GOLDEN PLAINS WIND FARM

EES REFERRAL
FLORA AND FAUNA ASSESSMENT
VOLUME A: MAIN REPORT

WestWind Energy Pty Ltd

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APPENDICES

ACRONYMS

AESDT	Australian Eastern Standard Daylight-savings Time
AusWEA	Australian Wind Energy Association
AVW	Atlas of Victorian Wildlife
BCS	Bioregional Conservation Status
BL&A	Brett Lane and Associates Pty. Ltd.
BOCA	Bird Observation and Conservation Australia
BOM	Bureau of Meteorology
CAMBA	China-Australia Migratory Bird Agreement
cm	Centimetre/s
C'wth	Commonwealth
DBH	Diameter at Breast Height
DEWHA	(former) Department of the Environment, Water, Heritage and the Arts (C'wth)
DEPI	Department of Environment and Primary Industries (Vic)
DoEE	Department of the Environment and Energy (C'wth)
DSE	(former) Department of Sustainability and Environment (Vic)
DSEWPaC	(former) Department of Sustainability, Environment, Water, Population and Communities (C'wth)
EES	Environment Effects Statement under the *Environmental Effects Act 1978*
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999 (C'wth)
ESO1	Environmental Systems Overlay – Schedule 1
EVC	Ecological Vegetation Class
FFG Act	Flora and Fauna Guarantee Act 1988 (Vic)
FIS	Flora Information System
FZ	Farming Zone
GEWVVP	Grassy Eucalypt Woodland of the Victorian Volcanic Plain
GIS	Geographic Information Systems
GHCMA	Glenelg Hopkins Catchment Management Authority
GPS	Global Positioning System
ha	Hectare/s
intro.	Introduced
km	Kilometre/s
m	Metre/s
min	Minute/s
JAMBA	Japan-Australia Migratory Bird Agreement
NCR	Nature Conservation Reserve
NRC	National Research Council
NTGVVP	Natural Temperate Grasslands of the Victorian Volcanic Plain
NVIM	Native Vegetation Information Management system
NVMF	Native Vegetation Management Framework
NWCC	National Wind Coordinating Committee
OMNR	Ontario Ministry of Natural Resources
PVA	Population Viability Assessment
RDZ1	Road Zone Category 1
RoI	Radius of Investigation
RSA	Rotor Swept Area

SHWTLP	Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains
VBA	Victorian Biodiversity Atlas
Vic	Victoria
VROTS	Victorian Rare or Threatened Species
VVP	Victorian Volcanic Plain bioregion
WBPGWFC	Western Basalt Plains (River Red Gum) Grassy Woodland Floristic Community
WPGC	Western (Basalt) Plains Grassland Community

1 EXECUTIVE SUMMARY

WestWind Energy Pty Ltd engaged Brett Lane & Associates Pty Ltd (BL&A) to conduct flora and fauna assessments of the proposed Golden Plains Wind Farm (GPWF). This report has been specifically prepared to accompany the referral under the *Environment Effects Act 1978.* It presents the results of all flora and fauna investigations undertaken between July 2016 and April 2017, which is a significant proportion of the investigations currently underway to inform the development application for the project later in 2017. This report will be revised following the additional work and will accompany the planning permit application.

As the complete flora and fauna assessments will be presented in the development application, the current report is to assist the Minister for Planning in deciding if an Environment Effects Statement is required under the Victorian *Environment Effects Act 1978* (EE Act). It does not include information to address the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), other than reference to the presence of any matters of national environmental significance. This information will be presented in a separate Referral under that Act.

The proposed GPWF comprises about 17,345 hectares of land in the Golden Plains Shire. The proposed wind farm comprises up to 235 turbines, access tracks, underground cabling and associated infrastructure, such as temporary site office, temporary batching plant, collector stations, temporary construction compounds and a substation (see Figure 1 below). The access tracks on the wind farm site connect to the public road network at a number of points. The Golden Plains Wind Farm (GPWF) is described in more detail in Section 3 below.

A separate report has been prepared to assess the impact of the proposed wind farm on the state-threatened Brolga (BL&A 2017).

The results and conclusions from this investigation are summarised below under the following headings:

- Vegetation Assessment (Section 5)
- Fauna Overview Assessment (Section 6)
- Bird Utilisation Surveys (Section 7)
- Bat Assessment (Section 8)
- Striped Legless Lizard Surveys (Section 9)

1.1 Vegetation Assessment

The current proposed footprint will result in the loss of a total 'extent' of 81.29 hectares of native vegetation. This constitutes area small proportion of the native vegetation within the larger wind farm site.

Offsets required to compensate for the proposed removal of native vegetation from the study area include 2.698 *general* biodiversity equivalence units and specific offsets of varying amounts for 12 DELWP listed species.

The proposed wind farm footprint will result in the loss of 10.08 hectares of the FFG Act listed community Western (Basalt) Plains Grassland (WBPG).

The proposed wind farm footprint will remove EPBC Act listed communities:

- 49.52 hectares of NTGVVP;
- 2.54 hectares of SHWTLP; and
- 0.56 hectares of GEWVVP.

As the development footprint has been derived in accordance with the 'avoid' and 'minimise' principles, the majority of the best grassland habitat has been avoided and will be retained. The residual impact, involving the removal of 81.29 hectares, represents less than one percent of the entire area of the wind farm site and less than two percent of the native vegetation on the site.

The proposed wind farm will impact potential habitat for the following EPBC Act and FFG Act listed flora species:

- Small Milkwort (FFG Act listed);
- Small Scurf-pea (FFG Act listed);
- Tough Scurf-pea (FFG Act listed);
- Small Golden Moths (EPBC Act listed (endangered), FFG Act listed);
- Clumping Golden Moths (FFG Act listed);
- Trailing Hop-bush (EPBC Act listed (vulnerable));
- Clover Glycine (EPBC Act listed (vulnerable), FFG Act listed);
- White Sunray (EPBC Act listed (endangered), FFG Act listed);
- Spiny Rice-flower (EPBC Act listed (critically endangered), FFG Act listed);
- Shelford Leek-orchid (FFG Act listed);
- Fragrant Leek-orchid (EPBC Act listed (endangered), FFG Act listed);
- Hairy Tails (FFG Act listed);
- Button Wrinklewort (EPBC Act listed (endangered), FFG Act listed);
- Large-headed Fireweed (EPBC Act listed (endangered), FFG Act listed);
- Swamp Fireweed (EPBC Act listed (vulnerable));
- Basalt Sun-orchid (FFG Act listed); and
- Swamp Everlasting (EPBC Act listed (vulnerable), FFG Act listed).

Targeted surveys in areas of suitable habitat for these listed flora species have been undertaken in May 2017 for Spiny Rice-flower and will be undertaken in October and December 2017 for spring/summer flowering species so that the impact of the proposed project on these species can be fully considered by the responsible authority as part of the planning permit application assessment process.

Micrositing within a radius of 100m from the current proposed turbines locations will minimise impacts should any of these species be found during the surveys. Residual impacts on these species will be offset accordingly.

1.2 Fauna Assessment

The majority of the wind farm site comprises agricultural land which is of low quality for fauna due to its extensive modification and the removal of most habitat elements. Small areas that have not been used agriculturally including planted trees, higher quality

grassland (for example on roadsides) or rocky outcrop, wetlands and creek lines on the wind farm site do provide moderate to high quality habitat for fauna species.

Based on existing information and an overview assessment in 2016, 56 listed fauna species were identified as having the potential to occur in the radius of investigation.

Following further investigations, 11 of these species, including seven birds, one mammal, one reptile, one frog and one invertebrate, were considered to have potential to occur within the wind farm site due to the presence of suitable habitat or the species being recorded during the overview assessment or targeted surveys.

