

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Willatook Wind Farm

Bat Species of Concern Assessment

Revised to align with the Minister's Recommendations and the Handbook (DEECA 2025) for the development of renewable energy in Victoria

ADVERTISED PLAN

Prepared for Willatook Wind Farm Pty Ltd

July 2026
Report No. 16087.29 (2.5)



Nature
Advisory

5/61-63 Camberwell Road
Hawthorn East, VIC 3123
PO Box 337, Camberwell VIC 3124
(03) 9815 2111
www.natureadvisory.com.au

Nature Advisory acknowledges the traditional owners and sovereign custodians of the land on which we work from – the Wurundjeri people of the Woi Wurrung language group. We extend our respect to their Ancestors and all First Peoples and Elders past and present.

Document history and status

The following table outlines the revisions made to this document.

Version	Date of issue	Description	Prepared by	Reviewed by	Approved by
v1.0	12/5/ 2022	Initial assessment for EES	Curtis Doughty, Bernard O'Callaghan, Brett Lane	Bernard O'Callaghan	Brett Lane
v2.0	3/10/2025	Update to align with Minister's Assessment and DEECA Handbook	Danielle Eastick, Mike Hitchcock, Lotus Hackenberger & Inga Kulik	Mike Hitchcock & Inga Kulik	Inga Kulik
v2.1	14/11/2025	Updated with responses from Wind Prospect and ENGIE	Danielle Eastick, Mike Hitchcock, Lotus Hackenberger & Inga Kulik	Mike Hitchcock	Inga Kulik
v2.2	5/12/2025	Updated with responses from Wind Prospect and ENGIE	Danielle Eastick, Mike Hitchcock, Lotus Hackenberger & Inga Kulik	Mike Hitchcock	Inga Kulik
v2.3	23/12/2025	Updated with responses from Wind Prospect and ENGIE	Danielle Eastick, Mike Hitchcock & Inga Kulik	Mike Hitchcock	Inga Kulik
V2.4	05/05/2026	Update to address comments from DEECA	Danielle Eastick	Mike Hitchcock	Inga Kulik
V2.5	03/07/2026	Update to address comments from DEECA	Danielle Eastick	Mike Hitchcock	Inga Kulik

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

**ADVERTISED
PLAN**

Executive summary

Willatook Wind Farm Pty Ltd engaged Nature Advisory Pty Ltd to undertake bat utilisation surveys at the proposed Willatook Wind Farm (WWF). The WWF proposal is to install 52 wind turbines, each comprising a tower, nacelle and blades with a maximum blade tip height of 254 m and a minimum blade tip height of 60 m. The focus of this investigation was to generate baseline data documenting the spatial presence/absence and temporal activity of bat species, in particular the Southern Bent-wing Bat (SBWB; *Miniopterus orianae bassanii*; Critically Endangered EPBC Act and FFG Act) and the Yellow-bellied Sheath-tail Bat (YBSB; *Saccolaimus flaviventris*; Vulnerable FFG Act). Additional investigations were undertaken to determine the risk to Grey-headed Flying Fox (GHFF; *Pteropus poliocephalus*; Vulnerable EPBC Act and FFG Act).

This assessment provides an update and reanalysis of the *Willatook Wind Farm: Flora and Fauna Assessment* (Nature Advisory 2022a), which supported the *Environment Effects Statement* (EES) of the project. In July 2023, the Minister for Planning released their Minister's Assessment of the EES (Minister for Planning 2023), which included several recommendations related to the SBWB.

Following the publication of the WWF Minister's Assessment, the Victorian Government formally published the *Handbook for the Development of Renewable energy in Victoria* (the *Handbook*; (DEECA 2025a, 2025b), which includes specific formal guidance relating to the assessment and management of Bat Species of Concern. This assessment addresses the Minister's recommendations while incorporating the relevant guidance outlined in the *Handbook*.

Assessment methods

Over the last decade, extensive echolocation surveys were undertaken. Survey effort totalled 4,646 nights over 107 unique sites in various seasons for five years between 2009 and 2020. These included:

- Ultrasonic surveys undertaken on, or near, the proposed WWF site during Spring 2009, Spring 2010, Summer-Autumn 2011, Spring 2018 and Summer/Autumn 2019;
- Habitat gradient studies undertaken in Summer/Autumn 2019 and Summer/Autumn 2020;
- At-height surveys at two met mast survey across 2019–2020 that was designed to detect the SBWB and YBSB at-height in the study area. Landholder and specialist groups were consulted to determine the potential of cave roost sites within the vicinity of the proposed project; and
- Desktop assessment of potential maternity/roosting sites and camps.

Assessment summary

A summary of the survey results includes:

- **General results:**
 - Calls from 10 species of bats were recorded during these bat detector surveys. eight of the bats recorded were common, widely distributed species that are not listed under either State or Commonwealth legislation.
 - Two species recorded were listed threatened bats; the Southern Bent-wing Bat, SBWB (EPBC Act: Critically Endangered, FFG Act: Critically Endangered) and the Yellow-bellied Sheath-tail Bat, YBSB (FFG Act: Vulnerable).
 - A further five multi-species complexes were recorded, including the SBWB-complex.

- Results of the met mast bat detector survey in the WWF study area recorded five species at height: Chocolate Wattled Bat, Gould's Wattled Bat, Large Forest Bat, Little Forest Bat and White-striped Free-tailed Bat. One SBWB-complex call was also recorded at height. It is noted that increased background noise, e.g. through wind, can interfere with a bat detector's ability to detect and record bat echolocation calls at height (see Appendix 1).
- **Southern Bent-wing Bat:**
 - Out of tens of thousands of recording files from the surveys, 160 were assigned to SBWB (i.e. SBWB-definite). There was one SBWB-definite call recorded in Spring 2009, 68 in Spring 2010, 31 in Autumn 2011, 6 in Spring 2018, 49 in Summer-Autumn 2019 and 4 in Summer-Autumn 2020. An additional call was recorded at the base of a meteorological (met) mast during the 2019–2020 year-long seasonal met mast surveys.
 - A further 3,696 calls were assigned to a species complex (i.e. SBWB-complex) that comprises echolocation calls with characteristics that could have been produced by SBWB, Little Forest Bat, or Chocolate Wattled Bat.
 - Out of the 160 SBWB-definite calls recorded during surveys, 101 (63%) were located near the Shaw River and eucalypt plantation in the south-west of the WWF boundary, and a wetland to the east of the WWF study area.
 - 57 calls (36%) were recorded within 250 m of permanent water, 128 calls (80%) were within 50 m of trees (plantation, tree rows, planted trees), and 23 (14%) were within open space greater than 250 m from permanent water and 50 m from trees.
- **Yellow-bellied Sheathtail Bat:**
 - Across the bat detector surveys conducted between 2009 and 2020, YBSB calls were recorded at 10 sites across the WWF area. In 2009, 39 YBSB calls were detected, and 8 were recorded in 2018. Numbers were not reported for other survey seasons. Due to the low number of calls recorded during initial surveys, the data collected from May 2019 to May 2020 was not analysed for YBSB as the survey effort was considered sufficient to determine that the species is not a frequent visitor to the site.
- **Grey-headed Flying-fox:**
 - No GHFF or their camps were observed across the WWF area. Little to no foraging habitat was recorded or modelled.

Application of the Mitigation Hierarchy

The (Minister for Planning 2023) made several recommendations to ensure potential impacts on the Southern Bent-wing Bat are acceptable and manageable. In response to the Minister's Assessment and applying the *Handbook* (DEECA 2025a, 2025b), several measures have been taken by the proponent to meet both the Minister's Assessment and the guidance of the *Handbook*. These measures follow a proactive avoidance and mitigation hierarchy, using a multi-faceted approach containing the measures listed below. These measures also account for the known ecology and behaviour of the SBWB and YBSB, with measures targeting site features relating to available habitat and foraging opportunities, and the influence of weather and season on bat activity.

Avoidance measures include:

- *Siting of wind farm* (AV01) - The Willatook Wind Farm has been located away from known GHFF camps and YBSB/SBWB roost and maternity caves.
- *Reduction in the size of the wind farm* (AV02) - Design of wind farm reduced from 190 turbines in 2010 down to 52 in the currently proposed layout.
- *Habitat buffers* (AV03) - Application of 200 m blade-to-habitat buffers around key habitat features, including those areas with higher SBWB call activity. While some overlap with remnant woodland is present (<0.01 ha), the proponents are committed to microsites this turbine (Turbine 4) to avoid overlap.
- *Micrositing of turbines* (AV04) - Micrositing of turbines to increase distance to potential bat habitat.
- *Siting of the on-site quarry* (AV05) - Locating quarry to not overlap with potential bat habitat.

Mitigation measures include:

- *Turbine height* (MM01) - Raising minimum tip height from 40 m to 60 m above the ground.
- *Nighttime cut-in speeds (all turbines)* (MM02) - Apply nighttime cut-in speeds of 4.5 m/sec to all turbines from September to May, from 30 minutes before sunset to 30 minutes after sunrise, when the temperature is above 10°C
- *Nighttime blade feathering* (MM03) - Reduce blade rotation in wind speeds below the cut-in speeds, for all turbines.
- *Deterrents* (MM04) - Investigate and implement a range of deterrent options as part of adaptive management in the BAM Plan.
- *Bat and Avifauna Management Plan* (MM05) - Development of a BAM Plan in agreement with DEECA.
- *Reduce quarry disturbance* (MM06) - Reduce the risk to disturbance of Bats by blasting only during the day, and to reduce the risk of disturbance of nearby roosting bats through a Quarry Blast Plan that aims to reduce noise, vibration, air blasts, and flyrock.

Alignment with the Minister's Recommendations

The Mitigation Hierarchy aligns with the Minister's Recommendations, as shown in Table 1.

Table 1: Summary of alignment with the Minister's Recommendations (Minister for Planning 2023)

Minister's Recommendations (Minister for Planning, 2023)	Application to the proposed Willatook Wind Farm	Relevant step(s) in the mitigation hierarchy
Applying a 200 m turbine-free buffer to the potential SBWB foraging habitat.	The Willatook Wind Farm has adopted a 200 m blade-to-habitat buffer for key habitat features and areas of higher concentration of SBWB activity. While there is some overlap with potential SBWB foraging habitat (<0.01 ha), the extent of overlap was minimised through Micrositing of turbines. The proponents are committed to further micrositing this turbine to avoid overlap all together.	AV03, AV04, and AV05

Minister's Recommendations (Minister for Planning, 2023)	Application to the proposed Willatook Wind Farm	Relevant step(s) in the mitigation hierarchy
Using a cut-in wind speed of at least 4.5 m/s from dusk to dawn between September and May for the life of the wind farm to help reduce potential bat mortalities.	Adopted by WWF, with a nighttime cut-in speed for all turbines under the following conditions: ▪ Time of year: September to May ▪ Time of night: 30 minutes before sunset to 30 minutes after sunrise ▪ Cut-in speed: 4.5 m/s ▪ Climatic conditions: Low wind speed curtailment to be implemented when the temperature is above 10°C and when it is not raining (relative humidity < 95%).	MM02
Applying the cut-in wind speed to all turbines of the project.	Adopted by WWF, with the nighttime cut-in speed to be applied to all turbines (under the above conditions).	MM02
Ongoing monitoring through the BAM Plan and implementation of appropriate additional mitigation measures in response to observed bird and bat impacts, noting that monitoring results should inform the potential need to increase the minimum cut-in wind speed or consider other effective management strategies if Southern Bent-wing Bat mortalities are recorded.	A BAM Plan has been drafted. This includes adaptive management measures, including the events that may trigger further increased cut-in speeds and other management strategies.	MM05

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Alignment with the DEECA Handbook

The Mitigation Hierarchy aligns with the *Handbook*, as shown in Table 2.

Table 2: Application of the Handbook (DEECA 2025b) to the Willatook Wind Farm.

Handbook's mitigation measures (DEECA, 2025b)	Application to the proposed Willatook Wind Farm	Relevant step(s) in the mitigation hierarchy
Nighttime low-wind-speed curtailment	Adopted by WWF, including of use of species-specific information to select the curtailment approach to timing and season. Temperature and humidity are proposed as an additional condition for curtailment, where curtailment will only be active above 10°C and when it is not raining (relative humidity < 95 %) when bats are more active.	MM02
Feathering below cut-in speed	Adopted by WWF, with feathering proposed for all turbines under all conditions.	MM03

Handbook's mitigation measures (DEECA, 2025b)	Application to the proposed Willatook Wind Farm	Relevant step(s) in the mitigation hierarchy
Acoustic deterrents	Proposed for trialling as an adaptive management measure after triggering events in the BAM Plan.	MM04
Increased turbine height	Adopted by WWF. The initial EES included a minimum tip-height of 40 m, which has been increased to 60 m.	MM01

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

**ADVERTISED
PLAN**

Contents

Executive summary	iii
Contents	
Glossary and acronyms	4
1. Introduction	5
1.1. Project background	5
1.2. Report outline	6
2. Background	7
2.1. Proposed development	7
2.2. Study area	7
2.2.1. Fauna habitat	8
2.3. Ecology of relevant bat species	10
2.3.1. Southern Bent-wing Bat (SBWB)	10
2.3.2. Yellow-bellied Sheathtail Bat (YBSB)	12
2.3.3. Grey-headed Flying-fox	14
3. Regulatory context	17
3.1. Previous assessment and background	17
3.2. Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act)	17
3.3. Flora and Fauna Guarantee Act 1988	18
3.4. Environmental Effects Act 1978	19
3.5. The Handbook for the Development of Renewable Energy in Victoria	20
3.6. Other Guidelines	20
4. Methods	22
4.1. Echolocating insectivorous bat surveys	22
4.1.1. Survey effort	22
4.1.2. Location of survey sites	24
4.2. Echolocation call identification	27
4.3. Southern Bent-wing Bat call analysis	27
4.4. Cave roost assessment	28
4.5. Turbine buffers	28
4.6. Assumptions and limitations	31
5. Assessment results	33
5.1. Echolocating insectivorous bat surveys	33
5.1.1. EHP survey results (Spring 2009, Spring 2010 & Autumn 2011)	33
5.1.2. Nature Advisory Survey results (Spring 2018 & Summer/Autumn 2019)	37

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

5.1.3.	Gradient surveys.....	40
5.1.4.	Surveys at-height.....	42
5.2.	Species of Concern results	42
5.2.1.	Southern Bent-wing Bat.....	42
5.2.2.	Yellow-bellied Sheath-tail Bat.....	55
5.2.3.	Grey-headed Flying-fox.....	58
5.3.	Turbine buffers overlaps.....	59
6.	Risks and impacts to Species of Concern.....	60
6.1.	Direct impact pathways.....	60
6.2.	Indirect impact pathways.....	63
6.3.	Cumulative impacts.....	63
6.4.	Risk assessment	64
7.	Application of the mitigation hierarchy.....	71
7.1.	Avoidance measures.....	71
7.1.1.	Turbine-habitat buffers	72
7.1.2.	Turbine micro-siting to maximise separation from potential habitat.....	73
7.2.	Mitigation measures	73
7.2.1.	Turbine height.....	75
7.2.2.	Blade feathering.....	76
7.2.3.	Cut-in speeds.....	76
7.2.4.	Deterrents.....	78
7.2.5.	Bat and Avifauna Management Plan (BAM Plan).....	79
7.3.	Residual impacts.....	84
7.3.1.	Southern Bent-winged Bat.....	84
7.3.2.	Yellow-bellied Sheath-tailed Bat.....	86
7.3.3.	Grey-headed Flying-fox.....	87
7.4.	Compensation.....	90
8.	Alignment with the Minister’s Recommendations and the DEECA Handbook	91
8.1.	Minister’s recommendations.....	91
8.2.	Handbook guidance	93
9.	References.....	94
	Appendix 1. Potential limitations of bat detector surveys	103
	Appendix 2. Description of the sites used for the bat detector survey at Willatook Wind Farm (2009-2020).....	105
	Appendix 3. Detailed bat survey effort for each monitoring site.....	112
	Appendix 4. Example of SBWB spectrograms used in identification	117

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Appendix 5. Summary of SBWB call activity and habitat within the 262 m turbine buffers	119
--	-----

Tables

Table 1: Summary of alignment with the Minister’s Recommendations (Minister for Planning 2023)	v
Table 2: Application of the Handbook (DEECA 2025a) to the Willatook Wind Farm.	vi
Table 3: Survey effort at the proposed Willatook Wind Farm site (2009-2020).....	22
Table 4: Microbat species recorded during the bat detector survey at the Willatook wind farm site	33
Table 5: Bat species recorded during the Spring 2009 surveys at Willatook wind farm	34
Table 6: SBWB-definite and SBWB-complex recording locations at Willatook Wind Farm during Spring 2009, Spring 2010 and Autumn 2011	36
Table 7: Summary of results for Willatook Wind Farm bat species for the Spring 2018 survey	37
Table 8: SBWB-definite and SBWB-complex recording locations at Willatook Wind Farm during Spring 2018, Summer/Autumn 2019, Summer/Autumn 2020 and Autumn 2019-2020	39
Table 9: Results of the gradient studies	40
Table 10: Results of wetland studies.....	41
Table 11: Southern Bent-wing Bat recorded in the study area.	44
Table 12: Publicly known and important Southern Bent-wing Bat maternity and non-breeding caves	50
Table 13: Detection times of Southern Bent-wing Bats.....	52
Table 14: Bat habitat overlap with the Willatook Wind Farm study area and turbine buffers	59
Table 15: Total Southern Bent-wing Bat mortalities reported to DEECA up to April 2026	61
Table 16: Likelihood criteria of an impact to fauna occurring across 12-month period*	65
Table 17: Predicted consequence criteria of an impact on fauna	65
Table 18: Risk ratings to fauna based on the likelihood of an impact occurring and the consequence of the impact.....	66
Table 19: Biodiversity impact rating criteria framework	66
Table 20: Impact rating for Bat Species of Concern prior to mitigation hierarchy.....	67
Table 21: Measures to avoid impacts to Bat Species of Concern at Willatook Wind Farm.	71
Table 22: Mitigation measures to reduce impacts on Bat Species of Concern at Willatook Wind Farm.	73
Table 23: Summary of findings from SBWB and weather studies at Hexham Wind Farm, Kentbruck Wind Farm and Mt Fyans Wind Farm	77
Table 24: Adaptive mitigation measures in the event of repeated collisions with Bat Species of Concern	82

Table 25: Summary of potential impact risk BEFORE and AFTER the application of the mitigation hierarchy.....	88
Table 26: Application of the Minister’s Recommendations to the Willatook Wind Farm.	92
Table 27: Application of the Handbook (DEECA 2025) to the Willatook Wind Farm.	93

Figures

Figure 1. Potential Bat habitat at Willatook wind farm	15
Figure 2. Locations of Willatook wind farm and Southern Bent-wing Bat roost caves in the surrounding landscape.....	16
Figure 3. Bat detector survey sites (all surveys) and habitat features	25
Figure 4: Schematic showing 262 m turbine-habitat buffer.	30
Figure 5: SBWB-definite calls per night at Willatook wind farm	48
Figure 6: SBWB combined definite and complex calls per night at Willatook wind farm	49
Figure 7: Location of Yellow-bellied Sheathtail Bats recorded at Willatook wind farm between 2009–2020.....	57
Figure 8: Grey-headed Flying-fox habitat distribution model, HDM (DEECA 2025d).	58
Figure 9: Turbine-habitat buffers and SBWB-definite activity	79
Figure 10: Turbine-habitat buffers and SBWB combined definite and complex activity	80
Figure 11: Example decision-making framework for identifying and mitigating impacts of WWF	83

Appendices

Appendix 1. Potential limitations of bat detector surveys	103
Appendix 2. Description of the sites used for the bat detector survey at Willatook Wind Farm (2009-2020).....	105
Appendix 3. Detailed bat survey effort for each monitoring site	112
Appendix 4. Example of SBWB spectrograms used in identification	117
Appendix 5. Summary of SBWB call activity and habitat within the 262 m turbine buffers	119

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

**ADVERTISED
PLAN**

Glossary and acronyms

**ADVERTISED
PLAN**

Term/Acronym	Definition
BAM Plan	Bat and Avifauna Management Plan
C'wth	Commonwealth
cm	Centimetre/s
DCCEEW	Department of Climate Change, Energy, the Environment and Water (C'wth)
DEECA	Department of Energy, Environment and Climate Action (Vic)
DELWP	(former) Department of Environment, Land, Water and Planning (Vic)
DEWHA	(former) Department of the Environment, Water, Heritage and the Arts (C'wth)
EES	Environment Effects Statement under the <i>Environment Effects Act 1978</i>
EHP	Ecology and Heritage Partners
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (C'wth)
FFG Act	Flora and Fauna Guarantee Act 1988 (Vic)
GPS	Global Positioning System
GHFF	Grey-headed Flying-fox
km	Kilometre/s
m	Metre/s
min	Minute/s
MNES	Matters of National Environmental Significance
RSA	Rotor Swept Area
RSH	Rotor Swept Height
SBWB	Southern Bent-wing Bat
TSSC	Threatened Species Scientific Committee
VBA	Victorian Biodiversity Atlas
WWF	Willatook Wind Farm
YBSB	Yellow-bellied Sheath-tail Bat

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

1. Introduction

Willatook Wind Farm Pty Ltd engaged Nature Advisory Pty Ltd to undertake microbat utilisation surveys at the proposed Willatook Wind Farm (WWF; the 'study area'). The proposed wind farm is located in south-west Victoria approximately 25 km north of Port Fairy in Moyne Shire.

Bat utilisation surveys have been undertaken since 2009 to inform the assessment of the potential impacts the construction and operation of the proposed WWF may have on bat species. To determine the presence of echolocating bat species utilising the study area, particularly that of bat species listed under the EPBC Act and FFG Act, ultrasonic bat detectors were deployed for several weeks at a time in a wide variety of locations. The bat utilisation surveys were undertaken according to the *Survey Guidelines for Australia's Threatened Bats* (DEWHA 2010). They were also consistent with the methods used at many wind farms in eastern Australia to provide information for decision-makers and regulators over the last 20 years.

The objectives of this bat assessment are to:

- Re-assess the spatial presence/absence and temporal activity of bat species, in particular the Southern Bent-wing Bat (SBWB; *Miniopterus orianae bassanii*; Critically Endangered EPBC Act and FFG Act) and the Yellow-bellied Sheath-tail Bat (YBSB; *Saccolaimus flaviventris*; Vulnerable FFG Act). Additional investigations were undertaken to determine the risk to Grey-headed Flying Fox (GHFF; *Pteropus poliocephalus*; Vulnerable EPBC Act and FFG Act). These assessments include consideration of additional material and research since the initial investigation.
- Assess potential impacts to bat species by the WWF and apply the mitigation hierarchy by considering the recommendations from the Minister's Assessment (Minister for Planning 2023), and guidance from the *Handbook for the Development of Renewable Energy in Victoria* (DEECA 2025a), *Species specific guidance for onshore wind energy facilities – Bat species of concern* (DEECA 2025b), and *Onshore Wind Farm Guidance: Best practice approaches when seeking approval under Australia's national environmental law* (DCCEEW 2024),

1.1. Project background

This assessment provides an update and reanalysis of the *Willatook Wind Farm: Flora and Fauna Assessment* (Nature Advisory 2022a), which supported the Environment Effects Statement (EES) of the project. Following a public exhibition of the EES, an independent Inquiry and Panel (IAP) was appointed by the Minister for Planning (the 'Minister') to hear submissions and assess environmental effects under both the *Environment Effects Act 1978* and the *Planning & Environment Act 1987*. In July 2023, the Minister for Planning released her Minister's Assessment of the EES (Minister for Planning 2023), which included several recommendations related to the SBWB (outlined in Section 3.4).

The Minister for Planning concluded that:

"the project can proceed with acceptable environmental effects, providing the modifications recommended herein are implemented together (section 5) with environmental management measures (EMMs) consistent with those endorsed by the IAP and as refined through this assessment. In particular, the turbine-free buffers for Brolga and Southern Bent-wing Bat need to be increased and revised buffers should be mapped, in consultation with the Department of Energy, Environment and Climate Action (DEECA), before amended development plans are submitted to me as responsible authority for approval."

With respect to the SBWB, the Minister supported the IAP's recommendation that a:

"200 m turbine-free buffer from foraging habitat should be applied to all potential Southern Bent-wing Bat foraging habitat consistent with the Eurobat Guidelines."

Since the conclusion of the EES process, the Victorian Government has undertaken further work to develop an updated biodiversity policy specifically relating to onshore wind energy. In May 2025, the Victorian Government formally published the *Handbook for the Development of Renewable Energy in Victoria – Guidance to Avoid, Minimise, Mitigate and Compensate for Impacts on Threatened Bird and Bat Species* (hereafter *Handbook*; DEECA 2025a). These guidelines reflect the Victorian Government's commitment to achieving net-zero emissions by 2045 and aim to facilitate the implementation of renewable energy projects whilst ensuring that impacts on threatened species are appropriately managed. This provides further guidance regarding the assessment and mitigation of potential impacts on bat species in Victoria for the development of onshore wind farms *Appendix 3: Species specific guidance for onshore wind energy facilities – Bat species of concern* (DEECA 2025b).

In response, the project proponent has refined the wind farm layout and reduced the overall project scale to align with the Minister's recommendations, but also to respond to the new biodiversity policy in the *Handbook* that provides the current policy framework for which impacts to threatened species, and more specifically SBWB, are assessed and managed for onshore wind energy developments in Victoria. To comply, the project has undergone substantial design refinement, including:

- Reduction in the number of proposed wind turbine generators
- Refinement of turbine locations and adjustments to associated infrastructure footprints to avoid key ecological values
- Improved mitigation and monitoring commitments.

Given these changes, the WWF is submitting a revised application under the Development Facilitation Program (DFP). This updated pathway offers a streamlined planning process and provides an opportunity to formally integrate the new biodiversity policy into the approvals framework.

1.2. Report outline

This report is divided into the following sections:

Section 2 provides a background to the proposed wind farm and the Bat Species of Concern.

Section 3 provides information on regulatory requirements and the previous assessment of the project.

Section 4 describes the study methods used.

Section 5 presents and discusses the assessment results.

Section 6 discusses the potential risks to Bat Species of Concern.

Section 7 outlines the application of the mitigation hierarchy and addresses residual impacts.

Section 8 outlines the alignment with the Minister's Recommendations and the DEECA *Handbook*.

This report was prepared by a team from Nature Advisory comprising Dr Danielle Eastick (Senior Zoologist), Maya Zaeim (GIS Analyst), Mike Hitchcock (Senior Ecologist and Project Manager) and Dr Inga Kulik (Project Director).

Bat call analysis was undertaken by Rob Gration (Director and Principal Ecologist, EcoAerial Environmental Services).

**ADVERTISED
PLAN**



This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

2. Background

2.1. Proposed development

The proposed development is a wind energy facility that will connect turbines with an on-site substation and battery energy storage system to the national grid through the existing Moorabool to Heywood 500 kV transmission line. It is expected to produce over 1,300 gigawatt hours annually. The development includes:

- Up to 52 wind turbines – rotor swept area of 60 to 254 m
- Transmission lines
 - Approximately 55.8 km of trenches to house underground 33 kV lines to connect turbines and on-site substation
 - 300 m above-ground 132 kV lines to connect to the on-site substation to the Tarrone Terminal Station
- On-site quarry – 16.2 ha
- Operations and maintenance facility – 1.5 ha
- Four permanent meteorological masts – up to 166 m high
- Battery Energy Storage System – 5.5 ha
- Five site access points and 45.6 km of internal access tracks
 - 6 m wide,
 - Construction footprint of approximately 20 m
- Temporary components (e.g. construction laydowns, batching plants, office and amenities, etc.)

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

2.2. Study area

The location of the proposed wind farm is approximately 32 km to the north-west of Warrnambool and extends across both sides of the Woolsthorpe-Heywood Road, between Penhurst-Warrnambool Road and Hamilton-Port Fairy Road (Figure 1). The area is located in the Victorian Volcanic Plain bioregion of western Victoria.

Budj Bim National Park (formerly known as Mount Eccles National Park), recently added to the World Heritage list, and Mount Napier State Park are located approximately 12 km and 20 km north-west of the project site, respectively. Other reserves within 20 km of the project include Yambuk Coastal Reserve, Woolsthorpe Nature Conservation Reserve, Yambuk Wetlands Nature Conservation Reserve, Tower Hill Wildlife Reserve, as well as other smaller bushland and flora reserves.

Geology

The WWF site falls on the southern margin of the Western Plains of Victoria. The Western Plains is a landscape developed mainly on volcanic rocks with enclaves of older sedimentary rocks. The geology across the WWF site is basaltic lava with a regolith of basalt stones, weathered basalt and a variable thickness of alluvial and swamp deposits. Over most of the areas of the younger lava flows, basalt is exposed at the surface as blocks, boulders and locally continuous outcrop. The site is relatively flat, supporting soils of volcanic origin on a dissected landscape featuring many rocky outcrops and wet depressions.

The geology of the WWF site is described in detail in the *Proposed Willatook Farm Geoheritage Assessment* (Environmental GeoSurveys Pty Ltd 2022).

Hydrology

The WWF site falls within the Shaw River catchment in the west, and the Moyne River catchment in the east. Major aquatic systems within the WWF site include the Moyne River at the eastern extremity, Back Creek (a tributary of the Moyne River) in the east of the site, the Shaw River in the north and west of the site, and the Cockatoo Swamp complex in the centre of the site. Several other smaller ephemeral drainages occur within the site. The site receives an average annual rainfall in excess of 700 mm (BoM 2021). Much of the site is low-lying and has a poorly defined drainage system, resulting in numerous small, ephemeral wetlands that fill during wet periods.

Characterisation of the existing hydrology of the site, including modelling of peak flow events, was conducted by Water Technology Pty Ltd (2021, 2024, 2025).

Land-use history

The WWF site has been used for sheep and cattle farming for over 150 years. It comprises several properties owned by individuals and companies. The site has been subject to extensive removal of native vegetation in the past. Fertiliser has been extensively applied on the site and, in places, the site has been cultivated for pasture improvement.

Vegetation

The land use of the site and surrounds is agricultural (primarily livestock grazing), and widespread clearing of the study area and surrounds has resulted in native vegetation being largely restricted to roadside reserves. Vegetation within most private properties around the site consists predominantly of introduced vegetation. This includes areas of improved and unimproved pasture dominated by common, introduced pasture species.

The dominant landscape across the WWF site is rocky outcrops interspersed with lower depressions that hold water ephemerally. Some rocky outcrops support Stony Knoll Shrubland vegetation, with native grasses and Austral Bracken being the dominant native species, and higher-quality examples retaining shrubs such as Sweet Bursaria and Tree Violet. Many rocky outcrops no longer support native vegetation due to heavy grazing and are now dominated by pasture grasses. Many landscape depressions support Plains Grassy Wetland, although much of this is species depauperate due to stock grazing. Plains Grassy Wetland was generally dominated by Common Tussock Grass, with higher quality examples supporting a greater diversity of graminoids and some aquatic herbs.

Some of the higher-quality vegetation within the WWF site is associated with roadsides and includes Higher-rainfall Plains Grassy Woodland and Basalt Shrubby Woodland. Higher-rainfall Plains Grassy Woodland was also mapped in association with the Shaw River in the west of the site, while Tall Marsh was mapped along Back Creek in the east of the site.

2.2.1. Fauna habitat

Habitats across the site are highly modified and exist in an agricultural landscape. While some changes may have occurred in small-scale habitats across the site, such as individual wetlands, field work on the site in 2018 and 2019 found that habitat types had not changed significantly since the assessments in 2009 and 2010. The fauna habitat descriptions summarised below are largely taken from the EHP (2018) report, with added context for bats.

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

Bat habitat across WWF

Habitat at WWF that is of higher quality for bats includes woodland, rivers and creeks with permanent water sources, and native and planted tree rows which connect to these higher quality areas and ephemeral wetlands (Figure 1). However, bats potentially also use fragmented tree rows or patches during foraging, roosting or commuting. In addition, bats can use artificial structures as roosts, such as old farmhouses, sheds and culverts, which are present throughout the surrounding landscape.

Modified Woodland, scattered trees and planted vegetation

Modified woodland habitat consists of stands of trees to 15 m tall along roadsides and some patches in agricultural land, and scattered remnant trees. It is lacking the mid-storey and understorey components that many fauna species require and provides limited connectivity. Generally localised in roadside reserves and scattered in grazing land, where it completely lacks understorey, this provides remnant habitat in a highly modified agricultural landscape.

Planted vegetation consists mainly of young stands of planted exotic and native trees, usually in wind breaks. This habitat is of low quality for fauna. The habitat occasionally contains trees of up to 20 m tall but lacks understorey and other habitat components, such as hollows.

Patches of remnant and planted treed areas and scattered trees provide foraging and roosting opportunities for bats, particularly edge-space foraging species such as the SBWB. They also provide connectivity for commuting to higher-quality foraging areas.

Rivers, creek and drainage lines

These habitats vary in form from permanent rivers to ephemeral drain lines, with many supporting terrestrial and aquatic vegetation. Some of these habitats hold water year-round and support vegetated habitat along edges to varying extents. Other areas were ephemeral and less vegetated, and provide temporary habitat when they hold water.

Both ephemeral and permanent water sources are important for bats, particularly those with emergent and fringing vegetation and trees, such as the Shaw River in the south-west end of the WWF site.

Swamps, marshes and artificial waterbodies

Much of the original wetland habitat in the study area has been modified or drained, with the limited area of remaining ephemeral wetland habitats being of moderate quality for fauna habitat. Typically lacking floristic diversity and mostly characterised by sedges and rushes, the low-lying areas are typically inundated during the wetter months. These areas are mostly grazed whenever possible. The largest of these habitats is Cockatoo Swamp, which is spread out across agricultural land with limited remnant indigenous vegetation cover.

Artificial waterbodies, including farm dams and drains in drained wetlands, exist in the WWF site. Some support aquatic or fringing vegetation, typically surrounded by grazing and cropped land. Bats would be likely to use these vegetated water bodies.

Modified native grassland and exotic pasture and crops

Modified native grassland habitat was described as of moderate quality for fauna species, being deficient in some key habitat components, such as a diversity of flora species and refuge sites, and being fragmented within the landscape. It is largely restricted to roadsides.

Rocky rise/stony knolls occur over much of the southern section of the WWF site. This habitat consists of embedded rocks and typically some vegetation cover, and primarily occurs in grazing land and has been

impacted by farm stock grazing and weed invasion. Though lacking a diversity of indigenous plant species, the structure of the rocky habitat provides important shelter for reptiles, such as skinks and lizards.

Of low quality for fauna, the exotic grasses and pasture habitat are largely grazed for farming purposes and provide little habitat or shelter for indigenous fauna. This habitat covers much of the study area and consists mostly of pasture grass and crops.

Where trees are absent, these native/exotic grassland areas and rocky knolls are most likely used predominantly by open-spaced foraging bats, such as White-striped Free-tailed Bats and Yellow-bellied Sheath-tail Bats, and occasionally edge-space foraging bats. However, as the WWF site is largely cleared of high-quality treed habitat corridors, bats may move across these cleared areas to access the higher-quality habitat areas.

2.3. Ecology of relevant bat species

2.3.1. Southern Bent-wing Bat (SBWB)

The Southern Bent-wing Bat (SBWB) is an obligate cave-roosting species with a restricted distribution (19,452 km²) in south-eastern Australia that spans an area from Robe, Naracoorte and Port MacDonnell in south-east South Australia, extending eastwards to Lorne and Pomborneit in south-west Victoria (Churchill 2008; TSSC 2021). There is a small area of overlap in the distribution of the SBWB and Eastern Bent-wing Bat in western Victoria, where individuals of each subspecies may roost together in some non-maternity caves (TSSC 2021). In this region, SBWB and Eastern Bent-wing Bat (EBWB) cannot be reliably distinguished using traditional field-based techniques, such as comparing morphometrics (DELWP 2020).

In 2000, the SBWB was recognised as a subspecies distinct from the Northern (*Miniopterus orianae orianae*) and Eastern (*Miniopterus orianae oceanensis*) Bent-winged Bats (Cardinal and Christidis, 2000). With a mean weight of 15.7 g, head and body length of 52–58 mm, and forearm length of 45–49 mm, the SBWB is slightly larger than the other two *Miniopterus orianae* subspecies. However, the three subspecies are morphologically very similar (Churchill 2008).

The SBWB has undergone a serious population decline since the 1960s (DELWP 2020). Consequently, in 2007, the SBWB was listed as Critically Endangered under the EPBC Act. In Victoria, the species is listed as Critically Endangered under the FFG Act. A draft national recovery plan for the SBWB was issued in 2015 (Lumsden and Jemison 2015), and a revised plan was formally adopted under the EPBC Act in 2020 (DELWP 2020).

Recent population modelling predicted an 84% to 97% reduction in population size from 2020–2056 (Van Harten, Lawrence, Lumsden, T. Reardon, et al. 2022). Continued population decline is suspected to be driven primarily by historical and ongoing loss of foraging habitat via the conversion of wetlands and native vegetation for agricultural purposes. Drought and the introduction of White-nose Syndrome to Australia both pose significant threats to SBWB (Holz et al. 2019; Southern Bent-wing Bat National Recovery Team 2022). Furthermore, during the 2023/24 SBWB breeding season, there was a mass mortality event of pups at the Warrnambool maternity cave, with 780 dead pups found in December 2023; the cause of death was not identified. This was identified to likely have a significant impact on this population's recruitment for the 2023/24 season (Southern Bent-wing Bat National Recovery Team 2024).

Roosting and maternity sites

SBWB are a cave-roosting species whose distribution overlaps the WWF, and which are known to use a series of breeding and non-breeding caves across south-west Victoria (Figure 2).

WWF is located approximately 50 km from Starlight Cave (Warrnambool), which is a known maternity roosting cave for SBWB. Known non-breeding roosting caves are located approximately 18 km south-west (Yambuk and Deen Maar), 30 km north-west (Byaduk and Mt Napier) and 35 km south-east (Grassmere) of WWF.

SBWBs gather in late spring and early summer at maternity caves to give birth and raise their young, and then disperse in autumn to use non-breeding caves throughout the cooler parts of the year (Churchill 2008). There are two major SBWB maternity caves with long histories of use: ‘Bat Cave’, located in the limestone cave system at Naracoorte in South Australia, and ‘Starlight Cave’, a sea cliff cave located near Warrnambool in Victoria (TSSC 2021). During the breeding season, the majority of the SBWB population is thought to roost in the two main maternity caves: around 28,000–35,200 bats in Bat Cave (Naracoorte, SA), and 17,233–18,000 bats in Starlight Cave (Warrnambool, western Victoria) (TSSC 2021). A third, smaller maternity cave was discovered in 2015 near Portland, Victoria (Lumsden and Jemison 2015). In 2020, the Department of Environment, Land, Water and Planning (DELWP, now DEECA) estimated there was a population of 1,000–1,500 individuals (including juveniles) using the Portland maternity cave (TSSC 2021). Monitoring the abundance of SBWBs at the three maternity caves is ongoing, with data being used to develop long-term population models (Southern Bent-wing Bat National Recovery Team 2024).

The SBWB maternity caves have specific structural characteristics that allow heat and humidity to build up, creating conditions suitable for rearing and development of dependent young (Dwyer 1963). The caves used in winter are cooler, allowing the bats to lower their body temperature to facilitate the use of torpor, i.e. reduced metabolic rate (Baudinette et al. 1994; Hall 1982). In Victoria, there are 18 caves used as roosting sites, spread throughout the south-west of the state, and in South Australia, 52 caves are known to be used for roosting (DELWP 2020).

Recent studies have collected data on patterns of movement between and use of caves that challenge previously held concepts of roost fidelity and temporal patterns of roost use. The Conservation Advice for SBWB (TSSC 2021) summarises this as follows:

“While caves that are consistently used by large numbers of Southern Bent-wing Bats may be considered critical sites, the availability of a large number of sites, even those used infrequently, may be equally important for the subspecies’ survival.”

Foraging habitat

SBWB is a nocturnal, aerial hawking insectivorous species with a fast, direct flight pattern (Dwyer 1963). Where there are trees, SBWBs typically forage in open spaces above the canopy, but can fly closer to the ground in more open areas (Bush et al. 2025; Churchill 2008; TSSC 2021). Limited radio-tracking studies have shown that SBWBs hunt in a range of habitat types, forested areas, native remnant vegetation, and over cleared agricultural and grazing land (ARI 2025; Grant 2004; Stratman 2005; TSSC 2021). In a recent study of the movements of the SBWB, Bush et al. (2022) tracked the nightly foraging flights of individuals using miniature GPS/VHF units (~1.4 g) in a highly modified agricultural landscape in south-west Victoria. To investigate the importance of treed vegetation to the bats' flight paths, they measured the distance of each GPS fix to the nearest tree and compared this to the distance to trees of randomly generated points. Preliminary analysis revealed that bat locations were closer to trees than would be expected from random movement alone. This included both native and exotic paddock trees in addition to planted linear strips.

SBWB also show a preference for seasonally inundated wetlands (Stratman 2005). DELWP (2020) state that wetlands with terrestrial vegetation occurring around the fringes and aquatic vegetation within the

swamp itself are used extensively, with individuals recorded flying considerable distances from roost caves to reach these foraging areas.

