcomes have been achieved and criteria for triggering remedial action.
    i. Commit to a program to monitor and report on progress against the performance and completion criteria.
4. The approval holder must submit a Southern Bent-wing Bat Adaptive Management Plan for approval by the Minister prior to the operation of any wind turbines. The approved Southern Bent-wing Bat Adaptive Management Plan must be implemented.
5. Woorndoo-Darlington Road must not be used as a transport route for the action and no upgrade work to occur to this road.

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Appendices

Appendix 1 EPBC 2019/8589 Assessment Scope

Appendix 2 Mt Fyans Wind Farm Project Development Plans

Appendix 3 Mt Fyans Southern Bent-wing Bat Survey (Thomas 2019)

Appendix 4 Mondilibi Hill Geology, Geomorphology, Eruptive History and Potential for Bat Roost Cavities (Rosengren 2019)

Appendix 5 Southern Bent-wing Bat Roosting Habitat Assessment (Biosis 2020)

Appendix 6 Microbat Acoustic Surveys Data

Appendix 7 Vegetation of the Study Area

Appendix 8 Southern Bent-wing Bat Adaptive Management Plan