The majority of threatened birds recorded or considered likely to occur at the wind farm site are waterbirds. Given the limited availability of wetland habitat on the site and that waterbirds were not common during the BUS, no significant impacts are expected from the proposed wind farm.

In addition, the Swift Parrot may occasionally forage on flowering Sugar Gum. The infrequency and likely small numbers of this species on the wind farm site make a significant impact from the project highly unlikely.

The migratory (non-threatened) White-throated Needletail and Gull-billed Tern have the potential to occasionally fly across the wind farm site. White-throated Needletails often fly at rotor swept area heights and occasionally collide in small numbers with turbines. The numbers of birds affected is small and would not significantly affect the wider population of this non-threatened, migratory species. The Gull-billed Tern flies over wetlands and grasslands in search of food. It is unlikely that this species occurs regularly or in significant numbers on the wind farm site so the proposed development is unlikely to pose a significant risk to this species. Furthermore, turbines, tracks and other infrastructure are located at least 30 metres from almost all wetlands and waterways to avoid significant impacts on these habitats.

One species of migratory shorebird (Latham's Snipe) has the potential to occur in the wind farm site based on this initial investigation due to the presence of suitable habitat. This species spends most of its time in wetlands. The limited extent and quality of wetland habitat within the wind farm site make it highly unlikely that an important population of this species resides on the wind farm site. No other migratory shorebirds are expected to regularly occur in the study area.

The Yellow-bellied Sheathtail Bat was recorded in very low numbers in the study area during targeted bat surveys (see Section 1.4 for more details).

Targeted Striped Legless Lizard and Fat-tailed Dunnart surveys were undertaken in 2016. These two species were recorded in native grassland habitats in the study area (see Section 1.5 for more details).

The Growling Grass Frog was recorded from some of the higher quality wetlands in the study area. These wetlands are not to be impacted by the wind farm construction and operation since most of the habitat lies within a turbine exclusion buffer to minimise impacts on Brolga. Four turbines are located within the flood extents with the closest wind turbine being a minimum of 85 metres away from waterways. No infrastructure will be placed within 100 metres of confirmed Growling Grass Frog wetland sites.

The Golden Sun Moth was recorded in the study area and has the potential to occur throughout in suitable native grassland habitats. These habitats will be avoided where possible, in the case that these habitats are not able to be avoided the amount of habitat to be removed will be minimised and offset.

Three fish species listed under the EPBC Act and/or FFG Act, Australian Grayling, Dwarf Galaxias and Yarra Pygmy Perch, had potential to occur within the 10 km Radius of Investigation (RoI). None of these species was considered likely to occur on the wind farm site due to a lack of suitable permanent waterway habitat.

Three *EPBC Act* listed fauna species were detected during the fauna surveys, the Striped Legless Lizard, Growling Grass Frog and Golden Sun Moth.

No species listed under the *EPBC Act* Migratory Species list have been recorded at the wind farm site.

Five *FFG Act*-listed fauna species were confirmed as occurring in the study area during fauna assessments: Brolga, Yellow-bellied Sheathtail Bat, Striped Legless Lizard, Growling Grass Frog and Golden Sun Moth.

1.3 Bird Utilisation Surveys

Two Bird Utilisation Survey (BUS) undertaken during summer and autumn 2017 indicated that the most abundant species frequenting the proposed wind farm were common farmland birds as follows:

- House Sparrow
- Common Starling
- Australian Magpie
- Little Raven and
- White-plumed Honeyeater.

Almost all birds counted (97.5%) flew below the proposed Rotor Swept Area (RSA) height (RSA height = 40 to 190 metres).

The number of Wedge-tailed Eagle recorded over the study area of the proposed wind farm site was low with an average of 0.2 percent of all birds recorded. Risks to this species are therefore considered to be low.

Raptors made up 1 percent of all individual birds observed during the survey.

Waterbirds were not common during the BUS, reflecting the limited availability of wetland habitat on the site. They comprised 1.1 percent of all birds recorded.

The proposed wind farm is unlikely to have a significant impact on the common bird species, raptors and waterbirds utilising the wind farm site.

1.4 Bat Assessment

The bat survey was conducted over the period from 24th January to 8th February 2017. The recording of bat calls was undertaken over 16 consecutive nights. During the survey period, seven SongMeter recording units were operated concurrently at six recording sites. This included two detectors set up at the wind monitoring mast from the ground underneath the mast, and at 45 metres above the ground).

A total of 109 detector-nights of recording were made from seven sampling points across the proposed Golden Plains Wind Farm and nearby areas, totalling 872 detector-hours.

One site was devoted entirely to recording bat movements and flight heights at the wind mast. At the wind mast two concurrent recordings were made.

The remaining five sites were distributed over the wind farm site and nearby area covering a variety of habitats.

Seven individual species of bats were recorded: six were common, secure and widespread species, one was a threatened bat (Yellow-bellied Sheathtail Bat); additionally a further four multi-species complexes were recorded (Eastern Bentwing Bat/Forest Bat, Forest Bat sp., Long-eared Bat sp. and Freetail Bat *Mormopterus* sp.), The Eastern Bentwing Bat is listed as threatened in Victoria.

The vast majority of bat activity was attributable to common and widespread species.

The threatened species were recorded on very few nights with very low numbers of calls compared with most other species – a total of 12 calls were attributable to threatened species out of over 6,000 recordings (11 to the Yellow-bellied Sheathtail Bat and one to the species complex that included the Eastern Bentwing Bat).

Of all bat calls from the two different heights at the wind mast, 4.1 percent were recorded 45 metres above ground, and the remaining 95.9 percent from the ground.

The only species recorded from a height of 45 metres were the Gould's Wattled Bat and Long-eared Bat sp. (*Nyctophilus* sp.).

The vast majority of bat species calls (including threatened species) were recorded from close to the ground, indicating that most of the time, most of these species would avoid collision with operating turbines.

Furthermore, threatened species were recorded infrequently (twelve times out of a total of over 6,000 recordings during the survey) and not at turbine RSA height. At this low level of activity, collision risk is considered very low and no significant impact is expected on their populations.

1.5 Striped Legless Lizard Surveys

Ten tile grids survey sites were laid out to detect Striped Legless Lizard, listed as *vulnerable* under the EPBC Act, listed as threatened under the FFG Act and as *endangered* on DELWP's threatened species advisory list.

An established population of Striped Legless Lizard was detected across the proposed wind farm. A total of 45 observations of Striped Legless Lizard were recorded during the tile grid survey with at least one observation occurring at every tile grid location. The species was observed at each tile grid, along with additional vertebrate species, such as Tussock Skink and Fat-tailed Dunnart (both listed as *Lower Risk - Near Threatened* on DELWP's threatened species advisory list).

Impacts on the population of this species in the Golden Plains Wind Farm study area are not expected to be significant as the development footprint is to be confined to a small percentage of the thousands of hectares of habitat in the area. Mitigation measures to avoid any significant impacts upon the species are provided. The application of the 'avoid' and 'minimise' principles in relation to native vegetation removal for the project (see Section 5) have greatly assisted in reducing the area of habitat affected by the project.

Consideration should be given to implementing a salvage protocol to translocate individuals to adjacent, retained areas of grassland habitat in areas of higher quality habitat to be removed during construction of the proposed wind farm.

2 INTRODUCTION

WestWind Energy Pty Ltd engaged Brett Lane & Associates Pty Ltd (BL&A) to conduct flora and fauna assessments of the proposed Golden Plains Wind Farm (GPWF). This report has been specifically prepared to accompany the referral under the *Environment Effects Act 1978.* It presents the results of all flora and fauna investigations undertaken between July 2016 and April 2017, which is a significant proportion of the investigations currently underway to inform the development application for the project later in 2017. This report will be updated with the results of the additional work and will accompany the planning permit application.