In 1977, a dietary study examining stomach contents of 11 Bent-winged Bat (*Miniopterus schreibersii*) individuals collected from eastern and northern Australia found moths (Lepidoptera) were the main prey item (Vestjens and Hall 1977). In a recent study using arthropod DNA metabarcoding of guano collected from caves, Kuhne et al. (2022) also found that moths comprised the main component of the SBWB diet. Of the 67 moth species identified, many are associated with agricultural landscapes, such as Pasture Webworm (*Hednota pedionoma*) and Armyworm (*Persectania dyscrita*). These findings suggest SBWB may provide important ecosystem services by contributing to the control of populations of moth species considered to be agricultural pests (Kuhne et al. 2022).

Being an insectivorous bat, SBWBs have a high surface area to volume ratio and large, naked flight membranes, which, in combination, result in high rates of evaporative water loss (Webb et al., 1995). Consequently, they require access to surface water and drink on-the-wing from open waterbodies such as creeks and rivers, wetlands and farm dams (TSSC 2021). SBWBs are also known to access drinking water by licking droplets from drips in roost caves (Bourne and Hamilton-Smith 2007; Codd et al. 1999).

Threats

The SBWB is listed as Critically Endangered under both the FFG and EPBC Acts. The species is potentially impacted by a range of threats, with the most important being (TSSC 2021):

- Destruction and disturbance of roost sites (particularly maternity sites)
- Declining extent and quality of foraging habitat

The species is also expected to be at risk from white-nose syndrome, which is predicted to severely impact the species across its entire distribution (Holz et al. 2016, 2019; Turbill and Welbergen 2020).

2.3.2. Yellow-bellied Sheathtail Bat (YBSB)

The Yellow-bellied Sheathtail Bat (YBSB) is a wide-ranging species present throughout tropical and sub-tropical Australia. The species occurs in a wide range of habitats from wet and dry sclerophyll forests to open woodlands. It usually roosts in large tree hollows, but sometimes uses buildings (Churchill 2008; Menkhorst 1996; NSW Office of Environment and Heritage 2021).

There is no information on the number of YBSBs that are present in Victoria, but the species is considered to be a rare visitor to southern Australia, predominantly in late summer and autumn (NSW Office of Environment and Heritage 2021). Many of the YBSBs recorded in Victoria have been found in exposed situations in an exhausted condition (e.g., hanging from the outside wall of buildings in broad daylight, or on fence posts in open paddocks), which might suggest that they have been unintentionally driven south by adverse wind conditions.

The YBSB is a large (mean body weight = 44 g), open-space adapted species that flies high and fast above the canopy, but has been observed flying lower over open spaces and at the forest edge (Churchill 2008). The species has been recorded colliding with wind turbines further north in its range in NSW, where it is more abundant, indicating that it is vulnerable to turbine collision (Nature Advisory, unpublished data). Nature Advisory is not aware of any YBSB carcasses recorded during mortality monitoring at operational wind farms in Victoria.

Nature Advisory (unpublished data) has recorded individual records of this species at proposed wind farm sites from Queensland through to south-western Victoria. Typically, in Victoria and NSW, acoustic recordings indicate low levels of activity and are of a few calls (1–5) recorded on one or two nights at different locations across a site.

The species' diet consists of invertebrates, predominantly beetles. They are also known to forage on grasshoppers, leafhoppers, shield bugs, crickets, wasps and a few flying ants (Churchill 2008; Hall and Richards 2023).

Roosting and maternity sites

YBSB usually roosts in large tree hollows of live or dead trees, but sometimes uses buildings or mammal burrows (Churchill 2008; Menkhorst 1996; NSW Office of Environment and Heritage 2021). Roosting is often solitary, but can range up to 30 individuals (Churchill 2008; Hall 2009).

Foraging habitat

YBSB is a nocturnal, aerial hawking insectivorous species. Often foraging high and fast over the forest canopy, and lower in more open country (Churchill 2008; Lumsden and Menkhorst 1995). The species forages across most habitats within its range, from wet and dry sclerophyll forests to open woodlands (Churchill 2008; Lumsden and Menkhorst 1995).

Threats

The YBSB is listed as Threatened under the FFG Act. It is not listed under the EPBC Act and is listed as "least Concern" on IUCN's Red List of Endangered Species (Armstrong and Lumsden 2017).

The likely causes of the YBSB population decline are attributed to:

- Disturbance to roosting and summer breeding sites.
- Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions.
- Loss of hollow-bearing trees; clearing and fragmentation of forest and woodland habitat.
- Use of pesticides and herbicides, which may reduce the availability of insects and can result in the accumulation of toxic residues in an individual's fat stores.

This species is reported to have the highest prevalence of Australian bat Lyssavirus in Australian echolocating bats, though the implications for the species are not known (Armstrong and Lumsden 2017). Feral European honeybees commonly take over tree hollows in arid Australia and displace many fauna species, including YBSB. Habitat clearance and modification in eastern Australia are likely causes of a reduction in area of occupancy, as is the replacement of perennial species in riparian zones of arid areas (Armstrong and Lumsden 2017).

The IUCN Red List (Armstrong and Lumsden 2017) states:

"This bat is listed as Least Concern given its wide distribution, use of a broad range of habitats, large population size, occurrence in protected areas, and the absence of significant key threats or evidence for a decline. Acoustic surveys in northern Australia often encounter this species, especially those employing full spectrum detectors that allow harmonic profiles to be observed, suggesting that it can be relatively common. It is recorded rarely in southeastern Australia, and it is still unknown if these records represent occasional summer-autumn visitors (Hall and Richards, 2023), vagrants (Menkhorst, 1995) or small resident populations."

It is present in many protected areas throughout Australia. Targeted surveys in Papua New Guinea are needed to more clearly define the extent of occurrence and habitat association, as well as further ecological research to investigate its status in the southern parts of its range and its basic ecology and roosting habits (Armstrong and Lumsden 2017).

2.3.3. Grey-headed Flying-fox

The species occurs in a coastal belt from south of Gladstone in central Queensland to Adelaide in South Australia (Australasian Bat Society 2025). Only a small proportion of the range is in use at any one time, as the species forages according to food availability. As a result, patterns of occurrence and relative abundance vary greatly between places, seasons and years.

Foraging and movement

The species typically commutes each day between colony sites and foraging areas, usually within 15–20 km of the day roost site (Tidemann 1999), although GHFFs have been recorded foraging up to 50 km from their roosting sites. All individuals typically leave the roosting site synchronously at dusk (Parry-Jones and Augee 1992). The species is primarily a canopy-feeding frugivore and nectivore, most commonly utilising rainforests, open forest, and closed and open woodlands (Eby 1995; Hall and Richards 2000). The major food plants include blossoms of *Eucalyptus*, *Corymbia* and *Angophora* species, melaleucas and banksias (Eby and Law 2008).

Threats

The GHFF is currently listed as vulnerable under the EPBC Act (DAWE 2021) and vulnerable under the FFG Act. The primary threat to the species is loss and degradation of foraging and roosting habitat (DAWE 2021).

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

**ADVERTISED
PLAN**

Figure 1: Bat habitat at Willatook Wind Farm

Project No: 16087_29

Project: Willatook Wind Farm, VIC

Date: 31/07/2026

 Wind farm boundary

• Turbines

Habitat features

 Forestry plantation

 Planted trees

 Pine tree row

 Planted Eucalypts

 Remnant native trees / woodland

 Wetland - Periodically Inundated

 Farm dam

**ADVERTISED
PLAN**



PO Box 337, Camberwell, VIC 3124, Australia
www.natureadvisory.com.au
03 9815 2111 - info@natureadvisory.com.au

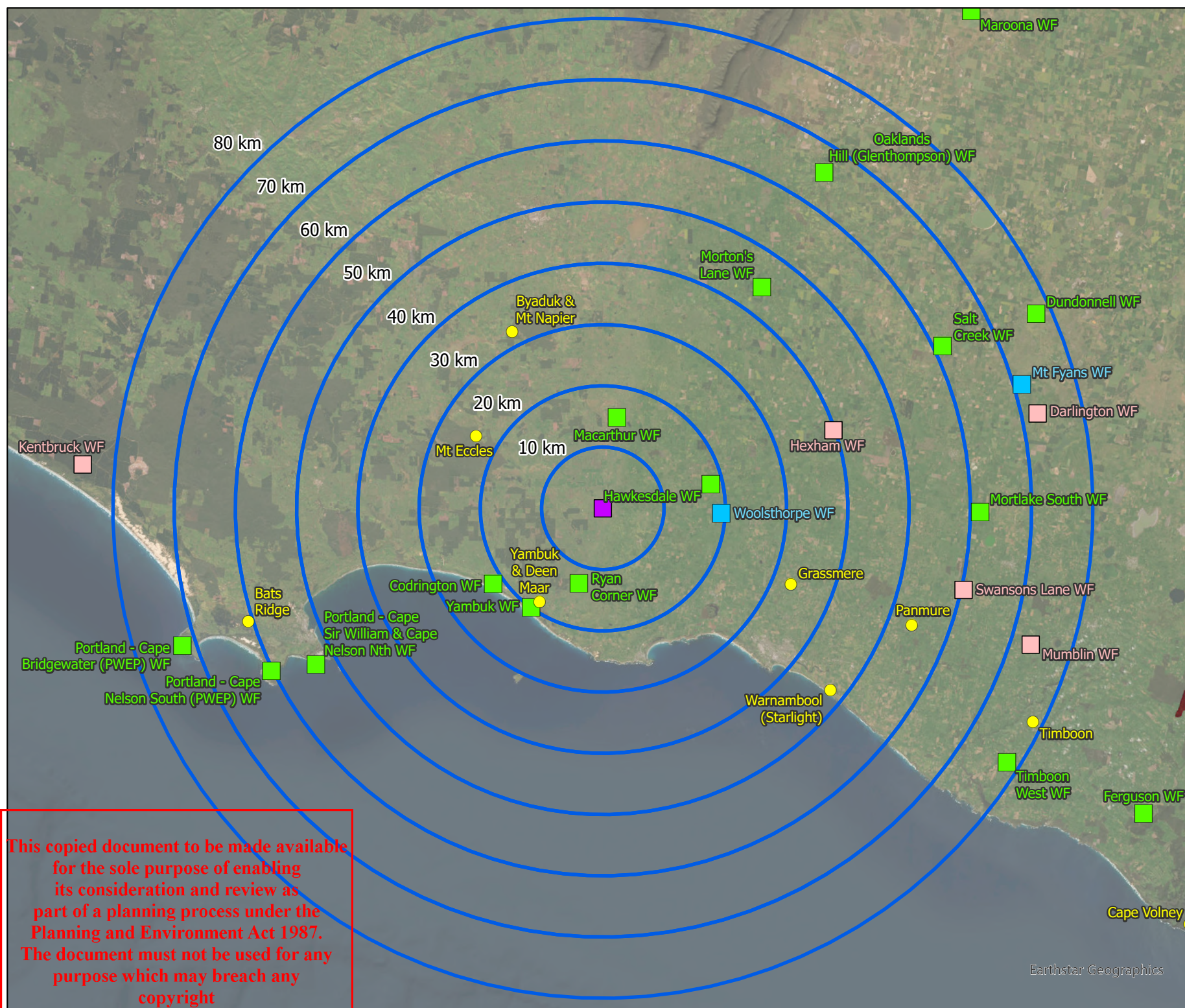
This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright

Earthstar Geographics

Figure 2: Location of Willatook wind farm and Southern Bent-winged Bat roost caves in the surrounding landscape

Project No: 16087_29
 Project: Willatook Wind Farm, VIC
 Date: 31/07/2026

- Search area
 - SBWB roost cave
 - Willatook Wind Farm
- Surrounding wind farm status**
- Approved (Not operational)
 - Operating
 - Planning application under development or consideration
 - Under construction



Kilometres

0 5 10 15 20

GDA2020 MGA Zone 54

Nature Advisory

PO Box 337, Camberwell, VIC 3124, Australia
www.natureadvisory.com.au
 03 9815 2111 - info@natureadvisory.com.au

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

3. Regulatory context

This section presents the relevant Commonwealth and State legislation, policy and guidelines relating to the protection of biodiversity during the planning, construction and operation of wind farm facilities.

3.1. Previous assessment and background

The project was determined to be a Controlled Action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and the EES process was an accredited assessment under the Commonwealth–Victoria bilateral agreement, with the EES informing the Commonwealth approval decision. Two Planning Permit applications were submitted to the Minister for Planning as the responsible authority for the WWF. The applications (PA2201620 and P22065, respectively) were for the wind farm and associated infrastructure within Moyne Shire, and an application to remove a small amount of native vegetation for the over-dimensional road route within Glenelg Shire. Both planning permit applications were called in by the Victorian Minister for Planning and assessed concurrently with the project's EES.

The Willatook Wind Farm *Environment Effects Statement* (EES) was prepared between 2019 and 2022. The EES included an assessment of the effects on listed bat species. The EES was publicly exhibited from 4 July 2022 to 12 August 2022, during which time submissions on the EES were provided. An independent Inquiry and Panel was appointed by the Minister for Planning to hear submissions and assess environmental effects under both the *Environment Effects Act 1978* and the *Planning & Environment Act 1987*. The public hearing was scheduled to run from 11 October 2022 to 7 November 2022. In July 2023, the Minister for Planning released their Minister's Assessment of the EES (Minister for Planning 2023). This included several recommendations related to the Southern Bent-wing Bat (SBWB; *Miniopterus orianae bassanii*).

In May 2025, the Victorian Government formally published the *Handbook for the Development of Renewable Energy in Victoria – Guidance to Avoid, Minimise, Mitigate and Compensate for Impacts on Threatened Bird and Bat Species* (DEECA 2025a). This provides further guidance regarding the assessment and mitigation of potential impacts on bat species in Victoria for the development of onshore wind farms *Appendix 3: Species specific guidance for onshore wind energy facilities – Bat species of concern* (DEECA 2025b).

The new *Handbook* Bat-specific guidelines provide clarity regarding the Victorian Government's position with respect to the assessment and management of onshore wind farm impacts on Bat Species of Concern. The *Handbook* provides clear guidance on a mitigation hierarchy to minimise impacts to bats. The guideline came into effect on 28 May 2025.

This assessment re-analyses previous results regarding listed Bats at the site, adds further data from subsequent investigations and then uses *Appendix 3: Species Specific Guidance for Onshore Wind Energy Facilities – Bat species of concern* (DEECA 2025b) as the basis for the assessment. This considers both the Minister's Assessment (Minister for Planning 2023) and guidance within the *Handbook* (DEECA 2025a, 2025b), and the latest Commonwealth guidance from the *Onshore Wind Farm Guidance: Best practice approaches when seeking approval under Australia's national environmental law* (DCCEEW 2024).

3.2. Commonwealth Environment Protection and Biodiversity Conservation Act (EPBC Act)

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protects a range of Matters of National Environmental Significance (MNES) and matters protected by international treaties. These matters include a list of threatened species, ecological communities and migratory

species that are matters of national environmental significance. Any impact on such matters that is considered significant requires the approval of the Commonwealth Minister for the Environment.

One bat species listed under the EPBC Act was recorded in the WWF study area:

- **Southern Bent-wing Bat (SBWB)** - Critically Endangered

One additional EPBC Act-listed species, the **Grey-headed Flying-fox (GHFF)** (Vulnerable), has the potential to occasionally fly over the wind farm area due to its proximity to the Warrnambool Grey-headed Flying-fox roosting camp.

Several specific EPBC Act guidelines and associated species-specific documents have been consulted, and directions from these have been applied during surveys and in formulating the investigations of fauna impacts described in this report. These include:

- *Matters of National Environmental Significance - Significant Impact Guidelines 1.1* (DoE 2013).
- *Onshore wind farm guidance - best practice approaches when seeking approval under Australia's national environment law* (DCCEE 2024).
- *Survey Guidelines for Australia's Threatened Bats: Guidelines for Detecting Bats Listed as Threatened Under the Environment Protection and Biodiversity Conservation Act 1999* (DEWHA 2010).
- Department of Environment, Land, Water and Planning, 2020. *National Recovery Plan for the Southern Bent-wing Bat *Miniopterus orianae bassanii**. Victorian Government, Melbourne (DELWP 2020).
- Threatened Species Scientific Committee, 2021. *Miniopterus orianae bassanii* (Southern Bent-wing Bat) *Conservation Advice* (TSSC 2021).
- Southern Bent-wing Bat National Recovery Team (SBWBRT) *Annual Progress Report 2021* (Southern Bent-wing Bat National Recovery Team 2021).
- *SBWBRT Annual Progress Report 2022* (Southern Bent-wing Bat National Recovery Team 2022).
- *SBWBRT Annual Progress Report 2024* (Southern Bent-wing Bat National Recovery Team 2024).

3.3. Flora and Fauna Guarantee Act 1988

The Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) lists threatened and protected species and ecological communities (DEECA 2024; DELWP 2019). The Environment Effects Statement (EES) process in Victoria requires that impacts on FFG Act-listed species be assessed, even on private land.

Two bat species listed under the FFG Act are present, or can potentially be present in the WWF study area:

- **Southern Bent-wing Bat (SBWB)** – Critically Endangered.
- **Yellow-bellied Sheathtail Bat (YBSB)** – Vulnerable.

There is an Action Statement produced for SBWB under the FFG Act (DEECA 2023). This guides the consideration of SBWB and is implemented alongside the FFG Act strategy *Protecting Victoria's Environment – Biodiversity 2037*.

The **GHFF** is also listed under the FFG Act (Vulnerable) and has the potential to occasionally fly over the wind farm area due to its proximity to the Warrnambool GHFF camp.

3.4. Environmental Effects Act 1978

The WWF was referred to the Victorian Minister for Planning (the ‘Minister’) in October 2018 under the Environmental Effects Act 1978 (EE Act). On 27 December 2018, the Minister determined that an EES was required for the project due to the potential for the project to have significant effects on environmental and social values.

Following consideration of the EES referral and public submissions on the draft scoping requirements, the final Scoping Requirements for Willatook Wind Farm Environment Effects Statement (scoping requirements) were issued by the Minister for Planning in August 2019 (DELWP 2019). The scoping requirements specify the specific matters to be investigated and documented in the EES, including the draft evaluation objectives for each of the topics to be addressed.

The EES scoping requirements (DELWP 2019) specify the following draft evaluation objective relevant to biodiversity, including bat species, which has guided this assessment:

“To avoid, and where avoidance is not possible, minimise potential adverse effects on biodiversity values within and near the site including native vegetation, listed threatened species and ecological communities, and habitat for these species. Where relevant, offset requirements are to be addressed consistent with state and Commonwealth policies.”

The key issues are outlined as follows:

- Direct loss or degradation of native vegetation and associated listed ecological communities, including those listed as threatened under the EPBC Act, the FFG Act and/or DELWP advisory lists
- Direct loss or degradation of habitat for flora and fauna listed as threatened under the EPBC Act, the FFG Act and/or DELWP advisory lists
- Disturbance and/or degradation of adjacent or nearby habitat that may support listed species or other protected flora, fauna or ecological communities
- Disturbance and/or individual to population level loss of flora and fauna species listed as threatened under the EPBC Act, FFG Act and/or DELWP advisory lists
- Indirect habitat loss or degradation resulting from other effects, such as edge effects, surface hydrological changes, groundwater drawdown, noise, vibration, light or the introduction of weeds/pathogens
- Disruption to the movement of fauna between areas of habitat across the broader landscape, including between roosting or breeding sites for the Southern Bent-wing Bat
- The availability of suitable offsets for the loss of native vegetation and habitat for listed threatened species under the EPBC Act and FFG Act
- Potential collision risk for protected bird and bat species with project infrastructure, including with wind turbine blades, and
- Potential cumulative effects on the relevant listed threatened species and communities of flora and/or fauna, in particular Brolga and Southern Bent-wing Bat, from the project in combination with the construction and operations of other energy facilities.

In July 2023, the Minister for Planning released their Minister’s Assessment of the EES (Minister for Planning 2023). The Minister concluded the following with respect to potential impacts on the Southern Bent-wing Bat:

The risk of residual impacts to Southern Bent-wing Bat are only considered acceptable and manageable provided:

- *The 200 m turbine-free buffer is applied to potential Southern Bent-wing Bat foraging habitat as shown in tabled document 67*
- *The cut-in wind speed specified in the BAM Plan is increased to at least 4.5 m/s from dusk to dawn between September and May for the life of the wind farm to help reduce potential bat mortalities*
- *The cut-in wind speed requirements should be applied to all turbines for the project; o the cut-in speed of a minimum of 4.5 m/s should also be applied during additional months if any Southern Bent-wing Bat mortalities are recorded during winter*
- *Any changes to turbine blade tip height to meet aviation safety requirements do not result in a reduction in the lower ground clearance for the rotor swept area (RSA), and*
- *There is ongoing monitoring through the BAM Plan and implementation of appropriate additional mitigation measures in response to observed bird and bat impacts, noting that monitoring results should inform the potential need to increase the minimum cut-in wind speed or consider other effective management strategies if Southern Bent-wing Bat mortalities are recorded.*

3.5. The Handbook for the Development of Renewable Energy in Victoria

The *Handbook for the Development of Renewable Energy in Victoria*, released by the Department of Energy, Environment and Climate Action (DEECA) on 29 May 2025, provides comprehensive guidance for assessing and managing the environmental impacts of renewable energy projects, particularly on threatened bird and bat species. It introduces a risk-based approach to planning and approval processes, incorporating a mitigation hierarchy (avoid, minimise, mitigate, and compensate) to address biodiversity concerns associated with onshore wind energy facilities. The handbook applies to all approval pathways for such projects, including Development Facilitation Programs and Environmental Effects Statements.

The DEECA *Handbook* includes *Appendix 3: Species specific guidance for onshore wind energy Facilities – Bat species of concern* (DEECA 2025b). Appendix 3 provides detailed species-specific guidance for managing impacts on (relevant species highlighted in bold):

- **Southern Bent-Wing Bat**
- Eastern Bent-wing Bat
- South-eastern Long-eared Bat
- **Yellow-bellied Sheathtail Bat**
- **Grey-headed Flying-fox**

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Appendix 3 (DEECA 2025b) outlines the process under which wind energy facilities must assess, mitigate, and compensate impacts on these Bat Species of Concern.

3.6. Other Guidelines

In addition to the foregoing policy and legislative instruments, a number of wind farm-specific guidelines have been consulted, and key directions from these have been applied in formulating the investigations of potential impacts to fauna described in this report. These include:

- *Guidelines for Bat Surveys in Relation to Wind Farm Developments* (Lumsden L F 2007).

- *Best Practice Guidelines for Implementation of Wind Energy Projects in Australia* (Clean Energy Council 2018).
- *Policy and Planning Guidelines - Development of Wind Energy Facilities in Victoria* (DELWP 2021).

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

**ADVERTISED
PLAN**

4. Methods

4.1. Echolocating insectivorous bat surveys

Bat detector surveys were undertaken to determine the microbat species that utilise the study area, particularly the listed threatened species. Between 2009 and 2020, six targeted bat surveys over six years were undertaken at the proposed WWF to determine the presence and activity levels of bats, and inform the assessment of the impacts of the wind farm on bat species. In addition, a year-long survey at height on two meteorological masts was undertaken. Best-practice survey techniques were deployed to detect which bat species occur across the study area. Ultrasonic detectors that passively detect and record echolocation calls emitted by free-flying insectivorous bat species were deployed to identify, through expert opinion, the species occurring at the proposed site.

Deployment of ultrasonic bat detectors occurred for several weeks at a time at 100 unique survey sites during both spring and late summer to early autumn. This targeted times when general bat activity is high, but in particular when the EPBC Act-listed critically endangered Southern Bent-wing Bat (*Miniopterus orianae bassanii*) occurs. Recordings were undertaken at ground level and at heights of 42 – 45 m on meteorological masts to detect species flying at height to investigate which species may be at greater risk of collision with operating wind turbines, which at WWF will have a minimum RSA height of 60 m.

Although ultrasonic detectors are the recommended technique to detect most insectivorous bats (Department of Energy, Environment and Climate Action, 2025a), there are limitations to acoustic surveys and the interpretation of their data, as outlined in Appendix 1.

4.1.1. Survey effort

Due to the occurrence of SBWB, an intensive survey effort was undertaken, which, upon conclusion, totalled 4,646 detector nights. To date, this is one of the greatest bat survey efforts of any proposed wind farm in Victoria.

Table 3 summarises the survey effort at WWF and includes the number of detector-nights (where available) for each surveying period. Figure 3 shows the locations of all survey points and the proposed WWF layout, and habitat descriptions at each detector site are described in Appendices 2 and 3 presents the detailed survey effort for each site.

Table 3: Survey effort at the proposed Willatook Wind Farm site (2009-2020)

Survey Period	Consultant	Min and max no. of detectors	No. of sites (total)	Total detector nights
Spring 2009 30 Oct – 22 Nov	EHP	Undisclosed*	7	128
Spring 2010 20 Oct – 22 Nov	EHP	6–32	21	177
Summer/Autumn 2011 9 Feb – 31 Mar	EHP	6–49	18	333
Spring 2018 25 Oct – 14 Dec	Nature Advisory	4–49	36	325

Survey Period	Consultant	Min and max no. of detectors	No. of sites (total)	Total detector nights
Summer/Autumn 2019 27 Feb – 1 May	Nature Advisory	20–83	31	1793
Summer/Autumn 2020 19 Feb – 2- May 2020	Nature Advisory	20–90	18	750
Autumn 2019 – Autumn 2020 Met mast surveys 2 May 2019 – 19 May 2020	Nature Advisory	273–294	4	1140
Total number of detector nights				4,646

Notes: * = Number of recorder nights not indicated in EHP (2018) Biodiversity Assessment

EHP (2009 to 2011)

The 2009 – 2011 surveys were undertaken by EHP (2018), using Anabat ultrasonic recorders (Titley Electronics, Ballina NSW; model not disclosed).

Seven bat detectors were placed in the Spring of 2009 in different parts of the landscape that were representative of the bat habitat across the entire study area (Figure 3; Appendix 2), including one detector that was attached to a meteorological mast at a height of approximately 42 m (see Section 4.1.2). Bat detectors were deployed at a total of 18 sites over the survey period in a range of habitats, including open paddocks, adjacent to farm dams, near areas of remnant native vegetation (e.g. along waterways) and planted wind rows. The detector recording commenced on 30 October 2009 and ceased on 22 November 2009, and approximately 128 detector nights were completed.

Eight bat detectors were deployed throughout the WWF site in October and November 2010, and seven detectors were deployed in February and March 2011. At the time, the literature indicated that SBWB underwent migrations to the maternity caves; however, more recent data have shown that more movements occur throughout summer between maternity caves and non-maternity caves than was previously thought (Threatened Species Scientific Committee, 2021). During each survey period, one detector was mounted on the meteorological mast with the microphone placed at a height of approximately 42 m (see Section 4.1.2). Detectors were moved weekly during the October–November (Spring) sampling season across 21 different locations and weekly to fortnightly during the February–March (Autumn) sampling season across 18 different locations. Batteries were changed weekly, and calls were downloaded from cards at this time. EHP (2018) reported a total of 268 bat detector nights (i.e. the total number of detectors by the total number of nights, excluding nights where detectors malfunctioned) were undertaken during the current surveys. This does not match the number of nights outlined in Table 8 of the EHP (2018) report, from which Nature Advisory have extracted the data. Nature Advisory have followed Table 8, which totals 510 detector nights based on the date ranges provided.

Detectors were deployed at ground level in suitable locations throughout the landscape, which were likely to represent areas of greatest bat activity. Locations were chosen that were close to windrows or remnant trees, dams, watercourses and ridge-tops. Open paddock areas were not often chosen as bat activity in these areas was likely to be very low.

Detector settings were not disclosed in the EHP (2018) report.

Nature Advisory (2018 to 2020)

The 2018–2020 surveys were undertaken by Nature Advisory, using Songmeter ultrasonic recorders (SM4; Wildlife Acoustics; Table 3).

An increased survey effort was undertaken from May 2019 – May 2020 in response to recommendations from DELWP (now DEECA; Barwon, SW). This reflected current and evolving best practice survey methodology based on the Survey Guidelines for Australia's Threatened Bats (Department of the Environment, Water, Heritage and the Arts, 2010) to build upon the previous survey efforts undertaken a decade prior. The additional surveys also sought to target a wider range of areas and habitats across the site, as opposed to only suitable habitats where threatened species may occur. This approach aimed to gain a complete understanding of bat usage across the proposed WWF site, including areas of relatively poor habitat where turbines are proposed to be located.

(Van Harten 2020) has expressed concern that wind farm proponents may underestimate bat activity if pre-construction monitoring is undertaken only for short-term, or during summer when juveniles are still dependent on adult females at maternity caves. This study has been undertaken over all seasons, but with emphasis during spring and autumn when the species is considered to be actively flying across the landscape and less confined to maternity caves. Seasonal at-height surveys spanning a year at height were undertaken from May 2019 – May 2020 to capture seasonal variation.

The bat detectors were secured to trees or fence posts approximately 1.5–2 m above ground level. The detectors were programmed to commence recording approximately 30 minutes before sunset and cease approximately 30 minutes after sunrise. During this nighttime period, they were automatically triggered by ultrasonic noise.

4.1.2. Location of survey sites

The bat detectors were deployed within a range of habitats across the study area (Figure 3). Appendix 2 presents the habitat descriptions for each of the 100 survey sites and the proximity of the site to treed habitats and permanent waterbodies. Treed habitats refer to Blue Gum plantations, planted rows of trees and remnant vegetation (usually along road reserves or creeks and rivers). The vast majority of wetlands in the study area are ephemeral and only hold water for part of the year. Few permanent waterbodies occur across the landscape, and during most of the surveys, surface water was limited to farm dams and parts of the Shaw River.

After the initial surveys during 2009–11 established the presence of listed bat species, the majority of survey sites from 2018 onwards were placed where turbines are proposed and consisted of open paddocks. This was the dominant habitat of the study area, being an altered agricultural landscape that has been mostly cleared of native vegetation and is primarily used for grazing sheep and cattle. Habitat descriptions for each site are presented in Appendix 2, and the coordinates of all deployments are presented in Appendix 3.

Commonly used 'planted trees' in the study area include Blue Gum, Sugar Gum and Monterey Cypress, usually along fence lines and around farmhouses. Blue Gum plantations occur nearby but not within the proposed wind farm itself. Remnant indigenous trees, comprising *Eucalypt* and *Acacia* species, occur along road reserves and along the banks of creeks and rivers in the study area.

Stoney rise areas are recent lava flows where surface basalt rocks remain. They are usually treeless, though remnant vegetation occurs here, including bracken, and some native grasses and herbs, with a significant exotic grass component.

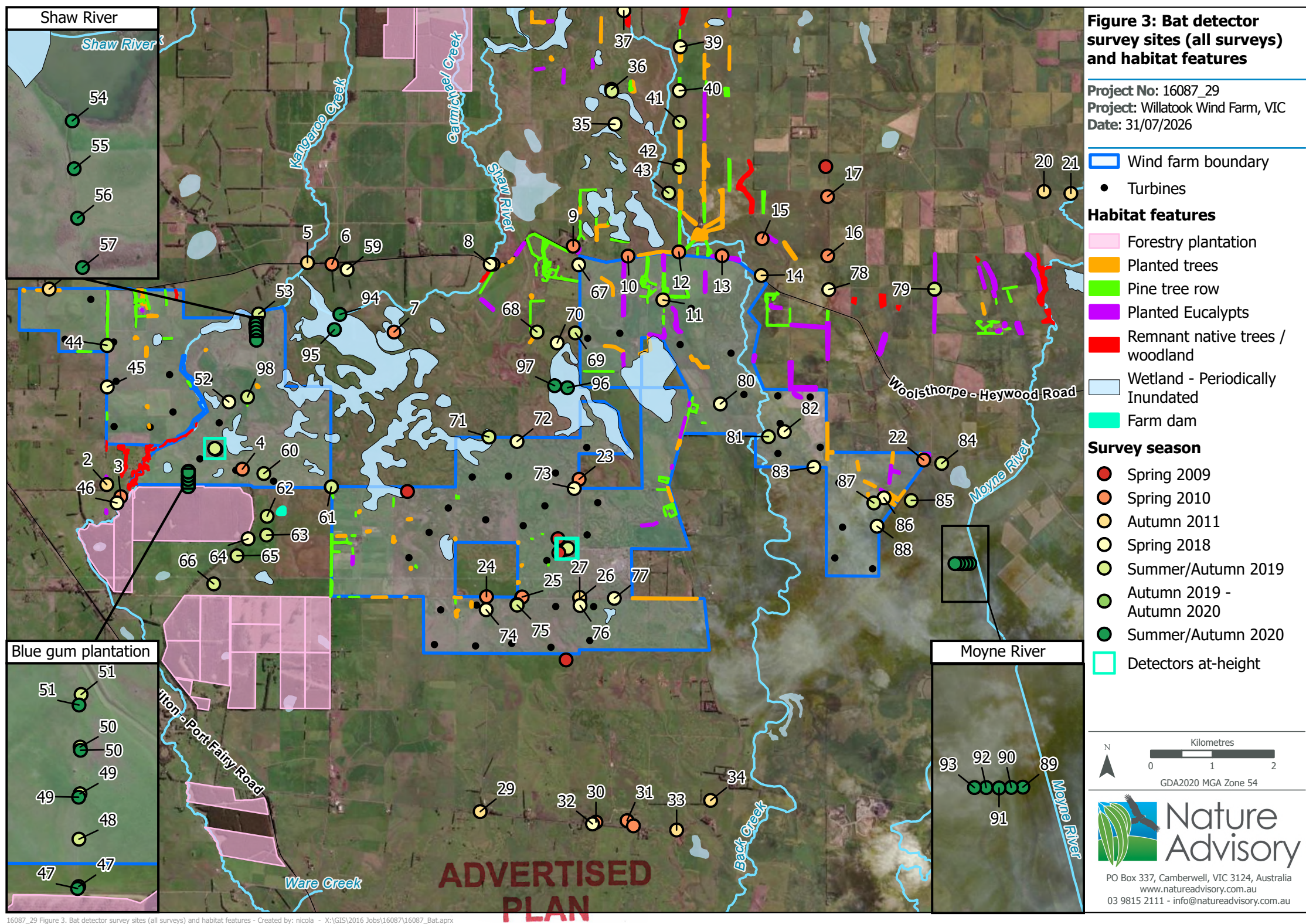


Figure 3a. Gradient surveys at Shaw river

Project No: 16087_29

Project: Willatook Wind Farm, VIC

Date: 31/07/2026

 Wind farm boundary

 River

Habitat features

 Wetland - Periodically Inundated

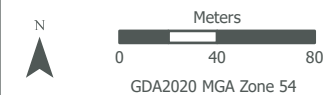
Survey season

 Summer/Autumn 2019

 Summer/Autumn 2020



**ADVERTISED
PLAN**



PO Box 337, Camberwell, VIC 3124, Australia
www.natureadvisory.com.au
03 9815 2111 - info@natureadvisory.com.au

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

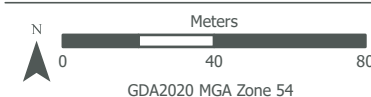


Figure 3b. Gradient surveys at Blue Gum plantation

Project No: 16087_29
Project: Willatook Wind Farm, VIC
Date: 31/07/2026

-  Wind farm boundary
- Habitat features**
 -  Forestry plantation
- Survey season**
 -  Summer/Autumn 2019
 -  Summer/Autumn 2020

ADVERTISED PLAN





**Nature
Advisory**

PO Box 337, Camberwell, VIC 3124, Australia
www.natureadvisory.com.au
03 9815 2111 - info@natureadvisory.com.au



Figure 3c: Gradient surveys at the Moyne River

Project No: 16087_29

Project: Willatook Wind Farm, VIC

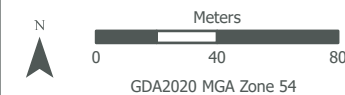
Date: 31/07/2026

— River

Survey season

● Summer/Autumn 2020

ADVERTISED
PLAN



PO Box 337, Camberwell, VIC 3124, Australia
www.natureadvisory.com.au
03 9815 2111 - info@natureadvisory.com.au

Gradient studies (2019 to 2020)

In 2019–20, “gradient surveys” were undertaken to determine the level of bat activity at increasing distances from areas considered to be preferred foraging habitats. This data was intended to inform appropriate buffer areas between turbine locations and preferred foraging habitat on site, thus reducing the risk of bat interaction with turbines.

The surveys involved five detectors positioned at 60 metre intervals in a straight line from a specific ecological feature, including a treed area and permanent water, which are habitats known to typically attract higher bat activity (DELWP 2020; Mills and Pennay 2017; Richards 2007; Stratman 2005). Gradient surveys were deployed at the following locations (Figure 3):

- A Blue Gum plantation, *Eucalyptus globulus* – sites 47–51 (2019 and 2020);
- A permanent pool along the Shaw River – sites 54–58 (summer/autumn 2019); and
- An inundated area at the Moyne River basin – sites 89–93 (summer/autumn 2019).

Wetland surveys

At WWF, wetlands and ephemeral wetlands were considered in discussions with DELWP (now DEECA) to provide potential foraging habitat for SBWB. To determine the utilisation of these habitats, sites within 30 m of watercourses, wetlands or dams were investigated further.

During the 2019-2020 surveys, water levels, or “fill” levels, were recorded at three of these wetlands, which are summarised below:

- Cockatoo Swamp (VWI: 25957; site 94):
 - April - 30%, May - 40%, June - 60%, July - 80%
- Wetland 3 (VWI: 25677; site 96):
 - April - 0%, May - 20%, June - 30%, July - 50%, and
- The permanent pool at Shaw River (sites 53 and 54):
 - April - 40%, May - 50%, June - 70%, July - 90%.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

From August to December 2020, all wetlands were generally 100% full as it was an above-average rainfall year. Water levels were not collected prior to this survey period.

Height surveys (2019 to 2020)

The height distribution of bats was studied using bat detectors installed on two meteorological masts (met masts) for a total of 851 bat detector nights during the following periods:

- Eastern Met Mast – spring 2010, autumn 2011, spring 2018, summer/autumn 2019, and autumn 2019 to autumn 2020
- Western Met Mast – spring 2018, summer/autumn 2019, and autumn 2019 to autumn 2020.

Paired microphones were installed at ground level and at 42–45 m above ground level (AGL) during each survey period (Figure 3). The height of 45 m AGL was chosen to lie within the initial RSA for the proposed turbines at WWF, however the minimum RSA has since been raised as a mitigation measure for bats (outlined in Section 7.2.1). In suitable weather conditions, the detectors at height would be able to record calls up to 15-75 m AGL. However, in windy or rainy conditions, the detection area would decrease (see Section 4.6).

Due to the high frequency of bat calls, they are subject to geometric attenuation and atmospheric attenuation (Voigt et al. 2021). Coupled with the limited sensitivity of ultrasonic microphones and the additional noise interference at height, the detection distance of bat calls at height is likely to be less than that of bat calls at ground level, impeding the ability to accurately identify calls to species level.

4.2. Echolocation call identification

The following call analysis was undertaken for each of the survey seasons:

- Summer 2009 and Spring 2018 – all bat calls were analysed to identify all species recorded in the study area.
- Spring 2010, Summer/Autumn 2011, Summer/Autumn 2019 – only the calls of threatened bat species were analysed and identified to species and species complex levels due to the volume of data collected.
- 2019–2020 year-long survey – only SBWB and all the species in the SBWB /Chocolate Wattled Bat/Little Forest Bat/forest bat complex were analysed, which was considered the most suitable approach to assess impacts on threatened bat species.

Calls from the detectors were filtered by Kaleidoscope® Lite 5.4 software (Wildlife Acoustics Inc.) to group the recordings (one group per night per bat detector), which were sent to Rob Gration (EcoAerial Ecological Services, Newport, Victoria) for identification. Call identification was based on a key developed by comparing the characteristics of bat calls with reference calls from known species recorded from Victoria. Identification is largely based on the recorded change in frequency patterns over time. For confidence, only those recordings that contained at least two definite and discrete calls were classified as bat calls. For most species, a call sequence of several seconds in duration is required before identification can be made confidently.

4.3. Southern Bent-wing Bat call analysis

The analysis of SBWB calls was guided by the parameters below.

- Call sequences required a minimum of five pulses.
- Key call identification characters used were: long characteristic section, frequency range of 46-50 kHz based on (Conole 2000).
- Filters used include those described below.

If SBWB-only is required to be analysed, the following filter is applied: frequency range 45~55kHz. This filter was developed by Chris Corben & Terry Reardon. It also incorporates the Little Forest Bat, Chocolate Wattled Bat and Southern Bent-wing Bat call complex

For Willatook, a 10-55 kHz filter was used as the presence of all species was requested.

- The reference call used for the Southern Bent-wing Bat was of the species exiting Panmure Cave, recorded by Rob Gration.
- The threshold for assigning to a call complex included: a call sequence consisting of a range of call shapes that could be attributed to Little Forest Bat, Chocolate Wattled Bat and Southern Bent-wing Bat; no one call shape dominated, and a consistent pulse sequence was lacking (refer to Appendix 4 Spectrogram 3).
- Data were provided to Nature Advisory (as per ECOAERIAL's standard approach since the Australian Bat Society reporting standards were published) in the following ways:

- Detailed numbers of calls attributed to the Southern Bent-wing Bat and the Southern Bent-wing Bat call complex were provided in a spreadsheet for each site and the relevant date. Call images for each call attributed to the Southern Bent-wing Bat were also provided.
- Where required, comments were provided in relation to the bat call image.

The call characteristic graphs and identification for the two threatened species were provided to Greg Ford (Director and Principal Consultant at Balance! Environmental) to peer review for confirmation of the identification to species and/or complexes. Greg Ford has over 25 years' experience in ecological research, impact assessment, biodiversity monitoring and land use planning throughout eastern Australia. He is a recognised expert on bats, with specialist expertise in acoustic analysis of bat echolocation calls for species identification.

4.4. Cave roost assessment

Landholder surveys

Detailed landholder surveys were completed to assess potential roosting sites. A key element of the surveys was to identify the presence of any caves on their properties.

Interviews using a community questionnaire were held with landholders within the wind farm from 10 km from the wind farm site, from 3rd to 7th December 2018. All landowners, including absent landowners, and dwelling owners within 10 km of the boundary of the wind farm were contacted by letter and invited to take part. Where possible and if information was available, follow-up calls were made with all landowners within 10 km. If the phone numbers were not available, it was not possible to contact these additional landholders.

Specialist consultation

Further information on the occurrence of SBWB non-breeding caves in the Southern Volcanic Plains region was sought from Nicholas White (Victorian Speleologist Association) and Amanda Bush (Arthur Rylah Institute) on the 8th and 11th of May 2020. The Geoscience assessment by Neville Rosengren also undertook an assessment of lava tunnels in the study area (Environmental GeoSurveys Pty Ltd 2022)(Environmental GeoSurveys, 2022).

4.5. Turbine buffers

It is well-established that, for most insectivorous bats, activity increases closer to important habitat features, such as treed areas and water bodies, and decreases further away from these habitats into more open areas with less tree cover. Consequently, placing turbines close to these important bat habitats is likely to increase the chance of bat-turbine interactions (Arnett et al., 2016).

The *Handbook* (DEECA 2025b) suggests that habitat buffers should be implemented, but does not prescribe a buffer distance. There are currently no Australian State or Commonwealth guidelines that prescribe appropriate buffer distances between turbine blade edges and habitat features that are important for insectivorous bats (e.g., treed areas and water bodies) to reduce collision risks to an acceptable level. Two different turbine-habitat buffer distances have been proposed in the Northern Hemisphere:

- United Kingdom - minimum 50 m from nearest habitat feature (trees, hedges) to blade-tips (Natural England, 2014)
- Europe – minimum 200 m from nearest habitat feature (woodland, tree lines, hedgerow networks, wetlands, waterbodies and watercourses) to blade-tips (Rodrigues et al. 2015)

Justification presented for the 50 m buffer distance is based on evidence that the activity of bats found in the UK tends to decline rapidly with increasing distance from linear landscape features and woodlands (Natural England 2014). In comparison, the EUROBATS guidelines were designed for a region with much greater species diversity, including several migratory bats that fly very long distances across the landscape, including over open areas with minimal tree cover (Rodrigues et al. 2015).

The effectiveness of buffer zones is less clear for bats like the SBWB that travel long distances for both daily and seasonal movement between foraging and roosting sites, and has not been specifically investigated in Australia (Umwelt 2024).

The *Handbook* has provided further clarification on the approach to defining and managing habitat buffers for sensitive species. *Guidance for Bat species of concern* (DEECA 2025b) notes:

“Acknowledging that avoidance of all features may not be feasible or practical, proponents are encouraged to prioritise avoiding the following features, where practicable:

- *Areas of native vegetation. While essential to support Bat Species of Concern such as Grey-headed Flying-foxes, native vegetation also provides a host of broader biodiversity benefits to a range of species and ecosystems*
- *Areas where survey monitoring has detected the highest concentrations of bat activity regardless of the vegetation type. If methods recommended in this guidance have been followed, this should allow the proponent to avoid the areas with potentially the greatest impact on Bat Species of Concern.”*

The Minister has recommended that the turbine-free habitat buffers at WWF follow a 200 m buffer around all bat habitat. As acknowledged by DEECA during discussions with the proponent and Nature Advisory, it is not considered feasible to avoid all potential SBWB foraging and commuting habitat throughout south-west Victoria using 200 m buffers. The *Handbook* encourages avoidance of areas of native vegetation and areas of highest concentrations of bat activity, regardless of habitat presence.

Willatook Wind Farm Pty Ltd and Nature Advisory have collaborated to microsite the proposed turbines based on an overlap of 262 m buffer around turbines (see calculation below) with habitat and SBWB and YBSB activity (Figure 9 and Figure 10). The following key habitat features were prioritised for avoidance:

- The southern end of the Shaw River and associated riparian vegetation,
- The large wetland system in the centre of the study area (brolga turbine-free buffer),
- Remnant native woodland,
- Forestry plantations, and
- Areas with a higher number of SBWB-definite or complex calls per night relative to other sites within the study area.

[Turbine buffer size calculation](#)

Buffer distances for WWF are somewhat uncertain, given that a final decision on the specific turbine model has not been made. Presuming that the turbines will have a hub height of 150 m and blade length of 87.5 m (minimum RSA height of 60 m AGL), using the method to calculate the distance from the edge of the RSA to the edge of the nearest habitat feature (presuming that was a 30-m tall tree) described by Natural England (2014), the buffer distance would be 262 m from the base of the turbine to the nearest habitat edge for the EUROBATS (2015) 200-m buffer from RSA edge to habitat edge.

The formula used to calculate these turbine-habitat buffer distances is (Natural England, 2014, page 2):

$$b = \sqrt{(c + bl)^2 - (hh - fh)^2}$$

Where:

b = distance from the base of the turbine tower to the edge of the habitat feature.

c = prescribed buffer distance from the blade tip to the edge of the habitat feature.

bl = blade length

hh = hub height.

fh = feature height (in m) (see Figure 4).

ADVERTISED PLAN

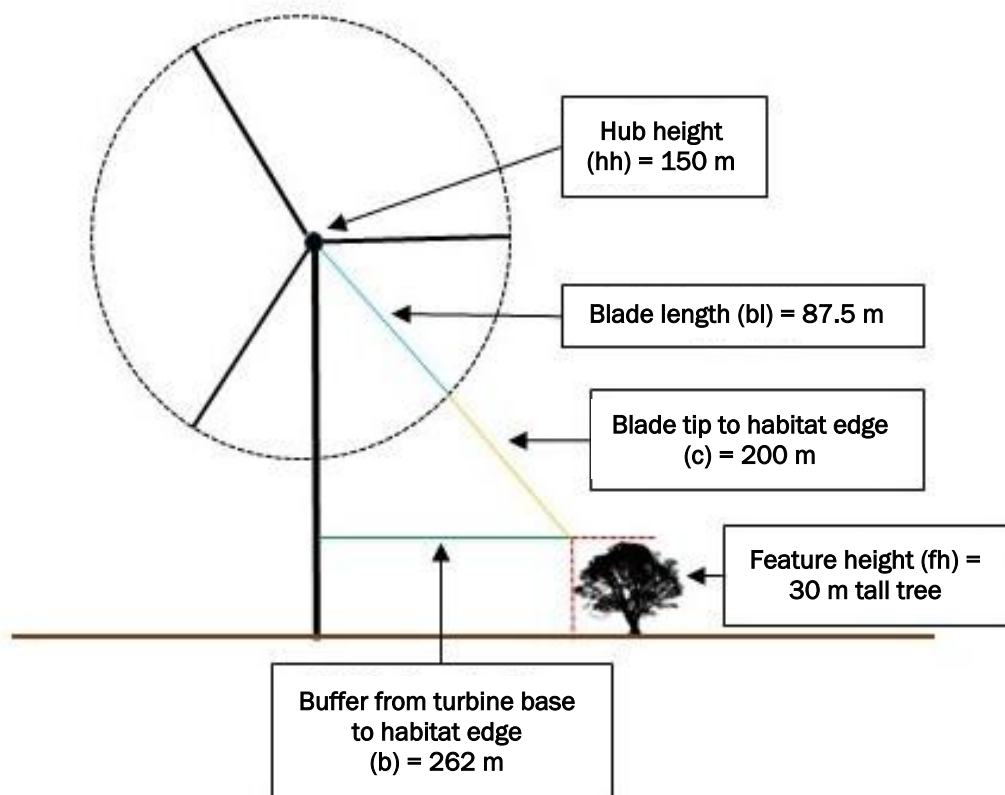


Figure 4: Schematic showing 262 m turbine-habitat buffer.

NOTE: This diagram is not to scale.

The 262 m buffer required to achieve 200 m separation from blade tips to habitat edges includes a contingency, because most trees present across the WWF study area are significantly less than 30 m tall, i.e. the distance from blade tips to the habitat features that are less than 30 m would be greater than 262 m.

It should be noted that the formula uses the maximum blade length and hub height that may apply to the final turbine model selected. The buffer required would be calculated using this formula and the final turbine model specifications.

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

4.6. Assumptions and limitations

The bat detector survey effort at WWF was one of the largest of its kind at a Victorian wind farm to-date, and has been guided by DEECA through consultation, and is considered suitable for impact assessment purposes.

However, there are limitations to undertaking bat detector surveys; an explanation of the limitations of using bat detectors and bat call analysis to study echolocating insectivorous bats is outlined in Appendix 1. A summary of the limitations and efforts to counteract these limitations is provided below.

Detecting capabilities and technical difficulties

- **Technical difficulties** – can result in variation in the number of nights and total hours of recording between the different detectors deployed during a survey. To account for this, the number of calls per night was calculated for each detector location.
- **Detecting capabilities** – bat detectors are only capable of detecting echolocation calls that arrive at the microphone above a critical sound pressure level and at a sufficiently high signal-to-noise ratio. This means that, for an echolocation call to be recorded by a bat detector, it must be louder than the background or ambient noise. Furthermore, the call data collected is from only a small fraction of the entire three-dimensional airspace in which the turbines will operate. This limitation was taken into consideration when assessing the impacts on bats and designing the avoidance and mitigation hierarchy.
- **Zone of detection** – echolocation calls produced by bats attenuate (reduce in amplitude) as they travel through air, with higher frequency calls attenuating faster than lower frequency calls. This limitation was taken into consideration when assessing the impacts on bats and designing the avoidance and mitigation hierarchy.

Survey variation

- **Survey variation** - There are variables when collecting field data, including variation in the way the detectors are installed, environmental/seasonal conditions, methodology, survey purposes, locations where data was collected, and personnel collecting the data.
- **Consultant variation** – due to development in survey techniques and surveys being undertaken by different consultancies, the current study contained variation in methodologies. This may influence results as comparison across survey periods has limitations. An increased survey effort was undertaken by Nature Advisory to account for variation between surveys, and with 4,646 bat detector nights it is one of the largest survey efforts at a Victorian wind farm.

Bat activity

- **Bat activity levels across weather conditions** – bat activity levels within and between nights may vary in response to weather variables such as air temperature, relative humidity, barometric pressure, wind speed, direction and gusts, and rain.
- **Relative activity vs abundance** – passively collected echolocation call data cannot be used to quantify the numbers of bats present in a given area. Therefore, it is not possible to determine population numbers (abundance), but rather only a measure of relative activity (e.g., calls per night per site).

Species complexes

Overlap in species-specific call characteristics – calls produced by one bat species may at times closely resemble those of other species. The considerable variability in calls produced by free-flying echolocating bats often makes it difficult, or sometimes impossible, to assign species-level identifications to passively

recorded calls. Therefore, all calls that cannot be reliably identified to species level are placed into a call complex. For the purposes of this assessment, all calls within a call complex that contained a threatened species were assumed to possibly be from that threatened species.

The echolocation calls produced by Southern Bent-wing Bats (SBWB) can be difficult to distinguish from those of the Chocolate Wattled Bat and Little Forest Bat. Therefore, ambiguous calls with a frequency range consistent with these taxa were allocated to an SBWB + Chocolate Wattled Bat + Little Forest Bat species complex.

Echolocation calls produced by long-eared bats (*Nyctophilus* spp.) cannot be distinguished to species level and, hence, are grouped as a long-eared bat complex (Pennay et al., 2004). The species of this complex that are likely to occur at the WWF site include the Lesser Long-eared Bat (*N. geoffroyi*) and Gould's Long-eared Bat (*N. gouldi*).

The echolocation calls of forest bats (*Vespadelus* spp.) can be difficult to differentiate to the species level. Therefore, some *Vespadelus* calls were grouped into a forest bat complex.

Similarly, the echolocation calls of some free-tailed bats (*Ozimops* spp.) can be difficult to differentiate to the species level. Therefore, some *Ozimops* calls were grouped into a free-tailed bat complex. The species of this complex that are likely to occur at the WWF site include Ride's Free-tailed Bat (*O. ridei*) and Southern Free-tailed Bat (*O. planiceps*).

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

**ADVERTISED
PLAN**

5. Assessment results

5.1. Echolocating insectivorous bat surveys

The microbat utilisation surveys conducted in the WWF study area identified 10 species and four species complexes (Table 4). Of the species identified, eight are common and widespread in farmland and woodland habitats throughout eastern and south-eastern Australia. Two species are listed as threatened under the Commonwealth EPBC Act and/or the VIC FFG Act (Table 4).

While not recorded during surveys for the project, the Grey-headed Flying-Fox has the potential to occasionally fly over the wind farm site based on the distance of the known roosting camps at Warrnambool and Hamilton.

Table 4: Microbat species recorded during the bat detector survey at the Willatook wind farm site

Common name	Scientific name	Conservation status
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright
Eastern Falsistrelle	<i>Falsistrellus tasmaniensis</i>	
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	
Inland Forest Bat	<i>Vespadelus baverstocki</i>	
Large Forest Bat	<i>Vespadelus darlingtoni</i>	
Little Forest Bat	<i>Vespadelus vulturnus</i>	
Southern Bent-wing Bat	<i>Miniopterus orianae bassanii</i>	EPBC Act: Critically endangered; FFG Act: Critically endangered
Southern Free-tailed Bat	<i>Ozimops planiceps</i>	-
White-striped Free-tailed Bat	<i>Austronomus australis</i>	-
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>	FFG Act: Vulnerable
Species complex		
Forest Bat species complex	<i>V. darlingtoni</i> / <i>V. regulus</i> / <i>V. vulturnus</i>	-
Free-tailed Bat species complex	<i>O. planiceps</i> / <i>O. ridei</i>	-
Long-eared Bat species complex	<i>Nyctophilus geoffroyi</i> / <i>N. gouldi</i>	-
Southern Bent-wing Bat / Chocolate Wattled Bat / Forest Bat complex	<i>M. o. bassanii</i> / <i>C. morio</i> / <i>V. vulturnus</i>	EPBC Act: Critically endangered; FFG Act: Critically endangered

Notes: Rows shaded grey are listed threatened species under the EPBC Act and/or FFG Act.

5.1.1. EHP survey results (Spring 2009, Spring 2010 & Autumn 2011)

The Spring 2009 surveys included a detailed analysis of all bat species on site, while only threatened species, their associated species complexes, and the other species in the SBWB complex (Chocolate Wattled Bat and Little Forest Bat) were studied during the 2010 and 2011 bat surveys.

In Spring 2009, there were 1380 call files identified, with 462 allocated to a species and 146 to a species complex (Table 5). The remaining 772 calls could not be assigned to any species due to background noise or poor call resolution (usually because of distance from the microphone).

EHP previously reported 11 bat species recorded in 2009. However, as the Eastern Bent-winged Bat was listed, but there does not appear to be any calls assigned to this species (and it is outside the species range), Nature Advisory assumes this is an error. Consequently, ten bat species and four species complexes were recorded in the WWF study area during the 2009 surveys.

Table 5: Bat species recorded during the Spring 2009 surveys at Willatook wind farm

Common Name	Scientific name	Anabat ID (exact location not specified)							Total
		A	B	C	D	E	Eastern Met Mast (Ground)	Eastern Met Mast (at-Height)	
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	46	8	16	37	18	1	-	126
Eastern Falsistrelle	<i>Falsistrellus tasmaniensis</i>	5	-	4	2	-	-	-	11
Gould's Wattled Bat	<i>Chalinolobus gouldi</i>	2	-	10	33	175	3	1	224
Large Forest Bat	<i>Vespadelus darlingtoni</i>	32	-	9	7	1	-	-	49
Little Forest Bat	<i>Vespadelus vulturnus</i>	-	-	1	2	-	-	-	3
Ride's Freet-ailed Bat	<i>Ozimops ridei</i> ¹	-	-	-	-	-	-	-	0
Southern Bent-wing Bat	<i>Miniopterus schreibersii bassani</i>	-	-	1	-	-	-	-	1
Southern Free-tailed bat	<i>Ozimops planiceps</i> ²	-	-	3	-	1	-	-	4
White-striped Free-tailed Bat	<i>Tadarida australis</i>	4	1	-	-	-	-	-	5
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>	-	-	39	-	-	-	-	39
Species complexes									
Free-tailed Bat complex	<i>O. ridei</i> / <i>O. planiceps</i>	-	-	2	1	-	1	4	8
Gould's Wattled Bat / Free-tailed Bats	<i>Chalinolobus gouldi</i> / <i>O. ridei</i> / <i>O. planiceps</i>	1	-	5	6	5	-	2	19
Long-eared Bat complex	<i>Nyctophilus</i> sp	14	2	11	6	7	-	-	40
Southern Bent-wing Bat / Chocolate Wattled Bat / Little Forest Bat	<i>Miniopterus orinanae bassani</i> / <i>Chalinolobus morio</i> / <i>Vespadelus vulturnus</i>	26	1	-	-	-	-	-	27
Forest Bat complex	<i>Vespadelus darlingtoni</i> / <i>V. regulus</i> / <i>V. vulturnus</i>	12	5	11	24	-	-	-	52

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Common Name	Scientific name	Anabat ID (exact location not specified)							Total
		A	B	C	D	E	Eastern Met Mast (Ground)	Eastern Met Mast (at-Height)	
Total identified		142	17	112	118	207	5	7	608
Unidentified (poor quality)		501	11	99	92	61	4	4	772
TOTAL		643	28	211	210	268	9	11	1380

NOTES: Rows shaded grey are listed threatened species under the EPBC Act and/or FFG Act.

¹Previously reported as Eastern Free-tailed Bat *Mormopterus* sp2 in EHP (2018).

²Previously reported as *Mormopterus* sp4 in EHP (2018)

YBSB was recorded during all three survey seasons. During spring 2009, YBSB was recorded 39 times at site C (Table 5). It was also recorded at four sites during the 2010 surveys and two sites during the 2011 surveys.

Similarly, the SBWB was recorded across all three survey seasons, with a total of 100 calls identified. During the spring 2009 surveys, one SBWB-definite call was recorded at site C, which was located in the north-east of the study area (Table 5, Table 6). In addition, there were 27 calls recorded that were attributed to the SBWB species complex. Twenty-six of these calls were at site A in the southern part of the study area, where the Chocolate Wattled Bat was also recorded in relatively large numbers. The exact location of the 2009 sites was not reported in EHP (2018), instead, unlabelled bat detector locations were displayed on a map.

SBWB-definite calls were recorded at four sites during Spring 2010, with a total of 68 calls. During Autumn 2011, SBWB-definite calls were recorded at three sites, totalling 31 calls. The SBWB-complex was recorded from 18 locations in Spring 2010 (totalling 1030 calls) and nine locations in Autumn 2011 (totalling 2484 calls; Table 6).

According to EHP (2018), sites 2 and 3 are located near each other and detected a total of 61 SBWB-definite and 1364 SBWB-complex calls during mid-November 2010 and late March 2011. The survey effort at this location was higher than at other sites due to the presence of higher-quality habitat (Table 6). Sites 2 and 3 are located on the western boundary of the study area, with site 2 near roadside vegetation consisting of mature and recruiting Manna Gums and Swamp Gums with a mid-storey of natives including Black Wattle, and the Shaw River approximately 350 m to the east. Site 3 is located 50 m from the Shaw River, along the edge of the forestry plantation. Good quality riparian vegetation supporting mature trees grows along this section of the Shaw River, and the nearby paddocks are scattered with mature Swamp Gums. The habitat is of higher quality within this section of the WWF study area, and may explain the higher SBWB-definite calls recorded. The Shaw River and associated riparian vegetation may represent a nightly foraging commuting path and a part of the migration route for SBWB between roosting caves. YBSB calls were also recorded in this area in 2010 and 2011.

Site 22, where 30 SBWB-definite calls were recorded in Spring 2010, is located approximately 600 m from 'Wild Dog Swamp', which is a BioSite of regional significance, also known as 'Willatook Wetland'. During surveys, this swamp contained a considerable amount of water and is adjacent to a canalised section of the Moyne River. It represents the highest quality wetland in the immediate landscape around the wind farm area, and likely represents an important foraging area for microbats.

The remaining sites, which detected low numbers of SBWB-definite calls, were dispersed across the WWF study area. Two occurred adjacent to areas where windrows interconnected with linear roadside remnant vegetation (sites 32 and 34) and the remaining location was next to a small farm dam (site 1).

The Chocolate Wattled Bat was the most commonly detected species within the call complex. This species was detected at all sites during spring 2009, 14 locations during Spring 2010 and nine locations during the Autumn sampling. Little Forest Bat was not detected during the Spring 2010 survey, but was recorded at two sites in Spring 2009 and three sites in Autumn 2011.

Table 6: SBWB-definite and SBWB-complex recording locations at Willatook Wind Farm during Spring 2009, Spring 2010 and Autumn 2011

Survey period	Sites	No of nights surveyed	No of SBWB definite calls	Average definite calls per night	No of SBWB complex calls	Average complex calls per night
Spring 2009	A	Not reported	-	N/A	26	N/A
	B	Not reported	-	N/A	1	N/A
	C	Not reported	1	N/A	-	N/A
Spring 2010	3	12	35	2.92	190	15.83
	6	7	-	-	9	1.29
	7	7	-	-	1	0.14
	16	7	-	-	44	6.29
	22	12	30	2.5	658	54.83
	24	7	2	0.29	124	17.71
	32	7	1	0.14	-	-
	Eastern met mast (at-height)	19	-	-	4	0.21
Autumn 2011	1	14	4	0.29	405	28.93
	2	29	26	0.9	1174	40.48
	5	7	-	-	50	7.14
	8	8	-	-	35	4.38
	11	14	-	-	107	7.64
	14	21	-	-	136	6.48
	18	8	-	-	74	9.25
	20	15	-	-	48	3.20
	21	14	-	-	27	1.93
	26	7	-	-	3	0.43
	27	21	-	-	87	4.14
	29	14	-	-	192	13.71
	33	29	-	-	107	3.69
	34	7	1	0.14	33	4.71
	Eastern met mast (ground)	49	-	-	5	0.11
	Eastern met mast (at-height)	49	-	-	1	0.02
TOTAL			100		3541	

**ADVERTISED
PLAN**



This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

5.1.2. Nature Advisory Survey results (Spring 2018 & Summer/Autumn 2019)

The Spring 2018 surveys included a detailed analysis of all bat species on site, while only threatened species, their associated species complexes and the other species in the SBWB complex (Chocolate Wattled Bat and Little Forest Bat) were identified during the 2019 and 2020 bat surveys. The 2019–2020 year-long survey – only SBWB and all the species in the SBWB/Chocolate Wattled Bat/Little Forest Bat/forest bat complex were analysed, which was considered the most suitable approach to assess impacts on threatened bat species.

In Spring 2018, there were 11,058 call files identified over 354 detector nights, with 511 allocated to a species and 226 to a species complex. The remaining 10,322 calls could not be assigned to any species, due to background noise or poor resolution of the call itself (usually because of distance from the microphone). Nine species and four species complexes were recorded on the site (Table 7).

Table 7: Summary of results for Willatook Wind Farm bat species for the Spring 2018 survey

Common name	Scientific name	Conservation status	Total no. of calls Spring 2018
		(FFG/ EPBC)	
White-striped Free-tailed Bat	<i>Austronomus australis</i>	-	35
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	-	174
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	-	104
Eastern Falsistrelle	<i>Falsistrellus tasmaniensis</i>	-	30
Southern Bent-wing Bat	<i>Miniopterus orianae bassanii</i>	EPBC: Critically endangered; FFG: Critically endangered	6
Southern Free-tailed Bat	<i>Ozimops planiceps</i>	-	10
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>	FFG: Vulnerable	8
Little Forest Bat	<i>Vespadelus vulturnus</i>	-	39
Large Forest Bat	<i>Vespadelus darlingtoni</i>	-	103
Inland Forest Bat	<i>Vespadelus bavors</i>	-	2
Species complexes			
Forest Bat sp.	<i>V. darlingtoni</i> / <i>V. regulus</i> / <i>V. vulturnus</i> (Species complex)	-	113
Free-tailed Bat sp.	<i>Ozimops. planiceps</i> / <i>O. ridei</i>	-	44
Long-eared Bat sp.	<i>Nyctophilus geoffroyi</i> / <i>N. gouldi</i> (Species complex)	-	61
Southern Bent-wing Bat/Chocolate Wattled Bat/Little Forest Bat	<i>M. orianae bassanii</i> / <i>C. morio</i> / <i>V. vulturnus</i> (Species complex)	EPBC: Critically endangered; FFG: Critically endangered	8
TOTAL			737

The SBWB was recorded across both survey seasons, with a total of 6 calls in 2018 and 49 calls in 2019 (Table 8). Sites with the highest number of calls were focused in the area near Shaw River and the eucalypt plantation (sites 49 & 50), and the wetland to the south-east of the wind farm site (sites 84, 85 & 87).

The 2019 and 2020 gradient surveys are presented in Section 5.1.3 and the 2019–2020 surveys at height are presented in Section 5.1.4 The SBWB findings and species ecology is discussed further in Section 5.2.1.

Similar to 2009-2011, the Chocolate Wattled Bat was the most commonly detected species within the call complex in Spring 2018.

YBSB was recorded during the Spring 2018 and Summer/Autumn 2019 survey seasons. During spring 2018, YBSB was recorded four times at site 46 and four times at site 30. It was also recorded at site 66 in Summer/Autumn 2019, but the number of calls was not recorded for this season. The YBSB findings and species ecology are discussed further in Section 5.2.2.

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

**ADVERTISED
PLAN**

Table 8: SBWB-definite and SBWB-complex recording locations at Willatook Wind Farm during Spring 2018, Summer/Autumn 2019, Summer/Autumn 2020 and Autumn 2019-2020

Survey period	Sites	No of nights surveyed	No of definite calls	Average definite calls per night	No of complex calls	Average complex calls per night
Spring 2018	45	6	1	0.17	2	0.33
	59	5	1	0.2	1	0.2
	61	6	1	0.17	-	-
	64	8	1	0.13	-	-
	78	7	1	0.14	1	0.14
	86	7	1	0.14	4	0.57
Summer/ Autumn 2019	41	81	-	-	2	0.02
	43	20	-	-	1	0.05
	44	61	1	0.02	1	0.02
	48	62	1	0.02	2	0.03
	49	62	7	0.11	3	0.05
	50	62	7	0.11	1	0.02
	51	62	1	0.02	1	0.02
	53	34	4	0.12	2	0.06
	61	60	-	-	1	0.02
	62	20	1	0.05	1	0.05
	63	61	-	-	3	0.05
	66	21	-	-	2	0.10
Summer/ Autumn 2020	68	61	1	0.02	5	0.08
	69	20	4	0.2	5	0.25
	71	61	-	-	1	0.02
	75	81	-	-	4	0.05
	79	61	-	-	1	0.02
	81	81	1	0.01	-	-
	84	81	8	0.10	22	0.27
	85	81	5	0.06	17	0.21
	87	81	7	0.09	34	0.42
	98	60	-	-	1	0.02
	Western Met Mast (ground)	82	1	0.01	-	-
	Western Met Mast (at-height)	82	-	-	7	0.09
Autumn 2019 - Autumn 2020	49	32	1	0.03	-	-
	54	90	1	0.01	24	0.27
	56	69	1	0.01	-	-
	57	69	-	-	2	0.03
	58	90	-	-	3	0.03
	95	20	1	0.05	-	-
TOTAL	Eastern Met Mast (ground)	294	1	0.00	-	-
	Eastern Met Mast (at-height)	279	-	-	1	0.00

5.1.3. Gradient surveys

Important habitats

Gradient surveys in 2019–2020 positioned five detectors at 60 m intervals in a straight line from one treed area and two permanent water sources, which are habitats known to typically attract higher bat activity.

The gradient studies undertaken did not show any trends in SBWB activity levels. At the Blue Gum plantation gradient site, 72% of SBWB calls were within 130 m of the plantation (Table 9). Only two SBWB calls were recorded at the Shaw River gradient site, and none at the Moyne River gradient site. With very few calls of SBWB recorded, it is difficult to draw conclusions on activity levels at increasing distances from potential foraging habitats such as treed areas and waterways. However, in this subset of the data, 85% of SBWB calls were within 130 m of habitat, which is in line with the proposed 262 m turbine buffers.

Table 9: Results of the gradient studies

Survey period	Habitat	Site	Distance from Plantation/ wetland (m)	No. of SBWB calls	No. of nights surveyed	Average calls per night
Summer/ Autumn 2019	Plantation	48	70	1	63	0.02
		49	130	7	63	0.11
		50	190	1	63	0.02
		51	250	1	63	0.02
Summer/ Autumn 2020	Plantation	47	10	-	69	-
		49	70	1	69	0.01
		50	190	-	69	-
		51	250	-	69	-
Summer/ Autumn 2020	Shaw River	54	0	1	91	0.01
		55	60	-	70	-
		56	120	1	70	0.01
		57	180	-	70	-
		58	240	-	91	-
Summer/ Autumn 2020	Moyne River	89	0	-	68	-
		90	60	-	68	-
		91	120	-	68	-
		92	180	-	68	-
		93	240	-	33	-

Watercourses and wetlands

Sites within 30 m of watercourses or wetlands did not show overall higher levels of SBWB activity. Table 10 below presents the results of the studies undertaken at watercourses or wetlands in the study area. The site with the highest number of calls and most activity was Site 3, located along the Shaw River, which contained remnant vegetation along its banks. Overall, low activity levels of SBWB were recorded near most watercourses, farm dams and ephemeral wetlands (mostly modified) on the WWF site, with the majority of such sites recording no SBWB activity.

Table 10: Results of wetland studies

Site	Waterbody	Survey period	No. of SBWB calls	No. of nights surveyed	Average calls per night
1	Farm dam	Autumn 2011	4	14	0.29
3	Shaw River	Spring 2010	35	12	2.92
5	Kangaroo Creek	Autumn 2011	-	7	-
8	Shaw River	Autumn 2011	-	8	-
		Spring 2018	-	7	-
14	Farm dam	Autumn 2011	-	21	-
15	Black Creek	Spring 2010	-	12	-
21	Moyne River	Autumn 2011	-	14	-
37	Black Creek	Spring 2018	-	8	-
46	Shaw River	Spring 2018	-	6	-
53	Shaw River	Summer/Autumn 2019	-	35	-
54	Shaw River	May 2019 – May 2020	1	91	0.01
71	Ephemeral wetland	Spring 2018	-	8	-
		Summer/Autumn 2019	-	62	-
72	Ephemeral wetland	Spring 2018	-	6	-
82	Black Creek	Spring 2018	-	7	-
89	Moyne River	May 2019 – May 2020	-	68	-
94	Ephemeral wetland	May 2019 – May 2020	-	21	-

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Site	Waterbody	Survey period	No. of SBWB calls	No. of nights surveyed	Average calls per night
96	Ephemeral wetland	May 2019 – May 2020	-	22	-

The results above suggest that the wetland and waterway habitat across the site is not consistently or regularly utilised by this species. As available studies suggest, SBWB prefers remnant vegetation for foraging and dispersing across the landscape (ARI 2025; DELWP 2020) as opposed to the treeless habitat and unvegetated farm dams and wetlands, which are more prevalent at the proposed WWF.

These findings indicate that although the species may occasionally fly across the site, there is no habitat within the site that is consistently favoured by the species, although there was a high number of calls at the Shaw River site in Spring 2010. With sporadic arrival times to the WWF site, routine utilisation is unlikely, strongly suggesting it is not a core habitat of significance for the species.

5.1.4. Surveys at-height

The following five bat species were recorded at-height (42–45 m above the ground) from the two met masts:

- Chocolate Wattled Bat
- Gould's Wattled Bat
- Large Forest Bat
- Little Forest Bat and
- White-striped Free-tailed Bat.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

In addition, one **SBWB complex** call was recorded at height during the Autumn 2011 survey (Table 6).

The SBWB was recorded on one occasion at ground level at each of the eastern and western met masts. This species was not recorded at-height (45 m above the ground) at these two locations despite extensive survey efforts. However, due to the limitations of bat detector ability at-height (discussed in Section 4.5), and recent findings that SBWB may occasionally take flights up to 144 m AGL (Bush et al. 2025); discussed further in Section 5.2.1) it can be assumed that the SBWB may fly up to RSA height on occasion.

5.2. Species of Concern results

The findings of the bat assessments will form the basis of the avoidance and mitigation process.

There were two threatened bat species recorded in the study area:

- **Southern Bent-wing Bat (SBWB)** was recorded at 33 sites of the 107 sites (Table 11),
 - The Southern Bent-wing Bat/Chocolate Wattled Bat/Forest bat complex (hereafter SBWB-complex) was recorded at 53 sites.
- **Yellow-bellied Sheath-tail Bat (YBSB)** was recorded at nine sites (Figure 7).

The **Grey-headed Flying-fox (GHFF)** was not recorded in the study area, but may on occasion pass through the wind farm. For this reason, it was included within the assessment here. These three species are discussed further below.

5.2.1. Southern Bent-wing Bat

The SBWB was recorded from 33 of the 107 sites across the study area from 2010 to 2020 (Table 11). A single record of the species in spring 2009 was not given a location (EHP, 2018).

SBWB were recorded at the following locations, noting that the survey efforts were substantially higher in 2019 and 2020:

- One unknown location in spring 2009
- Four locations during spring 2010
- Three locations during autumn 2011
- Six locations during spring 2018
- 14 locations in summer-autumn 2019
- Five locations from May 2019–May 2020.

**ADVERTISED
PLAN**

Of the total 160 confirmed calls recorded for the project, 99 were during the 2010–2011 surveys (68 in the Spring of 2010 and 31 from Autumn of 2011; Table 11). In Spring 2018, there were substantially fewer calls (6) of the SBWB compared with the period between 2010 and 2011 (68 and 31, respectively). More calls were recorded in Autumn 2019 (49), and from this point until Autumn 2020, only single calls were recorded.

The site with the highest number of calls was site 3, which had 35 calls or an average of 2.92 SBWB calls per survey night. Site 3 was located along the Shaw River, where remnant vegetation occurs along the riverbank. This site lies approximately 1200 m from the closest proposed wind turbines at the south-western edge of the proposed wind farm (Turbines 4 & 6). This area supported good-quality riparian habitat and a larger area of forestry plantation that provided good foraging habitat compared to elsewhere, either on the WWF site, which is largely cleared for agricultural purposes, or in the surrounding area. This plantation has since been logged and replanted.

Site 22 had an average of 2.5 SBWB calls per night over a 12-night recording period. This site was located to the east of the wind farm site with surrounding planted trees. The closest proposed turbine to this site is approximately 1,500 m to the west (Turbine 56). The planted trees at this site are likely to provide good foraging opportunities for the bat.

One further site (site 2, not far from site 3) was found to have 0.9 SBWB calls/night. Site 2 is over 1000 m from the nearest proposed turbine. It was located along a treed road reserve in habitat not characteristic of the WWF site, but it is located approximately 350 m from the Shaw River and forestry plantation. All other sites recorded less Southern Bent-wing Bat activity than this. A few other locations that had smaller numbers of confirmed calls comprised treed areas in road reserves, planted trees along fence lines and some in open areas.

57 calls (36%) were recorded within 250 m of permanent water, 128 calls (80%) were within 50 m of trees (plantation, tree rows, planted trees), and 23 (14%) were within open space greater than 250 m from permanent water and 50 m from trees (Table 11).

Usage of the study area by SBWB was infrequent, with an overall average of 0.03 calls per detector night when averaging the 160 confirmed calls in the study area (Table 11). The usage of WWF by SBWB has been taken into consideration when establishing the design and avoidance and mitigation plan.

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

Table 11: Southern Bent-wing Bat recorded in the study area.

Survey period	Site	No. of calls	No. of nights surveyed	Average calls per night	Habitat description	Habitat category (within 30m radius)	Proximity to nearest treed habitat (m)	Proximity to nearest permanent waterbody (m)
Spring 2009	C	1	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Spring 2010	3	35	12	2.92	Open paddock, near the Shaw River and remnant trees	Open paddock, remnant trees, creek	20	30
	22	30	12	2.5	Planted trees and open paddocks	Open paddock, planted trees	0	560
	24	2	7	0.29	Open paddock	Open paddock	50	250
	32	1	7	0.14	Planted trees, open paddocks	Open paddock, planted trees	0	600
Autumn 2011	1	4	14	0.29	Planted pine trees, farm dam and open paddocks	Open Paddock, planted trees, farm dam	20	20
	2	26	29	0.9	Remnant trees along a road reserve, open paddock	Open paddock, remnant trees	0	340
	34	1	7	0.14	Remnant trees and open paddocks	Open paddock, remnant wattle trees	0	670
Spring 2018	45	1	7	0.14	Open paddock	Open paddock	430	90
	59	1	5	0.2	Open paddocks, nearby stands of planted eucalypts and radiata pine rows	Open paddocks, planted trees	50	660
	61	1	7	0.14	Open paddock	Open paddock	100	830

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

**ADVERTISED
PLAN**

Survey period	Site	No. of calls	No. of nights surveyed	Average calls per night	Habitat description	Habitat category (within 30m radius)	Proximity to nearest treed habitat (m)	Proximity to nearest permanent waterbody (m)
	64	1	10	0.1	Open paddocks and blue gum plantation adjoin the road, with predominantly acacia lining the roadside.	Open paddocks, blue gum plantation, remnant acacia patches.	0	470
	78	1	8	0.13	Roadside native vegetation (small in extent). Open paddocks	Open paddocks, small patches of roadside remnant vegetation	0	380
	86	1	8	0.13	Patches of acacia, open paddocks.	Open paddocks, with sparse planted rows of treed vegetation.	0	960
Summer/Autumn 2019	44	1	61	0.02	Small row of remnant acacia amongst <i>Themeda</i> grasses. Planted stand of established radiata pine. Open paddocks.	Open paddocks, remnant and planted trees.	0	240
	48	1	62	0.02	Grazing pasture, situated adjacent to blue gum plantation.	Open paddock	70	820
	49	7	62	0.11	Grazing pasture, situated adjacent to blue gum plantation.	Open paddock	130	750
	50	7	62	0.11	Grazing pasture, situated adjacent to blue gum plantation	Open paddock	190	750
	51	1	62	0.02	Grazing pasture, situated adjacent to blue gum plantation	Open paddock, planted trees.	250	730

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

**ADVERTISED
PLAN**

Survey period	Site	No. of calls	No. of nights surveyed	Average calls per night	Habitat description	Habitat category (within 30m radius)	Proximity to nearest treed habitat (m)	Proximity to nearest permanent waterbody (m)
	53	4	34	0.12	Grazing pasture bordering the Shaw River, this was one of the very few permanent water bodies in the area at this time of year.	Open undulating paddocks, river.	220	30
	62	1	20	0.05	Open paddock close to a roadside with remnant acacia vegetation.	Open paddock, remnant trees.	200	170
	68	1	61	0.02	Planted row of eucalypts amongst grazing pasture	Open, undulating paddocks, planted trees	0	430
	69	4	20	0.2	Open paddock with planted row of exotic pine trees.	Open undulating paddocks, planted trees	0	900
	81	1	81	0.01	Grazing pasture.	Open paddock	520	770
	84	8	81	0.1	Planted row of eucalypts amongst a great matrix of grazing pasture.	Open paddocks, planted trees.	0	190
	85	5	81	0.06	Planted patch of exotic trees within a grazing paddock.	Open paddocks, planted trees.	0	800
	87	7	81	0.09	Planted row of eucalypts within grazing pasture.	Open paddocks, planted trees.	0	1340
	Western Met Mast (ground)	1	82	0.01	Open paddock	Open paddock	450	450

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

**ADVERTISED
PLAN**

Survey period	Site	No. of calls	No. of nights surveyed	Average calls per night	Habitat description	Habitat category (within 30m radius)	Proximity to nearest treed habitat (m)	Proximity to nearest permanent waterbody (m)
Summer/Autumn 2020	49	1	69	0.01	Grazing pasture, situated adjacent to blue gum plantation.	Open paddock	130	750
	54	1	91	0.01	Located at a permanent pool of water in the Shaw River, open paddocks surround.	Permanent water in the river, open paddocks	308	0
	56	1	70	0.01	Dry flood plain, grazing paddock, rock rise.	Open undulating paddock	480	120
	95	1	21	0.05	Dry floodplain, grazed paddock.	Open paddock	620	260
May 2019 - May 2020	Eastern Met mast (ground)	1	295	0.003	Open paddock	Open paddock	230	500
TOTALS		160	4,646	0.03				

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

**ADVERTISED
PLAN**

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED PLAN

Figure 5: Location of Southern Bent-winged Bat definite calls between 2009 - 2020.