As the complete flora and fauna assessments will be presented in the development application, the current report is to assist the Minister for Planning in deciding if an Environment Effects Statement is required under the Victorian *Environment Effects Act 1978* (EE Act). It does not include information to address the Commonwealth EPBC Act, other than reference to the presence of any matters of national environmental significance. This information will be presented in a separate Referral under that Act.

2.1 Proposed development

The proposed GPWF comprises about 17,345 hectares of land in the Golden Plains Shire. The proposed wind farm comprises up to 235 turbines, access tracks, underground cabling and associated infrastructure, such as temporary site office, temporary batching plant, collector stations, temporary construction compounds and a substation (see Figure 1 below). The access tracks on the wind farm site connect to the public road network at a number of points. The Golden Plains Wind Farm (GPWF) is described in more detail in Section 3 below.

2.2 Scope and timeline of the surveys

The works undertaken to investigate and document the flora and fauna of the study area were conducted between July 2016 and April 2017. It is anticipated that surveys will be ongoing over the next months to provide further information to inform the planning process.

Key elements of the BL&A work undertaken for the project are presented in this report as follows.

- Section 5: Vegetation Assessment
- Section 6: Fauna Overview Assessment
- Section 7: Bird Utilisation Surveys
- Section 8: Bat Assessment
- Section 9: Striped Legless Lizard Surveys

The Brolga assessment overview has been incorporated into a separate report titled “Brolga Assessment Overview” – Report 16064 (2.0) (BL&A 2017).

Table 1 shows the timing of all flora and fauna field surveys undertaken for this project in 2016 and 2017.

Table 1: Timing of all flora and fauna assessments

	Month	Flora Overview	Native Vegetation	Targeted Flora	Bird Utilisation	Bat Surveys	Striped Legless Lizard	Brolga
2016	J							
	F							
	M							
	A							
	M							
	J							
	J							
	A							
	S							
	O							
	N							
	D							
2017	J							
	F							
	M							
	A							
	M							
	J							
	J							
	A							
	S							
	O							
	N							
	D							

Note: Pale fill represents planned work, the results of which will be presented as part of the development application process.

These assessments were undertaken by a team from BL&A, comprising Elinor Ebsworth (Senior Ecologist), Justin Sullivan (Senior Ecologist), Davide Coppolino (Senior Ecologist), Brett Macdonald (Senior Ecologist), Verity Fyfe (Botanist), Greg Cranston (Botanist), Jackson Clerke (Zoologist), Khalid Al-Dabbagh (Zoologist), Teisha Lay (Zoologist), Curtis Doughty (Senior Zoologist), Bernard O'Callaghan (Senior Ecologist & Project Manager), Inga Kulik (Senior Ecologist & Project Manager) and Brett Lane (Principal Consultant).

Figure 1: Location of Golden Plains Wind Farm

See Volume B

3 SITE DESCRIPTION

3.1 Landscape overview

The Golden Plains Wind Farm will be located at Barunah Park, Werneth and Rokewood, approximately 60 kilometres North West of Geelong, Victoria (Figure 1). It is primarily bounded to the north by the Rokewood-Shelford Road, Wingeel Road in the east, Cressy-Shelford Road and Ledwell Lane to the south and Pitfield-Cressy Road to the west. The proposed Golden Plains Wind Farm is in the Golden Plains Shire local government area, the Corangamite Catchment Management Authority (CCMA) region and the Victorian Volcanic Plains bioregion.

The wind farm site supports an undulating landscape dissected by drainage lines, with basalt outcrops associated with the volcanic geology of the area. Basalt outcrops feature more heavily in the south-east of the site than the north-west. The main waterways that traverse the site are Ferrers Creek, Mia Mia Creek, Kurac a Rac Creek (Meadows Creek) and Mount Misery Creek (also known as Little Woady Yallock Creek), while several ephemeral and unnamed watercourses were also noted.

Pre–European EVC mapping (DELWP 2016b) indicated that the majority of the site would originally have been a mosaic of Plains Grassland (EVC 132) and Plains Grassy Wetland (EVC 125) in lower-lying areas. Riparian Woodland (EVC 641), Creekline Grassy Woodland (EVC 68) or Swamp Scrub (EVC 53) would have occurred along the major drainage lines, with Plains Grassy Woodland (EVC 55) on the adjacent plains. In the north-west of the study area Grassy Woodland (EVC 175) would have occurred near the bioregional boundary with the Central Victorian Uplands.

Most the study area is used for agriculture, with a combination of cropping (cereal and canola) and livestock (primarily sheep) grazing. This land use pattern has meant that on private land in many areas in the south-east of the site a mosaic of remnant vegetation associated with rocky areas often persists surrounded by areas cropped or sown to pasture. In the north-west of the site remnant native vegetation is found more often as large blocks dedicated to grazing which have not been cropped or improved. The vegetation on private land varies in quality between areas that have been heavily grazed and may only support one or two indigenous species, and large areas of high-quality native vegetation with excellent species diversity.

The site includes several roadsides, and some of these (particularly where a wider road reserve exists) support high-quality remnant native vegetation, including threatened species records (both historic and taken incidentally during the current investigation).

3.2 Proposed development

The proposed Golden Plains Wind Farm will be located on a site of 17,345 hectares. It is estimated that the total area of all wind farm infrastructure will be around 178 hectares which will cover approximately 1% of the total site.

The GPWF is planned as follows:

- Up to 235 wind turbines
- Wind turbine capacity - 3-5 Megawatts (MW)
- Wind turbine height - up to 230m from the natural ground level to the tip
- Wind turbine rotor - in the order of 150m in diameter

- Wind turbine lower rotor sweep - 40m from the natural ground level.
- Total installed capacity - Approximately 800 MW

The following infrastructure will support the Golden Plains Wind farm:

- Total length of access tracks 152 km
- Length of underground cables 207 km
- Length of above ground cables 26 km
- Proposed permanent meteorological masts (anemometers) – 6
- Number of collector stations – 4
- Number of terminal stations – 1
- Batching plant
- Temporary and permanent site offices
- Amenities

Wind turbine foundations will be:

- Concrete gravity foundations or rock anchor foundations (subject to final geotechnical assessment).
- Depth: approx. 3.5m
- Diameter: considering an octagonal design, approx. 20m across faces

The wind farm layout has been adjusted to avoid, where practicable, and minimise impacts on important native vegetation and fauna habitats on the site. All land within the site is currently used for agriculture and will continue to be used for this purpose during and after wind farm construction.

The internal transmission lines will connect the wind farm to the 500 kV powerline that bisects the site. In total these will be 26 km in length. They will be monopole configurations with the lowest insulators approximately 12.4m above ground and the highest wire mount on each pole no higher than 21m above ground. There will be sections with only three wires attached to poles and other sections with 6 wires attached to the poles. These lines will collect the electricity from the four collector stations and transmit it to the large terminal station. Poles will be approximately 150 - 180m apart on average.

4 REGULATORY CONTEXT

4.1 National Legislation

4.1.1 *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*

The EPBC Act protects a range of matters of national environmental significance and matters protected by international treaties. These matters include a list of threatened species, ecological communities and migratory species that are considered to be of national conservation significance. Any impact on such species or ecological communities which is considered significant requires the approval of the Federal Minister for the Environment.

The Golden Plains Wind Farm proposal will be referred under the EPBC Act as a controlled action. This referral will be submitted in May 2017.

4.2 State Legislation / Policy

4.2.1 *Flora and Fauna Guarantee (FFG) Act 1988*

The Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) lists threatened and protected species and ecological communities (DELWP 2015a, DELWP 2015b). The *FFG Act* has limited direct application to private land.