Project No: 16087_29

Project: Willatook Wind Farm, VIC

Date: 31/07/2026

- Turbines
- Wind farm boundary
- + Survey site (EHP, 2009)
- River

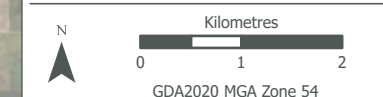
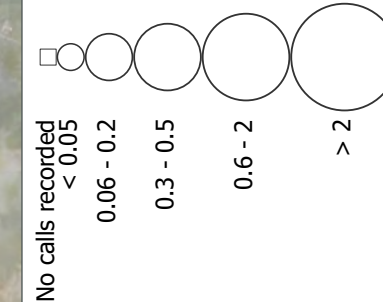
Habitat features

- Forestry plantation
- Planted trees
- Pine tree row
- Planted Eucalypts
- Remnant native trees / woodland
- Wetland - Periodically Inundated
- Farm dam

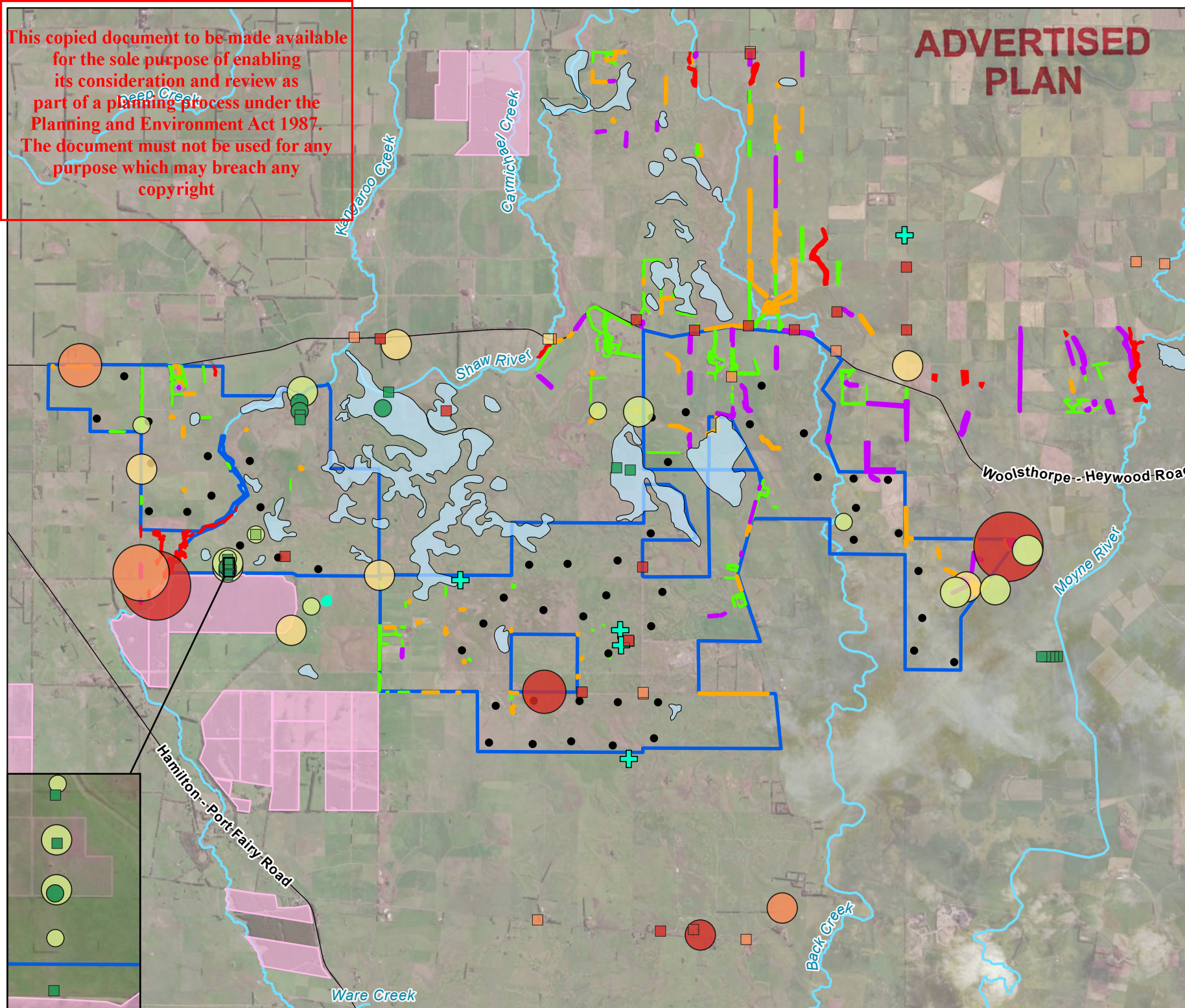
Survey season

- Spring 2010
- Autumn 2011
- Spring 2018
- Summer/Autumn 2019
- Autumn 2019 - Autumn 2020
- Summer/Autumn 2020

Average SBWB-definite call per night



PO Box 337, Camberwell, VIC 3124, Australia
www.natureadvisory.com.au
 03 9815 2111 - info@natureadvisory.com.au



This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED PLAN

Figure 6: Location of Southern Bent-winged Bat combined definite and complex calls between 2009 - 2020.

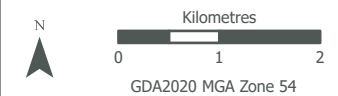
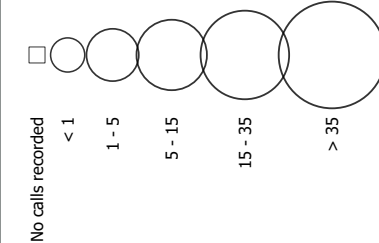
Project No: 16087_29

Project: Willatook Wind Farm, VIC

Date: 31/07/2026

- Turbines
- Wind farm boundary
- + Survey site (EHP, 2009)
- Habitat features**
 - Forestry plantation
 - Planted trees
 - Pine tree row
 - Planted Eucalypts
 - Remnant native trees / woodland
 - Wetland - Periodically Inundated
 - Farm dam
 - River
- Survey season**
 - Spring 2010
 - Autumn 2011
 - Spring 2018
 - Summer/Autumn 2019
 - Autumn 2019 - Autumn 2020
 - Summer/Autumn 2020

Combined definite-complex calls per night



PO Box 337, Camberwell, VIC 3124, Australia
www.natureadvisory.com.au
 03 9815 2111 - info@natureadvisory.com.au

Maternity/roost caves

Table 12 lists publicly known and important SBWB roost cave locations throughout Victoria and Figure 2 shows their location in relation to WWF and other proposed and operational wind farms in south-west Victoria. Yambuk and Deen, Mt Eccles, Byaduk and Mt Napier, and Grassmere non-maternity caves are SBWB caves identified within 50 km of the WWF study area. The Warrnambool maternity cave is located 41 km south-east of WWF. The WWF study area is possibly on the route of a flyway between the maternity site and non-breeding caves.

During investigations for this report, further information on the occurrence of SBWB roosting caves in the Victorian Volcanic Plains region was sought from Nicholas White (Victorian Speleologist Association) on 8th May 2020, and from Amanda Bush (Arthur Rylah Institute) on 11th May 2020. Both experts confirmed that the important SBWB roost locations listed in Table 12 are the current extent of publicly available and confirmed SBWB roosting locations in the Victorian Volcanic Plains region and surrounds.

Smaller caves may occur throughout the region in areas of volcanic activity, particularly around volcanoes, recent lava flows and lava extrusion points, as outlined in the sections above, and provide potential SBWB habitat. However, many of these formations are small and very difficult to identify, requiring on-ground surveys by geological and SBWB ecology experts.

Four of the known non-breeding caves listed are located within 30 km of the proposed wind farm (Table 12), which is the average straight-line distance travelled by GPS-tracked Southern Bent-wing Bat individuals' day roosting cave (Bush et al. 2022; ARI 2025). These caves are located at Byaduk and Mt. Napier, Mt Eccles, Yambuk/Deen Mar/Codrington and Grassmere non-breeding caves. Several other roosting and maternity caves are located within 85 km of the proposed wind farm (Table 12), which is within the greatest straight-line distance travelled from the individuals' day roosting cave (Bush et al. 2022; ARI 2025). The Warrnambool maternity cave is located 41 km from the proposed wind farm site.

Table 12: Publicly known and important Southern Bent-wing Bat maternity and non-breeding caves

Location	Distance from WWF	Description
Mt Eccles National Park	15.6 km West-Northwest	Situated within the Mt Eccles National Park, and an important non-breeding site (ACCIONA Energy 2009; Richards 2006).
Yambuk	16 km Southwest	Known non-breeding caves (ACCIONA Energy 2009). SBWB was detected near a cave here by Rob Gration in 2019 (pers. comm. 2019). A number of caves on the coast near Yambuk, including Codrington.
Byaduk	25.5 km West	A series of caves and a well-known non-breeding site (Lumsden and Jemison 2015).
Grassmere	26.8 km Southeast	Cave on private property (Rob Gration pers. comm. 2019; (DELWP 2020). Known to support large non-breeding SWBW numbers (ACCIONA Energy 2009).
Warrnambool	41 km southeast	One of the major maternity caves with recent population estimates of up to 18,000 bats (TSSC 2021).

Location	Distance from WWF	Description
Panmure	47 km Southeast	Known non-breeding lava tube cave on private property (Lumsden and Jemison 2015; Biosis 2018). Large numbers of bats use this as a roost (ACCIONA Energy 2009).
Pomborneit	50 km Southeast	Known non-breeding cave (Lumsden and Jemison 2015; Rob Gration <i>pers. comm.</i> 2019). It can have up to 3000-4000 SBWB individuals, which fluctuates over the winter period as bats move around (Reardon 2019). It was formerly mined for guano, but recent disturbance to the cave is limited (Biosis 2018).
Bats Ridge	55 km Southwest	A series of caves and a known non-breeding location near Portland (Lumsden and Jemison 2015; Rob Gration <i>pers. comm.</i> 2019).
Portland	60 km Southwest	Coastal sea cave with reasonable numbers (ACCIONA Energy 2009), recently discovered that a small number of Southern Bent-wing Bat breed here (TSSC 2021).
Porndon	97 km Southeast	Used as an important non-breeding roost (ACCIONA Energy 2009).
Cape Volney	117 km Southeast	A series of sea cliff caves in the western end of the Otways is used as an important non-breeding roost (ACCIONA Energy 2009). Signs of bat activity, but not confirmed as SBWB in 2019 (Rob Gration personal communication 2019).
Lower Glenelg National Park	138 kms West	Reasonable numbers of SBWB (ACCIONA Energy 2009).
Lorne	155 km Southeast	Used as an important non-breeding roost (ACCIONA Energy 2009).
Cape Patton	155 km Southeast	Used as an important non-breeding roost (ACCIONA Energy 2009). Sea cliff caves are exposed to the ocean between Lorne and Apollo Bay. No signs of SBWB in 2019 (Rob Gration <i>pers. comm.</i> 2019).

Examining when SBWB are recorded within the study area can reveal possible nearby roosting locations. From the Spring 2018 and Autumn 2020 survey periods, only one SBWB was recorded within an hour of sunset (Table 13). Time data for SBWB recordings during prior surveys were not reported (EHP 2018). All other SBWB recordings were substantially later in the night. Therefore, the almost complete lack of call recordings early in the night suggests that the SBWB is commuting some distance to the study area, and an undetected nearby roost is unlikely.

**ADVERTISED
PLAN**



This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Table 13: Detection times of Southern Bent-wing Bats

Survey Season	Site	Date	Time	Minutes after sunset
Spring 2018	61	13/11/2018	2:33	375
Spring 2018	64	24/11/2018	22:40	130
Spring 2018	86	28/11/2018	4:25	474
Spring 2018	78	13/12/2018	0:09	231
Autumn 2019	84	7/02/2019	unknown	-
Autumn 2019	84	8/02/2019	unknown	-
Autumn 2019	84	8/02/2019	unknown	-
Autumn 2019	48	10/02/2019	22:49	133
Autumn 2019	84	14/02/2019	22:08	97
Autumn 2019	85	18/02/2019	22:55	149
Autumn 2019	68	24/02/2019	21:56	98
Autumn 2019	68	24/02/2019	23:43	205
Autumn 2019	68	24/02/2019	23:42	204
Autumn 2019	68	24/02/2019	unknown	-
Autumn 2019	84	26/02/2019	unknown	-
Autumn 2019	84	26/02/2019	unknown	-
Autumn 2019	49	28/02/2019	4:56	523
Autumn 2019	84	28/02/2019	1:00	287
Autumn 2019	85	28/02/2019	unknown	-
Autumn 2019	50	7/03/2019	20:52	49
Autumn 2019	87	10/03/2019	4:44	526
Autumn 2019	87	10/03/2019	unknown	-
Autumn 2019	87	10/03/2019	unknown	-
Autumn 2019	87	10/03/2019	unknown	-
Autumn 2019	87	11/03/2019	unknown	-
Autumn 2019	87	11/03/2019	unknown	-
Autumn 2019	49	14/03/2019	21:54	122
Autumn 2019	Western met mast ground	16/03/2019	21:43	104
Autumn 2019	85	18/03/2019	21:45	119
Autumn 2019	68	20/03/2019	unknown	
Autumn 2019	85	22/03/2019	1:59	379
Autumn 2019	84	23/03/2019	unknown	-
Autumn 2020	Eastern met mast ground	23/02/2020	unknown	-
Autumn 2020	WP3	3/03/2020	5:26	559
Autumn 2020	56	3/03/2020	unknown	
Autumn 2020	54	9/03/2020	0:44	287
Autumn 2020	95	29/04/2020	19:35	110

**ADVERTISED
PLAN**

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

Flight behaviour

There were no SBWB definite calls recorded at height during the present study, and one SBWB complex call.

Recent research has provided new insights into SBWB intercave movement patterns (ARI 2025; Bush et al. 2022; van Harten et al. 2022a; van Harten et al. 2022b). The traditional view, based on the work of Dwyer (1963), had assumed there were two seasonal migrations with all bats leaving overwintering caves in spring and taking several weeks to return to the maternity caves via stopovers at transition caves. In Autumn, bats were thought to disperse from the maternity sites to overwintering caves, where they would enter extensive periods of torpor. Individuals were assumed to remain at these overwintering caves for the duration of winter. However, more recent research, which tracks PIT-tagged SBWBs in South Australia, has revealed far more complex movement patterns (Van Harten et al. 2022a). Tracking data has shown that so-called ‘overwintering caves’ can be used at any time of year, leading to the discontinuation of the term ‘overwintering cave’ in favour of ‘non-maternity cave’ (Bush et al. 2022).

The use of non-maternity caves is now understood to be highly dynamic. For example, bats leaving the Naracoorte maternity cave in early autumn may visit many non-maternity caves over the course of a few weeks before returning to the maternity cave (Van Harten et al. 2022a). Large distances can be flown in short periods. There are numerous examples of individuals (up to approximately 2.5% of the known population) flying between the Naracoorte maternity cave and a non-maternity cave 70 km away over the period of just a few hours, and sometimes returning to the maternity cave on the same night – a total distance of 140 km in 24 hours (Van Harten et al. 2022a). Periods of torpor also appear to be shorter than previously thought, with some rare activity during winter, including movement between caves (Van Harten et al. 2022a).

Seasonal variations in flight distances have also been documented in SBWB tagged in the Portland area (ARI 2025). During spring, SBWB moved an average distance of 11.6 km and a maximum distance of 78.2 km, focusing more period focused more around nearby coastal areas. Whereas in summer-autumn, SBWB moved an average distance of 35.7 km and a maximum distance of 143.1 km (ARI 2025), and were recorded foraging further inland and moving more frequently through the larger areas of forests and farmland.

Given average nightly travel distances of 35 km from roost caves to foraging areas (Bush et al. 2022), plus longer intercave movements of 70 to 143 km (ARI 2025; Bush et al. 2022; Van Harten et al. 2022). SBWBs are likely to be present across and forage within southwestern Victoria, including the WWF site, on an ongoing basis when accessing foraging areas or moving across the landscape between caves.

SBWB have a fast, direct flight pattern for foraging in open spaces (Dwyer, 1965). Observational records indicate that, in treed areas, SBWB typically forage just above the canopy or within gaps below the canopy (DELWP 2020). New research has been released on GPS tracking studies undertaken in Victoria and South Australia in summer-autumn 2021–2024 and spring 2023 to directly investigate flight heights of SBWBs, which has been published as a preprint (i.e. not yet peer-reviewed; (Bush et al. 2025). This study found that most SBWB flights occurred within 0–30 m altitude, although flights up to 80 m were observed. The modelled data showed that SBWB are capable of flying to heights of more than 70 m and potentially up to 144 m above the ground at times (based on the upper bounds of the model estimates), and can change height from near ground level to around 40 m within minutes. In addition, during summer, SBWB were found to fly higher above treed areas than non-treed areas. The results suggest that, although the SBWB

primarily flies at lower heights, it exceeds 30 m altitude at times, increasing the risk of mortalities due to wind turbine collision.

More generally, there is limited or no information on flight heights for most Australian bats, primarily due to technical limitations in recording bat activity across a vertical gradient (Adams et al. 2009). Only a handful of peer-reviewed studies worldwide have attempted to quantify different bat species' use of vertical space (i.e. vertical niche partitioning; (Voigt et al. 2020). To address this limitation, the EUROBATs *Guidelines for Consideration of Bats in Wind Farm Projects* recommend that, for pre-commissioning bat surveys designed to generate data for impact assessments at proposed wind farms, bat detectors should be used to survey bat activity above the canopy, preferably within proposed rotor swept heights (Rodrigues et al 2015). The EUROBATs Guidelines suggest that at-height survey methods using detectors attached to kites or balloons have been shown to generate data that is limited in use, and instead recommend using stationary structures. Therefore, attaching detectors to meteorological towers (met masts) is the most commonly employed method for investigating bat flight heights during pre-commissioning bat surveys at European wind farms (Roemer et al. 2017), which was the method adapted for WWF.

Following the EUROBATs Guidelines recommendation for monitoring bat activity at-height, several peer-reviewed studies, published in authoritative scientific journals, have used echolocation calls recorded by paired detectors placed at ground-level and at-height on met masts to quantify the activity of European insectivorous bats across a vertical gradient. The findings have been used to correlate relative activity at height to echolocation call structure and wing morphology, and also to model the predicted risk of collisions with wind turbines. This research showed that for Schreiber's Bent-winged Bat *Miniopterus schreibersii*, 0.01% of all activity was recorded at-height (40-85 m AGL; Roemer et al., 2017, 2019a, 2019b). This co-generic European bent-winged bat species has similar body size, wing morphology, and high-frequency echolocation calls to SBWB (~53kHz). For more information, see:

- Roemer, C., Bas, Y., Disca, T., Coulon, A., 2019. Influence of landscape and time of year on bat-wind turbines collision risks. *Landscape Ecology* 34, 2869–2881.
- Roemer, C., Coulon, A., Disca, T., Bas, Y., 2019. Bat sonar and wing morphology predict species vertical niche. *The Journal of the Acoustical Society of America* 145, 3242–3251.
- Roemer, C., Disca, T., Coulon, A., Bas, Y., 2017. Bat flight height monitored from wind masts predicts mortality risk at wind farms. *Biological Conservation* 215, 116–122.

Further, a recent study conducted in Kenya, East Africa, also used bat detectors attached to met masts to quantify bat flight heights and relate the findings to the risk wind farms could pose to species that the authors characterised as either low, medium or high flying (Rainho et al., 2023). The study also concluded that those species that prefer to fly at lower altitudes were strongly associated with habitat variables, as opposed to those flying at higher altitudes, which were more influenced by weather conditions.

Initial guidelines for monitoring bats at proposed wind farm developments published by the Victorian Government in 2007 recommended proponents undertake bat detector surveys with paired detectors at ground-level and at-height on a met mast or other portable tower structure (Lumsden 2007). During Technical Reference Group consultations that Nature Advisory has been involved in, DEECA has routinely suggested that this is a methodology that wind farm proponents should incorporate into pre-commissioning bat detector surveys. Consequently, over the last decade or so, met mast bat detector surveys have been conducted during pre-commissioning surveys at multiple proposed wind farms in south-west Victoria in an attempt to quantify use of

vertical space by SBWB; for example, at Dundonell Wind Farm, Mortlake South Wind Farm, Bulgana Wind Farm, Kentbruck Wind Farm and Mt Fyans Wind Farm.

It is noted that there are a number of potential limitations with recording echolocation calls at height, such as increased noise from higher wind speeds. Plus, the high-frequency calls produced by SBWBs can be difficult to detect in these conditions due to increased atmospheric attenuation. However, as mentioned above, studies published in international peer-reviewed journals have shown that detectors attached at-height to meteorological masts are capable of recording high-frequency (45-50 kHz) calling bat species (Roemer et al. 2017; Roemer, Coulon, et al. 2019; Rainho et al. 2023).

5.2.2. Yellow-bellied Sheathtail Bat

Calls were analysed for YBSB from studies from 2009 to April 2019 from a total of 2,857 detector nights, with calls detected from ten sites over this survey period. Due to the low number of calls recorded during initial surveys, the data collected from May 2019 – May 2020 was not analysed for YBSB as the survey effort was considered sufficient to determine that the species is not a frequent visitor to the site. The YBSB was recorded from 10 sites across the study area (Figure 7):

- One location in spring 2009
- Four locations in spring 2010
- Two locations in autumn 2011
- Two locations in spring 2018
- One location in summer/autumn 2019.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

The YBSB was recorded in areas generally outside where turbines are proposed, notwithstanding the considerable survey effort within the proposed wind farm layout.

Even though there were 39 calls ascribed to the species in 2009, representing a relatively high level of encounter with the species, the species was recorded at much lower levels during the 2018 surveys (8 calls). The call numbers were not presented in any other season for this species. However, over the past 10 years, bat call analysts have realised that calls which were previously attributed to YBSB in Victoria are more likely to be calls at the lower end of the Gould's Wattled bat call range, and therefore a number of the calls recorded as YBSB in 2009 are possibly incorrectly identified (R Gration, *pers. comm.*).

There is no information on the number of YBSB that visit Victoria, as it is typically recorded rarely and irregularly. The number of individuals that occur in Victoria is not known, but the low numbers recorded in the WWF bat survey area, compared with other, more common bat species, indicate that the Victorian population would be small and unlikely to represent a highly significant part of the overall, larger, national population.

Given the very small number of calls recorded in recent years, despite considerable survey effort, the potential level of activity of the species is low. It is considered unlikely that the proposed wind farm will lead to regular mortality of this species and, therefore, a very low impact on the YBSB is predicted.

Flight behaviour

The YBSB is an open-space adapted species that flies high and fast above the canopy of forests and woodlands (Hall and Richards 2023). An extensive study of habitat utilisation by the YBSB in the Cadia Valley (Orange district, NSW) was conducted in November 2004 by Richards (2008). In

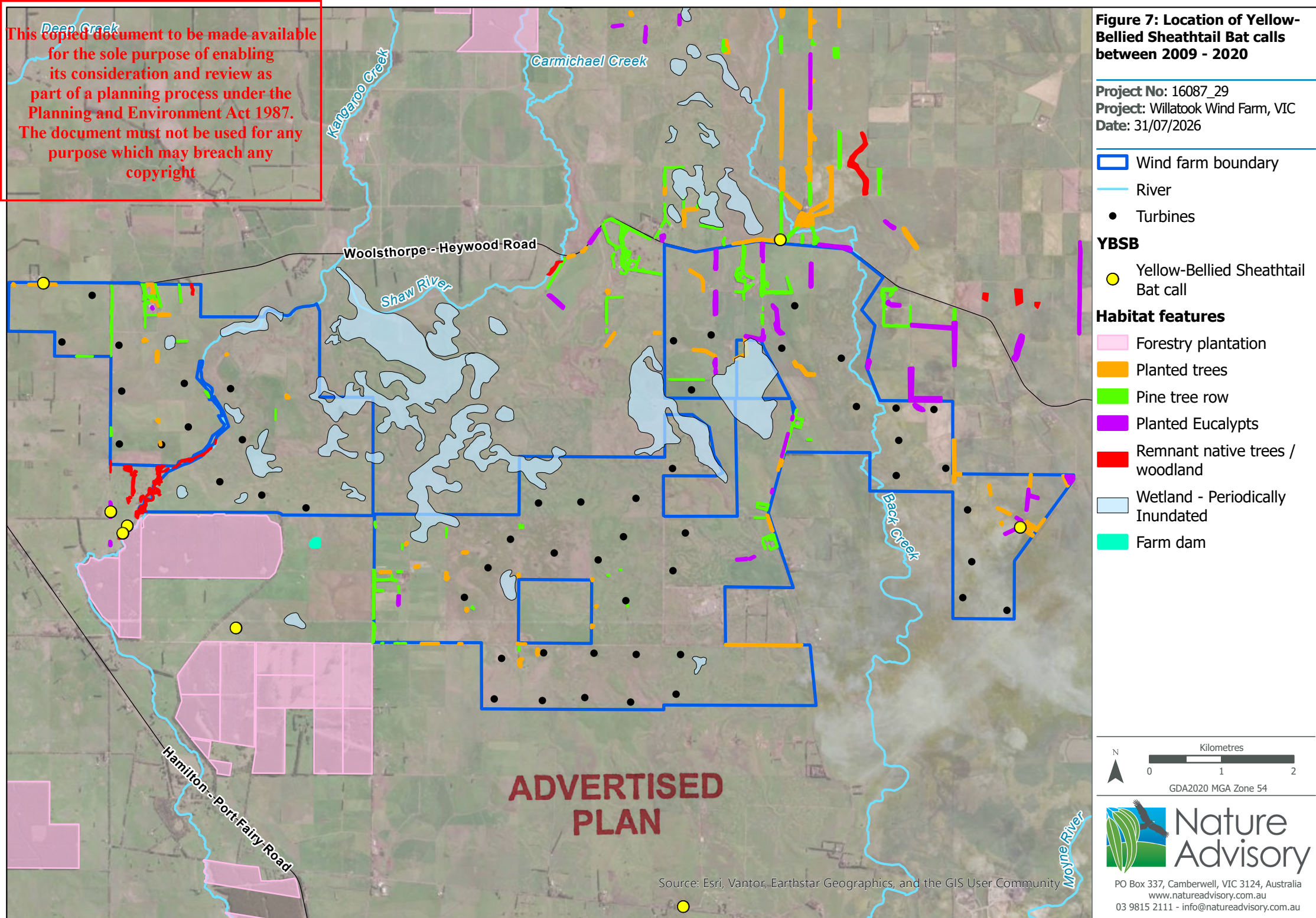
this study, ten woodland/open forest remnants ranging in size from 20–1700 ha were monitored for this species. Regression analysis of the number of calls recorded was highly correlated ($R^2 = 0.9459$) with the approximate size of the remnants studied. There appeared to be a threshold of at least 500 ha before high levels of activity and relative abundance were observed (Richards 2008).

At WWF, YBSB was not recorded flying at a height of 42–45 m during the 2009–2019 surveys. Analysis for this species was not undertaken during the year-long 2019–2020 survey, as this was targeted to SBWB.

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

**ADVERTISED
PLAN**

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright



5.2.3. Grey-headed Flying-fox

No Grey-headed Flying-fox (GHFF) were recorded in the WWF study area. No targeted surveys were undertaken due to i) the lack of modelled foraging habitat within the WWF study area (Figure 8), ii) lack of foraging habitat identified during detailed vegetation assessments, iii) the distance from permanent GHFF camps (see below) and iv) the lack of existing records. Habitat patches in the area are generally modelled as closer to the coast, with the most abundance around Warrnambool and Port Fairy regions (Figure 8; DEECA 2025b).

The species may infrequently traverse the WWF; however, the absence of habitat patches means there is no clear directional pattern for movements to or from the area, resulting in unpredictable flight paths.

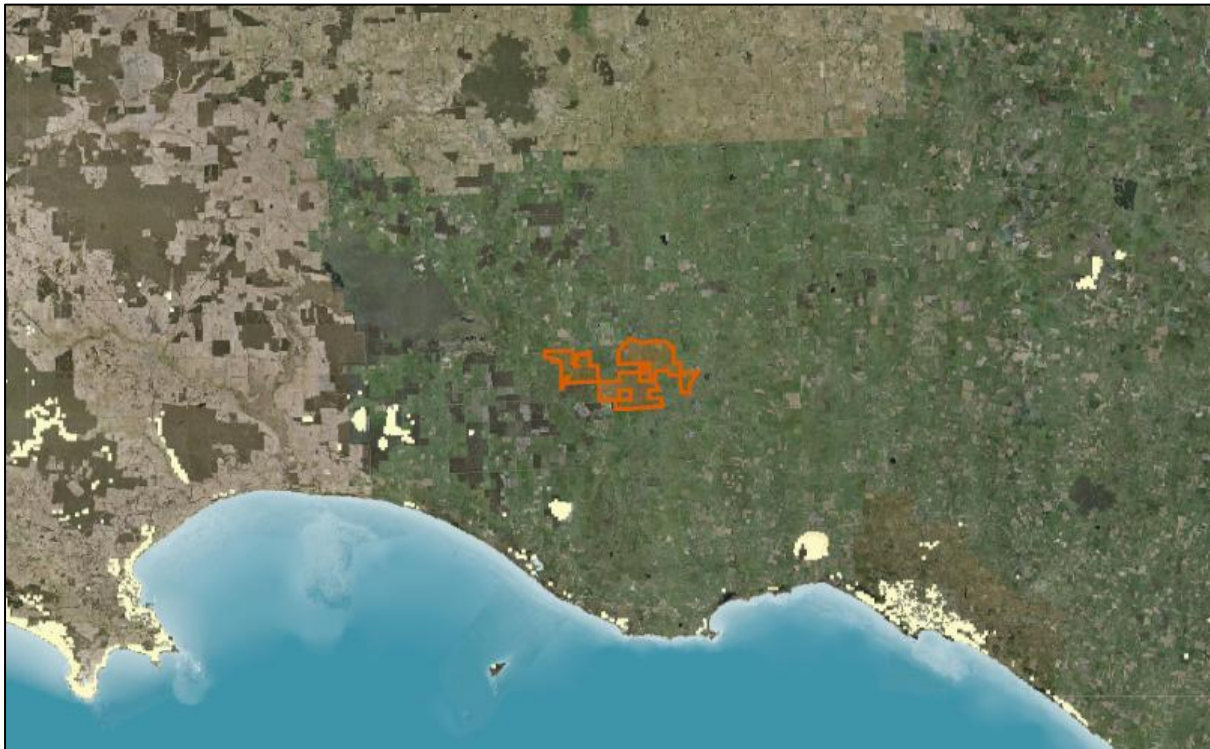


Figure 8: Grey-headed Flying-fox habitat distribution model, HDM (DEECA 2025d).

NOTE: Colours in the HDM refer to habitat suitability on a scale from 1 to 100 - warmer / darker tones indicate higher predicted suitability; cooler / lighter tones indicate lower suitability. Note that there is only lighter tones present on this figure.

Camps

The VBA contains one record of GHFF from 2020 within 20 km of the study area, and the Atlas of Living Australia (ALA 2025) contains five records within 20 km of the study area. The nearest known roosting camps for the GHFF are the Warrnambool Botanic Gardens camp (permanent, 40 km south-east) and the Hamilton Botanic Gardens camp (new; 47 km north). Both of these camps have recorded recent activity (within May/June 2025; DEECA 2025b). Additional seasonal camps are recorded in Lismore (110 km east) and Mumbanner (85 km west), and a temporary GHFF camp is recorded in Hexham (55 km north-east). The proposed WWF lies within the mapped GHFF distribution (Australasian Bat Society 2025) and mapped foraging habitat (DEECA 2025b; Figure 8). Therefore, the WWF may be within the daily home range of GHFF using these camps. Detailed radio tracking of GHFF showed the mean distance of a foraging site from the camp in which the

GHFF had roosted and to which it returned was 10.9 km (quartile range from 6.2 - 27.9 km), with the maximum distance recorded being 148.3 km (Westcott et al. 2015).

5.3. Turbine buffers overlaps

The 262-metre blade-to-habitat buffer (detailed in the Methods, Section 4.5) was applied around each proposed turbine location, corresponding to the turbine's rotor-swept envelope plus a precautionary clearance zone. Using this buffer, spatial analysis was undertaken to identify any areas of overlap between the turbine influence zones and the mapped potential habitat. Turbines were microsituated to minimise overlap with these habitat buffers.

A summary of turbine buffer overlaps with habitat is provided in Table 14, with full details for each turbine provided in Appendix 5.

Table 14: Bat habitat overlap with the Willatook Wind Farm study area and turbine buffers

Habitat	Area (ha) of habitat in study area (% of total area)	Total area (ha) within 262 m turbine buffers (% of total habitat feature)	Percentage of total habitat feature in buffer (%)
Forestry plantation	0.0001 (<0.01 %)	0 (0 %)	0 %
Pine tree row	45.29 (1.09 %)	2.78 (6.14 %)	0.24 %
Planted Eucalypts	13.61 (0.33 %)	2.82 (20.71 %)	0.24 %
Planted trees	12.35 (0.30 %)	1.67 (13.52 %)	0.14 %
Remnant native woodland	10.10 (0.24 %)	<0.01 (0.09 %)	0.001 %
Wetland - Periodically Inundated	183.53 (4.42 %)	5.98 (3.26 %)	0.51 %
Open	3891.34 (93.63 %)	1151.28 29.59 %	98.86 %
TOTAL	4156.22 ha	1164.54 ha	100 %

**ADVERTISED
PLAN**



**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

6. Risks and impacts to Species of Concern

The following risks were identified which may result in direct or indirect impacts on bats at WWF (DEECA 2025a):

- **Direct impact pathways:**

- Mortality resulting from collision with turbines and transmission lines;
- Mortality resulting from electrocution on electricity transmission lines; and
- Barotrauma from operating wind turbines.

- **Indirect impact pathways:**

- Habitat loss through clearance or displacement;
- Disturbance to roosting and maternity sites; and
- Displacement and barrier effects.

- **Cumulative impact pathways:**

- Consideration of the above impacts in the context of similar nearby renewable energy facilities.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

These risks are discussed below, and a risk assessment for each Bat Species of Concern is undertaken in Section 6.4.

6.1. Direct impact pathways

Southern Bent-wing Bat

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

“The impact of the recent proliferation of wind farms within the range of Southern Bent-wing Bats is currently unclear, however, it is possible that any wind farm built close to a Southern Bent-wing Bat significant roosting site could have a major impact on that population.

International studies suggest there may be cumulative impacts of wind farms on migratory species in particular, with the impacts greater at particular times of the year and under certain weather conditions (Johnson et al. 2004; Kunz et al. 2007). The risk increases the closer the wind farm is to an important site, particularly a maternity site or migration path. Risks include cave destruction during construction, mortalities due to collisions, and altered access to foraging areas (Kerr and Bonifacio 2009).”

The FFG Action Statement for SBWB also identifies wind farms as a threat (DEECA, 2023b), pp 2):

“Onshore wind farm developments pose a number of risks to bats, including cave destruction during construction, mortalities due to collisions and barotrauma (a result of changing air pressure around moving blades), and limiting access to foraging areas. Evidence suggests peak mortality occurs over autumn.”

The primary cause of bat mortality at wind farms is collision with operational turbine blades. Barotrauma has also been suggested as a direct impact pathway (Baerwald et al. 2008), but this remains somewhat controversial due to difficulties in diagnosing the specific cause of death for bat carcasses discovered at wind farms (Rollins et al. 2012). To avoid confusion, it seems

reasonable to assume that, for bat carcasses found beneath operating wind turbines, mortality was most likely the result of direct interaction with rotating turbine blades.

As of April 2026, Nature Advisory is aware of a total of 36 SBWB mortalities detected during carcass searches at operational wind farms in Victoria that have been reported to DEECA (Table 15), with preliminary mortality estimates for three wind farms ranging between 7.8 – 37.1 SBWB mortalities across the facility per year (DEECA 2025d).

The investigation described in this report shows that SBWBs were recorded at multiple sites across the study area, particularly close to water bodies and native treed habitats. Consequently, there is a possibility that SBWB could occasionally collide with operational turbines at WWF.

Table 15: Total Southern Bent-wing Bat mortalities reported to DEECA up to April 2026

Source	Time period	Number of SBWB mortalities
Macarthur Wind Farm (Wood 2017)	2014 – 2015	1
DEECA - Location not publicly available	2015	1
Cape Nelson North Wind Farm (Bennett et al. 2022)	2016 – 2017	6
Cape Nelson North Wind Farm (Bennett et al. 2022)	2018 – 2019	3
DEECA - Locations not publicly available	2020 – 2022	2
Dundonnell Wind Farm (Biosis 2024a)	March – June 2023	3
DEECA - Locations not publicly available	2023	6
Mortlake South WF (Nature Advisory 2025a; Acciona Energia 2025)	Aug 2023 – Dec 2024	3
DEECA - Locations not publicly available	2024	5
DEECA - Locations not publicly available	2025	2
DEECA - Locations not publicly available	Autumn 2026	4
TOTAL		36

These mortalities represent actual carcasses found during searches, and the estimated mortality would be higher, considering survey effort, scavenger rates and searcher efficiency. Detected mortalities are believed to represent a small fraction of overall bat mortality at operational wind farms (Moloney et al. 2019; Symbolix 2020). Even in well-designed mortality monitoring programs, the likelihood of detecting carcasses of small insectivorous bats is relatively low (Moloney et al. 2019; Symbolix 2020). Furthermore, there is potential for undetected impacts at operational wind farms when the BAM Plan monitoring period has ended.

Electrocution risk arises where fauna bridge electrical potential by contacting two conductors or a conductor and an earthed structure. Given the limited body size and reach of SBWB, the likelihood of such contact is extremely low, and therefore it is considered not to be at risk of electrocution.

Yellow-bellied Sheathtail Bat

The YBSB is a high-flying species that usually flies fast and straight above the canopy, but flies lower over open spaces and at the forest edge (Churchill 2008). It is thus potentially susceptible to collision with wind turbines in treed areas, where the tree height may force it to fly higher. The species has been recorded colliding with wind turbines interstate, further north in its range, where it is more abundant (Nature Advisory data), indicating that it is vulnerable to turbine collision. Nature Advisory are unaware of any recorded YBSB collisions in Victoria, and they are not listed as mortalities in Moloney et al. (2019) and Symbolix (2020).

There is no information on the number of YBSB that visit Victoria, as it is typically recorded rarely and irregularly. The number of individuals that occur in Victoria is not known, but the low occurrence recorded in the WWF bat survey area, compared with other, more common bat species, indicates that the Victorian population would be small and unlikely to represent a highly significant part of the overall, larger, national population.

Electrocution from transmission lines is not a risk to YBSB due to their small size.

Given the very small occurrence of the species at WWF in recent years, despite considerable survey effort, the potential level of activity of the species is low. It is considered unlikely that the proposed wind farm will result in levels of mortality sufficient to cause a significant impact on the species.

Grey-headed Flying-fox

Within the WWF site, there are patches of native vegetation and scattered trees that contain species that may comprise the diet of this species, such as eucalyptus trees. Also, on the southern border of the WWF site is a Blue Gum forestry plantation.

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

The VBA contains one record of GHFF from 2020 within 20 km of the study area, and the Atlas of Living Australia (ALA 2025) contains five records within 20 km of the study area. The nearest known roosting camps for the GHFF are the Warrnambool Botanic Gardens camp (permanent, 40 km south-east) and the Hamilton Botanic Gardens camp (new; 47 km north). Both of these camps have recorded recent activity (within May/June 2025; DEECA 2025b). Additional seasonal camps are recorded in Lismore (110 km east) and Mumbanner (85 km west), and a temporary GHFF camp is recorded in Hexham (55 km north-east). The proposed WWF lies within the mapped GHFF distribution (Australasian Bat Society 2025) and mapped foraging habitat (DEECA 2025b; Figure 8). Therefore, the WWF may be within the daily home range of GHFF using these camps.

However, it is considered unlikely that the GHFF would visit the proposed WWF regularly to feed, although there may be occasional flights across the site. Consequently, the risk of collision with turbines and infrastructure or electrocution from transmission lines is low, and it is considered

unlikely that the proposed wind farm will result in levels of mortality sufficient to cause a significant impact on the species.

6.2. Indirect impact pathways

Effects of construction and operational noise, traffic and artificial light and hydrological impacts on natural vegetation, wetlands and waterways, and roost locations (both inside and outside the WWF area) have been considered.

Construction will result in the loss of an insignificant amount of vegetation in the context of the broader landscape. The loss of native vegetation is unlikely to have a material effect on the availability of foraging habitat for bat populations, however any removal of hollow-bearing trees will result in loss of habitat for hollow-roosting bat species, including YBSB. Through an iterative and careful design process, a substantial proportion of impacts on native vegetation was avoided.