Any removal of threatened flora species or communities (or protected flora) listed under the FFG Act from public land requires a permit under the Act, obtained from DELWP. Application forms for Protected Flora Permits can be obtained from DELWP offices or from their customer service centre or website. Should listed species or communities be affected by access points on public roads, a permit under this Act will be required for their removal. Assessments in winter, spring and summer 2017 will confirm if such a permit is required.

4.2.2 *Environment Effects Act 1978*

Under the EE Act, proponents of projects that meet certain criteria (DSE 2006) are required to prepare a Referral to the Minister for Planning, who will determine if an Environment Effects Statement (EES) is required for the project. The 2006 criteria determine whether a project needs to be referred; it is the Minister's decision on a case-by-case basis whether an EES is required.

An EES is a process that integrates all project approvals, ensures that environmental effects are adequately investigated and mitigated, and provides for more extensive community consultation for assessing the development application.

The Golden Plains Wind Farm proposal has been referred to the Minister for Planning to determine whether an EES is required for this project. This report is specifically written to accompany the EES Referral.

4.2.3 *Planning and Environment Act 1987*

State Planning Policy Framework

State planning provisions are established under the Victorian *Planning and Environment Act 1987*. This section discusses planning provisions in the local planning scheme applicable to flora and fauna.

Under Clause 52.17 of all Victorian Planning Schemes a planning permit is required for the destruction, lopping or removal of native vegetation on land which has an area of 0.4 hectares or more (together with all contiguous land in single ownership). This includes the removal of dead trees with a DBH (diameter at breast height of 1.3 metres) of 40 centimetres or more and any individual scattered native plants.

Before issuing a planning permit, Responsible Authorities must refer to Clause 12.01 (Biodiversity) in the Planning Scheme. This refers in turn to the following online tool and document:

- The Native Vegetation Information Management system (NVIM) (DELWP 2016a) — a database administered by DELWP; and
- *Permitted clearing of native vegetation – Biodiversity assessment guidelines* (DEPI 2013).

A planning permit under Clause 52.17 of the Golden Plains Planning Scheme is required for the removal of native vegetation associated with the development of the wind farm.

The application of the *Native Vegetation Information Management* system (NVIM) (DELWP 2016a) and *Permitted clearing of native vegetation – Biodiversity assessment guidelines* (the 'Guidelines') (DEPI 2013) are explained further in Appendix 1: Details of the Guidelines assessment process

Clause 66.02 of the planning scheme determines the role of DELWP in the assessment of native vegetation removal permit applications. If an application is referred, DELWP may make certain recommendations to the responsible authority in relation to the permit application. An application to remove native vegetation must be referred to DELWP in the following circumstances:

- Applications where the native vegetation to be removed is 0.5 hectares or more (this does not apply to removal of scattered trees only);
- All applications in the high risk-based pathway;
- Applications where a property vegetation plan applies to the site; and
- Applications on Crown land which is occupied or managed by the responsible authority.

Local planning policy framework

The study area is located within the Golden Plains Shire local government area. It is currently zoned Farm Zone in the shire Planning Scheme. It is located within a Bushfire-prone Area.

Local planning provisions apply under the Victorian *Planning and Environment Act 1987*.

Local Planning Policies

Local Planning Policy 21.04: Environment and Natural Resources in the Golden Plains Planning Scheme is relevant to the current investigation. One objective of this LPP is to encourage the protection of significant habitats, remnant vegetation and maintain bio-diversity.

This is implemented through the application of overlays, including Environmental Significance, Vegetation Protection and Significant Landscape overlays (see below).

Overlays

The study area is subject to three overlays in the Golden Plains Shire Planning Scheme which are relevant to this assessment. The purpose of these overlays is discussed below.

Environmental Significance Overlay Schedule 2 (ESO2): Watercourse protection

Within the site this overlay occurs along the Mount Misery, Kuruk-a-ruk and Ferrers Creeks (Figure 2).

Requirement for a permit: Under ESO2 a permit is required to remove, destroy or lop any vegetation, including dead vegetation.

Decision guidelines: Before deciding on an application for a permit, the responsible authority must consider, as appropriate:

- Existing use of land and the reason for the development in relation to that use;
- Possible effect of the development on the quality and quantity of water;
- Potential for flooding to occur;
- Conservation of natural terrestrial and aquatic habitats;
- Preservation of and the impact on soils and the need to prevent erosion;
- Protection of the area for its recreational value;
- Effect of any development on the flow of flood waters and flood control measures;
- Need to prevent or reduce the concentration of diversion of floodwater or stormwater;
- Conservation of natural habitats and the preservation of native fauna, fish and other aquatic life;
- Proper management of the land as a watercourse area; and
- The need for fencing off of waterways and other land management measures.

Vegetation Protection Overlay Schedule 1 (VPO1): Western Plains Grasslands

Within the study area this overlay occurs along Geggies Road (Figure 2).

Requirement for a permit: Under VPO1 a permit is required to remove, destroy or lop areas of remnant grasslands that are significant for their representative nature of the Western Plains Grasslands.

Decision guidelines: Before deciding on an application for a permit, the responsible authority must consider, as appropriate:

- The conservation and enhancement of the area;
- The preservation of, and impact on, the natural environment, vegetative or landscape values;
- The role of native vegetation in conserving the flora and fauna and in the provision of food and habitat; and
- The objectives of and, any recommendations made under, the Flora and Fauna Guarantee Act

Vegetation Protection Overlay Schedule 2 (VPO2): Bushland Reserves and Roadside Vegetation Areas

Within the study area this overlay occurs within bushland reserves and government road reserves and along the Rokewood-Shelford Road (Figure 2).

Requirement for a permit: Under VPO2 a permit is required to remove, destroy or lop significant remnant vegetation located within bushland reserves and government road reserves. Such areas include significant species of rare and endangered flora and fauna species of regional significance.

Decision guidelines: Before deciding on an application for a permit, the responsible authority must consider, as appropriate:

- The conservation and enhancement of the area;
- The preservation of, and impact on, the natural environment, vegetative or landscape values;
- The role of native vegetation in conserving the flora and fauna and in the provision of food and habitat;
- The need to retain native vegetation if it is rare or supports rare species of flora or fauna and where it forms part of a wildlife corridor;
- Whether provision is made or is to be made to establish and maintain vegetation elsewhere on the land; and
- The sensitive siting and construction of driveways and crossings over roadsides.

Works in roadside areas will have regard to the need to undertake preventative measures to prevent the spread of pest plants.

4.3 Local laws and regulations

Section 111, Part 5 of the *Local Government Act 1989* gives authority to local governments to make local laws for or with respect to any act, matter or thing that it has jurisdiction over under any Act.

There are no Golden Plains Shire local laws relevant to the biodiversity impacts of the proposed wind farm.

4.4 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 applied in formulating the investigations of flora and fauna impacts described in this report. These include:

- AusWEA (2005) *Wind Farms and Birds: Interim Standards for Risk Assessment*. Australian Wind Energy Association.
- Environment Protection and Heritage Council (2011) *Draft National Wind Farm Development Standards*. EPHC, Adelaide.
- DELWP (2016b) *Policy and planning guidelines for the development of wind energy facilities in Victoria.* DELWP, Melbourne

- DSE (2012) *Interim Guidelines for the Assessment, Avoidance, Mitigation and Offsetting of Potential Wind Farm Impacts on the Victorian Brolga Population*. Victorian Government (DSE), East Melbourne.
- Clean Energy Council (2013) *Best Practice Guidelines for Implementation of Wind Energy Projects in Australia*. Clean Energy Council.

Figure 2: Relevant Planning Overlays

See Volume B

5 VEGETATION ASSESSMENT

KEY FINDINGS

- The current proposed footprint will result in the loss of a total 'extent' of 81.29 hectares of native vegetation. This constitutes a small proportion of the native vegetation within the larger wind farm site (less than 2%).
- Offsets required to compensate for the proposed removal of native vegetation from the study area include 2.698 *general* biodiversity equivalence units and specific offsets of varying amounts for 12 DELWP listed species.
- The proposed wind farm footprint will result in the loss of 10.08 hectares of the FFG Act listed community Western (Basalt) Plains Grassland (WBPG).
- The proposed wind farm footprint will remove EPBC Act listed communities:
    - 49.52 hectares of NTGVVP;
    - 2.54 hectares of SHWTLP; and
    - 0.56 hectares of GEWVVP.
- As the development footprint has been derived in accordance with the 'avoid' and 'minimise' principles, the majority of the best quality grassland habitat has been avoided and will be retained. The residual impact, involving the removal of 81.29 hectares, represents less than one percent of the entire area of the wind farm site and less than two percent of the native vegetation on the site.
- The proposed wind farm will impact potential habitat for the following EPBC Act and FFG Act listed flora species:
    - Small Milkwort;
    - Small Scurf-pea;
    - Tough Scurf-pea;
    - Small Golden Moths;
    - Clumping Golden Moths;
    - Trailing Hop-bush;
    - Clover Glycine;
    - White Sunray;
    - Spiny Rice-flower;
    - Shelford Leek-orchid;
    - Fragrant Leek-orchid;
    - Hairy Tails;
    - Button Wrinklewort;
    - Large-headed Fireweed;
    - Swamp Fireweed;
    - Basalt Sun-orchid; and

KEY FINDINGS

- Swamp Everlasting.

Targeted surveys in areas of suitable habitat for these listed flora species will be undertaken so that the impact of the proposed project on these species can be fully considered by the responsible authority as part of the planning permit application assessment process.

- Micrositing within a radius of 100m from the current proposed turbines locations will minimise impacts should any of these species be found during the surveys. Residual impacts on these species will be offset accordingly.

5.1 Introduction

The aim of the vegetation surveys was to identify native vegetation and ascertain whether EPBC Act and FFG Act listed threatened flora species have the potential to be present in the GPWF development footprint. The information from these surveys has been used to inform the proposed wind farm layout to avoid and minimise native vegetation removal in accordance with the Guidelines. The vegetation surveys to date have provided an overview of the occurrence of habitats for threatened flora species within the wind farm footprint. Targeted flora surveys during the appropriate seasons will be undertaken in proposed impact areas that are suitable habitat for threatened flora species.

This section of the report presents the results of the vegetation survey. The methods used and sources of information are considered first. The native vegetation that lies within the investigation area is then described, including vegetation mapping. The impacts on vegetation and potential impacts to threatened species are considered next, followed by mitigation measures for reducing the impacts of the project. Implications of the project under applicable legislation and planning policies are also summarised.

For the purposes of assessing the impacts of the project on vegetation and threatened flora species, the layout provided on 7th April 2017 and described in Section 3.2 was used.

5.2 Methods

This section describes the methods used for the vegetation survey and determination of the presence of habitat for listed flora species, including sources of information reviewed to ensure a comprehensive consideration of native vegetation and flora species was undertaken.

The Victorian Government is currently undertaking a review of the native vegetation regulations, with a modified system scheduled to come into effect later in 2017. In light of the proposed changes, native vegetation and flora assessments have been undertaken to meet the requirements of both the current *Permitted clearing of native vegetation: Biodiversity assessment guidelines* (DEPI 2013) and the *Native Vegetation Clearing: Draft Assessment Guidelines* (DELWP 2016).

5.2.1 *Existing information*

Existing information used for this investigation is described below. Existing information was reviewed both at the wind farm site scale, and an area termed the 'region of

interest' (ROI), defined here as an area with a radius of ten kilometres from the approximate site boundary; a polygon with the following coordinates:

- latitude 37˚ 53' 19" S and longitude 143˚ 40' 31" E
- latitude 37˚ 58' 04" S and longitude 143˚ 54' 05" E
- latitude 38˚ 00' 45" S and longitude 143˚ 54' 35" E
- latitude 38˚ 00' 48" S and longitude 143˚ 44' 49" E
- latitude 37˚ 57' 35" S and longitude 143˚ 40' 35" E
- latitude 37˚53' 19" S and longitude 143˚ 40' 31" E

Native vegetation

Pre-1750 (pre-European settlement) vegetation mapping administered by DELWP was reviewed to determine the type of native vegetation likely to occur in the wind farm site and surrounds. Information on Ecological Vegetation Classes (EVCs) was obtained from published EVC benchmarks. These sources included:

- Biodiversity Interactive Maps (DELWP 2016b); and
- Relevant EVC benchmarks for the Victorian Volcanic Plains bioregion[1] (DELWP 2015c).

Existing flora species records and information about the potential occurrence of listed matters was obtained for the ROI.

A list of the flora species recorded in the ROI was obtained from the Victorian Biodiversity Atlas (VBA), a database administered by DELWP (2016c).

The 'Vegetation/Modelled FFG Act Communities' layer in DELWP's Biodiversity Interactive Map (DELWP 2016a) was consulted to determine which ecological communities listed as threatened under the FFG Act were modelled to potentially occur in the ROI.

The online *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (Department of the Environment 2016) was consulted to determine whether nationally listed species or communities potentially occurred in the ROI based on habitat modelling.

5.2.2 *Field methods*

A vegetation overview assessment was undertaken within the initial site boundary (the 'southern section') (see Figure 3) in August 2016. Since this time, the proposed GPWF has undergone several layout changes in response to the findings of flora and fauna studies, cultural heritage investigation, landowner consultation and operational considerations (see Appendix 2). These included an amendment to the site boundary to incorporate an additional area to the north-west (the 'northern section') of the initial proposed site boundary. This has resulted in an overview vegetation assessment (of all vegetation) being conducted within the southern section, and detailed vegetation assessment (habitat scoring of the development footprint) having been completed for the current layout, in addition to several previous layout iterations in both the southern and

[1] A bioregion is defined as "a geographic region that captures the patterns of ecological characteristics in the landscape, providing a natural framework for recognising and responding to biodiversity values". In general bioregions reflect underlying environmental features of the landscape (DNRE 1997).

northern sections. The entire area in which detailed vegetation surveys have been undertaken, referred to hereafter as the investigation area, is shown in Figure 3 and includes the working layouts provided on the following dates:

- 25th November 2016;
- 20th February 2017;
- 22nd February 2017;
- 27th February 2017;
- 3rd March 2017;
- 22nd March 2017;
- 29th March 2017;
- 30th March 2017;
- 31st March 2017; and
- 7th April 2017.

Vegetation field assessments were conducted during the following periods:

- Overview vegetation assessment within the southern section 9th August 2016 – 18th August 2016;
- Detailed vegetation assessment within proposed layout for the northern section 24th November 2016 – 7th December 2016;
- Detailed vegetation assessment within the proposed layout (across the entire site) 20th February 2017 – 10th March 2017; and
- Detailed vegetation assessment within the current footprint (due to minor layout changes) 4th – 5th April 2017.

During these assessments, the investigation area was surveyed initially by vehicle and areas supporting remnant native vegetation were inspected in more detail on foot.

Sites in the investigation area found to support native vegetation or with potential to support listed matters were mapped. Mapping was undertaken through a combination of aerial photograph interpretation and ground-truthing using a hand held GPS (accurate to approximately five metres). Species and ecological communities listed as threatened under the EPBC Act or FFG Act (where they occurred on public land) were also mapped using the same method.