Most construction stage activity will occur during daylight hours and will be temporary and intermittent (estimated to last for short periods at any work site within the longer project construction period). Nighttime security lighting should only be used at the terminal station, and at temporary construction compounds. Any impacts of lighting or noise during construction will be temporary, and lighting can be baffled and placed away from high-quality bat habitat, including woodland areas, waterbodies and waterways, and tree rows.

Once construction is complete, there will be a lower level of vehicle traffic and human activity associated with operating the completed wind farm. During operation, turbines generally only require aviation warning lighting when within close proximity to airfields. This consists of red flashing lights, which are not known to attract bats, and there is no known international literature to suggest that this kind of lighting is of any concern at onshore wind farms.

6.3. Cumulative impacts

It is difficult to determine the cumulative impacts without a central registry of operational monitoring data of wind farms in Victoria, and it has recently been concluded that the cumulative effects of multiple wind farms over space and time for SBWB are unknown (Bush and Lumsden 2025). Most mortality data from Victorian wind farms is not publicly available.

The Arthur Rylah Institute are developing a Population Viability Analysis for the SBWB that may be able to predict the cumulative impacts of any proposed wind farm. Furthermore, the Threatened Species Scientific Committee has undertaken a Population Viability Analysis on the combined South Australian and Victorian population of SBWB. Two models were used to calculate the number of mature adults predicted to be alive in 2056, and they revealed an overall population decline of 84% – 97% (TSSC 2021).

An analysis was undertaken by Symbolix (2020) to produce cumulative statistics and quantify the collision rates of different bird and bat species at wind farms in Victoria.

Key findings were:

- Between 7 – 10.8 bat mortalities occur per turbine per year in Western Victoria
- The two most common bat species found to collide with turbines are the White-striped free-tailed Bat and Gould's Wattled Bat
- Mortalities are higher for White-striped free-tailed Bat than for any other bird or bat.
- There were no specific mortality estimates for the SBWB.

However, in the last 12 months, DEECA has provided additional information, as listed above in Table 15, of mortality of at least 32 SBWB collisions known to have occurred to date at a variety of wind farms in SW Victoria.

While the scale of overall impact on the SBWB is low compared with other species, given that there have been recorded mortalities of this species, it is possible that, despite the mitigation measures above, mortality will occur.

The YBSB is considered a rare visitor to Victoria in the late summer and autumn. While Nature Advisory are not aware of any collisions of YBSB with operating turbines in Victoria, there were three known collisions at wind farms in NSW from over 18 years of carcass monitoring at 24 wind farms (Nature Advisory *unpublished mortality data*). There is potential for YBSB to encounter several wind farms on their seasonal migration pathways.

Similarly, there is potential for GHFF to encounter several wind farms in their seasonal and long-distance foraging movements. It is expected that impacts would accumulate across their range, but little information is available to inform such effects.

6.4. Risk assessment

The risk assessment methodology is consistent with the requirements for “Level One” investigations in the *Wind Farms and Birds - Interim Standards for Risk Assessment* issued by the Australian Wind Energy Association (AusWEA 2005). This methodology also follows the AS ISO 31000 2018 (ISO 2018) risk assessment procedure, and is broadly acceptable for application to bat species.

The risk assessment methodology is based on the Risk Evaluation Matrix Model which complies with the AS ISO 31000:2018 Risk Management Guidelines (ISO 2018). This model is currently used across a wide range of industry sectors for assessing environmental risk. The model is used to measure the risk of an event, in this case bats striking wind turbine blades and wind turbine towers (direct impact) or being deterred from using part of the study area due to disturbance or barrier effects (indirect impact). The risk assessment is based on the likelihood of an impact occurring, and should it occur, its consequences.

The assessment required criteria to be developed for likelihood and consequence. These criteria are provided respectively in Table 16 and Table 17. In the absence of data collected in the Project Area during targeted monitoring or the absence of any collision risk modelling for individual species, a conservative approach has been taken in determining the likelihood and consequence of an impact.

The likelihood criteria represent the chance of a loss of an individual (WTG collision, but also due to habitat removal or disturbance) over a 12-month period, which is a full breeding cycle for most bats in the temperate zone of Australia. The consequence criteria in Table 17 determines the ecological significance proportion of a population. For the purposes of this assessment an ecological significant proportion of a population is considered to be 0.1%. A combination of conservation advice, recovery plans and Species Profile and Threat Database (DCCEEW 2026). Table 18 shows the risk rating matrix applied for the risk assessment and Table 19 the interpretation of the risk rating (impact rating). The set of impact rating criteria, from very low to very high, was developed specifically for biodiversity and used to qualitatively describe the level of potential impact expected to bats at WWF.

Residual impacts (following implementation of mitigation measures) were then assessed (outlined in section 847.3).

Table 16: Likelihood criteria of an impact to fauna occurring across 12-month period*

Likelihood	Across a 12-month period	
	Description	Approximate probability (%)
Very rare	Very improbable that impact could occur	<5
Less likely	Less probable than more probable that impact could occur	5 to < 50
Possible	Equally probable that impact could or could not occur	50
Likely	More probable than not that impact could occur	>50 to 95
Almost certain	Very probable that impact could occur	>95

*12 month period is selected as the time during which a breeding cycle may be completed.

Table 17: Predicted consequence criteria of an impact on fauna

Predicted to seriously disrupt an ecological significant proportion ¹ of a threatened species' population		Consequence
Total population annually	Population in the Project Area and surrounds for the life of the wind farm	
No	None	Negligible
No	Short-term	Low
No	Medium-term	Moderate
Yes	Medium-term	High
Yes	Long-term	Severe

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

**ADVERTISED
PLAN**

¹ The 0.1% population threshold is derived from the EPBC Act policy statement on listed migratory species and the definition of an important population at a national level (DEE 2017).

Table 18: Risk ratings to fauna based on the likelihood of an impact occurring and the consequence of the impact

		Consequence				
		Negligible	Low	Moderate	High	Severe
Likelihood	Very rare	Very low	Very low	Very low	Low	Low
	Less likely	Very low	Very low	Low	Medium	High
	Possible	Very low	Low	Medium	High	High
	Likely	Very low	Low	Medium	High	Very high
	Almost certain	Very low	Low	High	Very high	Very high

Table 19: Biodiversity impact rating criteria framework

Impact rating	Qualitative description of impact
Very low	The impact is localised (immediate vicinity) and/or short-term, and changes to the receptor are unlikely to be detectable above natural conditions. Having a negligible effect on the known population or range of the receptor
Low	The impact is at the site scale and/or is medium-term, and results in reversible changes (i.e. to conservation status/population viability / genetic resource, etc.) to the receptor once the activity has ceased. Having a minor effect on the known population or range of a receptor.
Medium	The impact is local scale and/or medium-term, and results in reversible changes to the receptor once the activity has ceased. Loss of a moderate proportion of the known population or range of a receptor.
High	The impact is regional scale and long-term, and results in reversible changes to the receptor once the activity has ceased. Loss of a high proportion of the known population or range of the receptor.
Very high	The impact is regional (or up to international) scale, and/or long-term, and results in substantial and possibly irreversible change (permanent), or total loss, to the receptor. Loss of a very high proportion of the known population or range of the receptor.

Impact rating for Bat Species of Concern

The impact rating for Bat Species of Concern prior to application of the mitigation hierarchy is outlined in Table 20.

**ADVERTISED
PLAN**



This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Table 20: Impact rating for Bat Species of Concern prior to mitigation hierarchy

Species	Impact pathway (risk)	Likelihood	Consequence	Impact rating BEFORE mitigation	Justification
Southern Bent-wing Bat	Direct impacts (collision and/or barotrauma)	Likely	Moderate	Medium	Activity – SBWB are known to collide with turbines in south-west Victoria, with 32 mortalities reported to date. The species has been recorded during surveys in the study area at 33 of the 107 surveyed areas. with a total of 160 calls over the survey period (0.03 calls per night). Commuting/foraging habitat – high quality foraging and commuting habitat (i.e., treed habitat and creeks/waterbodies) are not wide-spread within the study area, and most treed habitat is fragmented. 101 calls (63%) were located near the Shaw River and eucalypt plantation in the south-west of the study area, and a wetland to the east of the WWF study area. 57 calls (36%) were recorded within 250 m of permanent water, 128 calls (80%) were within 50 m of trees (plantation, tree rows, planted trees), and 23 (14%) were within open space greater than 250 m from permanent water and 50 m from trees. Distances to roosts – study area is located 41 km from Starlight (Warrnambool) maternity, and > 15 km from non-roost caves. GPS tracking of SBWB from the Warrnambool maternity cave has shown the median flight distance of SBWB is approximately 35 km in summer/autumn, with less in winter. The study area is within foraging range on some smaller non-maternity caves, but most movements from the maternity cave are likely to be less than the distance to the study area. Flight height – In Bush et al (2025), SBWBs were recorded primarily flying below 30 m above ground-level in spring and summer/autumn. Approximately 4.0% of modelled flight heights, using altitude data from these studies, were recorded above 30 m (95% CI 2.8–5.6), with the maximum modelled height being 140 m (upper 95% CI). Mean modelled flight heights tended to be higher when bat locations were associated with trees. However, it is uncertain whether SBWB are attracted to turbines, and may be drawn into RSA height. Taking a precautionary approach and assuming that SBWB activity across the study area may be higher than recorded, it is considered likely that direct impacts will occur to SBWB at WFF before applying the mitigation hierarchy (Table 16). This is, however, unlikely to interrupt an ecologically significant
This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright					

Species	Impact pathway (risk)	Likelihood	Consequence	Impact rating BEFORE mitigation	Justification
					proportion of the population (0.1% or 40 individuals ² ; Table 17). A medium impact is therefore predicted to the SBWB prior to applying the mitigation hierarchy (Table 18Table 19).
	Indirect impacts (habitat loss, disturbance, displacement, and/or barrier effects)	Less likely	Low	Very low	Construction will result in the loss of an insignificant amount of vegetation in the context of the broader landscape. SBWB roosting caves are located > 20 km from the study area and will not be disturbed. Any impacts during construction, such as disturbance due to noise and light, are likely to be temporary and will occur mostly during daylight hours. Indirect impacts due to habitat loss, displacement and/or barrier effects are considered less likely.
Yellow-bellied Sheathtail Bat	Direct impacts (collision and/or barotrauma)	Possible	Low	Low	Species was recorded in the study area, but in very low numbers. Species has been reported colliding with turbines in NSW, but no reported collision in Victoria. Tends to fly lower over cleared areas, which represents the majority of the study area (93.63%). There is no information regarding the population size of YBSB in Australia. Furthermore, there is no information on the number of YBSB that visit Victoria, as it is typically recorded rarely and irregularly and thought to migrate to Victoria temporarily in warmer months. Due to their presence at WWF direct impacts through collision or barotrauma are possible prior to applying the mitigation hierarchy (Table 16), however are assumed to be an infrequent visitor to the area and WWF is therefore unlikely to affect an ecologically significant portion of the population (Table 17). A low impact is therefore predicted to the YBSB prior to applying the mitigation hierarchy (Table 18Table 19).

² The population of SBWB is estimated at 40,000 (DCCEEW 2021)

Species	Impact pathway (risk)	Likelihood	Consequence	Impact rating BEFORE mitigation	Justification
	Indirect impacts (habitat loss, disturbance, displacement, and/or barrier effects)	Less likely	Low	Very low	Removal of any hollow-bearing trees will result in habitat loss to YBSB, however construction will result in the loss of an insignificant amount of vegetation in the context of the broader landscape. Any impacts during construction, such as disturbance due to noise and light, are likely to be temporary and will occur mostly during daylight hours.
Grey-headed Flying-fox	Direct impacts (collision, barotrauma and/or electrocution)	Less likely	Low	Very low	Lack of modelled and identified (during vegetation surveys) GHFF foraging habitat in the study area, and lack of existing records in the surrounding landscape. Distance to closest permanent camps is 40 km from study area, and the mean foraging distance of the species has been reported as 10.9 km (interquartile range 6.2–27.9 km). Therefore, it is unlikely the species will frequently visit the area for foraging, and the risk of collision with turbines or electrocution from transmission lines is low. However, they may occasionally pass through the area when commuting across the landscape. Population estimate of 700,000 individuals in 2019, therefore an ecological significant proportion of this species is 700 individuals. It is unlikely the WWF will seriously disrupt an ecological significant proportion the GHFF population, and therefore the consequence is low. Due to the distance of WWF to GHFF camps and the lack of foraging habitat in the study area, it is considered less likely that direct impacts by collision, barotrauma and/or electrocution will occur to GHFF at WWF before applying the mitigation hierarchy (Table 16). This is, however, unlikely to interrupt an ecologically significant proportion of the population (0.1% or 320 individuals ³ ; Table 17). A very low impact is therefore predicted to the SBWB prior to applying the mitigation hierarchy (Table 18Table 19).

³ The population of GHFF is estimated at between 320,000 and 680,000 (DAWE 2021), so a precautionary approach was adopted

Species	Impact pathway (risk)	Likelihood	Consequence	Impact rating BEFORE mitigation	Justification
	Indirect impacts (habitat loss, disturbance, displacement, and/or barrier effects)	Less likely	Low	Very low	Removal of any eucalypt trees will result in habitat loss to GHFF, however construction will result in the loss of an insignificant amount of vegetation in the context of the broader landscape. Any impacts during construction, such as disturbance due to noise and light, are likely to be temporary and will occur mostly during daylight hours.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

**ADVERTISED
PLAN**

7. Application of the mitigation hierarchy

Under the *Handbook* (DEECA 2025a, 2025b), projects are required to meet several criteria to avoid, minimise, and mitigate impacts to bat species. This is intended to guide project proponents, planning assessors, and decision-makers about how to manage impacts on Victorian threatened bird and bat species from renewable energy development.

The proponent recognises that managing the risk of bat collisions with turbines requires a multi-faceted approach that is embedded in the avoidance and mitigation hierarchy but also accounts for the known ecology and behaviour of both species, site features relating to available habitat and foraging opportunities, and the influence of weather and season on bat activity. This approach aims to achieve a balanced outcome that enables wind farm operations whilst minimising, as far as practicable, the risk to SBWB, YBSB and GHFF.

The potential impact rating to Bat Species of Concern before and after application of the mitigation hierarchy is displayed in section 7.3.

7.1. Avoidance measures

The *Handbook* (DEECA 2025a, 2025b) defines the need to apply the mitigation hierarchy to manage impacts on Bat Species of Concern. The following avoidance measures are the first step in the mitigation hierarchy, and have been developed based on comprehensive information derived from field assessments and desktop studies, and in compliance with the *Handbook* (DEECA 2025a, 2025b) guidance requirements. These measures have been designed to avoid expected impacts during the design phase of the project (Table 21).

Table 21: Measures to avoid impacts to Bat Species of Concern at Willatook Wind Farm.

Avoidance ID	Impact	Description
AV01 Siting of wind farm	Known camps and maternity caves	The Willatook Wind Farm has been located away from known GHFF camps and YBSB/SBWB roost and maternity caves.
AV02 Reduction in the size of the wind farm	All pathways	The Willatook Wind Farm's design has been progressively refined from 190 proposed turbines in 2010, 83 in 2019, to 59 that were presented to the Minister in the 2022 EES layout. These refinements were informed by technical studies that assessed impacts to Brolga and other listed species. A further reduction occurred following the Minister's Assessment, as a result of further buffer refinements under the <i>Handbook's</i> guidance (2025b). The current layout proposes 52 turbines. Collectively, these reductions in the proposed size of the wind farm have the effect of minimising impacts to Bats and other listed species.
AV03 Habitat buffers	All pathways	A 262 m blade-to-habitat buffer has been applied around all turbines, giving an approximate 200 m buffer to habitat. Bat habitat was mapped across the site as part of this assessment, and the project layout was designed to minimise overlap with key bat habitat areas, including but not limited to: ▪ The southern end of the Shaw River and associated riparian habitat, ▪ Higher quality wetlands, ▪ Remnant native woodland,

Avoidance ID	Impact	Description
		- Forestry plantations, and - Areas with a higher number of SBWB-definite or complex calls per night relative to other site. Further details on these avoidance measures are described in Section 7.1.1.
AV04 Micrositing of turbines	All pathways	Turbines were micrositied to increase separation from habitat buffers. This provides a further layer of avoidance of habitat buffers, where the extent of overlap with moderate to low-quality bat habitat is reduced. Further details on this avoidance measure is outlined below in Section 7.1.2, and the degree of overlap with potential bat habitat is outlined in Section 5.3.
AV05 Siting of on-site quarry	All pathways	The quarry proposed for Willatook Wind Farm is not located in any identified habitat features (Figure 1), and is located 193 m from potential bat habitat (forestry plantation). This avoids the removal of habitat.

7.1.1. Turbine-habitat buffers

The 262-metre blade-to-habitat buffer (detailed in the Methods, Section 4.5) was applied around each proposed turbine location, corresponding to the turbine's rotor-swept envelope plus a precautionary clearance zone. These buffers aimed to avoid or minimise overlap with key bat habitat areas and areas of higher SBWB or YBSB call numbers, relative to other areas of the study area.

Through the development of the project, the design has progressively increased turbine-free buffers around wetlands that provide potential nesting and foraging habitat for Brolga (Nature Advisory 2026a). Early assessments identified that these temporary wetland areas form an interconnected network across parts of the site and are ecologically significant during wetter periods. In response, successive design iterations have expanded setback distances and removed turbines from within and adjacent to these areas to ensure full protection of potential Brolga habitat (Figure 9 and Figure 10).

This refinement has resulted in the creation of a single wetland complex within the central portion of the site, encompassing the majority of the identified ephemeral wetlands. The consolidation of this area into a contiguous, turbine-free corridor enhances landscape connectivity and maintains the ecological integrity of these habitats for both Brolga, bats, and a range of other wetland-dependent species.

While the turbine-free wetland complex was primarily designed to address Brolga habitat requirements, it also provides benefits for other fauna, including the SBWB. While bat recording in these wetland areas failed to record the species in high or even moderate levels, the species is known to utilise waterways and waterbodies.

This formed a baseline design that was used to then microsite turbines relative to higher priority areas based on habitat and known SBWB activity. The aim of this approach was to reduce the area of bat habitat within 262 m of turbines.

**ADVERTISED
PLAN**



This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

7.1.2. Turbine micro-siting to maximise separation from potential habitat

Following the establishment of turbine buffers around areas of key bat habitat areas and higher call abundances (Table 21), a further layer of refinement was undertaken through a micro-siting process. This process focused on optimising the precise location of each turbine to maximise the separation or minimise the overlap between turbine infrastructure and potential habitat areas identified for SBWB and YBSB. The objective is to ensure that, even within the developable area, turbine placement minimises the likelihood of interaction with potential habitats and flight paths.

Using the 262 m buffer outlined above, spatial analysis was undertaken to identify any areas of overlap between the turbine influence zones and the mapped potential habitat. Where overlaps occurred, turbines were micro-sited or rotated to reduce the extent of overlap and to increase the horizontal distance between the blade sweep area and habitat features such as wetlands and planted tree rows.

This micro-siting exercise was repeated iteratively. By applying this systematic, spatially informed approach, the design ensures that residual risks are kept to the lowest practicable level, consistent with the principles of avoidance and minimisation. This approach has resulted in over 98 % of the area within the 262 m turbine buffers being open landscape (Table 14). Residual risk to Bat Species of Concern following avoidance measures is managed through mitigation measures outlined in section 7.3.2.

7.2. Mitigation measures

The *Handbook* (DEECA 2025a, 2025b) defines the need to apply the mitigation hierarchy to manage impacts on Bat Species of Concern. All mitigation measures for the project have been developed based on comprehensive information derived from field assessments and desktop studies, and in compliance with the *Handbook* (DEECA 2025a, 2025b) guidance requirements. These measures have been designed to minimise expected impacts before the commencement of the construction and operation phase (Table 22).

All mitigation measures suggested within the *Handbook* have been adopted for WWF.

Table 22: Mitigation measures to reduce impacts on Bat Species of Concern at Willatook Wind Farm.

Mitigation ID	Impact	Description
MM01 Turbine height	Collision risk	The previous EES included a minimum tip height of 40 m (i.e., the lower RSA, with all wind turbine blades will be at least 40 m from ground level). Following the Minister's Assessment, this has been increased to 60 m. This aligns with guidance within the <i>Handbook</i> to reduce bat collisions, and also with current research and mortality data for bat species. See more discussion in Section 7.2.1.
MM02 Nighttime cut-in speeds (all turbines)	Collision risk	The project proposes to increase the low-wind speed cut-in. This is considered the most effective measure for mitigation of bat collisions (Bennett et al. 2022). This mitigation is proposed to be implemented across all turbines under the following conditions: ▪ Time of year: 1 September to May 31 (inclusive) ▪ Time of night: 30 minutes before sunset to 30 minutes after sunrise ▪ Cut-in speed: 4.5 m/s ▪ Climatic conditions: Low wind speed curtailment to be implemented when the temperature is above 10°

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

**ADVERTISED
PLAN**

Mitigation ID	Impact	Description
		Further details are discussed below in Section 7.2.3.
MM03 Nighttime blade feathering (all turbines)	Collision risk	The project proposes to reduce blade rotation in wind speeds below the cut-in speed, known as ‘blade feathering’. This is known to reduce bat collision mortality (Whitby et al. 2024). This mitigation measures is proposed to be implemented across the wind farm under all conditions. Further details are discussed below in Section 0.
MM04 Deterrents	Collision risk	Deterrents may reduce the activity of echolocating bats around turbines, lowering collision risk. Some of these deterrents require further investigation into their efficacy. The proponents propose to investigate the use of deterrents through trialling as an adaptive management measure after triggering events in the BAM plan. These may include: ▪ Acoustic deterrents ▪ Visual deterrents ▪ Physical deterrents Discussion on these deterrents is provided in Section 7.2.4.
This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright		Development of a Bat and Avifauna Management Plan (BAM Plan), that would aim to: ▪ Minimise the impacts from the WWF on threatened fauna listed under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) and/or the Victorian <i>Flora and Fauna Guarantee Act 1988</i> (FFG Act); ▪ An informed understanding of the turbine collision risk to Bats (and other listed fauna) that occurs on-site; ▪ An informed understanding of how Bats (and other listed fauna) use the site changes in response to wind farm construction and operation; ▪ Monitoring for the timely identification of turbine collisions and the timely collection and analysis of data; ▪ Responsive updates to, and regular validation of, the impact assessment framework for Bats (and other listed fauna regularly recorded on site), using monitoring data to support a robust adaptive management approach to reducing impacts, where possible; ▪ Where applicable, the development and implementation of tangible, on-ground management actions to promote a long-term collision risk reduction on Bats and other listed threatened and migratory bird and bat species. The BAM Plan will require finalisation by agreement with DEECA during the approval process (Section 7.2.5).
MM05 Bat and Avifauna Management Plan (BAM Plan)	Collision risk	
MM06 Reduce Quarry Disturbance	Disturbance of roosting bats	Quarry blasting will only occur during daylight hours. However, it has the potential to disturb Bat Species of Concern if they are nearby roosting/breeding, through noise, vibration, air blasts, and/or flyrock events. A Blast Management Plan should be developed to reduce the impact of these events.

7.2.1. Turbine height

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

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

Furthermore, the *Handbook* lists increased turbine height as a potential mitigation measure for bats, but highlights that there are uncertainties on the effectiveness of this measure and results will be species-specific. The initial proposed WWF design included a minimum RSA height of 40 m, however, taking into account the *Handbook* and recent literature (Bush et al. 2025), the minimum RSA height for the proposed turbine model at WWF has been raised to 60 m AGL.

Available data from site-specific acoustic monitoring and regional studies indicate that the majority of SBWB activity occurs below 50–60 m above ground level. By ensuring the lowest point of the blades is elevated above this activity zone, the project design significantly reduces the likelihood of interaction or collision. This measure reflects a conservative and precautionary approach consistent with best practice in wind farm design and current guidance under the *Handbook*.

Nature Advisory understands that the minimum RSA height of turbines at the wind farms where SBWB carcasses have been detected is under 45 m AGL. However, given that information on all SBWB mortalities detected to date at operational wind farms has not been made publicly available, it is unknown if the minimum RSA height of 45 m incorporates all turbines where mortalities have occurred. At WWF, several detectors were placed at height (42–45 m) and only one call was attributed to a threatened species (a SBWB-complex call) recorded at 45 m AGL during surveys between 2010–2020. This corresponds with findings by Bush et al. (2025), who found that most SBWB flights occurred within 0–30 m altitude, although flights up to 80 m were observed on occasion. The link between minimum RSA height and SBWB and YBSB mortalities remains uncertain, due to the limited available evidence.

Similarly, the impact of higher RSA heights to other higher-flying species, such as the White-striped Free-tailed Bat, remains uncertain, and it is possible there will be unintended adverse impacts to increasing the RSA further into their flight zone. However, the mitigation measures intended for WWF are for Bat Species of Concern, and therefore implementation of the mitigation hierarchy has prioritised their requirements.

Nature Advisory is currently undertaking an analysis of existing monitoring data to investigate how turbine model specifications influence mortality rates for Australian bat species (Nature Advisory 2025b). Mortality data have been sourced from post-commissioning monitoring conducted at 20 operational wind farms in Victoria, ACT and NSW. Preliminary results to date have revealed a trend whereby total bat mortality significantly decreases as minimum RSA height increases above 40 m AGL. Further, as turbine blades are raised higher above the ground, the number of microbat species impacted decreases, with open-space-adapted taxa accounting for most mortalities. These findings are similar to those reported from the Northern Hemisphere, where the risk of colliding with turbines has been shown to correlate with wing morphology and echolocation frequency (characteristics that are used to group bats into foraging guilds) and the proportion of time that bats from different foraging guilds spend flying high above the canopy at RSA heights (Arnett et al. 2016; Roemer et al. 2017, 2019).

Importantly, this increase in turbine hub and tip height does not alter the horizontal layout or footprint of the project, maintaining the already-established avoidance buffers from important habitats and foraging areas. Instead, it provides a vertical safeguard that further limits overlap between turbine operation and the expected bat flight envelope, particularly during peak foraging periods and low-altitude commuting flights.

7.2.2. Blade feathering

Turbine blades can still rotate below the cut-in speed when electricity is not being generated. ‘Feathering’ is the act of preventing the turbine blades from free-spinning below the cut-in speed, which is achieved by locking turbine blades or angling the blades to be parallel to the wind (Barré et al. 2023). In some cases, the blades may still move a minimal amount (e.g. 1–2 rotations/minute). Turbine blade feathering at WFF is intended to reduce the risk of collision and/or barotrauma by bats, as it reduces the risk of bats colliding with spinning turbine blades (Whitby et al. 2024).

Several international studies have reported reductions in bat mortality associated with blade feathering, although there have been some mixed results. Brown and Hamilton (2006) found 40% of recorded bat fatalities occurred at feathered turbines compared to 60% at non-feathered turbines that weren’t feathered, while no difference was detected at these turbines when before feathering was implemented. Similarly, Good et al. (2012) reported a 36% reduction in total bat fatalities at feathered turbines, and Young et al. (2013) reported a 62% reduction. In contrast, Young et al. (2012) found no difference in feathered vs non-feathered turbines. As the available literature on turbine blade feathering is based on international studies, there remains some uncertainty on the effectiveness of this measure on Australian bats.

The proponent is committed to feathering turbine blades below the cut-in speed from the offset of operation to mitigate impacts to bats. This will be applied to all turbines across the wind farm at all times of the year. Blade feathering will operate alongside the low wind-speed curtailment outlined in Section 7.2.3.

7.2.3. Cut-in speeds

Low wind-speed curtailment is the process whereby the speed at which the turbines begin to turn is increased (i.e. low-wind speed cut-in). This is currently considered the most effective mitigation measure for bats colliding with turbines (Bennett et al. 2022; Regan et al. 2025; Whitby et al. 2024).

At the WWF hearing, the proponent proposed a curtailment strategy as a precautionary measure for SBWB and YBSB. This included increasing the turbine cut-in speed to 4.5 m/s from 3 m/s for all turbines adjacent to high-quality habitat areas. The Minister recommended that the cut-in wind speed specified in the BAM Plan be increased to at least 4.5 m/s from dusk to dawn between September and May for the life of the wind farm to help reduce potential bat mortalities, and that the cut-in speed requirements should be applied to all turbines for the project. The Minister additionally noted that the cut-in speed should be applied during additional months if any SBWB mortalities are recorded during winter. The Minister suggested reviewing the curtailment regime after a two-year period, but recommended that, in lieu of further evidence suggesting otherwise, it should be implemented for the life of the project.

Since the Minister’s recommendations were released, the newly published *Handbook* (DEECA 2025a) has described smart curtailment as an appropriate option to mitigate risks to bats. The *Handbook* states that applying smart curtailment only at times of monitored high bat activity or

other risk factors may result in a reduction of mortality at a similar rate to continuous dusk till dawn curtailment during low wind speeds over high activity months.

In line with the *Handbook*, and considering the Minister’s recommendations, a smart curtailment strategy will be implemented to increase the nighttime low-windspeed cut-in during periods when SBWB are most actively moving across the landscape. This regime draws on rigorous studies undertaken at nearby wind farms: Hexham Wind Farm (Nature Advisory 2025c), Kentbruck Wind Farm (Biosis 2024b) and Mt Fyans Wind Farm (Biosis 2022). All studies undertook analysis to determine SBWB activity levels at varying wind speeds, and temperature was investigated at Hexham Wind Farm and Kentruck Wind Farm. Biosis (2024) also investigated humidity at Kentbruck. Table 27 summarises the main findings of these studies.

Table 23: Summary of findings from SBWB and weather studies at Hexham Wind Farm, Kentbruck Wind Farm and Mt Fyans Wind Farm

Wind Farm	Temperature	Wind Speed	Humidity
Hexham WF (Nature Advisory 2025c)	90% of SBWB calls were recorded between temperatures of 9.5 and 19.9 °C.	77% of SBWB calls occur under a wind speed of approximately 4.5 m/s. 90% of SBWB calls occur under a wind speed of approximately 6 m/s.	Not tested.
Kentbruck WF (Biosis 2024b)	91% of SBWB calls were recorded above 10 °C.	Analysis was combined with all bat species. Therefore, results are likely skewed from larger species such as the White-striped Free-tailed Bat. Approximately 70% of calls were below 7 m/s.	90% of SBWB calls were recorded when the relative humidity was below 90%.
My Fyans WF (Biosis 2022)	Not tested.	96% of SBWB calls occur under a wind speed of 7 m/s.	Not tested.

WWF curtailment regime

The BAM Plan outlines the conditions for each turbine, and considers SBWB activity across wind speeds, temperature and time of night. The following provides the minimum basis for all turbines for the life of the project:

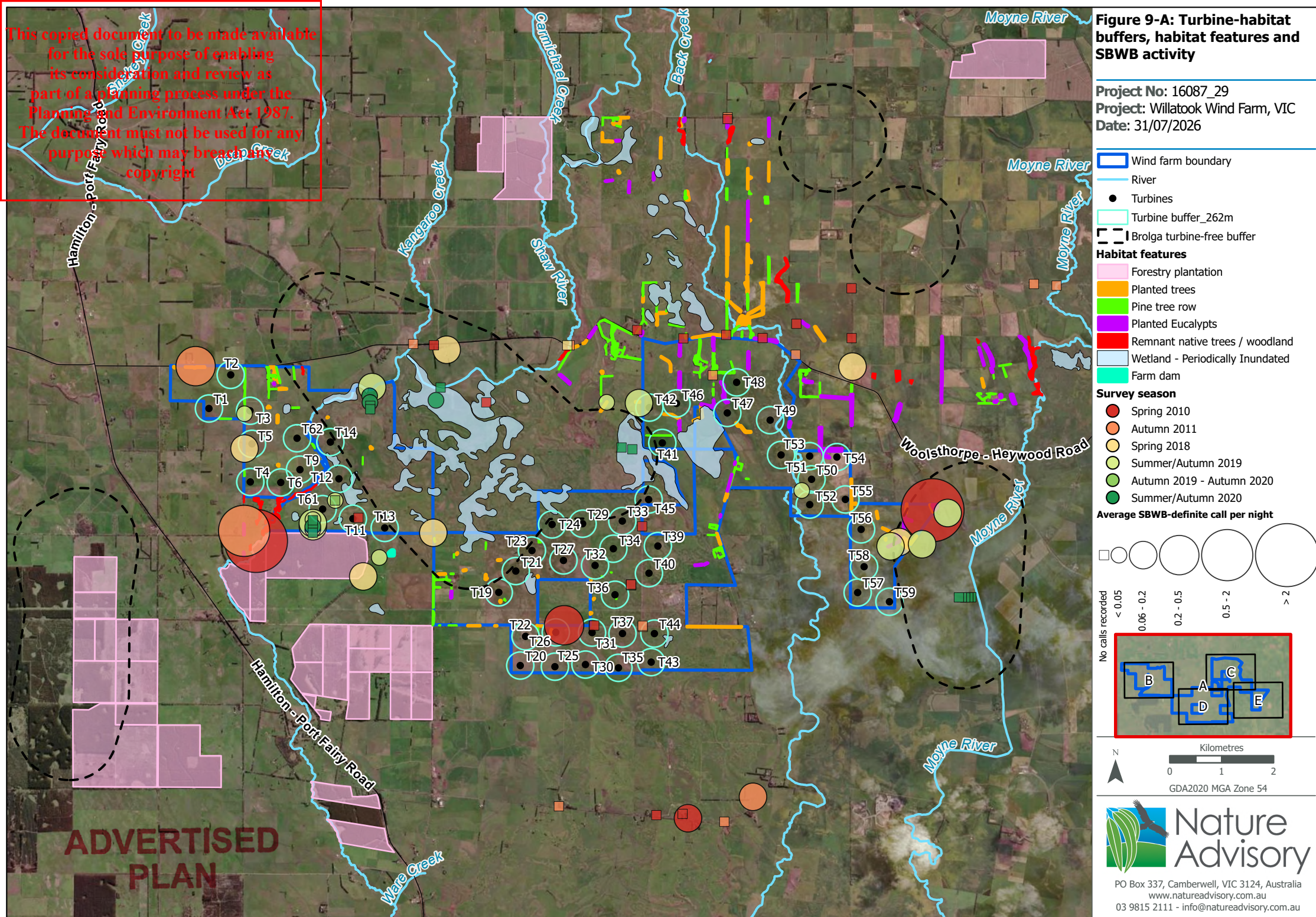
- **Time of year:** 1 September to 31 May (inclusive)
- **Time of night:** 30 minutes before sunset to 30 minutes after sunrise
- **Cut-in speed:** Turbines curtailed (feathered below cut-in) when hub-height wind speed <4.5 m/s
- **Climatic conditions:** Low wind speed curtailment to be implemented when the ambient temperature is above 10 °C.

The BAM Plan (Nature Advisory 2026b) details the methods which will be used to apply the curtailment regime across the site, i.e., meteorological data sources and data integration via the Supervisory Control and Data Acquisition (SCADA) system.

Most mitigation measures outlined for SBWB will have limited benefit to open-space foraging species, such as the YBSB. However, increasing the nighttime low windspeed cut-in for all turbines may provide a benefit to these faster-flying bat species that tend to fly higher and at higher windspeeds, as shown by studies regarding benefits for bat species in general from increased low windspeed cut-in (Bennett et al., 2022). The YBSB is believed to be most active in Victoria over the summer, and this curtailment strategy covers the period of highest activity for YBSB as well. This curtailment regime would therefore be expected to provide enhanced protection.