Native vegetation

Native vegetation is currently defined in the Victoria Planning Provisions as 'plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses'. The *Biodiversity assessment guidelines* define native vegetation as belonging to two categories (DEPI 2013):

- Remnant patch; or
- Scattered trees.

The definitions of these categories are provided below, along with the prescribed DELWP methods to assess them.

Remnant patch

A remnant patch of native vegetation is either:

- An area of native vegetation where at least 25 per cent of the total perennial understorey plant cover is native; and/or
- Any area with three or more native canopy trees[2] where the canopy foliage cover[3] is at least 20 per cent of the area.

Remnant patch condition is assessed using the habitat hectare method (Parkes *et al*. 2003; DSE 2004) whereby components of native vegetation (e.g. tree canopy, understorey and ground cover) are assessed against an EVC benchmark. The score effectively measures the percentage resemblance of the vegetation to its original condition.

The NVIM system (DELWP 2016a) provides modelled condition scores for native vegetation to be used in certain circumstances (see Appendix 1).

The condition score assists in defining the biodiversity equivalence score of the native vegetation and the offset targets if removal of native vegetation is approved (see Appendix 1 for details of how scoring works).

Mapped Wetlands

Under the guidelines, all wetlands mapped on DELWP's current wetland layer are treated as a remnant patch. DELWP mapped wetlands were examined to determine their hydrological condition, and included as a remnant patch where it was determined that the wetland could still be inundated (i.e. the wetlands had not been permanently drained). In these cases, the DELWP modelled score was applied to these areas.

On-ground assessments of these areas were undertaken to determine if any vegetation present met the criteria for any listed ecological community.

Scattered trees

The *Biodiversity assessment guidelines* define scattered trees as a native canopy tree[2] that does not form part of a remnant patch of native vegetation.

Scattered trees are counted, the species identified and their DBH (diameter at breast height or 1.3 metres above ground) measured or estimated.

Flora species and habitats

Records of flora species were made in conjunction with sampling methods used to undertake habitat hectare assessments of native vegetation described above. Specimens requiring identification using laboratory techniques were collected.

Species protected under the FFG Act were determined by crosschecking against the FFG Act Protected Flora List (DELWP 2015a).

The potential for habitats to support listed flora species was assessed based on the criteria outlined below:

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[2] A canopy tree is a reproductively mature tree that is greater than 3 metres in height and is normally found in the upper layer of the relevant vegetation type.
[3] Foliage cover is the proportion of the ground that is shaded by vegetation foliage when lit from directly above.

- The presence of suitable habitat for flora species such as soil type, floristic associations and landscape context; and
- The level of disturbance of suitable habitats by anthropogenic disturbances and invasions by pest plants and animals.

Wherever appropriate, a precautionary approach was adopted in determining the likelihood of occurrence or flora listed under the EPBC Act and/or FFG Act. That is, where insufficient evidence was available on the potential occurrence of a listed species, it was assumed that it could be in an area of suitable habitat.

Threatened ecological communities

The investigation area was assessed against published descriptions of relevant listed ecological communities modelled to potentially occur in the study area.

Reviewed ecological community descriptions comprised identification criteria and condition thresholds from listing advice for EPBC Act communities as well as FFG Act listed community descriptions (SAC 2015).

Limitations of vegetation assessments

The site assessments were carried out in winter, spring, late summer and early autumn. The short duration and seasonal timing of field assessments can result in some species not being detected when they may occur at other times. Additionally, some flora species and life-forms may be undetectable at the time of the survey or unidentifiable due to a lack of flowers or fruit. The survey covered a number of seasons, including an average to above average rainfall period in winter and spring 2016. For these reasons the state of vegetation during surveys was considered suitable to ascertain the extent and condition of native vegetation for assessment under the Guidelines and for identification of threatened ecological communities.

As the overview assessment was undertaken in winter, grass species identification was difficult in some areas that had been heavily grazed. In these areas a conservative approach was taken, and any vegetation that may have met the DELWP criteria for a remnant patch mapped as such.

During the detailed native vegetation assessment in February-March 2017 and April 2017, some areas of roadside vegetation had recently been burnt for the purposes of managing fuel loads and fire risk. These areas have been treated as native vegetation and the DELWP modelled score applied. For these areas, the determination of whether a listed community may be present was based on the surrounding vegetation.

These limitations were not considered to compromise the validity of the current investigation, which was designed to address the relevant policies and decision guidelines.

Limitations of threatened flora assessments

The vegetation surveys to date have provided an overview of the occurrence of habitats for threatened flora species within the wind farm site. This has been achieved through determination of whether vegetation recorded within the area constitutes suitable habitat for species known or modelled to occur within the ROI. Targeted surveys for threatened flora species for which suitable habitat occurs within the footprint are yet to be undertaken, due to the seasonal constraints of these surveys. Targeted flora surveys

during the appropriate seasons will be undertaken in proposed impact areas that are suitable habitat for threatened flora species, as detailed in Section 5.3.2.

Figure 3: GPWF site and investigation area

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5.3 Assessment results

5.3.1 *Native Vegetation*

Remnant patches

Evidence on site, including floristic composition and soil characteristics, indicated that Swamp Scrub (EVC 53), Plains Grassy Woodland (EVC 55_61), Creekline Grassy Woodland (EVC 68), Plains Grassy Wetland (EVC 125), *Heavier-soils* Plains Grassland (EVC 132_61), Non-eucalypt Grassy Woodland (EVC 175), Riparian Woodland (EVC 641) and Stony Knoll Shrubland (EVC 649) were present within the investigation area area (Figure 4). Descriptions of these EVCs are provided within the EVC benchmarks in Appendix 9.

There were 412.22 hectares of remnant native vegetation within 736 remnant patches (referred to herein as habitat zones) comprising the abovementioned EVCs identified in the investigation area (Figure 4). These included 375.66 hectares of *Heavier-soils* Plains Grassland (EVC 132_61), which was the most abundant EVC mapped, and 1.87 hectares of DELWP mapped wetlands. The area of each EVC recorded within the investigation area is included in Table 2.

Table 2: Areas of each EVC mapped within the investigation area

EVC	Area (ha) within investigation area
Heavier-soils Plains Grassland (EVC 132_61)	377.15
Plains Grassy Wetland (EVC 125)	13.80
Stony Knoll Shrubland (EVC 649)	10.83
Non-eucalypt Grassy Woodland (EVC 175_61)	4.74
Plains Grassy Woodland (EVC 55_61)	3.47
Creekline Grassy Woodland (EVC 68)	0.35
Swamp Scrub (EVC 53)	0.02
Riparian Woodland (EVC 641)	0.003
Mapped Wetlands	1.87
TOTAL	**412.233**

Condition scores ranged between 11 and 72 (out of 100). Detailed habitat hectare scores for each zone (including where the modelled score was used) are available as a separate document due to the large quantum of data.

Vegetation quality of mapped native vegetation has been categorised based on the Site Condition component of the habitat hectare score (out of 75) as per Table 3. Only the site condition component of the habitat hectare score has been used, as threatened flora species can persist in small, fragmented remnants and as such the landscape context component of the habitat hectare score was less relevant.

The vegetation quality categorisation informed project design through the application of the 'avoid' and 'minimise' principles (see Section 5.4.1), where avoidance or minimisation of removal of high quality vegetation was prioritised.

These categories have also been used to determine the areas of suitable habitat for threatened species to inform forthcoming targeted surveys (see Sections 5.3.2 and 5.4.3). The area of each vegetation quality category is provided in Table 3, with most vegetation falling into the 'Low' quality category, and only 12% of mapped vegetation falling into the 'High' quality category.

Table 3: Categorisation of vegetation quality

Site Condition Score	Quality	Area (Ha) in investigation area
0-25	Low	193.34
26-50	Moderate	169.39
51-75	High	49.49
TOTAL		412.22

Scattered trees

Scattered trees recorded in the study area would have once comprised the canopy component of Plains Grassy Woodland (EVC 55_61), Creekline Grassy Woodland (EVC 68) or Riparian Woodland (EVC 641). Eight scattered trees (or the tree protection zones of these trees) occurred within the investigation area (Figure 4), ranging in DBH (diameter at breast height) between 33 and 178 centimetres. Details of the scattered trees recorded are listed in Appendix 3.

Four large scattered River Red Gum trees (Figure 4) are considered to provide important habitat for fauna due to their size, age and availability of hollows. The four small scattered trees (Figure 4) comprise young plants that provide limited habitat value.

5.3.2 *Flora species*

Species recorded

During the habitat hectare assessments 215 plant species were recorded. Of these, 144 (67%) were indigenous and 71 (33%) were introduced or non-indigenous native in origin (Appendix 4).

Listed species

VBA records (VBA 2016) and the EPBC Protected Matters Search Tool (Department of the Environment 2016) indicated that within the ROI there were records of, or there occurred potential suitable habitat for, 17 species listed under the Commonwealth EPBC Act and 22 listed under the state FFG Act, including 15 listed under both Acts. One flora species listed under both the EPBC Act and FFG Act, one listed under the EPBC Act and one listed as threatened under the FFG Act were recorded during the field survey.

The likelihood of occurrence in the investigation area of species listed under the EPBC Act and FFG Act is addressed in Table 4. Species considered 'likely to occur' are those that have a very high chance of being in the study area based on numerous records in the search region and suitable habitat in the study area. Species considered to have the 'potential to occur' are those where suitable habitat exists, but recent records are scarce.

This analysis indicates that 17 listed flora species are likely to occur or have the potential to occur. These species are listed below.

- Small Milkwort (*Comesperma polygaloides*), FFG Act listed – recorded within the investigation area
- Small Scurf-pea (*Cullen parvum*), FFG Act listed
- Tough Scurf-pea (*Cullen tenax*), FFG Act listed

- Small Golden Moths (*Diuris basaltica*), EPBC Act listed (endangered), FFG Act listed
- Clumping Golden Moths (*Diuris gregaria*), FFG Act listed
- Trailing Hop-bush (*Dodonaea procumbens*), EPBC Act listed (vulnerable) – recorded within the investigation area
- Clover Glycine (*Glycine latrobeana*), EPBC Act listed (vulnerable), FFG Act listed
- White Sunray (*Leucochrysum albicans* var. *tricolor*), (EPBC Act listed (endangered), FFG Act listed)
- Spiny Rice-flower (*Pimelea spinescens* subsp. *spinescens*), EPBC Act listed (critically endangered), FFG Act listed – recorded within the investigation area
- Shelford Leek-orchid (*Prasophyllum fosteri*), FFG Act listed
- Fragrant Leek-orchid (*Prasophyllum suaveolens*), (EPBC Act listed (endangered), FFG Act listed)
- Hairy Tails (*Ptilotus erubescens*), FFG Act listed
- Button Wrinklewort (*Rutidosis leptorhynchoides*), EPBC Act listed (endangered), FFG Act listed
- Large-headed Fireweed (*Senecio macrocarpus*), EPBC Act listed (endangered), FFG Act listed
- Swamp Fireweed (*Senecio psilocarpus*), EPBC Act listed (vulnerable)
- Basalt Sun-orchid (*Thelymitra gregaria*), FFG Act listed
- Swamp Everlasting (*Xerochrysum palustre*), EPBC Act listed (vulnerable), FFG Act listed

The appropriate survey time for each of these species is included in Table 4. The analysis contained within Table 4 indicates that the following habitat types potentially support listed species:

- Plains Grassy Wetland (EVC 125) – Moderate and High Quality;
- Plains Grassy Woodland (EVC 55_61) – Low, Moderate and High Quality; and
- *Heavier-soils* Plains Grassland (EVC 132_61) – Low, Moderate and High Quality.

As indicated in Table 4, three survey periods (in May, October and December) would be required to cover the appropriate survey time for all listed species. The areas to be surveyed during each survey period are included in Table 5.

Table 4: FFG Act and EPBC Act listed flora species and likelihood of occurrence

Common Name	Scientific name	EPBC	FFG	DELWP	Habitat	No. of record	Date of last record	Likelihood of occurrence	J	F	M	A	M	J	J	A	S	O	N	D
Dwarf Spider-orchid	*Caladenia pumila*	EN	L	e	High quality Grassy Woodland. Known only from the Bannockburn area west of Geelong (Jeanes & Backhouse 2006).	None	N/A	No suitable habitat. Unlikely to occur.												
Small Milkwort	*Comesperma polygaloides*		L	v	Found in remnant native grasslands and grassy woodlands on heavy soils (Walsh 1999) on the Western Basalt Plains, dominated by Kangaroo Grass, Silver Tussock and, less commonly, wallaby grasses and spear grasses (DSE 1999)	52	27/06/2014	Suitable habitat. Likely to occur in areas of Moderate and High Quality 55_61 and 132_61 across the study area. Recorded on Geggies Road.												
Small Scurf-pea	*Cullen parvum*		L	e	The species grows in grasslands and grassy (River Red-gum) woodlands in areas with rainfall of between 450 and 700 mm (Jeanes, 1996). These sites are subject to irregular flooding, and have relatively rich soils derived from alluvium. An exception is the population near Shelford, which grows on rocky clay soils derived from basalt (DSE 2005).	31	27/06/2014	Suitable habitat. Potential to occur in areas of Low to High Quality 55_61 and 132_61 across the study area.										
Tough Scurf-pea	*Cullen tenax*		L	e	Grasslands and grassy woodlands, subject to irregular flooding, with relatively rich soils derived from alluvium. *An exception is the population near Shelford, which grows from rocky clay soils derived from basalt* (DSE 2005).	3	27/06/2014	Suitable habitat. Potential to occur in areas of Moderate and High Quality 55_61 and 132_61 across the study area.										
Matted Flax-lily	*Dianella amoena*	EN	L	e	Lowland grassland and grassy woodlands on well-drained to seasonally waterlogged fertile sandy loams to heavy cracking soils derived from sedimentary or volcanic Geology. It is widely distributed from eastern to south-western Victoria (Carter 2010).	None	N/A	No suitable habitat. Unlikely to occur.												
Small Golden Moths	*Diuris basaltica*	EN	L	e	Herb-rich native grasslands dominated by Kangaroo Grass on heavy basalt soils, often with embedded basalt boulders. Vegetation dominated by a ground layer of tussock-forming perennial grasses, with a wide variety of wildflowers and herbs growing among the tussocks. All sites are NTGVVP and WBPGC (Backhouse & Lester 2010).	1	11/10/2002	Suitable habitat. Potential to occur in areas of High Quality 132_61 across the study area.										
Clumping Golden Moths	*Diuris gregaria*		L	e	Grassland dominated by Kangaroo Grass and among rocks on basalt outcrops in red-brown to blackish loams. Highly localised in Derrinallum-Chatsworth area (Jones 2006).	1	29/11/1990	Suitable habitat. Potential to occur in areas of High Quality 132_61 across the study area.										