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

**ADVERTISED
PLAN**



This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Figure 9-B: Turbine-habitat buffers, habitat features and SBWB activity

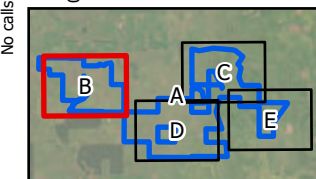
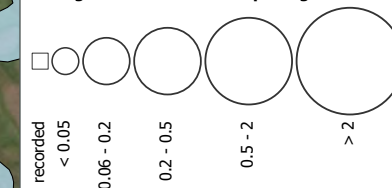
Project No: 16087_29

Project: Willatook Wind Farm, VIC

Date: 31/07/2026

- Wind farm boundary
- River
- Turbines
- Turbine buffer_262m
- Brolga turbine-free buffer
- Habitat features**
 - Forestry plantation
 - Planted trees
 - Pine tree row
 - Planted Eucalypts
 - Remnant native trees / woodland
 - Wetland - Periodically Inundated
 - Farm dam
- Survey season**
 - Spring 2010
 - Autumn 2011
 - Spring 2018
 - Summer/Autumn 2019
 - Autumn 2019 - Autumn 2020
 - Summer/Autumn 2020

Average SBWB-definite call per night



PO Box 337, Camberwell, VIC 3124, Australia
www.natureadvisory.com.au
03 9815 2111 - info@natureadvisory.com.au

**ADVERTISED
PLAN**

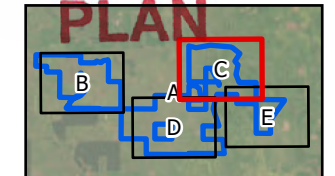
This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Figure 9-C: Turbine-habitat buffers, habitat features and SBWB activity

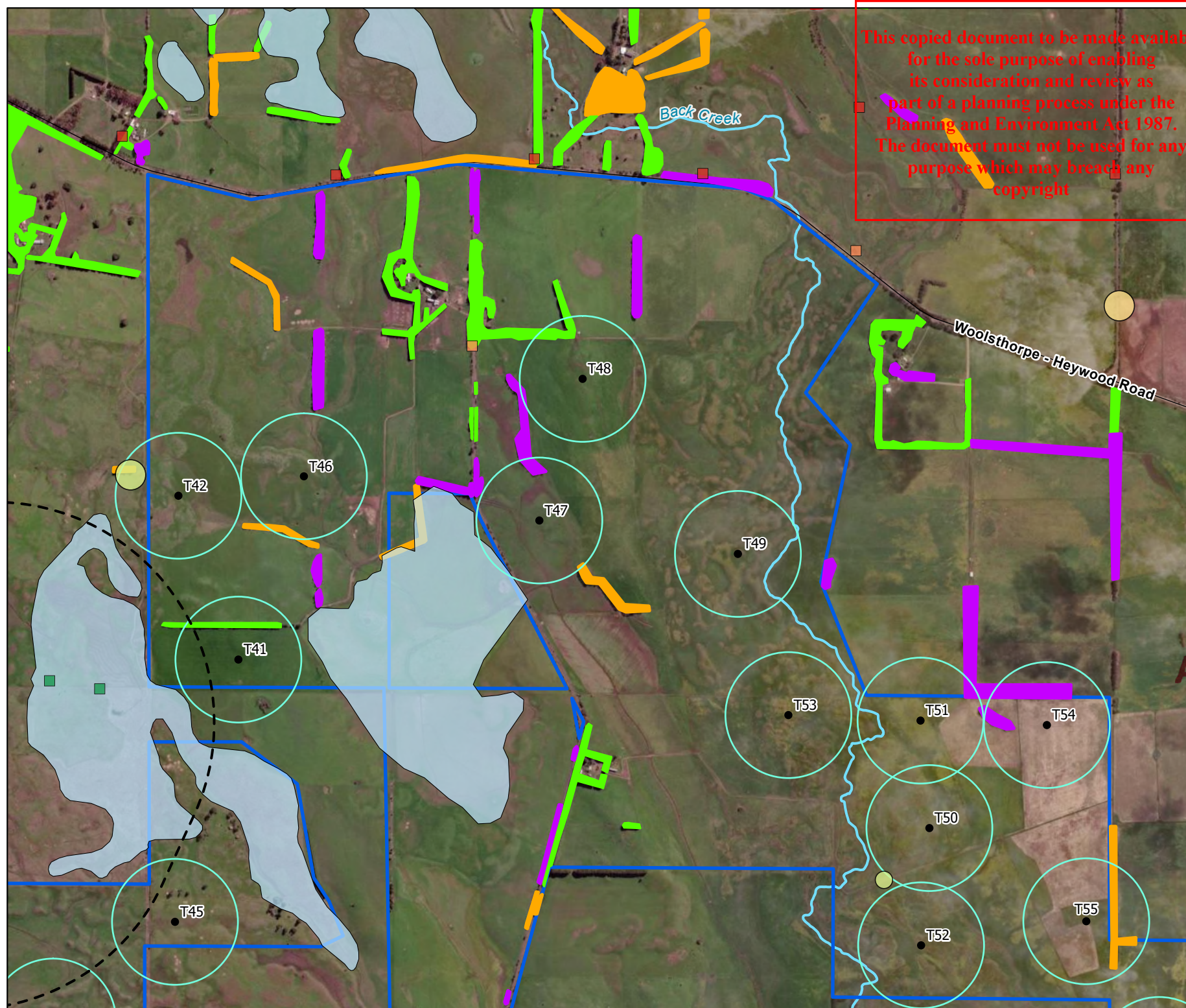
Project No: 16087_29
Project: Willatook Wind Farm, VIC
Date: 31/07/2026

- Wind farm boundary
- River
- Turbines
- Turbine buffer_262m
- Broлга turbine-free buffer
- Habitat features**
- Planted trees
- Pine tree row
- Planted Eucalypts
- Remnant native trees / woodland
- Wetland - Periodically Inundated
- Survey season**
- Spring 2010
- Autumn 2011
- Spring 2018
- Summer/Autumn 2019
- Summer/Autumn 2020
- Average SBWB-definite call per night**
- No calls recorded
- < 0.05
- 0.06 - 0.2

ADVERTISED PLAN



PO Box 337, Camberwell, VIC 3124, Australia
www.natureadvisory.com.au
 03 9815 2111 - info@natureadvisory.com.au



This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Figure 9-D: Turbine-habitat buffers, habitat features and SBWB activity

Project No: 16087_29

Project: Willatook Wind Farm, VIC

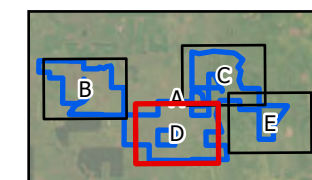
Date: 31/07/2026

- Wind farm boundary
- Turbines
- Turbine buffer_262m
- Brolga turbine-free buffer
- Habitat features**
- Planted trees
- Pine tree row
- Planted Eucalypts
- Wetland - Periodically Inundated
- Survey season**
- Spring 2010
- Autumn 2011
- Spring 2018
- Summer/Autumn 2019
- Autumn 2019 - Autumn 2020

Average SBWB-definite call per night



ADVERTISED PLAN



PO Box 337, Camberwell, VIC 3124, Australia
www.natureadvisory.com.au
 03 9815 2111 - info@natureadvisory.com.au

Figure 9-E: Turbine-habitat buffers, habitat features and SBWB activity

Project No: 16087_29

Project: Willatook Wind Farm, VIC

Date: 31/07/2026

- Wind farm boundary
- River
- Turbines
- Turbine buffer_262m
- Brolga turbine-free buffer

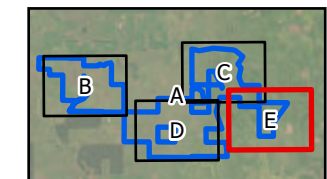
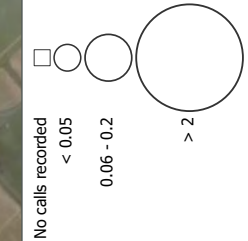
Habitat features

- Planted trees
- Planted Eucalypts

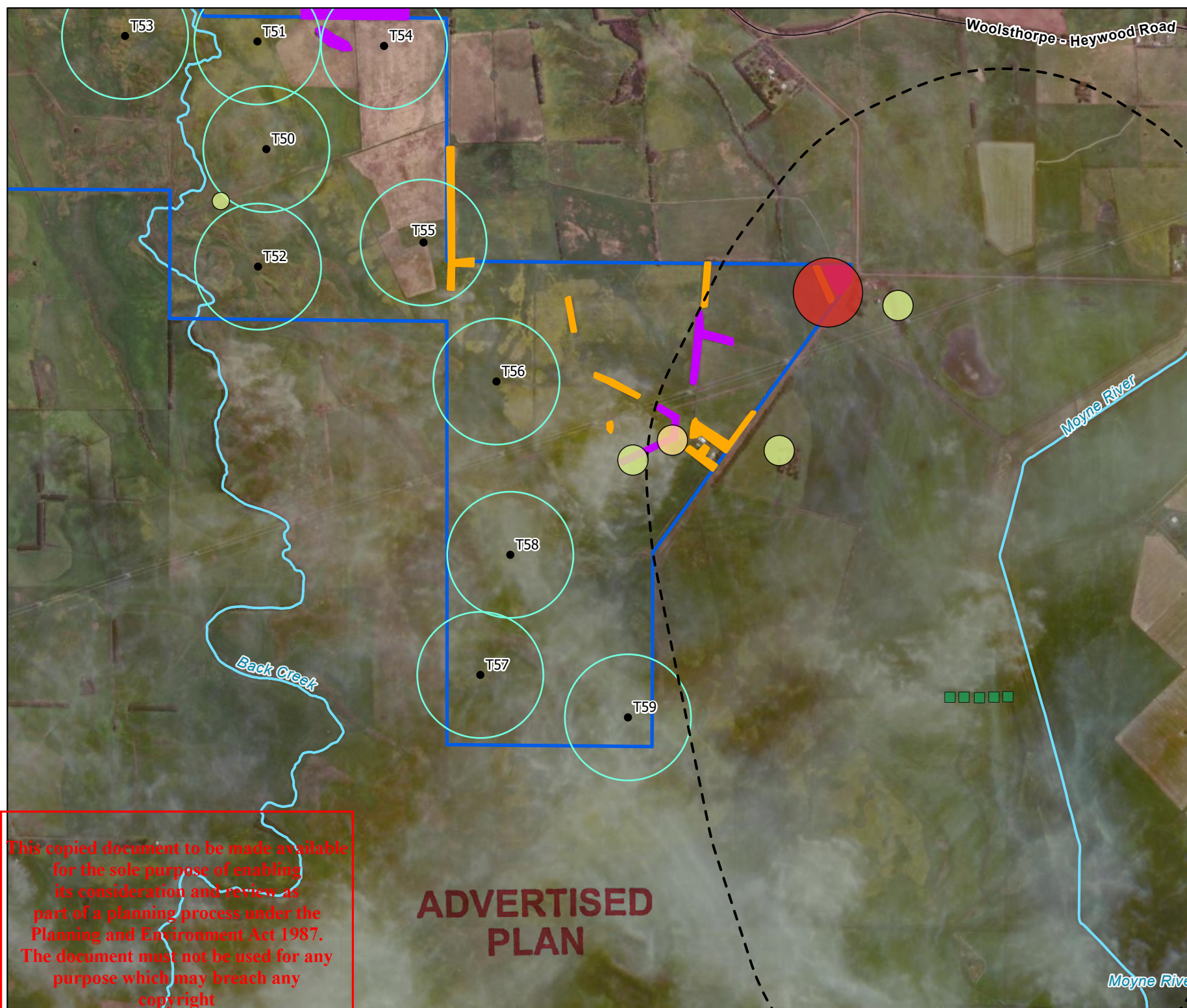
Survey season

- Spring 2010
- Spring 2018
- Summer/Autumn 2019
- Summer/Autumn 2020

Average SBWB-definite call per night

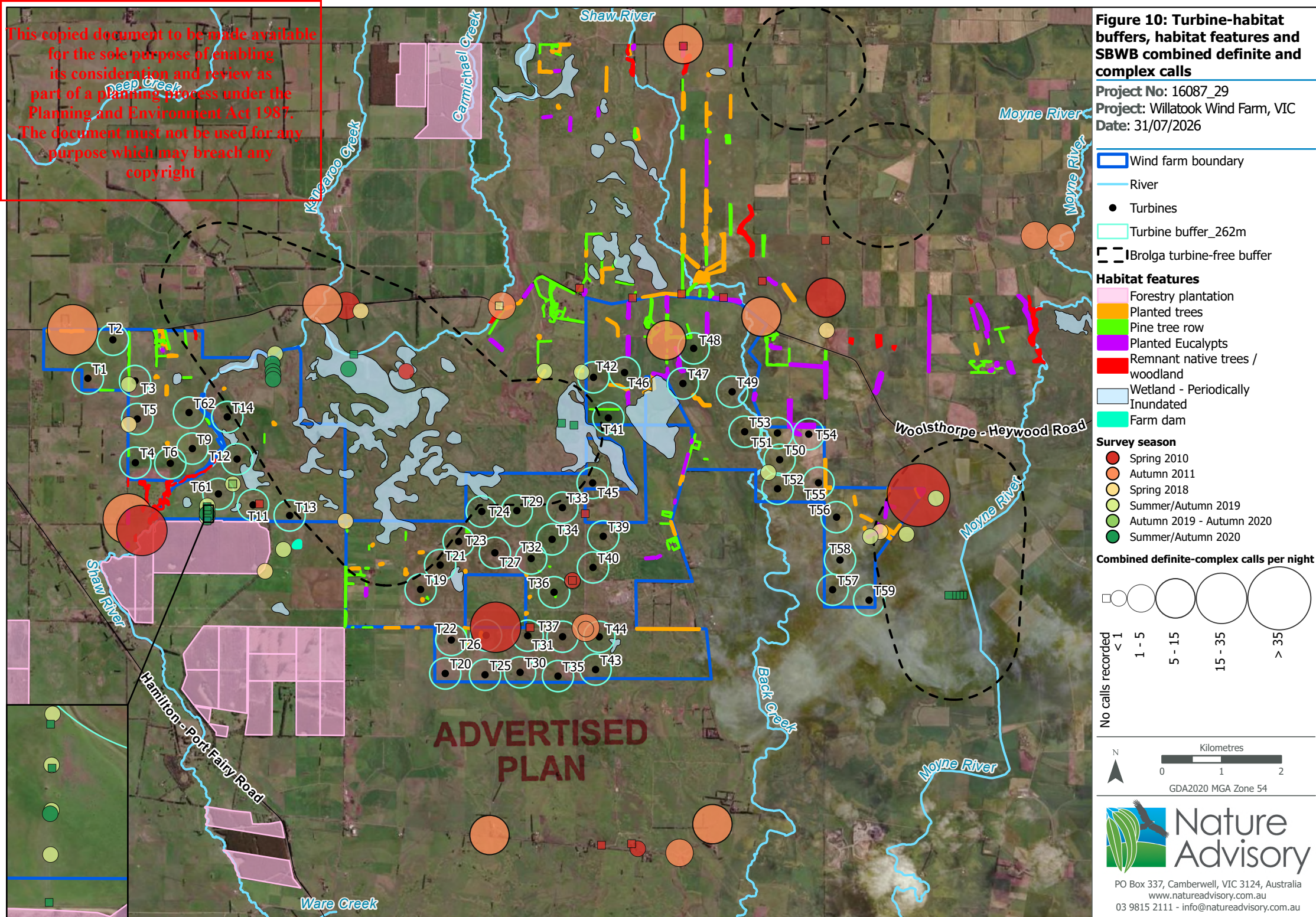


PO Box 337, Camberwell, VIC 3124, Australia
www.natureadvisory.com.au
03 9815 2111 - info@natureadvisory.com.au



This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED
PLAN



7.2.4. Deterrents

Acoustic deterrents

Ultrasonic acoustic deterrent systems have been proposed as a method to reduce the activity of echolocating bats to mediate bat-human conflicts (Zeale et al. 2016), including close to wind turbines. These systems generate ultrasonic sound within the frequency range used by bats that is designed to mask returning echoes from the bat's echolocation signal, forcing them to leave the airspace (Arnett et al. 2013). Findings presented by Weaver et al. (2020) provide promising evidence that ultrasonic acoustics deterrents can reduce bat collisions, but the effectiveness appears to be species-specific. Good et al. (2022) had similar findings, however, were tested on turbines alongside a curtailment of 5 m/s and not as a stand-alone measure.

While this technology has the potential to play a role in impact reduction for at least some bat species, there are limitations, and its efficacy for reducing impacts to Australian bats needs to be systematically tested. Acoustic deterrents mounted on a turbine tower or nacelle cannot generate a high frequency (40-50kHz) acoustic envelope that covers the entire rotor swept area at a sound pressure level loud enough to generate deterrence behaviour from echolocating bats (Arnett et al. 2013; Good et al. 2022; Schirmacher 2020; Weaver et al. 2020). As higher frequencies attenuate faster as they travel through air than lower frequencies, ultrasonic acoustic deterrents will potentially have the lowest level of effectiveness for high-frequency calling species (e.g. SBWB).

In response to the impact triggers detailed in the BAM Plan, the proponent is committed to investigating the feasibility of acoustic deterrent trials alongside consultation with DEECA. It is acknowledged that, as an emerging technology, the application and effectiveness of these devices are largely inconclusive, particularly for specific species such as SBWB. However, it is also recognised that efficacy trials of available technologies may yield acceptable results for future implementation, and as such, is listed as a supplementary mitigation measure for WWF in conjunction with other evidence-backed measures.

Other technologies in development or testing

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

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

The evolution of these emerging technologies may help manage collision risk and residual impacts on bats, but will require assessment. An adaptive monitoring and management approach, in line with intervening developments in scientific research, government policy and mitigation technologies, is proposed for this project.

7.2.5. Bat and Avifauna Management Plan (BAM Plan)

The Bat and Avifauna Management Plan (BAM Plan) will be developed in line with the *Handbook's Appendix 4: Guidance for post-construction mortality monitoring for birds and bats from onshore wind energy facilities* (DEECA 2025e) and *Appendix 5: Guidance for developing Bat and Avifauna Management (BAM) Plans for Onshore Wind Energy Facilities* (DEECA 2025f). The BAM Plan will aim for long-term mitigation and minimisation of potential impacts to birds and bats. Specific outcomes to meet this aim include (those targeted toward bat species are highlighted in **bold** and detailed below):

- **Minimise the number of collisions by implementing monitoring and mitigation measures. This may be achieved by implementing the following:**
 - **Design and implementation of a long-term carcass monitoring program;**
 - **Identifying impact triggers and applying mitigation measures;**
 - Carrion removal to make the area less attractive for raptors;
 - Reduce or avoid lighting to reduce attractiveness to birds and bats at night;
 - Limit grain feeding of stock under turbines to make the area less attractive to grain-feeding birds, including Brolga, parrots and cockatoos; and
 - **Low wind-speed curtailment and feathering turbine blades of all turbines to reduce the amount of bat fatalities;**
 - Investigating the feasibility of acoustic deterrent trials, in conjunction with other evidence-backed measures, in response to trigger events.
- **Measure if there are changes in bird and bat utilisation across the site by implementing a long-term bird and bat monitoring program. This will be achieved by implementing the following:**
 - Bird utilisation surveys;
 - **Bat studies; and**
 - Brolga breeding monitoring.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

The BAM Plan will use an adaptive management approach where management measures are adapted to manage and mitigate impacts more effectively based on the findings of the monitoring program. Ongoing monitoring requirements will be informed by the results of the initial monitoring program, and the monitoring regime can be adapted based on observed impacts and regulatory feedback.

A draft BAM Plan has been prepared for WWF to outline the monitoring, reporting and adaptive management obligations of the proponent (Nature Advisory 2022b) in line with the *Onshore Wind Farm Guidance – interim guidance on bird and bat management* (DAWE 2022). The BAM Plan will be updated in accordance with the Minister's recommendations, the *Handbook* and input from DEECA and DCCEEW.

A summary of the conditions for SBWB, YBSB and GHFF are outlined below, and will be detailed in the BAM Plan.

Mortality monitoring program

Mortality monitoring should aim to determine the actual impact on Bat Species of Concern mortality, in addition to other bat and bird species. This program should include the following components:

Mortality monitoring

- *Timing*: mortality monitoring will be conducted monthly immediately following commissioning, with additional higher frequency searches to be decided upon in consultation with DEECA/DCCEEW, such as fortnightly searches undertaken during September to April (DEECA 2025b), when bats are generally more active;
- *Turbine selection*: at least 20 turbines (38 % of all turbines). Turbine selection follows guidance in the *Handbook* (DEECA 2025e), and include:
 - Turbines located around areas of higher activity (e.g. Shaw River) as based on pre-construction surveys,
 - A randomised stratification of other turbines to ensure representation of factors such as habitat type, unlit versus lit turbines, and turbines located at the edge versus interior of the site, and
 - Changing a subset of the selected turbines each year to increase the likelihood that any mortality ‘hotspots’ are not missed. The remaining subset will be consistent between years to allow for comparisons of patterns between seasons and years.
- *Search area*: the areas of monthly and fortnightly searches will be based on an analysis of fall zones, with statistical modelling used to gain insight into the proportion of carcasses to likely fall further afield.
- *Search method*: carcass searching with conservation scent dogs, following the search method and carcass detection protocol outlined in the *Handbook* (DEECA 2025e). If, on occasion, conservation scent dogs are not available, human searchers will be used. Noting the lower search efficiency and detection success of human searchers and additional requirements (DEECA 2025e), any searches without dogs will be reported on, including justification for human-only search effort and efficiency rates.

Searcher efficiency trials

- Searcher efficiency trials will be conducted to identify the proportion of carcasses that are likely to be missed to accurately estimate annual mortality rates. These trials will follow the process outlined in the *Handbook* (DEECA 2025e).

Carcass persistence trials

- Carcass persistence trials will be conducted to determine how long carcasses remain in place before they are no longer detectable because they are removed by scavengers or degrade in the environment. These trials will follow the process outlined in the *Handbook* (DEECA 2025e).

This program should be implemented over the course of at least 5 years (or 3 if agreed to with DEECA/DCCEEW) to ensure robust results and statistically usable data for estimating the mortality rate.

Impact triggers and adaptive mitigation measures

Impact triggers, the circumstances that result in notification, further investigation, and additional mitigation measures, should be clearly detailed. Responses to triggering events should be outlined in

a decision-making framework, such as that displayed in Figure 11. If triggering events reoccur, mitigation measures should be applied simultaneously to reduce the likelihood or consequence of additional triggers.

Impact triggers and adaptive mitigation measures for Bat Species of Concern may follow, but are not limited to:

- The occurrence of an impact trigger will be reported immediately to the Project's Responsible Officer, who will report it to the relevant statutory planner at DEECA and/or DCCEEW within five business days of the impact trigger being detected;
- Immediate investigation to determine if the impact was a one-off event or potential to be ongoing;
- This rapid investigation will aim to provide a clearer understanding of the cause of the impact, informed by on-site investigations of the occurrence of the species on the WWF site, leading to a recommendation, where possible, of effective mitigation actions;
- This will identify the most effective available mitigation measures to be implemented, with those measures to be implemented as soon as practicable based on the information collected during the investigation (increased mortality searches and bat monitoring using ultrasonic recording devices):
 - Examples of mitigation measures that will be evaluated include, but are not limited to, those outlined in Table 24. As wind turbine collision mitigation studies are ongoing worldwide, new knowledge on the nature and effectiveness of mitigation will be incorporated into this evaluation as it is generated.
- Increase carcass searching will be immediately expanded to cover all turbines once a fortnight in the subsequent six weeks to determine if the species concerned is colliding was a one-off event or a potential ongoing event;
- Bat monitoring using ultrasonic recording devices will be initiated at the turbine of collision, both at-height (on top of the nacelle) and at one metre off the ground (if currently not already undertaken); and
- Investigation report to be provided to DEECA/DCCEEW and the responsible authority.

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

**ADVERTISED
PLAN**

Table 24: Adaptive mitigation measures in the event of repeated collisions with Bat Species of Concern

Adaptive Mitigation Measures
<i>Nighttime low wind speed curtailment.</i> Low wind speed curtailment is a well-known and broadly applied, effectively proven mitigation measure to reduce bat collisions worldwide (Adams et al. 2021; Bennett et al. 2022). Cut-in speeds for curtailment will increase from 4.5 m/s to 5.5 m/s as impact triggers are reached.
<i>Ultrasonic acoustic deterrents.</i> This mitigation measure can be used in combination with curtailment or alone if proven to be effective by further research (Good et al. 2022; Weaver et al. 2020). The combination of this mitigation with curtailment can also be used to revert curtailment cut-in speeds if further research proves it to be an effective mitigation measure.
<i>GHFF detection technology.</i> There is limited information due to a lack of existing studies (therefore, high uncertainty) on the effectiveness of mitigation measures for flying foxes. The proponent is committed to trialling mitigation measures as evidence emerges on their effectiveness, including on-demand shutdown (using radar or thermal/infrared cameras) or targeted shutdown (using weather radar) in the event of a GHFF trigger.
<i>Other technologies,</i> as they become available and effective, including acoustic detectors, radar, thermal or a combination, could be used to implement smart curtailment or deterrents (Gilmour et al. 2020; Matzner et al. 2020; Rabie et al. 2022). A comprehensive literature review of available methods indicates that curtailment and acoustic deterrents are the most tested and proven mitigation options, either alone or in combination (see Section 7.2.4).

Operational monitoring of Bat Species of Concern

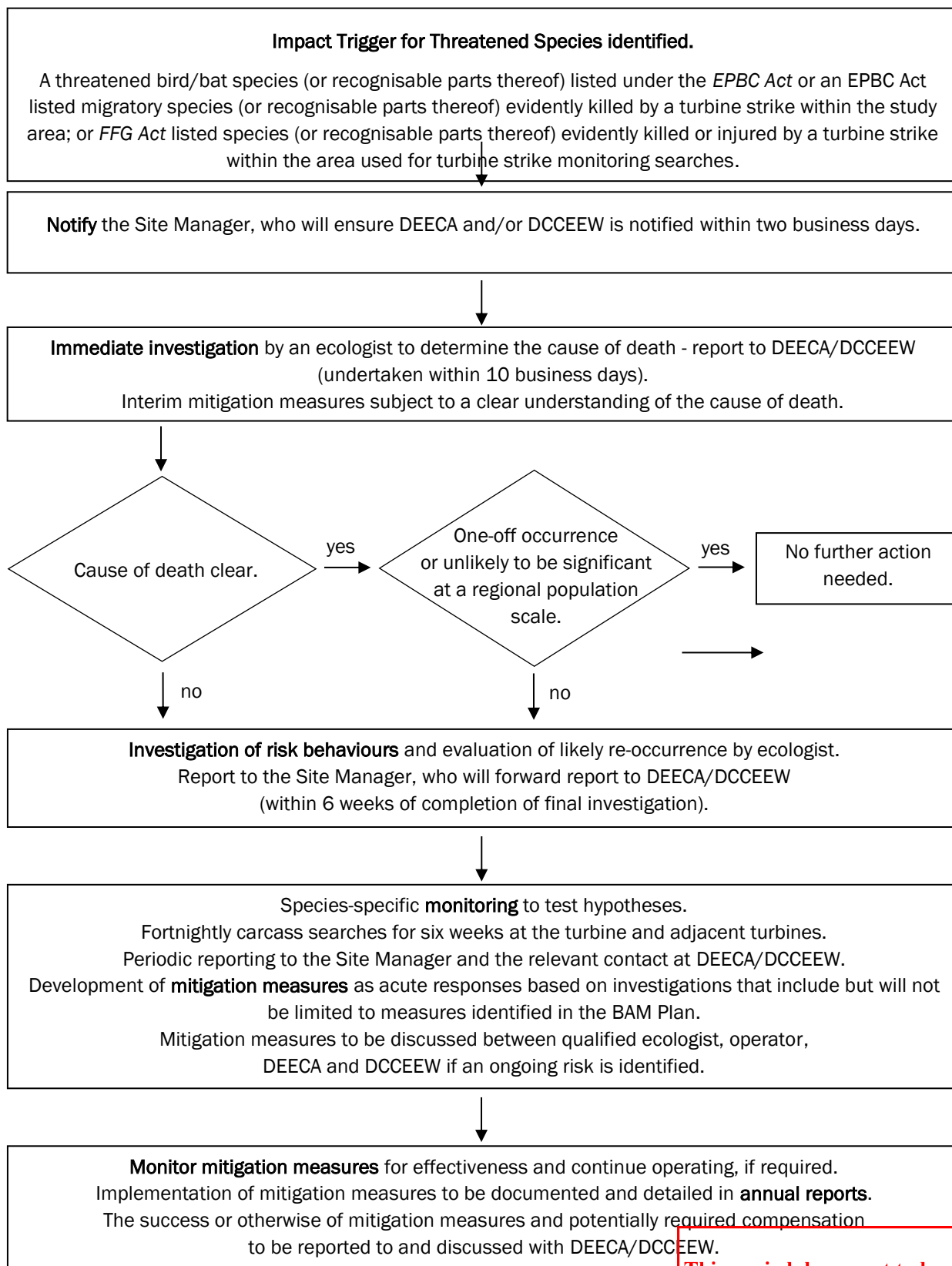
Bat detector surveys during the two-year post-commissioning period will be required to collect further data on temporal activity patterns of SBWB and YBSB in the study area. Paired bat detectors should be placed at ground level and on turbine nacelles. Consultation with DEECA will be required to determine the frequency, timing and duration of the bat detector surveys.

A critical component of the post-commissioning bat detector surveys is to use weather data recorded at ground level and nacelle to test how variation in a range of environmental factors, such as wind speed, air temperature and rainfall, influences bat activity to further inform the smart curtailment regime (outlined in Section 7.2.3). A two-year survey period combining site-specific information on weather conditions, bat echolocation call activity and bat mortalities could generate sufficient data to refine the smart curtailment algorithm for WWF. Research in the Northern Hemisphere has shown smart curtailment algorithms that make predictions about the level of risk to bats at wind energy facilities under various environmental conditions, and then use this information to guide curtailment decisions, have great potential in reducing bat fatalities while also reducing energy loss when compared to employing blanket turbine curtailment (Barré et al. 2023; Behr et al. 2017; Hayes et al. 2019, 2023).

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED
PLAN

Figure 11: Example decision-making framework for identifying and mitigating impacts of WWF



7.3. Residual impacts

The Willatook Wind Farm has adopted the mitigation hierarchy outlined in the *Handbook*, and has committed to all of the measures suggested in the *Handbook*, including curtailment, habitat avoidance, feathering, and increasing turbine heights (outlined above in Sections 7.1 and 7.2). The recommendations from the Minister's Assessment have also largely been implemented, including increased cut-in speeds and the development of a BAM Plan. Further, the size of the wind farm has been decreased. These comprehensive mitigation measures have reduced the likelihood of impacts to Bat Species of Concern.

However, even with the proposed avoidance and mitigation measures in place, it is possible that some bats, including SBWB and YBSB, may collide with turbines, and the residual impacts on these species from wind farms are difficult to quantify. A BAM Plan with specific triggers will be implemented to respond to impacts on these species if impacts are higher than anticipated.

The potential impact rating to Bat Species of Concern before and after the application of the mitigation hierarchy is shown in Table 25. Following the application of avoidance and mitigation measures outlined in Sections 7.1 and 7.2, the impact rating is expected to be low or very low for Bat Species of Concern. This signifies that the impact is localised and/or short term (see definitions in Table 19).

The following sections outline how the proposed avoidance and mitigation measures have reduced the impact rating for each Bat Species of Concern.

7.3.1. Southern Bent-winged Bat

Direct impacts

Due to the medium pre-mitigation risk rating identified in Section 6.4 and Table 20, design measures were implemented to minimise the risk of collision and barotrauma for SBWB. These measures included siting the wind farm away from SBWB caves (AV01), reducing the wind farm from its original size (AV02), applying habitat buffers (AV03) and micro-siting turbines to increase separation from potential bat habitat (AV04). Through these avoidance measures, key high-quality bat habitat areas within WWF are now turbine-free, including areas of high SBWB activity near the Shaw River, eucalypt plantation and near the large waterbody to the east of the WWF, and throughout the wetland complex. Avoiding these high activity areas is predicted to reduce the number of SBWB interactions with operating turbines.

In addition, WWF will implement all the mitigation measures recommended for bats in the *Handbook*. These include increase in turbine height to 60 m (MM01), increased nighttime cut-in speeds (MM02), nighttime blade feathering (MM03) and acoustic deterrents if deemed appropriate by DEECA (MM04). International literature indicates these measures have resulted in reductions to bat mortalities, although the strength of evidence varies between measures and some uncertainty remains regarding their effectiveness for SBWB due to a bias towards international literature.

International studies indicate that nighttime low wind-speed curtailment consistently provides a statistically significant reduction in overall bat mortalities compared to normal turbine operation (Lentini et al. 2025). However, there are currently insufficient turbines operating at 4.5 m/s within the SBWB range to determine the effectiveness of this cut-in speed for reducing SBWB collisions. Bennett et al. (2022) reported a reduction in SBWB collisions at Cape Nelson North Wind Farm when the cut-in speed was increased from 3 m/s to 4.5 m/s, although the sample size was small with two SBWB recorded at 3 m/s and one recorded at 4.5 m/s. An international metanalysis found that curtailment reduced total bat fatalities by 33% with every 1 m/s increase in curtailment wind speed up to 5 m/s (Whitby et al. 2024). International literature has been considered in an expert elicitation regarding mitigation measures for

Australian bats, which estimated that year-round low-windspeed curtailment at 7.5 m/s would reduce SBWB mortalities by 85%, and that 4.5m/s would reduce mortality by 48%. Curtailment from September to May was estimated to be only slightly less effective, although exact values were not stated (Regan et al. 2025).

Evidence for increased turbine height and nighttime blade feathering is more variable, and the degree of benefit for bats is less certain. Increasing the height of turbines and their rotor sweep height has been estimated to reduce Southern Bent-wing Bat mortalities by up to 35% for a minimum rotor sweep height of 65 m (Regan et al. 2025). Internationally, an increase in ground clearance has shown a decrease in bat mortalities (Garvin et al. 2024). This result was also found in Australia in Nature Advisory's (2025b) combined species study, but this dataset did not include SBWB. However, other Australian studies have found no relationship between turbine size and bat mortalities (Lumsden 2025; Stark 2025). Approximately 4% of SBWB flights have been recorded above 30 m above ground level, with some flights estimated to reach up to 130 m (Bush et al. 2025; Bush and Lumsden 2025). Therefore, it is expected that SBWB flights will occur in the RSA of WWF, but this is a small proportion, which will be further mitigated by increasing the cut-in speed and blade feathering.

Furthermore, international literature has shown turbine feathering can reduce bat fatalities by 36–62% compared to non-feathered turbines (Brown and Hamilton 2006; Good et al. 2012; Young et al. 2013). However, some studies have not found a difference (Young et al. 2012), indicating there is likely some species-specific variation in effectiveness. There is a large amount of uncertainty around the effectiveness of acoustic deterrents for reducing bat collisions, and therefore this measure is only proposed if further evidence suggests effectiveness or it is endorsed by DEECA.

Residual uncertainty will be managed through adaptive management under the BAM Plan (MM05), including the capacity to further increase turbine cut-in speeds up to 6 m/s if SBWB trigger events occur.

Following implementation of the avoidance and mitigation measures, the likelihood of SBWB collision and/or barotrauma is considered to be reduced to 'less likely' (Table 16). This conclusion is supported by the avoidance of high-activity bat habitats, increased minimum turbine height, nighttime curtailment and blade feathering during high-activity periods, ongoing monitoring and adaptive management through the BAM Plan, and the ability to trigger additional mitigation if SBWB trigger events occur. The consequence of a direct impact would remain moderate (Table 17), resulting in a residual impact rating of low (Table 18, Table 19).

Indirect impacts

Habitat loss, disturbance, displacement, and/or barrier effects were initial risks identified for Bat Species of Concern associated with the WWF.

WWF underwent an iterative and careful design process, including siting of the wind farm away from bat roosts (AV01), a reduction from the original wind farm size (AV02), habitat buffers (AV03), micro-siting of turbines (AV04) and re-siting of the quarry to avoid bat habitat (AV05). These measures have reduced both the amount of vegetation removed and the amount of habitat that overlaps with the 262 m turbine buffer, resulting in a reduction in habitat loss and the potential for displacement and barrier effects.

As the pre-mitigation indirect impact rating for SBWB was very low, the residual impact rating remains very low following application of the mitigation hierarchy.

**ADVERTISED
PLAN**



**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

7.3.2. Yellow-bellied Sheath-tailed Bat

Direct impacts

The pre-mitigation risk rating for YBSB was low, as identified in Section 6.4 and Table 20. The design and mitigation measures implemented for SBWB are expected to reduce the risk of collision and/or barotrauma for YBSB. These measures included reducing the wind farm from its original size (AV02), applying habitat buffers (AV03) and micro-siting turbines to increase separation from potential bat habitat (AV04). Through these avoidance measures, key high-quality bat habitat areas within WWF are now turbine-free, including areas near the Shaw River, eucalypt plantation and near the large waterbody to the east of the WWF, and throughout the wetland complex. Avoiding these high bat activity areas is predicted to reduce the number of YBSB interactions with operating turbines.

In addition, WWF will implement all the mitigation measures recommended for bats in the *Handbook*. These include an increase in turbine height to 60 m (MM01), increased nighttime cut-in speeds (MM02), nighttime blade feathering (MM03) and acoustic deterrents if deemed appropriate by DEECA (MM04). International literature indicates these measures have resulted in reductions in bat mortalities, although the strength of evidence varies between measures and species and some uncertainty remains regarding their effectiveness for YBSB due to a bias towards international literature.

International studies show that low wind-speed curtailment at night consistently provides a statistically significant reduction in overall bat mortalities compared to normal turbine operation (Lentini et al. 2025). An international meta-analysis found that curtailment reduced total bat fatalities by 33% with every 1.0 m/s^{-1} increase in curtailment wind speed up to 5 m/s (Whitby et al. 2024). The international literature has been taken into consideration in an expert elicitation regarding mitigation measures for Australian bats, which concluded that September to May low wind speed curtailment at 4.5 m/s was estimated to reduce YBSB mortalities by approximately 35% (Regan et al. (2025).

The benefit of increased turbine height for YBSB is less certain, as this species is a higher-flying open-space forager. There is potential that increased turbine height will increase the risk to this species (Regan et al. 2025), however, due to the limited literature in Australia, this is not clear. Due to the low number of YBSB calls across the study area, it is not expected to increase the impact to the species at a population level.

This uncertainty will be addressed through adaptive management under the BAM Plan (MM05), including further increasing the cut-in speed of turbines up to 6 m/s if YBSB trigger events occur.

Following implementation of the avoidance and mitigation measures, the likelihood of YBSB collision and/or barotrauma is considered to be reduced to 'less likely' (Table 16). This conclusion is supported by the avoidance of high-activity bat habitats, nighttime curtailment and blade feathering during high-activity periods, ongoing monitoring and adaptive management through the BAM Plan, and the ability to trigger additional mitigation if YBSB trigger events occur. The consequence of a direct impact would remain low (Table 17), resulting in a residual impact rating of very low (Table 18, Table 19).

Indirect impacts

Habitat loss, disturbance, displacement, and/or barrier effects were initial risks identified for Bat Species of Concern associated with the WWF.

The WWF underwent an iterative and careful design process, including siting of the wind farm away from bat roosts (AV01), a reduction from the original wind farm size (AV02), ~~applying habitat buffers (AV03),~~ micro-siting of turbines (AV04) and re-siting of the quarry to avoid bat habitat (AV05). These measures

have reduced both the amount of vegetation removed and the area of bat habitat overlapping with the 262 m turbine buffer, thereby reducing habitat loss and the potential for displacement and barrier effects.

As the pre-mitigation indirect impact rating for YBSB was very low, the residual impact rating remains very low following application of the mitigation hierarchy.

7.3.3. Grey-headed Flying-fox

The pre-mitigation risk rating for GHFF was very low, as identified in Section 6.4 and Table 20. However, avoidance and mitigation measures outlined for other threatened bat species are also expected to benefit GHFF. These include the reduction from the original wind farm size (AV02), habitat buffers (AV03) and micro-siting of turbines (AV04), which reduce potential interaction with GHFF foraging habitat. Increased the turbine height (MM01), increased nighttime cut-in speed (MM03) and nighttime blade feathering may also have some benefit to GHFF, although these measures are not specifically targeted to this species.

Adaptive management will occur for this species via the threatened species framework in the BAM Plan (MM05).

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

**ADVERTISED
PLAN**

As the pre-mitigation impact rating for GHFF was very low, the residual impact rating for both direct and indirect impacts remains unchanged at very low following application of the mitigation hierarchy.

Table 25: Summary of potential impact risk BEFORE and AFTER the application of the mitigation hierarchy

Species	Impact pathway (risk)	Initial Impact Rating (Table 20)			Mitigation	Residual Impact Rating			Justification
		Likelihood	Consequence	Impact Rating		Likelihood	Consequence	Impact Rating	
Southern Bent-wing Bat	Direct impacts (collision and/or barotrauma)	Likely	Moderate	Medium	AV01 – 04, MM01 – 05	Less likely	Moderate	Low	Due to the risk rating prior to application of the mitigation hierarchy being medium, design measures to minimise the risk of collision and barotrauma for SBWB were implemented. These measures included siting of the wind farm away from bat roosts (AV01), a reduction from the original wind farm size (AV02), habitat buffers (AV03) and micro-siting of turbines (AV04). In addition, WWF will implement all mitigation measures for SBWB as suggested in the <i>Handbook</i> . These include an increase in turbine height to 60 m (MM01), nighttime blade feathering (MM03), increased nighttime cut-in speeds (MM02), and acoustic deterrents if deemed appropriate by DEECA (MM04). Furthermore, adaptive management will occur via the BAM Plan (MM05). Based on the above avoidance and mitigation measures being implemented, the risk of collision and/or barotrauma is considered less likely to occur (Table 16). However, the consequence of direct impacts occurring would remain at moderate (Table 17), resulting in an impact rating of low (Table 18, Table 19). See section 7.3.1 for more detail.
	Indirect impacts (habitat loss, disturbance, displacement, and/or barrier effects)	Less likely	Low	Very Low	AV01 – 05, MM06	Less likely	Low	Very Low	WWF underwent an iterative and careful design process, including siting of the wind farm away from bat roosts (AV01), a reduction from the original wind farm size (AV02), habitat buffers (AV03), micro-siting of turbines (AV04) and re-siting of the quarry to avoid bat habitat (AV05). See Section 7.3.1.
Yellow-bellied Sheathtail Bat	Direct impacts (collision and/or barotrauma)	Possible	Low	Low	AV02 – 05, MM01 – 05	Less likely	Low	Very Low	The design and mitigation measures implemented for SBWB will reduce the risk of collision and/or barotrauma for YBSB. Adaptive management will occur for this species via the BAM Plan (MM05). See Section 7.3.2 for more detail.
	Indirect impacts (habitat loss, disturbance, displacement, and/or barrier effects)	Less likely	Low	Very Low	AV01 – 5, MM06	Less likely	Low	Very Low	WWF underwent an iterative and careful design process, including siting of the wind farm away from bat roosts (AV01), a reduction from the original wind farm size (AV02), habitat buffers (AV03), micro-siting of turbines (AV04) and re-siting of the quarry to avoid bat habitat (AV05). See Section 7.3.2 for more detail.
Grey-headed Flying-fox	Direct impacts (collision and/or electrocution)	Less likely	Low	Very low	AV01 – 02, MM01 – 03, MM05	Less likely	Low	Very low	Avoidance and mitigation measures outlined for other threatened bat species will benefit GHFF. The impact rating has remained the same as prior to the application of the mitigation hierarchy, with a very low rating. Adaptive management will occur for this species via the threatened species framework in the BAM Plan (MM05). See Section 7.3.3 for more detail.

ADVERTISED
PLAN

Species	Impact pathway (risk)	Initial Impact Rating (Table 20)			Mitigation	Residual Impact Rating			Justification
		Likelihood	Consequence	Impact Rating		Likelihood	Consequence	Impact Rating	
	Indirect impacts (habitat loss, disturbance, displacement, and/or barrier effects)	Less likely	Low	Very low	AV02 – 04	Less likely	Low	Very low	Avoidance and mitigation measures outlined for other threatened bat species will benefit GHFF, such as a reduction from the original wind farm size (AV02), habitat buffers (AV03) and micro-siting of turbines (AV04). These measures aid in the avoidance of GHFF foraging habitat. See Section 7.3.3 for more detail.

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED
PLAN

7.4. Compensation

The final element of the *Handbook's* (DEECA 2025a, 2025b) mitigation hierarchy looks to compensate for any residual impacts after the predicted impacts have been avoided, minimised and mitigated. The *Handbook* states that:

“Residual impacts are most likely to occur where risks from a project are ongoing and result in long-term or permanent impacts.”

Although the residual impacts on SBWB and YBSB from wind farm collisions are difficult to quantify, it is unlikely that significant long-term impacts will occur after implementation of the application of the mitigation hierarchy and implementation of adaptive management as outlined in a BAM Plan. Compensatory measures, as outlined in the *Handbook* are unlikely to be required.

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

**ADVERTISED
PLAN**

8. Alignment with the Minister's Recommendations and the DEECA Handbook

The Minister's Assessment (Minister for Planning 2023) noted that there is uncertainty around bat activity levels, flight heights, and movement patterns across the site, making impact predictions uncertain, and the project poses a potential collision and barotrauma risk for bats, particularly during low wind speeds and night-time operation. In regard to the SBWB, the Minister noted the species is known to forage across the region between maternity caves at Warrnambool and Portland, and the species is likely to traverse the project area during foraging movements, although local detections were low and intermittent. The Independent Advisory Panel and Minister concluded that the residual risk to the species could be significant unless further design and operational mitigation is applied. The Minister accepted that the project could proceed with strengthened safeguards, including turbine-free buffers around key foraging areas, low-wind-speed curtailment during high bat activity periods, and adaptive monitoring.

The proponent has acknowledged the findings of the Minister's Assessment (July 2023) in relation to potential bat impacts, particularly the importance of strengthened mitigation for the SBWB. In response, the project will adopt the Minister's recommended measures in line with the *Handbook*, including the application of low-wind-speed curtailment during peak bat activity periods, turbine-free buffers around potential foraging habitat, and an adaptive monitoring framework under the Bat and Avifauna Management Plan.

8.1. Minister's recommendations

The Minister made several recommendations related to Southern Bent-wing Bat in their assessment (Minister for Planning, 2023). The Bat-specific IAP/Minister's recommendations have been addressed by the proponent as the *Willatook Wind Farm Project: Application of the Victorian Renewable Energy Handbook and Response to the Minister's Assessment* (Wind Prospect 2026).

Below provides a summary of key recommendations, with the relevant application of the mitigation hierarchy in Table 26.

Habitat buffers

The Minister recommended a minimum 200-m turbine free buffer from potential SBWB foraging habitat. The intention was to further reduce collision risk to SBWB by strengthening spatial avoidance of key habitat features using a precautionary approach. Applying the Minister's recommendations in conjunction with the revised bat assessment and species-specific guidance of the *Handbook* led to the removal of several turbines near higher-activity habitats, including the treed riparian corridor along the Shaw River where most SBWB detections were recorded. Additional turbines were repositioned to minimise risk by detailed micro-siting to reduce overlap between turbine zones of influence and mapped habitat features.

Low wind speed curtailment

The Minister recommended the inclusion of low wind speed curtailment, including a cut-in speed of at least 4.5 m/s between September and May, and any other months in which SBWB mortality was recorded, and monitoring to inform adaptive management. These were recommended across all turbines in the project.

The Project has adopted this recommendation and will implement nighttime low wind speed curtailment across all turbines, consistent with the Minister's recommendation and species-specific guidance in the *Handbook*. Curtailment will operate from September to May, commencing 30 minutes before sunset and

continuing until 30 minutes after sunrise, with a minimum cut-in speed of 4.5 m/s applied to all turbines for the life of the wind farm.

To further refine this approach, the Project proposes to incorporate a temperature-based trigger informed by the results of monitoring and knowledge of the species' ecology. Specifically, curtailment will be applied in accordance with the Minister's recommendation when ambient temperatures exceed 10°C, ensuring the measure is targeted to periods of higher bat activity.

Other bat recommendations are captured within the Bat and Avifauna Management (BAM) Plan.

Table 26: Application of the Minister's Recommendations to the Willatook Wind Farm.

Minister's Recommendations (Minister for Planning, 2023)	Application to the proposed Willatook Wind Farm	Relevant step(s) in the mitigation hierarchy
Applying a 200 m turbine-free buffer to the potential SBWB Bat foraging habitat.	This was adopted for high-priority habitats where possible. The Willatook Wind Farm has adopted a 200 m buffer, as defined from the blade-to-habitat distance. While there is some overlap with potential SBWB foraging habitat, the extent (<0.01 ha) of overlap was minimised. Willatook Wind Farm is committed to meeting these buffers and will investigate micro-siting turbines to avoid overlaps.	AV03, AV04, and AV05
Using a cut-in wind speed of at least 4.5 m/s from dusk to dawn between September and May for the life of the wind farm to help reduce potential bat mortalities.	Adopted by WWF, with a nighttime cut-in speed for all turbines under the following conditions: ▪ Time of year: September to May ▪ Time of night: 30 minutes before sunset to 30 minutes after sunrise ▪ Cut-in speed: 4.5 m/s ▪ Climatic conditions: Implemented when the temperature is above 10°C	MM02
Applying the cut-in wind speed to all turbines of the project.	Adopted by WWF, with the nighttime cut-in speed to be applied to all turbines (under the above conditions).	MM02
Ongoing monitoring through the BAM Plan and implementation of appropriate additional mitigation measures in response to observed bird and bat impacts, noting that monitoring results should inform the potential need to increase the minimum cut-in wind speed or consider other effective management strategies if Southern Bent-wing Bat mortalities are recorded.	A BAM Plan has been drafted. This includes adaptive management measures, including the events that may trigger further increased cut-in speeds to 5.5 m/sec and other management strategies. ADVERTISED PLAN	MM05

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

8.2. Handbook guidance

The table below demonstrates how the mitigation measures within the *Handbook* are applied to the proposed Willatook Wind Farm (Table 27).

Table 27: Application of the Handbook (DEECA 2025) to the Willatook Wind Farm.

Handbook's mitigation measures (DEECA, 2025b)	Application to the proposed Willatook Wind Farm	Relevant step(s) in the mitigation hierarchy
Nighttime low-wind-speed curtailment	Adopted by WWF, including of use of species-specific information to select the curtailment approach to timing and season. Temperature and humidity are proposed as an additional condition for curtailment, where curtailment will only be active above 10°C, when bats are more active.	MM02
Feathering below cut-in speed	Adopted by WWF, with feathering proposed for all turbines under all conditions.	MM03
Acoustic deterrents	Proposed for trialling as an adaptive management measure after triggering events in the BAM Plan.	MM04
Increased turbine height	Adopted by WWF. The initial EES included a minimum tip-height of 40 m, which has been increased to 60 m.	MM01

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

**ADVERTISED
PLAN**

9. References

Acciona Energia 2025, *Mortlake South Wind Farm – Summary of the Year 2 Implementation of the Bird and Bat Adaptive Management Plan*, Acciona Energia Pty Ltd.

ACCIONA Energy 2009, Mortlake Wind Farm, Preliminary Documentation (EPBC: 2008/4128), July 2009.

Adams EM, Gulka J and Williams KA 2021, A review of the effectiveness of operational curtailment for reducing bat fatalities at terrestrial wind farms in North America, *PLoS ONE*, 16(11):e0256382.

Adams M, Law B and French K 2009, Vegetation structure influences the vertical stratification of open- and edge-space aerial-foraging bats in harvested forests, *Forest Ecology and Management*, 258(9):2090–2100.

ALA 2025, *Atlas of Living Australia*, <https://www.ala.org.au/>.

ARI 2025, *Foraging flights of the Southern Bent-wing Bat during two seasons*, Arthur Rylah Institute, Melbourne.

Armstrong K and Lumsden LF 2017, *Saccolaimus flaviventris*. The IUCN Red List of Threatened Species 2017 [WWW Document], <http://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T19799A.22006694.en>, accessed 8 March 2018.

Arnett EB, Baerwald EF, Mathews F, Rodrigues L, Rodríguez-Durán A, Rydell J, Villegas-Patraca R and Voigt CC 2016, Impacts of Wind Energy Development on Bats: A Global Perspective, in CC Voigt and T Kingston (eds) *Bats in the Anthropocene: Conservation of Bats in a Changing World*, Springer International Publishing, Cham, doi:10.1007/978-3-319-25220-9_11.

Arnett EB, Hein CD, Schirmacher MR, Huso MMP and Szewczak JM 2013, Evaluating the effectiveness of an ultrasonic acoustic deterrent for reducing bat fatalities at wind turbines, *PLoS ONE*, 8(6):e65794.

Australasian Bat Society 2025, *BatMap - Pteropus poliocephalus*, <http://ausbats.org.au/batmap>, accessed 16 June 2025.

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

Baerwald EF, D'Amours GH, Klug BJ and Barclay RMR 2008, Barotrauma is a significant cause of bat fatalities at wind turbines, *Current Biology*, 18(16):R695–R696, doi:10.1016/j.cub.2008.06.029.

Barré K, Froidevaux JSP, Sortillo A, Roemer C and Kerbiriou C 2023, Drivers of bat activity at wind turbines advocate for mitigating bat exposure using multicriteria algorithm-based curtailment, *Science of the Total Environment*, 866, doi:161404. <https://doi.org/10.1016/j.scitotenv.2023.161404>.

Baudinette R, Wells R, Sanderson K and Clark B 1994, Microclimatic conditions in maternity caves of the bent-wing bat, *Miniopterus schreibersii*: an attempted restoration of a former maternity site, *Wildlife Research*, 21, doi:https://doi.org/10.1071/WR9940607.

Behr O, Brinkmann R, Hichradel K, Mages J, Korner-Nievergelt F, Niemann I, Reich M, Simon R, Weber N and Nagy M 2017, Mitigating bat mortality with turbine-specific curtailment algorithms: a model based approach, in J Köppel (ed) *Wind Energy and Wildlife Interactions*, Springer International, Cham, Germany.

Bennett E, Florent S, Venosta M, Gibson M, Jackson A and Stark E 2022, Curtailment as a successful method for reducing bat mortality at a southern Australian wind farm, *Austral Ecology*, 47:1329–1339.

Biosis 2018, *Biosis 2018, Mt Fyans Wind Farm – Targeted flora and fauna survey report*, report for Hydro Tasmania, Authors: Gibson M, Arber S, Thomas G, Cable T, Byrne A, Venosta M, & Sofo K, Biosis Pty Ltd Ballarat, Project no. 14369.

Biosis 2022, *Southern Bent-wing Bat Adaptive management Plan*, report for Woolnorth Renewables, Smales I & Sims C, Biosis Pty Ltd, Melbourne, Vic. Project no. 34586.

Biosis 2024a, *Dundonnell Wind Farm: Year 3 annual report - bat and avifauna management plan implementation. Report for Tilt Renewables Australia Pty Ltd*, Melbourne, <https://tiltwebsite.blob.core.windows.net/tiltwebsitecontainer/2025/07/DDWF-Year-2-BAM-Plan-Monitoring-Report.pdf>.

Biosis 2024b, *Kentbruck Green Power Hub Environment Effects Statement Technical Report: Southern Bent-wing Bat Impact Assessment.*, report for Neoen Australia Pty Ltd. Smales, I, Gibson, M & Venosta, M. Biosis Pty Ltd. Melbourne, VIC. Project no 35014.

Birt P 2005, *National Population Assessment: Grey-headed flying foxes Pteropus poliocephalus*, a report to The Department of Environment and Heritage, Queensland Parks and Wildlife Service, NSW Department Environment and Conservation, Victorian Department Sustainability and Environment.

BoM 2021, *Climate data online: Monthly rainfall - Hawkesdale (Post Office)*, Bureau of Meteorology, <http://www.bom.gov.au>, accessed 23 August 2021.

Bourne S and Hamilton-Smith E 2007, *Miniopterus schreibersii bassanii and climate change*, Australasian Bat Society Newsletter.

Brown WK and Hamilton BL 2006, *Monitoring of bird and bat collisions with wind turbines at the Summerview Wind Power Project, Alberta, 2005–2006*, Vision Quest Windelectric report.

Bush A and Lumsden LF 2025, Bush, A. and Lumsden, L.F. (2025). Southern bent-wing bat: A review of current knowledge, and remaining knowledge gaps, relevant to wind farms.

Bush A, Lumsden LF and Prowse TAA 2022, GPS tracking reveals long distance foraging flights of Southern Bent-wing Bats in an agricultural landscape, *20th Australasian Bat Society Conference & AGM, 11th – 13th April 2022*, Brisbane, Queensland, Australia, doi:<https://doi.org/10.1101/2025.05.23.655017>.

Bush A, Lumsden LF and Prowse TAA 2025, Flight height patterns of a critically endangered insectivorous bat, impacted by wind turbine collision, *bioRxiv*, doi:<https://doi.org/10.1101/2025.05.23.655017>.

Churchill S 2008, *Australian Bats*, Allen & Unwin, Crows Nest.

Clean Energy Council 2018, *Best Practice Guidelines for the Australian Wind Industry*, Clean Energy Council, Melbourne, Australia.

Codd J, Clark B and Sanderson K 1999, Drinking by the common bent-wing bat *Miniopterus schreibersii* and calcium in cave water, *Bat Research News*, 40:9–10.

Conole L 2000, Acoustic differentiation of Australian populations of the Large Bentwing-bat *Miniopterus schreibersii*, *Australian Zoologist*, 31(3):443–446.

Cooper D, Green T, Miller M and Rickards E 2020, *Bat impact minimization technology: an improved bat deterrent for the full swept rotor area of any wind turbine*, California Energy Commission, United States, <https://www.osti.gov/biblio/1608253>.

DAWE 2021, National Recovery Plan for the Grey-headed Flying-fox (*Pteropus poliocephalus*).

DAWE 2022, Onshore Wind Farms – Interim guidance on bird and bat management, *Department of Agriculture, Water and Environment Canberra*.

DCCEEW 2021, *Miniopterus schreibersii bassanii* (southern form), Southern Bent-wing Bat.

DCCEEW 2024, Onshore Wind Farm Guidance Best practice approaches when seeking approval under Australia's national environmental law, *Department of Climate Change, Energy, the Environment and Water, Canberra*.

DCCEEW 2026, *Species Profile and Threats Database*, *Department of Climate Change, Energy, the Environment and Water, Canberra*, <https://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>, accessed 27 March 2026.

DEE 2017, *EPBC Act Policy Statement 3.21 - Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species*, Department of Environment and Energy, Commonwealth of Australia, Canberra, <https://www.dcceew.gov.au/sites/default/files/documents/bio4190517-shorebirds-guidelines.pdf>.

DEECA 2023, Southern Bent-winged Bat Action Statement.

DEECA 2024, *Flora and Fauna Guarantee Act 1988 – Threatened List, June 2024*, Department of Energy, Environment and Climate Action (DEECA), Melbourne.

DEECA 2025a, *Handbook for the development of renewable energy in Victoria*, Department of Energy, Environment, and Climate Action, Victoria.

DEECA 2025b, *Appendix 3: Species specific guidance for onshore wind energy facilities - Bat species of concern*, Department of Energy, Environment, and Climate Action, Melbourne, https://www.environment.vic.gov.au/__data/assets/pdf_file/0022/752080/Appendix-3-Guidance-for-Onshore-Wind-Energy-Facilities-Bat-Species-of-Concern.pdf.

DEECA 2025c, *DEECA flying-fox viewer – State Government of Victoria*.

DEECA 2025d, *Comparison of pre- and postconstruction survey results for birds and bats at Victorian wind energy facilities. Do pre-construction assessments predict post-construction mortalities?*, Department of Climate Change, Energy, the Environment and Water, East Melbourne, Victoria.

DEECA 2025e, *Appendix 4: Guidance for post-construction mortality monitoring for birds and bats from onshore wind energy facilities*, Department of Energy, Environment, and Climate Action, Melbourne.

DEECA 2025f, *Appendix 5: Guidance for developing Bat and Avifauna Management (BAM) Plans for Onshore Wind Energy Facilities*, Department of Energy, Environment, and Climate Action, Melbourne, https://www.environment.vic.gov.au/__data/assets/pdf_file/0020/752060/Appendix-5-Guidance-for-BAM-Plans-for-Onshore-Wind-Energy-Facilities.pdf.

DELWP 2019, *Flora and Fauna Guarantee Act 1988 - Protected Flora List November 2019*, The Victorian Government Department of Environment, Land, Water and Planning, Melbourne.

DELWP 2020, National Recovery Plan for the Southern Bent-wing Bat *Miniopterus orianae bassanii*.

DELWP 2021, *Policy and Planning Guidelines – Development of Wind Energy Facilities in Victoria*, The Victorian Government Department of Environment, Land, Water and Planning, Melbourne.

Willatook Wind Farm – Draft Bat and Avifauna Management Plan

DEWHA 2010, Survey Guidelines for Australia's Threatened Bats.

DoE 2013, *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance*, Department of the Environment, Canberra.

Dwyer P 1963, The breeding biology of *Miniopterus schreibersii blepotis* (Termminck) (Chiroptera) in north-eastern NSW, , 11:219–240, doi:<https://doi.org/10.1071/ZO9630219>.

Eby P 1995, *The biology and management of flying-foxes in NSW; Species management report number 18.*, Llewellyn, L. (ed). NSW Parks and Wildlife Services, Hurstville.

Eby P 2004, *National Count of Grey-headed Flying-foxes April 3 and 4 2004*, a report to the Department of the Environment and Heritage, Queensland Parks and Wildlife Service, NSW Department of Environment and Conservation, Victorian Department of Sustainability and Environment.

Eby P and Law B 2008, *Ranking the feeding habitats of Grey-headed flying foxes for conservation management*, A report for The Department of Environment and Climate Change (NSW) & The Department of Environment, Water, Heritage and the Arts.

EHP 2018, *Biodiversity Assessment: Willatook Wind Farm*, Report prepared for Willatook Wind Farm Pty Ltd.

Environmental GeoSurveys Pty Ltd 2022, *Proposed Willatook Farm Geoheritage Assessment*, consultant report prepared for Willatook Wind Farm Pty Ltd., Nature Advisory Pty Ltd, Hawthorn East.

Garvin J, Simonis J and Taylor J 2024, Does size matter? Investigation of the effect of wind turbine size on bird and bat mortality, *Biological Conservation*, 291:110474, doi:<https://doi.org/10.1016/j.biocon.2024.110474>.

Gilmour LRV, Holderied MW, Pickering SPC and Jones G 2020, Comparing acoustic and radar deterrence methods as mitigation measures to reduce human-bat impacts and conservation conflicts, *PLoS ONE*, 15(2):e0228668.

Good RE, Erickson K, Merrill A, Simon S and Fritchman C 2012, *Bat monitoring studies at the Fowler Ridge Wind Energy Facility, Benton County, Indiana, April 1 – October 31, 2011*, Western EcoSystems Technology, Inc. (WEST) report.

Good RE, Iskali G, Lombardi J, McDonald T, Dubridge K, Azeka M and Tredennick A 2022, Curtailment and acoustic deterrents reduce bat mortality at wind farms, *The Journal of Wildlife Management*, 86(6):e22244, doi:10.1002/jwmg.22244.

Gorresen PM, Cryan PM, Dalton DC, Wolf S, Johnson JA, Todd CM and Bonaccorso FJ 2015, Dim ultraviolet light as a means of deterring activity by the Hawaiian hoary bat *Lasiurus cinereus semotus*, *Endangered Species Research*, 28(3):249–257.

Grant C 2004, Radiotracking of *Miniopterus schreibersii* at Naracoorte, South Australia.

Hall LS 1982, The effect of cave microclimate on winter roosting behaviour in the bat, *Miniopterus schreibersii blepotis*, *Australian Journal of Ecology*, 7:129–136, doi:<https://doi.org/10.1111/j.1442-9993.1982.tb01586.x>.

Hall LS 2009, *Bats: A Wild Australia Guide*, Steve Parish Publishing, Queensland.

Hall LS and Richards G 2000, *Flying foxes : fruit and blossom bats of Australia*, UNSW Press, Sydney.

Hall LS and Richards GC 2023, Yellow-bellied Sheath-tail Bat *Saccolaimus flaviventris* (Peters, 1867), in *Strahan's Mammals of AUstralia*, Reed New Holland Publishers, NSW, Australia.

Hayes MA, Hooton LA, Gilland KL, Grandgent C, Smith RL, Lindsay SR, Collins JD, Schumacher SM, Rabie PA, Gruver JC and Goodrich-Mahoney J 2019, A smart curtailment approach for reducing bat fatalities and curtailment time at wind energy facilities, *Ecological Applications*, 29(4):e01881, doi:10.1002/eap.1881.

Hayes MA, Lindsay SR, Solick DI and Newman CM 2023, Simulating the influences of bat curtailment on power production at wind energy facilities, *Wildlife Society Bulletin*, 47(1):e1399, doi:10.1002/wsb.1399.

Holz P, Hufschmid J, Boardman WSJ, Cassey P, Firestone S, Lumsden LF, Prowse TAA, Reardon T and Stevenson M 2016, *Qualitative risk assessment: White-nose syndrome in bats in Australia*, report prepared for Wildlife Health Australia.

Holz P, Hufschmid J, Boardman WSJ, Cassey P, Firestone S, Lumsden LF, Prowse TAA, Reardon T and Stevenson M 2019, Does the fungus causing white-nose syndrome pose a significant risk to Australian bats?, *Wildlife Research*, 46, doi:https://doi.org/10.1071/WR18194.

ISO 2018, *AS ISO 31000:2018 Risk Management Guidelines*, Switzerland.

Kuhlmann K, Fontaine A, Brisson-Curadeau É, Bird DM and Elliott KH 2022, Miniaturization eliminates detectable impacts of drones on bat activity, *Methods in Ecology and Evolution*, 13(4):842–851.

Kuhne JG, Austin JJ, Reardon T and Prowse TAA 2022, Diverse moth prey identified in the diet of the critically endangered southern bent-wing bat (*Miniopterus orianae bassanii*) using DNA metabarcoding of scats, *Wildlife Research*, 49:571–582, doi:https://doi.org/10.1071/WR21052.

Lentini PE, Lumsden LF and van Harten E 2025, *Assessment, mitigation and monitoring of onshore wind turbine collision impacts on wildlife: A systematic review of the international peer-reviewed literature, and its relevance to the Victorian context*, Arthur Rylah Institute for Environmental Research report for the Department of Climate Change, Energy, the Environment and Water.

Lumsden L 2025, Defining key bat species of concern, quantifying collision impacts and developing guidelines for onshore wind farms in Victoria, Australia, *International Bat Research Conference*, Arthur Rylah Institute, Cairns, Australia.

Lumsden L F 2007, *Guidelines for bat surveys in relation to wind farm developments*, Department of Sustainability and Environment, Heidelberg.

Lumsden LF and Jemison ML 2015, *National recovery plan for the southern bent-wing bat Miniopterus schreibersii bassani*, Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water and Planning, Heidelberg Victoria.

Lumsden LF and Menkhorst P 1995, Yellow-bellied Sheath-tail-bat, in Menkhorst, P.W. (ed.) *Mammals of Victoria*, Oxford University Press, Melbourne.

Matzner S, Warfel T and Hull R 2020, ThermalTracker-3D: A thermal stereo vision system for quantifying bird and bat activity at offshore wind energy sites, *Ecological Informatics*, 57:101069, doi:10.1016/j.ecoinf.2020.101069.

McClure CJW, Rolek BW, Dunn L, McCabe JD, Martinson L and Katzner T 2021, Eagle fatalities are reduced by automated curtailment of wind turbines, *Journal of Applied Ecology*, 58(3):446–452.

Menkhorst P 1996, *Mammals of Victoria*, Oxford University Press, Melbourne, Australia.

Mills D and Pennay M 2017, *Landscape utilisation by the threatened eastern bentwing-bat (Miniopterus schreibersii oceanensis): a pilot study at Parsons Creek, Adjungbilly, NSW*, Ecosystems and Threatened Species, South East. NSW Office of Environment and Heritage.

Minister for Planning 2023, *Minister's Assessment of the Willatook Wind Farm Environmental Effects Statement*, Victorian Government, Melbourne.

Moloney S, Lumsden L and Smales I 2019, *Investigation of existing post-construction mortality monitoring at Victorian wind farms to assess its utility in estimating mortality rates*, Department of Environment, Land, Water and Planning (Vic).

Natural England 2014, *Natural England Technical Information Note TIN051. Bats and onshore wind turbines interim guidance, 3rd Edn*, Natural England, Worcester, UK.

Nature Advisory 2022a, *Willatook Wind Farm Flora and Fauna Assessment. Prepared for Willatook Wind Farm Pty Ltd. Report No. 16087(7.9).*, Nature Advisory, Hawthorne East, Victoria.

Nature Advisory 2022b, *Willatook Wind Farm: Draft Bird and Bat Adaptive Management Plan - Report no. 16087.21 (1.1)*, consultant report prepared for Willatook Wind Farm Pty Ltd, Nature Advisory Pty Ltd, Hawthorn East.

Nature Advisory 2025a, *Mortlake South Wind Farm – Summary of the Year 1 Implementation of the Bird and Bat Adaptive Management Plan*, consultant report prepared for ACCIONA Pty Ltd, Nature Advisory Pty Ltd, Hawthorn East.

Nature Advisory 2025b, *Bat mortality at Australian wind farms: long-term trends and mitigation strategies, International Bat Research Conference*, Cairns, Australia.

Nature Advisory 2025c, *Williams Wind Farm: Bird and bat overview and risk assessment - Report No. 25067.01 (1.0)*, consultant report prepared for NGH Consulting Pty Ltd, Nature Advisory Pty Ltd, Hawthorn East.

Nature Advisory 2026a, *Willatook Wind Farm: Brolga Impact Assessment - Report No. 16087.28 (2.4)*, consultant report prepared for Wind Prospect, April 2026, Nature Advisory Pty Ltd, Hawthorn East.

Nature Advisory 2026b, *Willatook Wind Farm: Bat and Avifauna Management Plan - Report No. 16087.33 (2.2)*, consultant report prepared for Wind Prospect, April 2026, Nature Advisory Pty Ltd, Hawthorn East.

NSW Office of Environment and Heritage 2021, *Threatened Species Profile Database - Yellow-bellied Sheath-tailed Bat Saccopteryx falcipennis*.

Parry-Jones K and Auger M 1992, *Movements of Grey-headed Flying-foxes (Pteropus poliocephalus) to and from a Colony Site on the Central Coast of New South Wales*, *Wildlife Research*, 19:331–340.

Rabie PA, Welch-Acosta B, Nasman K, Schumacher S, Schueller S and Gruver J 2022, *Efficacy and cost of acoustic-informed and wind speed-only turbine curtailment to reduce bat fatalities at a wind energy facility in Wisconsin*, *PLoS ONE*, 17(4):e0266500.

Rainho A, Ferreira DF, Makori B, Bartonjo M, Repas-Gonçalves M, Kirakou S, Maghuwa F, Webala PW and Tomé R 2023, *Guild vertical stratification and drivers of bat foraging in a semi-arid tropical region, Kenya*, *Biology*, 12(8), doi:10.3390/biology12081116.

Regan R, Bruce M, van Harten E and Lumsden L 2025, Estimating the potential effectiveness of wind farm mitigations using structured expert elicitation - Arthur Rylah Institute for Environmental Research Technical Report Series No. 394, https://www.ari.vic.gov.au/__data/assets/pdf_file/0022/751315/ARI-Technical-Report-394-Estimating-the-potential-effectiveness-of-wind-farm-mitigations-using-structured-expert-elicitation.pdf.

Richards G 2006, *Ecology and conservation of the Southern Bent-wing Bat in relation to the proposed Ryan Corner Wind farm, Victoria*, report submitted to Gamesa Energy Australia Pty. Ltd., October 2006, Greg Richards and Associates.

Richards G 2007, *An assessment of the bat fauna and patterns of regional migration in relation to the Ryan Corner wind farm site, Victoria.*, Report prepared for TME Australia Pty Ltd.

Richards GC 2008, *An assessment of bat fauna at the proposed Glenn Innes Wind Farm, NSW. Prepared for Connell Wagner Pty Ltd.*

Rodrigues et al. 2014, *Guidelines for consideration of bats in wind farm projects*, Bach, L., Dubourg-Savage, L.-M., Karapandza, B., Kovac, D., Kervyn, T., Dekker, J., Kepel, A., Bach, P., Collins, J., Harbusch, C., Park, K., Micevski, B., Minderman, J., UNEP/EUROBATS Secretariat, Bonn, Germany.

Roemer C, Bas Y, Disca T and Coulon A 2019, Influence of landscape and time of year on bat-wind turbines collision risks, *Landscape Ecology*, 34(12):2869–2881, doi:10.1007/s10980-019-00927-3.

Roemer C, Coulon A, Disca T and Bas Y 2019, Bat sonar and wing morphology predict species vertical niche, *The Journal of the Acoustical Society of America*, 145(5):3242–3251, doi:10.1121/1.5102166.

Roemer C, Disca T, Coulon A and Bas Y 2017, Bat flight height monitored from wind masts predicts mortality risk at wind farms, *Biological Conservation*, 215:116–122, doi:10.1016/j.biocon.2017.09.002.

Rollins KE, Meyerholz DK, Johnson GD, Capparella AP and Loew SS 2012, A forensic investigation into the etiology of bat mortality at a wind farm: barotrauma or traumatic injury?, *Veterinary Pathology*, 49(2):362–371, doi:10.1177/0300985812436745.

Romano WB, Skalski JR, Townsend RL, Kinzie KW, Coppinger KD and Miller MF 2019, Evaluation of an acoustic deterrent to reduce bat mortalities at an Illinois wind farm, *Wildlife Society Bulletin*, 43(4):608–618.

Schirmacher MR 2020, *Evaluating the Effectiveness of an Ultrasonic Acoustic Deterrent in Reducing Bat Fatalities at Wind Energy Facilities*, Office of Energy Efficiency and Renewable Energy, United States Department of Energy, Washington, DC.

Southern Bent-wing Bat National Recovery Team 2021, *Southern Bent-wing Bat National Recovery Team Annual Progress Report 2021*.

Southern Bent-wing Bat National Recovery Team 2022, *Southern Bent-wing Bat National Recovery Team Annual Progress Report 2022*.

Southern Bent-wing Bat National Recovery Team 2024, *Southern Bent-wing Bat National Recovery Team Annual Progress Report 2024*.

Stark E 2025, Can we avoid bat collision through early site and turbine choices? Insights from a meta-analysis of microbat and turbine post-construction wind farm monitoring, *International Bat Research Conference*, Symbolix Pty Ltd, Cairns, Australia.

**ADVERTISED
PLAN**

Stratman B 2005, Comparison of pine plantations and native remnant vegetation as habitat for insectivorous bats in south-eastern South Australia.

Symbolix 2020, *Post construction bird and bat monitoring at wind farms in Victoria*, prepared for 13th Wind Wildlife Research Meeting 2020.

Tidemann CR 1999, Biology and management of the Grey-headed Flying-fox, *Pteropus poliocephalus*, *Acta Chiropterologica* 11:151–164.

TSSC 2021, Southern Bent-wing Bat National Recovery Team Annual Progress Report 2021.

Turbill C and Welbergen JA 2020, Anticipating white-nose syndrome in the Southern Hemisphere: Widespread conditions favourable to *Pseudogymnoascus destructans* pose a serious risk to Australia's bat fauna, *Austral Ecology*, 45:89–96.

Umwelt 2024, *Southern Bent-wing Bat Analysis*, Report prepared for Clean Energy Council.

Van Harten E 2020, *Population Dynamics of the Critically Endangered Southern Bent-winged Bat* *Miniopterus orianae bassanii* [PhD Thesis], La Trobe University.

Van Harten E, Lawrence R, Lumsden LF, Reardon T, Bennett AF and Prowse TAA 2022, Seasonal population dynamics and movement patterns of a critically endangered, cave-dwelling bat, *Miniopterus orianae bassanii*, *Wildlife Research*, 49:646–658, doi:<https://doi.org/10.1071/WR21088>.

Van Harten E, Lawrence R, Lumsden LF, Reardon T. and Prowse TAA 2022, Novel passive detection approach reveals low breeding season survival and apparent lactation cost in a critically endangered cave bat, *Scientific Reports*, 12:7390, doi:<https://doi.org/10.1038/s41598-022-11404-4>.

Vestjens W and Hall LS 1977, Stomach contents of forty-two species of bats from the Australasian region, *Wildlife Research*, 4:25–35.

Voigt CC, Kravchenko K, Liechti F and Bumrungsri S 2020, Skyrocketing flights as a previously unrecognized behaviour of open-space foraging bats, *Acta Chiropterologica*, 21(2):331–339, doi:10.3161/15081109ACC2019.21.2.008.

Voigt CC, Russo D, Runkel V and Goerlitz HR 2021, Limitations of acoustic monitoring at wind turbines to evaluate fatality risk of bats, *Mammal Review*, 51(4):559–570, doi:10.1111/mam.12248.

Water Technology Pty Ltd 2021, *Willatook Wind Farm – Wetland Analysis*, consultant report prepared for Willatook Wind Farm Pty Ltd, Water Technology, Notting Hill, Victoria.

Water Technology Pty Ltd 2024, *Wetland 25668 and 25698*, memorandum prepared for Willatook Wind Farm Pty Ltd, Water Technology, Notting Hill, Victoria.

Water Technology Pty Ltd 2025, *Willatook Wind Farm – Wetland Analysis Addendum*, memorandum prepared for Willatook Wind Farm Pty Ltd, Water Technology, Notting Hill, Victoria.

Weaver SP, Hein CD, Simpson TR, Evans JW and Castro-Arellano I 2020, Ultrasonic acoustic deterrents significantly reduce bat fatalities at wind turbines, *Global Ecology and Conservation*, 24:e01099, doi:10.1016/j.gecco.2020.e01099.

Werber Y, Hareli G, Yinon O, Sapir N and Yovel Y 2023, Drone-mounted audio-visual deterrence of bats: implications for reducing aerial wildlife mortality by wind turbines, *Remote Sensing in Ecology and Conservation*, 9(3):404–419.

Westcott D, McKeown A, Parry H, Parsons J, Jurdak R, Kusy B, Sommer P, Dobbie M, Heersink D and Caley P 2015, *Implementation of the National Flying-Fox Monitoring Program*, Australian Government Rural Industries Research and Development Corporation.

Whitby MD, Teague O'Mara M, Hein CD, Huso MMP and Frick WF 2024, A decade of curtailment studies demonstrates a consistent and effective strategy to reduce bat fatalities at wind turbines in North America, *Ecological Solutions and Evidence*, 5(3):e12371, doi:<https://doi.org/10.1002/2688-8319.12371>.

Wood M 2017, *Macarthur Wind Farm – Bat and Avifauna Mortality Monitoring March 2014 to February 2015*, consultant report prepared for AGL Energy Pty Ltd, Australian Ecological Research Services, Portland.

Young DP, Nations C, Lout M and Bay K 2013, *Post-construction monitoring study, Criterion Wind Project, Garrett County, Maryland: April–November 2012.*, Western EcoSystems Technology, Inc. (WEST) report.

Young DP, Nomani S, Courage Z and Bay K 2012, *NedPower Mount Storm Wind Energy Facility post-construction avian and bat monitoring: July–October 2011*, Western EcoSystems Technology, Inc. (WEST) report.

Zeale MRK, Bennitt E, Newson SE, Packman C, Browne WJ, Harris S, Jones G and Stone E 2016, Mitigating the Impact of Bats in Historic Churches: The Response of Natterer's Bats *Myotis nattereri* to Artificial Roosts and Deterrence, *PLoS ONE*, 11(1), doi:10.1371/journal.pone.0146782.

Zeng Z and Sharma A 2023, Novel ultrasonic bat deterrents based on aerodynamic whistles, *arXiv*, 2302.08037.

ADVERTISED PLAN

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

Appendix 1. Potential limitations of bat detector surveys

General considerations

Remotely deployed electronic recording devices, such as bat detectors, occasionally experience technical difficulties, such as errors in writing data onto memory cards, failure of internal electronic components, loose internal connectors, and batteries discharging to a level where the unit shuts down (Hayes, 2000). As a result, the number of nights and total hours of recording can vary between the different detectors deployed during a survey (Griffiths et al., 2020).

Bat detectors are only capable of detecting echolocation calls that arrive at the microphone above a critical sound pressure level (SPL) and at a sufficiently high signal-to-noise ratio (SNR; (Russo et al., 2018). This means that, for an echolocation call to be recorded by a bat detector, it must be louder than the background or ambient noise (Agranat, 2014). Sources of background noise that can interfere with a bat detector's ability to detect and record bat echolocation calls include sound generated by civil infrastructure (e.g., wind turbines, power inverters), traffic, wind, rain, dripping/running water and insects (Fraser et al., 2020). As the level of background noise can change between nights or within a single night, bat detector surveys should sample an adequate number of nights when background acoustic conditions are conducive to recording bat calls (Department of the Environment, Water, Heritage and the Arts, 2010).

Bat activity levels within and between nights may vary in response to weather variables such as air temperature, relative humidity, barometric pressure, rain, and wind direction and speed (average and gusts (Erickson and West, 2002; Milne et al., 2005). Typically, bats are less active under the following conditions:

- When the minimum nighttime temperature drops below a critical threshold (dependent on survey location)
- At high wind speeds (e.g., > 10 m/s)
- During moderate to heavy rainfall

Overlap in species-specific call characteristics

Insectivorous bats vocalise in the ultrasonic range and listen to the corresponding echoes, which provide the bat with a three-dimensional acoustic image of their immediate surroundings (Fenton, 2013). As opposed to bird song, where calls are used to communicate with conspecifics, bats use echolocation calls to orientate, detect obstacles and acquire spatial information on food and other key resources (Moss and Surlykke, 2001). To optimise the sensory information provided by echolocation, bats change their call structure according to the habitat structure (e.g., open versus cluttered areas) or task (e.g., commuting or foraging; (Runkel et al., 2021). Consequently, calls produced by one bat species may, at times, closely resemble those of other species (Barclay, 1999). The considerable variability in calls produced by free-flying echolocating bats often makes it difficult, or sometimes impossible, to identify species from passively recorded calls (Barclay, 1999; Russo et al., 2018).

Further, some Australian co-generic species produce echolocation calls that cannot be distinguished; for example, all species within the *Nyctophilus* genus (long-eared bats). Consequently, calls produced by species that are problematic to differentiate are grouped into *species complexes* (Milne, 2002; Pennay et al., 2004).

Relative activity versus abundance

Passively collected echolocation call data cannot be used to quantify bats within a given area (Hayes, 2000). As an example, if 10 calls of a particular species are recorded, it is not known whether this represents 10 individuals, one individual flying past the detector 10 times, or a combination. Therefore,

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

it is not possible to determine *abundance* but only *relative activity* (e.g., calls per night per site). Activity indices generated from passively collected echolocation data are the industry standard for investigating factors driving landscape-scale patterns and processes in bat communities, and are used worldwide in ecological research and environmental management (Fraser et al., 2020). Trapping is required to obtain additional information such as local abundance, morphometric measurements, or demographic variables (sex, age, reproductive status).

Zone of detection

Bat echolocation calls attenuate (reduce in amplitude) as they travel through air. Higher frequency calls attenuate faster than lower frequency ones (Schnitzler and Kalko, 2001). Calls are influenced by *geometric* and *atmospheric attenuation*. In geometric attenuation, the call amplitude halves as the distance to the bat doubles (Russo et al., 2018). Atmospheric attenuation is influenced by several factors, including air temperature, humidity and call frequency. It causes a linear decline in SPL with increasing distance between the bat and bat detector (Goerlitz, 2018).

Because lower-frequency calls travel further through air than higher-frequency ones, they can be detected at greater distance (Adams et al., 2012). In Australia, species with low-frequency calls (e.g., White-striped Free-tailed Bat *Austronomus australis*; characteristic frequency 10–15 kHz) are likely to be detected at greater distances than species with higher-frequency calls (e.g., Chocolate Wattled Bat *Chalinolobus morio*; 47–51 kHz). The detection ranges of free-flying bats have been calculated for some species of the Northern Hemisphere.

In comparison, the detection ranges for free-flying Australian echolocating bats remain largely unknown. These ranges are difficult to measure in the field and are likely to vary significantly between surveys depending on the environmental conditions, surrounding habitat, type of detector used, and the bat's activity (Adams et al., 2012).

While call detection distances are likely to vary according to the species, habitat and environmental conditions, Song Meter bat detectors are typically able to record most echolocating species within approximately 20–30 m (the *detection zone*; Sherwood Snyder, Wildlife Acoustics, pers. comm.).

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**

**ADVERTISED
PLAN**

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Appendix 2. Description of the sites used for the bat detector survey at Willatook Wind Farm (2009-2020)

Site	Survey period	Habitat description	Habitat category (within 30 m radius)	Proximity to nearest treed habitat (m)	Proximity to nearest permanent waterbody (m)
A – E	Spring 2009	Not reported			
1	Autumn 2011	Planted pine trees, farm dam and open paddocks.	Open Paddock, planted trees, farm dam.	20	20
2	Autumn 2011	Remnant trees along a road reserve, open paddock.	Open paddock, remnant trees.	0	340
3	Spring 2010	Open paddock, near the Shaw River and remnant trees.	Open paddock, remnant trees, creek.	20	30
4	Spring 2010	Open paddock, Stony rise, some remnant wattle trees.	Open paddock, remnant wattles.	20	200
5	Autumn 2011	On the banks of the Kangaroo Creek, dry in warmer months, floodplain.	Open paddock, remnant trees, creek.	15	1180
6	Spring 2010	Near planted pine trees and remnant trees, open paddock, near a wetland in wetter months.	Open paddock, planted pine trees and remnant trees.	5	1460
7	Spring 2010	Stony rise, open paddock.	Open paddock, Stony rise.	490	520
8	Autumn 2011, Spring 2018	Along the banks of the Shaw River, Remnant vegetation, open paddocks.	River/creek side, lightwood riparian vegetation. Adjacent to open paddock.	10	30
9	Spring 2010	Open paddocks, planted and remnant trees.	Open paddock, planted and remnant trees.	0	270
10	Spring 2010	Open paddock, with a row of planted pine trees and remnant trees along road reserve.	Open paddock, planted and remnant trees.	30	630
11	Autumn 2011	Remnant trees, planted trees and open paddocks.	Open paddock, planted and remnant trees.	0	140
12	Spring 2010	Remnant trees, planted trees and open paddocks.	Open paddock, planted and remnant trees.	0	560
13	Spring 2010	Remnant trees, planted trees and open paddocks.	Open paddock, planted and remnant trees.	30	480
14	Autumn 2011	At an ephemeral dam, two planted trees, open paddocks.	Open Paddock, planted trees, farm dam.	0	0
15	Spring 2010	A tributary of the Black Creek, open paddock, planted trees.	Open paddock, ephemeral creek.	100	580
16	Spring 2010	Remnant trees, open paddocks.	Open paddock, remnant trees.	0	290

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright.**

Site	Survey period	Habitat description	Habitat category (within 50 m radius)	Proximity to nearest treed habitat (m)	Proximity to nearest permanent waterbody (m)
17	Spring 2010	Remnant trees, open paddocks.	Open paddock, remnant trees.	0	350
18	Autumn 2011	Remnant and planted trees, open paddocks.	Open paddock, planted and remnant trees.	0	500
19	Spring 2010	Remnant and planted trees, open paddocks.	Open paddock, planted and remnant trees.	0	510
20	Autumn 2011	Open paddocks.	Open paddock.	60	230
21	Autumn 2011	Open paddocks along the banks of the Shaw River.	Open paddock, river.	50	670
22	Spring 2010	Planted trees and open paddocks.	Open paddock, planted trees.	0	560
23	Spring 2010	Open paddock, Stony rise, remnant vegetation.	Open paddock, Stony rise, remnant vegetation.	15	290
24	Spring 2010	Open paddock	Open paddock.	50	250
25	Spring 2010, Autumn 2011	Open paddock, two remnant trees.	Open paddock, two remnant trees.	20	100
26	Autumn 2011	Remnant and planted trees, open paddocks.	Open paddock, planted and remnant trees.	10	590
27	Autumn 2011	Remnant and planted trees, open paddocks.	Open paddock, planted and remnant trees.	5	570
28	Autumn 2011	Planted trees, open paddocks.	Open paddock, planted trees.	10	630
29	Autumn 2011	Planted trees, open paddocks.	Open paddock, planted trees.	0	140
30	Spring 2010	Remnant trees, open paddocks.	Open paddock, remnant wattle trees.	15	960
31	Spring 2010	Planted trees, open paddocks.	Open paddock, planted trees.	0	700
32	Spring 2010, Spring 2018	Planted trees, open paddocks.	Open paddock, planted trees.	0	600
33	Autumn 2011	Open paddock.	Open paddock.	60	160
34	Autumn 2011	Remnant trees and open paddocks.	Open paddock, remnant wattle trees.	0	670
35	Spring 2018	Open paddocks.	Open paddocks.	590	660
36	Spring 2018, Summer/Autumn 2019	Open paddocks.	Open paddocks.	290	100
37	Spring 2018	Ephemeral creekside comprising stands of acacia.	Ephemeral creek, remnant acacia trees, planted trees.	0	370
38	Spring 2018	Roadside stands of acacia and radiata pine. Open paddocks.	Open paddocks, planted trees and shrubs.	0	510
39	Spring 2018	Open, undulating paddocks with scattered rows of planted vegetation (native and exotic).	Open, undulating paddocks, planted trees.	0	200

ADVERTISED PLAN

Site	Survey period	Habitat description	Habitat category (within 30 m radius)	Proximity to nearest treed habitat (m)	Proximity to nearest permanent waterbody (m)
40	Spring 2018	Planted row of established radiata pine.	Open paddocks, planted trees.	0	340
41	Summer/Autumn 2019	Grazing pasture, in close proximity to treed habitat.	Open paddocks, planted trees.	30	240
42	Spring 2018, Summer/Autumn 2019	Planted rows of eucalypts (small in size) and radiata pine nearby.	Open, undulating paddocks, planted trees.	0	380
43	Summer/Autumn 2019	Scattered paddock trees within grazing paddock.	Open undulating paddocks, planted trees, scattered remnant trees.	160	520
44	Spring 2018, Summer/Autumn 2019	Small row of remnant acacia amongst Themeda grasses. Planted stand of established radiata pine. Open paddocks.	Open paddocks, remnant and planted trees.	0	240
45	Spring 2018	Open paddocks.	Open paddocks.	430	90
46	Spring 2018	Remnant Manna Gum in riparian zone (mounted amongst this veg). Situated along the Shaw River. Blue Gum plantation and open paddocks.	Open paddocks, river, plantation, remnant eucalypts.	0	30
47	Summer/Autumn 2019, Autumn 2019 - Autumn 2020	Grazing pasture, situated adjacent to blue gum plantation.	Open paddock, planted trees.	10	850
48	Summer/Autumn 2019	Grazing pasture, situated adjacent to blue gum plantation.	Open paddock.	70	820
49	Summer/Autumn 2019, Autumn 2019 - Autumn 2020	Grazing pasture, situated adjacent to blue gum plantation.	Open paddock.	130	750
50	Summer/Autumn 2019, Autumn 2019 - Autumn 2020	Grazing pasture, situated adjacent to blue gum plantation.	Open paddock.	190	750
51	Summer/Autumn 2019, Autumn 2019 - Autumn 2020	Grazing pasture, situated adjacent to blue gum plantation.	Open paddock, planted trees.	250	730
52	Spring 2018	Open paddocks.	Open paddocks.	300	1340
53	Summer/Autumn 2019	Grazing pasture bordering the Shaw River, this was one of the very few permanent water bodies in the area at this time of year.	Open undulating paddocks, river.	220	30

ADVERTISED PLAN

Site	Survey period	Habitat description	Habitat category (within 30 m radius)	Proximity to nearest treed habitat (m)	Proximity to nearest permanent waterbody (m)
54	Autumn 2019 - Autumn 2020	Located at a permanent pool of water in the Shaw River, open paddocks surround.	Permanent water in the river, open paddocks.	380	0
55	Autumn 2019 - Autumn 2020	Dry flood plain, grazing paddock, rock rise.	Open undulating paddock.	420	60
56	Autumn 2019 - Autumn 2020	Dry flood plain, grazing paddock, rock rise.	Open undulating paddock.	480	120
57	Autumn 2019 - Autumn 2020	Rock rise with herbs and bracken, grazed.	Open Stoney rise.	540	180
58	Autumn 2019 - Autumn 2020	Rock rise with herbs and bracken, grazed.	High point in landscape, open Stoney rise.	600	240
59	Spring 2018	Open paddocks, nearby stands of planted eucalypts and radiata pine rows.	Open paddocks, planted trees.	50	660
60	Summer/Autumn 2019	Open paddock, rock rise, some planted trees in the vicinity.	Open undulating paddock.	90	630
61	Spring 2018, Summer/Autumn 2019	Open, undulating paddocks.	Open, undulating paddocks.	100	830
62	Summer/Autumn 2019	Open paddock close to a roadside with remnant acacia vegetation.	Open paddock, remnant trees.	200	170
63	Summer/Autumn 2019	Grazing pasture.	Open paddock.	265	390
64	Spring 2018	Open paddocks and blue gum plantation adjoin the road, with predominantly acacia lining the roadside.	Open paddocks, blue gum plantation, remnant acacia patches.	0	470
65	Summer/Autumn 2019	Open paddock close to a roadside with remnant acacia vegetation.	Open paddock, remnant trees.	90	200
66	Summer/Autumn 2019	Open paddock, close to Blue Gum plantation and remnant roadside vegetation.	Open, undulating paddocks, planted trees, remnant vegetation.	190	110
67	Spring 2018	Nearby planted stands of cypress pine and radiata pine.	Open paddocks, planted trees.	155	224

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright.

Site	Survey period	Habitat description	Habitat category (within 30 m radius)	Proximity to nearest treed habitat (m)	Proximity to nearest permanent waterbody (m)
68	Summer/Autumn 2019	Planted row of eucalypts amongst grazing pasture.	Open, undulating paddocks, planted trees.	0	430
69	Summer/Autumn 2019	Open paddock with planted row of exotic pine trees.	Open undulating paddocks, planted trees.	0	900
70	Spring 2018	Open paddocks, near rocky outcrops.	Open undulating paddocks.	280	560
71	Spring 2018, Summer/Autumn 2019	Open paddocks. Low lying areas with ephemeral wetlands.	Open, undulating paddocks, ephemeral wetlands.	1090	470
72	Spring 2018	Open paddocks. Low lying areas with ephemeral wetlands.	Open, undulating paddocks, ephemeral wetlands.	1300	680
73	Spring 2018	Open paddocks.	Open paddocks.	130	120
74	Spring 2018	Open paddocks.	Open paddocks.	240	400
75	Spring 2018, Summer/Autumn 2019	Lone patch of acacia. Open paddocks.	Open paddocks, small patch of acacia.	740	240
76	Spring 2018	Open paddocks. Acacias and other planted native shrub and tree species line the roadside nearby.	Open paddocks, planted trees and shrubs.	120	540
77	Spring 2018	Planted stands of acacia and other native trees and shrubs. Open paddocks.	Open paddocks, planted trees and shrubs.	0	460
78	Spring 2018	Roadside native vegetation (small in extent). Open paddocks.	Open paddocks, small patches of roadside remnant vegetation.	0	380
79	Spring 2018, Summer/Autumn 2019	Roadside strip of acacia and radiata pines. Open paddocks.	Open paddock, roadside trees.	0	435
80	Spring 2018	Open, undulating paddocks, with nearby dam.	Open, undulating paddocks, dam nearby.	340	170
81	Summer/Autumn 2019	Grazing pasture.	Open paddocks.	520	770
82	Spring 2018	Open paddocks comprising rocky outcrops and a nearby creek.	Open undulating paddocks, ephemeral creek.	670	600

ADVERTISED PLAN

Site	Survey period	Habitat description	Habitat category (within 30 m radius)	Proximity to nearest treed habitat (m)	Proximity to nearest permanent waterbody (m)
83	Spring 2018	Open paddocks, near rocky outcrops.	Open, undulating paddocks.	240	350
84	Summer/Autumn 2019	Planted row of eucalypts amongst a great matrix of grazing pasture.	Open paddocks, planted trees.	0	190
85	Summer/Autumn 2019	Planted patch of exotic trees within a grazing paddock.	Open paddocks, planted trees.	0	800
86	Spring 2018	Patches of acacia, open paddocks.	Open paddocks, with sparse planted rows of treed vegetation.	0	960
87	Summer/Autumn 2019	Planted row of eucalypts within grazing pasture.	Open paddocks, planted trees.	0	1,340
88	Spring 2018	Patches of acacia. Undulating, open paddocks.	Open paddocks, with sparse planted rows of treed vegetation.	370	1090
89	Autumn 2019 - Autumn 2020	At an inundated area of the Moyne River, open grazed paddocks.	Wetland, open paddock.	660	0
90	Autumn 2019 - Autumn 2020	Dry flood plain, grazed paddock.	Open paddock.	600	60
91	Autumn 2019 - Autumn 2020	Dry flood plain, grazed paddock.	Open paddock.	540	120
92	Autumn 2019 - Autumn 2020	Dry flood plain, grazed paddock.	Open paddock.	480	180
93	Autumn 2019 - Autumn 2020	Dry flood plain, grazed paddock.	Open paddock.	420	240
94	Autumn 2019 - Autumn 2020	Wetland, grazed paddock.	Wetland, open paddock.	390	0
95	Autumn 2019 - Autumn 2020	Dry floodplain, grazed paddock.	Open paddock.	620	260
96	Autumn 2019 - Autumn 2020	Wetland, grazed paddock.	Wetland, open paddock.	525	0
97	Autumn 2019 - Autumn 2020	Dry floodplain, grazed paddock.	Open paddock.	360	0
98	Summer/Autumn 2019	Planted row of native trees within a grazing paddock.	Open paddocks, with sparse planted rows of treed vegetation.	0	710
Eastern Met Mast - Ground	Spring 2010, Autumn 2011, Spring 2018, Summer/Autumn	Open paddocks.	Open paddocks.	230	500

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

Site	Survey period	Habitat description	Habitat category (within 30 m radius)	Proximity to nearest treed habitat (m)	Proximity to nearest permanent waterbody (m)
Eastern Met Mast - Height	2019, Autumn 2019 - Autumn 2020				
Western Met Mast - Ground	Spring 2018, Summer/Autumn 2019, Autumn 2019 - Autumn 2020	Open paddocks.	Open paddocks.	450	450
Western Met Mast - Height					

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

**ADVERTISED
PLAN**

This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright

Appendix 3. Detailed bat survey effort for each monitoring site

Org	Site	Start date	End date	Survey period	Nights	latitude	longitude
EHP	A – E	Not reported					
EHP	1	24/02/2011	10/03/2011	Autumn 2011	14	-38.1393	142.075354
EHP	2	16/02/2011	31/03/2011	Autumn 2011	29	-38.1678	142.086444
EHP	3	10/11/2010	22/11/2010	Spring 2010	12	-38.1696	142.089082
EHP	4	10/11/2010	22/11/2010	Spring 2010	12	-38.1653	142.111554
EHP	5	9/02/2011	16/02/2011	Autumn 2011	7	-38.135	142.123164
EHP	6	27/10/2010	3/11/2010	Spring 2010	7	-38.1352	142.127694
EHP	7	20/10/2010	27/10/2010	Spring 2010	7	-38.145	142.139364
EHP	8	16/02/2011	24/02/2011	Autumn 2011	8	-38.1349	142.157544
Nature Advisory		1/11/2018	8/11/2018	Spring 2018	7	-38.1349	142.15702
EHP	9	20/10/2010	27/10/2010	Spring 2010	7	-38.1321	142.172364
EHP	10	27/10/2010	3/11/2010	Spring 2010	7	-38.1334	142.182544
EHP	11	24/02/2011	10/03/2011	Autumn 2011	14	-38.1398	142.189113
EHP	12	3/11/2010	10/11/2010	Spring 2010	7	-38.1327	142.191954
EHP	13	3/11/2010	10/11/2010	Spring 2010	7	-38.1332	142.199963
EHP	14	10/03/2011	31/03/2011	Autumn 2011	21	-38.136	142.207283
EHP	15	10/11/2010	22/11/2010	Spring 2010	12	-38.1307	142.207353
EHP	16	27/10/2010	3/11/2010	Spring 2010	7	-38.133	142.219543
EHP	17	3/11/2010	10/11/2010	Spring 2010	7	-38.1244	142.219373
EHP	18	16/02/2011	24/02/2011	Autumn 2011	8	-38.0949	142.191654
EHP	19	20/10/2010	27/10/2010	Spring 2010	7	-38.0952	142.191643
EHP	20	9/02/2011	24/02/2011	Autumn 2011	15	-38.1232	142.259453
EHP	21	24/02/2011	10/03/2011	Autumn 2011	14	-38.1234	142.264443
EHP	22	10/11/2010	22/11/2010	Spring 2010	12	-38.1627	142.237843
EHP	23	10/11/2010	22/11/2010	Spring 2010	12	-38.1662	142.174004
EHP	24	20/10/2010	27/10/2010	Spring 2010	7	-38.1836	142.157104
EHP	25	27/10/2010	3/11/2010	Spring 2010	7	-38.1835	142.163724
EHP		16/02/2011	24/02/2011	Autumn 2011	8	-38.1836	142.163634
EHP	26	9/02/2011	16/02/2011	Autumn 2011	7	-38.1837	142.174404
EHP	27	10/03/2011	31/03/2011	Autumn 2011	21	-38.1835	142.174384
EHP	28	9/02/2011	16/02/2011	Autumn 2011	7	-38.1376	142.023794
EHP	29	24/02/2011	10/03/2011	Autumn 2011	14	-38.215	142.156434
EHP	30	27/10/2010	3/11/2010	Spring 2010	7	-38.2163	142.177934
EHP	31	20/10/2010	27/10/2010	Spring 2010	7	-38.2161	142.183704
EHP	32	3/11/2010	10/11/2010	Spring 2010	7	-38.2168	142.184903
Nature Advisory		8/11/2018	15/11/2018	Spring 2018	7	-38.2166	142.1773
EHP	33	16/02/2011	31/03/2011	Autumn 2011	29	-38.2173	142.192914
EHP	34	9/02/2011	16/02/2011	Autumn 2011	7	-38.2129	142.199153
Nature Advisory	35	29/11/2018	5/12/2018	Spring 2018	6	-38.1142	142.179837

Org	Site	Start date	End date	Survey period	Nights	latitude	longitude
Nature Advisory	36	29/11/2018	5/12/2018	Spring 2018	6	-38.1091	142.179081
Nature Advisory		27/02/2019	30/04/2019	Summer/Autumn 2019	62	-38.1094	142.179159
Nature Advisory	37	21/11/2018	29/11/2018	Spring 2018	8	-38.0975	142.181184
Nature Advisory	38	1/11/2018	8/11/2018	Spring 2018	7	-38.095	142.190902
Nature Advisory	39	5/12/2018	13/12/2018	Spring 2018	8	-38.1027	142.191727
Nature Advisory	40	20/11/2018	29/11/2018	Spring 2018	9	-38.1092	142.191651
Nature Advisory	41	7/02/2019	30/04/2019	Summer/Autumn 2019	82	-38.1138	142.19181
Nature Advisory	42	15/11/2018	20/11/2018	Spring 2018	5	-38.1202	142.191849
Nature Advisory		28/02/2019	27/03/2019	Summer/Autumn 2019	27	-38.1203	142.191893
Nature Advisory	43	7/02/2019	28/02/2019	Summer/Autumn 2019	21	-38.1242	142.189944
Nature Advisory	44	27/02/2019	30/04/2019	Summer/Autumn 2019	62	-38.1475	142.086224
Nature Advisory		31/10/2018	7/11/2018	Spring 2018	7	-38.1474	142.086213
Nature Advisory	45	8/11/2018	15/11/2018	Spring 2018	7	-38.1535	142.086326
Nature Advisory	46	1/11/2018	7/11/2018	Spring 2018	6	-38.1705	142.088393
Nature Advisory	47	27/02/2019	1/05/2019	Summer/Autumn 2019	63	-38.168	142.101557
Nature Advisory		19/02/2020	28/04/2020	Autumn 2019 - Autumn 2020	69	-38.168	142.10154
Nature Advisory	48	27/02/2019	1/05/2019	Summer/Autumn 2019	63	-38.1674	142.101552
Nature Advisory	49	27/02/2019	1/05/2019	Summer/Autumn 2019	63	-38.1669	142.10156
Nature Advisory		19/02/2020	28/04/2020	Autumn 2019 - Autumn 2020	69	-38.1669	142.10154
Nature Advisory	50	27/02/2019	1/05/2019	Summer/Autumn 2019	63	-38.1663	142.101553
Nature Advisory		19/02/2020	28/04/2020	Autumn 2019 - Autumn 2020	69	-38.1664	142.10156
Nature Advisory	51	27/02/2019	1/05/2019	Summer/Autumn 2019	63	-38.1657	142.101559
Nature Advisory		19/02/2020	28/04/2020	Autumn 2019 - Autumn 2020	69	-38.1659	142.10153
Nature Advisory	52	15/11/2018	20/11/2018	Spring 2018	5	-38.1555	142.108904
Nature Advisory	53	27/03/2019	1/05/2019	Summer/Autumn 2019	35	-38.1426	142.114225
Nature Advisory	54	19/02/2020	20/05/2020	Autumn 2019 - Autumn 2020	91	-38.1441	142.1137
Nature Advisory	55	19/02/2020	29/04/2020	Autumn 2019 - Autumn 2020	70	-38.1447	142.113737
Nature Advisory	56	19/02/2020	29/04/2020	Autumn 2019 - Autumn 2020	70	-38.1453	142.113796

Org	Site	Start date	End date	Survey period	Nights	latitude	longitude
Nature Advisory	57	19/02/2020	29/04/2020	Autumn 2019 - Autumn 2020	70	-38.1458	142.113878
Nature Advisory	58	19/02/2020	20/05/2020	Autumn 2019 - Autumn 2020	91	-38.1464	142.113874
Nature Advisory	59	1/11/2018	7/11/2018	Spring 2018	6	-38.1359	142.130517
Nature Advisory	60	6/02/2019	27/02/2019	Summer/Autumn 2019	21	-38.1659	142.115547
Nature Advisory	61	28/02/2019	30/04/2019	Summer/Autumn 2019	61	-38.1678	142.128117
Nature Advisory		8/11/2018	15/11/2018	Spring 2018	7	-38.1678	142.128074
Nature Advisory	62	6/02/2019	27/02/2019	Summer/Autumn 2019	21	-38.1722	142.116246
Nature Advisory	63	27/02/2019	30/04/2019	Summer/Autumn 2019	62	-38.1749	142.116198
Nature Advisory	64	20/11/2018	29/11/2018	Spring 2018	9	-38.1755	142.112775
Nature Advisory	65	6/02/2019	27/02/2019	Summer/Autumn 2019	21	-38.178	142.110747
Nature Advisory	66	6/02/2019	28/02/2019	Summer/Autumn 2019	22	-38.1822	142.106505
Nature Advisory	67	25/10/2018	1/11/2018	Spring 2018	7	-38.1348	142.17342
Nature Advisory	68	28/02/2019	1/05/2019	Summer/Autumn 2019	62	-38.1447	142.165852
Nature Advisory	69	7/02/2019	28/02/2019	Summer/Autumn 2019	21	-38.1448	142.17297
Nature Advisory	70	25/10/2018	1/11/2018	Spring 2018	7	-38.1463	142.169614
Nature Advisory	71	28/02/2019	1/05/2019	Summer/Autumn 2019	62	-38.1602	142.157192
Nature Advisory		5/12/2018	13/12/2018	Spring 2018	8	-38.1602	142.157192
Nature Advisory	72	28/11/2018	4/12/2018	Spring 2018	6	-38.1608	142.162403
Nature Advisory	73	25/10/2018	1/11/2018	Spring 2018	7	-38.1676	142.173131
Nature Advisory	74	25/10/2018	1/11/2018	Spring 2018	7	-38.1855	142.157079
Nature Advisory	75	7/02/2019	30/04/2019	Summer/Autumn 2019	82	-38.1847	142.162815
Nature Advisory		25/10/2018	1/11/2018	Spring 2018	7	-38.1846	142.162759
Nature Advisory	76	24/10/2018	31/10/2018	Spring 2018	7	-38.1847	142.174481
Nature Advisory	77	5/12/2018	13/12/2018	Spring 2018	8	-38.1836	142.180811
Nature Advisory	78	5/12/2018	13/12/2018	Spring 2018	8	-38.138	142.219822
Nature Advisory	79	27/02/2019	30/04/2019	Summer/Autumn 2019	62	-38.1377	142.239429
Nature Advisory		15/11/2018	21/11/2018	Spring 2018	6	-38.1377	142.239443
Nature Advisory	80	1/11/2018	8/11/2018	Spring 2018	7	-38.1549	142.199999

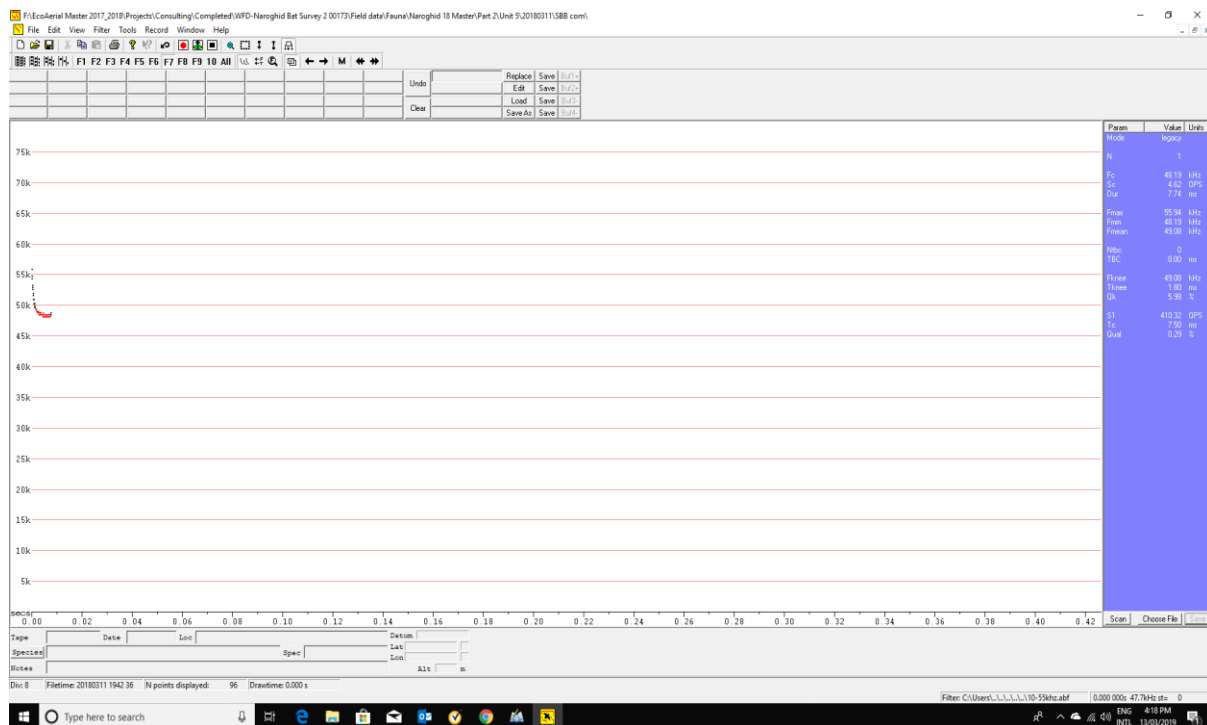
Org	Site	Start date	End date	Survey period	Nights	latitude	longitude
Nature Advisory	81	7/02/2019	30/04/2019	Summer/Autumn 2019	82	-38.1596	142.209
Nature Advisory	82	8/11/2018	15/11/2018	Spring 2018	7	-38.1588	142.211931
Nature Advisory	83	15/11/2018	21/11/2018	Spring 2018	6	-38.164	142.217501
Nature Advisory	84	7/02/2019	30/04/2019	Summer/Autumn 2019	82	-38.1632	142.241171
Nature Advisory	85	7/02/2019	30/04/2019	Summer/Autumn 2019	82	-38.1687	142.235634
Nature Advisory	86	21/11/2018	29/11/2018	Spring 2018	8	-38.1683	142.230563
Nature Advisory	87	7/02/2019	30/04/2019	Summer/Autumn 2019	82	-38.1691	142.2287
Nature Advisory	88	29/11/2018	5/12/2018	Spring 2018	6	-38.1725	142.229356
Nature Advisory	89	20/02/2020	26/10/2020	Autumn 2019 - Autumn 2020	68	-38.1778	142.24663
Nature Advisory	90	20/02/2020	29/04/2020	Autumn 2019 - Autumn 2020	68	-38.1778	142.24597
Nature Advisory	91	20/02/2020	29/04/2020	Autumn 2019 - Autumn 2020	68	-38.1778	142.24528
Nature Advisory	92	20/02/2020	29/04/2020	Autumn 2019 - Autumn 2020	68	-38.1778	142.24455
Nature Advisory	93	20/02/2020	29/04/2020	Autumn 2019 - Autumn 2020	33	38.17784	142.24389
Nature Advisory	94	29/04/2020	20/05/2020	Autumn 2019 - Autumn 2020	21	-38.1425	142.129284
Nature Advisory	95	29/04/2020	20/05/2020	Autumn 2019 - Autumn 2020	21	-38.1447	142.128302
Nature Advisory	96	20/05/2020	1/09/2020	Autumn 2019 - Autumn 2020	22	-38.1528	142.171632
Nature Advisory	97	20/05/2020	1/09/2020	Autumn 2019 - Autumn 2020	22	-38.1526	142.169246
Nature Advisory	98	28/02/2019	30/04/2019	Summer/Autumn 2019	61	-38.1548	142.112346
EHP	Eastern Met Mast - Ground	20/10/2010	22/11/2010	Spring 2010	19	-38.1763	142.17172
EHP		9/02/2011	31/03/2011	Autumn 2011	59	-38.1764	142.17172
Nature Advisory		25/10/2018	14/12/2018	Spring 2018	50	-38.1764	142.17172
Nature Advisory		6/02/2019	1/05/2019	Summer/Autumn 2019	84	-38.1763	142.17209
EHP	Eastern Met Mast - Height	19/10/2010	26/10/2010	Spring 2010	26	-38.1763	142.17172
EHP		9/02/2011	31/03/2011	Autumn 2011	59	-38.1764	142.17172
Nature Advisory		8/11/2018	3/12/2018	Spring 2018	25	-38.1764	142.171772
Nature Advisory		6/02/2019	1/05/2019	Summer/Autumn 2019	84	-38.1763	142.17209
Nature Advisory		25/07/2020	26/10/2020	Autumn 2019 - Autumn 2020	295	-38.1764	142.171772
Nature Advisory	Western Met Mast - Ground	8/11/2018	7/12/2018	Spring 2018	29	-38.1625	142.106642
Nature Advisory		6/02/2019	30/04/2019	Summer/Autumn 2019	83	-38.1624	142.106408

Org	Site	Start date	End date	Survey period	Nights	latitude	longitude
Nature Advisory		19/02/2020	25/07/2020	Autumn 2019 - Autumn 2020	200	-38.1624	142.106386
Nature Advisory	Western Met Mast - Height	8/11/2018	13/12/2018	Spring 2018	35	-38.1624	142.106386
Nature Advisory		6/02/2019	30/04/2019	Summer/Autumn 2019	83	-38.1624	142.106408
Nature Advisory		25/07/2020	26/10/2020	Autumn 2019 - Autumn 2020	218	-38.1624	142.106386

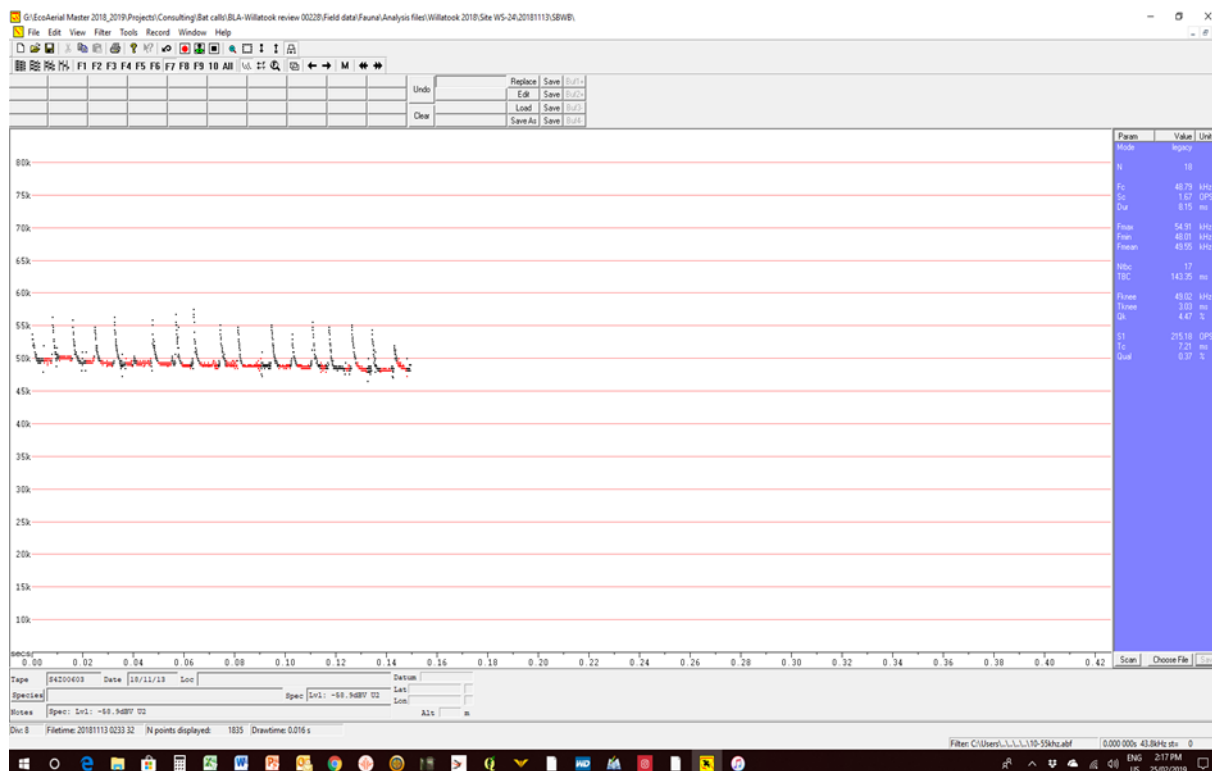
This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

**ADVERTISED
PLAN**

Appendix 4. Example of SBWB spectrograms used in identification



Spectrogram 1: Southern Bent-wing Bat call pulse characteristics used for identification

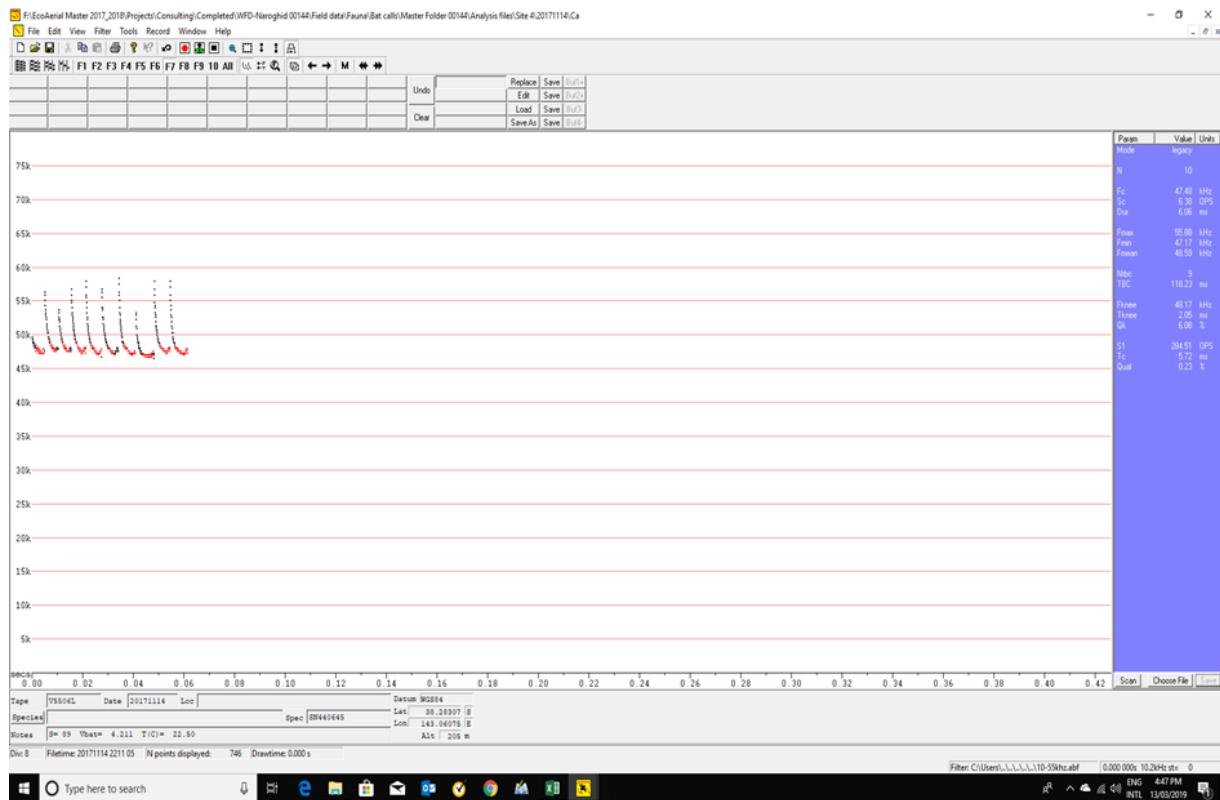


Spectrogram 2: Example of call sequence attributed to Southern Bent-wing Bat

**ADVERTISED
PLAN**



This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright



Spectrogram 3: Southern Bent-wing Bat call complex example. Call sequence consisting of a number of pulses that could be attributed to either Little Forest Bat or Southern Bent-wing Bat

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

ADVERTISED PLAN

This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright

Appendix 5. Summary of SBWB call activity and habitat within the 262 m turbine buffers

Turbine ID	SBWB call activity	Habitat type	Area	Percentage in 262m buffer	% of total habitat feature in Project Area
T01	No bat detector in buffer	Open	21.57	100	0.55
T02	No bat detector in buffer	Open	21.57	100	0.55
T03	Very low SBWB definite calls & very low SBWB complex calls	Open	20.89	96.87	0.54
		Pine tree row	0.67	3.13	1.49
T04	No bat detector in buffer	Open	21.30	98.77	0.55
		Pine tree row	0.26	1.19	0.57
		Remnant native woodland	0.01	0.04	0.09
T05	Low SBWB definite calls & low SBWB complex calls	Open	21.57	100	0.55
T06	No bat detector in buffer	Open	21.53	99.84	0.55
		Planted trees	0.04	0.18	0.32
T09	No bat detector in buffer	Open	21.57	100	0.55
T11	No bat detector in buffer	Open	20.87	96.78	0.54
		Wetland - Periodically Inundated	0.69	3.22	0.38
T12	No bat detector in buffer	Open	18.93	87.78	0.49
		Wetland - Periodically Inundated	2.64	12.22	1.44
T13	No bat detector in buffer	Open	21.57	100	0.55
T14	No SBWB recorded on detector	Open	21.26	98.58	0.55
		Wetland - Periodically Inundated	0.30	1.41	0.17
T15	No bat detector in buffer	Open	21.57	100	0.55
T19	No bat detector in buffer	Open	21.37	99.10	0.55
		Pine tree row	0.11	0.51	0.24
		Planted trees	0.09	0.40	0.69
T20	No bat detector in buffer	Open	21.57	100	0.55
T21	No bat detector in buffer	Open	21.00	97.38	0.54
		Wetland - Periodically Inundated	0.57	2.64	0.31
T22	No bat detector in buffer	Open	21.41	99.28	0.55
		Pine tree row	0.01	0.05	0.02
		Planted trees	0.14	0.67	1.16
T23	No bat detector in buffer	Open	21.36	99.05	0.55
		Pine tree row	0.21	0.97	0.46
T24	No bat detector in buffer	Open	20.85	96.68	0.54
		Wetland - Periodically Inundated	0.72	3.32	0.39
T25	No bat detector in buffer	Open	21.57	100	0.55
T26	Low SBWB definite calls, and high SBWB complex calls	Open	21.35	99.01	0.55
		Planted trees	0.21	0.99	1.73
T27	No bat detector in buffer	Open	21.57	100	0.55
T29	No bat detector in buffer	Open	21.57	100	0.55
T30	No bat detector in buffer	Open	21.57	100	0.55

This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright

Turbine ID	SBWB call activity	Habitat type	Area	Percentage in 262m buffer	% of total habitat feature in Project Area
T31	No bat detector in buffer	Open	21.57	100	0.55
T32	No bat detector in buffer	Open	21.52	99.79	0.55
		Pine tree row	0.04	0.20	0.10
T33	No bat detector in buffer	Open	21.57	100	0.55
T34	No bat detector in buffer	Open	21.57	100	0.55
T35	No bat detector in buffer	Open	21.57	100	0.55
T36	No bat detector in buffer	Open	21.51	99.74	0.55
		Pine tree row	0.06	0.26	0.12
T37	No bat detector in buffer	Open	21.57	100	0.55
T39	No bat detector in buffer	Open	21.57	100	0.55
T40	No bat detector in buffer	Open	21.57	100	0.55
T41	No bat detector in buffer	Open	20.83	96.59	0.54
		Pine tree row	0.73	3.40	1.62
T42	Low SBWB definite calls & low SBWB complex calls	Open	21.48	99.61	0.55
		Planted trees	0.09	0.42	0.73
T43	No bat detector in buffer	Open	21.57	100	0.55
T44	Low SBWB complex calls. No SBWB definite calls	Open	20.98	97.29	0.54
		Wetland - Periodically Inundated	0.59	2.73	0.32
T45	No bat detector in buffer	Open	21.57	100	0.55
T46	Low SBWB complex calls. No SBWB definite calls	Open	21.33	98.91	0.55
		Planted trees	0.24	1.10	1.91
T47	No bat detector in buffer	Open	20.76	96.27	0.53
		Planted Eucalypts	0.32	1.48	2.34
		Planted trees	0.02	0.08	0.14
		Wetland - Periodically Inundated	0.47	2.19	0.26
T48	No bat detector in buffer	Open	20.82	96.54	0.54
		Pine tree row	0.69	3.20	1.52
		Planted Eucalypts	0.06	0.27	0.43
T49	No bat detector in buffer	Open	21.57	100	0.55
T50	No SBWB recorded on detector	Open	21.57	100	0.55
T51	No bat detector in buffer	Open	21.26	98.58	0.55
		Planted Eucalypts	0.30	1.41	2.23
T52	No bat detector in buffer	Open	21.57	100	0.55
T53	No bat detector in buffer	Open	21.57	100	0.55
T54	No bat detector in buffer	Open	19.43	90.10	0.50
		Planted Eucalypts	2.14	9.91	15.70
T55	No SBWB recorded on detector	Open	20.72	96.08	0.53
		Planted trees	0.85	3.93	6.86
T56	No bat detector in buffer	Open	21.57	100	0.55
T57	No bat detector in buffer	Open	21.57	100	0.55
T58	No bat detector in buffer	Open	21.57	100	0.55
T59	No bat detector in buffer	Open	21.57	100	0.55

Turbine ID	SBWB call activity	Habitat type	Area	Percentage in 262m buffer	% of total habitat feature in Project Area
T60	No bat detector in buffer	Open	21.57	100	0.55
T61	No bat detector in buffer	Open	21.57	100	0.55
T62	No bat detector in buffer	Open	21.57	100	0.55

This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright

**ADVERTISED
PLAN**

ADVERTISED PLAN

**This copied document to be made available
for the sole purpose of enabling
its consideration and review as
part of a planning process under the
Planning and Environment Act 1987.
The document must not be used for any
purpose which may breach any
copyright**