Common Name	Scientific name	EPBC	FFG	DELWP	Habitat	No. of record	Date of last record	Likelihood of occurrence	J	F	M	A	M	J	J	A	S	O	N	D
Trailing Hop-bush	*Dodonaea procumbens*	VU		v	Grows in low lying, often winter wet areas in woodland, low open-forest heathland and grasslands on sands and clays. Largely confined to SW of Victoria (Duretto 1999).	6	12/11/2004	Suitable habitat. Potential to occur in areas of Moderate and High Quality 55_61 and 132_61 across the study area. Recorded along the Pitfield-Cressy Road.													
Clover Glycine	*Glycine latrobeana*	VU	L	v	In Victoria, occurs mainly in grasslands and grassy woodlands on basalt soils dominated by Kangaroo Grass or within intermittently flooded streamlines co-dominated by Yellow Gum and Scentbark over mixed grasses and shrubs (in the Grampians/Black Range area).	5	20/11/2008	Suitable habitat. Potential to occur in areas of Moderate and High Quality 55_61 and 132_61 across the study area.													
Adamson's Blown-grass	*Lachnagrostis adamsonii*	EN	L	v	Adamson's Blown-grass is mainly found on roadside depressions and flats, associated with drainage lines and small sluggish creeks that are usually moderately to highly saline, particularly where these sites are protected from wind by surrounding rises or by stands of tall grasses such as Phalaris aquatica, or sedges and rushes such as Juncus spp. or Gahnia spp. (DSE 2000). Associated species include Streaked Arrowgrass (Triglochin striata), Plains Saltmarsh-grass (Puccinellia stricta var. perlaxa), Australian Salt-grass (Distichlis distichophylla), Common Blown-grass (Lachnagrostis filiformis) and Beaded Glasswort (Sarcocornia quinqueflora) (Murphy 2010).	7	7/12/1998	No suitable habitat. Unlikely to occur.													
White Sunray	*Leucochrysum albicans var. tricolor*	EN	L	e	Western Victoria in dry, open situations (Marriott & Marriott 1998; Lunt et. al. 1998).	15	6/11/2013	Suitable habitat. Potential to occur in areas of Moderate and High Quality 132_61 across the study area.													
Spiny Rice-flower	*Pimelea spinescens subsp. spinescens*	CR	L	e	Grasslands or open shrublands on basalt derived soils (Entwisle 1996). Prefers shallow depressions and drainage lines with moderate soil moisture (D.Coppolino pers. obs.).	155	27/07/2014	Suitable habitat. Known to occur in high numbers on roadsides within the site. Potential to occur in areas of Moderate and High quality 132_61 elsewhere.													
Salt-lake Tussock-grass	*Poa sallacustris*	VU	L	v	Margins of brackish to salt lakes (Walsh 1994).	3	21/11/2008	No suitable habitat. Unlikely to occur.													
Shelford Leek-orchid	*Prasophyllum fosteri*		L	e	Highly localised to grasslands around Shelford, Victoria. Restricted to grasslands on red-brown basaltic loams. Very similar to Maroon Leek-orchid, which has a horseshoe-shaped callus (Jones 2006).	26	16/10/2008	Suitable habitat. Potential to occur in areas of High Quality 132_61 across the study area.													
Maroon Leek-orchid	*Prasophyllum frenchii*	EN	L	e	Favouring heathland and Grassland on black clays (Bates 1994).	2	13/11/1992	No suitable habitat. Unlikely to occur.													

Common Name	Scientific name	EPBC	FFG	DELWP	Habitat	No. of record	Date of last record	Likelihood of occurrence	J	F	M	A	M	J	J	A	S	O	N	D
Fragrant Leek-orchid	*Prasophyllum suaveolens*	EN	L	e	Occurs in open, species rich native grassland dominated by Themeda triandra with perennial herbs and lilies on poorly drained red-brown soil derived from basalt (DSE 2003).	4	14/11/2000	Suitable habitat. Potential to occur in areas of High Quality 132_61 across the study area.													
Hairy Tails	*Ptilotus erubescens*		L	v	Fertile soils with grassland and woodland communities (Walsh 1996).	13	26/11/2009	Suitable habitat. Potential to occur in areas of Moderate and High Quality 55_61 and 132_61 across the study area.													
Button Wrinklewort	*Rutidosis leptorhynchoides*	EN	L	e	Basaltic grasslands between Rokewood and Melbourne (Jeanes 1999).	23	30/10/2015	Suitable habitat. Potential to occur in areas of Moderate and High Quality 132_61 across the study area.													
Large-headed Fireweed	*Senecio macrocarpus*	VU	L	e	Occurs in a variety of habitats, including grasslands, sedgelands, shrublands and woodlands, generally on sparsely vegetated sites on sandy loam to heavy clay soils, often in depressions that are waterlogged in winter (Sinclair 2010).	None	N/A	Suitable habitat. Potential to occur in areas of Moderate and High Quality 55_61 and 132_61.													
Swamp Fireweed	*Senecio psilocarpus*	VU		v	Herb-rich winter-wet swamps on volcanic clays or peaty soils (Walsh 1999). Known from approximately 10 sites between Wallan, about 45 km north of Melbourne, and Honans Scrub in south-eastern South Australia (DSEWPC 2008).	None	N/A	Suitable habitat. Potential to occur in areas of Moderate and High Quality 125. Nearest records are over 30 kilometres from the study area, near Lal Lal (VBA).													
Metallic Sun-orchid	*Thelymitra epipactoides*	EN	L	e	Primarily in mesic coastal heathlands, grasslands and woodlands, but also in drier inland heathlands, open forests and woodlands. (Backhouse & Jeanes 1995 in DSEWPC 2003).	None	N/A	No suitable habitat. Unlikely to occur.													
Basalt Sun-orchid	*Thelymitra gregaria*		L	e	Tussock grasslands on rich, water-retentive red-brown soils derived from basalt (Backhouse & Jeanes 1995, Jones 2006 in in DSEWPC 2003).	6	22/10/2008	Suitable habitat. Potential to occur in areas of High Quality 132_61 across the study area.													
Spiral Sun-orchid	*Thelymitra matthewsii*	VU	L	v	Slightly elevated sites to 300m in well-drained soils (sandy loams to gravelly limestone soils) in light to dense forest; sometimes in coastal sandy flats (Weber & Entwisle 1994).	None	N/A	No suitable habitat. Unlikely to occur.													
Swamp Everlasting	*Xerochrysum palustre*	VU	L	v	Sedge-rich swamps and wetlands, usually on black cracking clay soils (Walsh and Entwisle 1999). Scattered occurrences in Victoria range from the South Australian border in the west to the Cobberas, near Benambra, in the East (DSE 2008).	None	N/A	Suitable habitat. Potential to occur in areas of Moderate and High Quality 125. Nearest records are over 30 kilometres from the study area, near Lal Lal (VBA).													
Suitable survey periods to cover all species																				

Notes: EPBC = threatened species status under EPBC Act: CR = critically endangered; EN = endangered; VU = vulnerable; **FFG** = threatened species status under the FFG Act: L = listed as threatened under the FFG Act; DELWP = status under DELWP's Advisory List (DEPI 2014); cr = critically endangered; e = endangered; v = vulnerable; r = rare

Table 5: Areas in which to undertake targeted surveys

Survey period	Area to be surveyed	Species to target
June	Moderate and High Quality *Heavier-soils* Plains Grassland (EVC 132_61) on public and private land.	Spiny Rice-flower
October	Moderate and High Quality Plains Grassy Woodland (EVC 55_61) and Moderate and High Quality *Heavier-soils* Plains Grassland (EVC 132_61) on public and private land.	Small Scurf-pea Tough Scurf-pea Small Golden Moths Clumping Golden Moths Clover Glycine Shelford Leek-orchid Fragrant Leek-orchid Button Wrinklewort Large-headed Fireweed Basalt Sun-orchid
December	Moderate and High Quality Plains Grassy Woodland (EVC 55_61), Moderate and High Quality Plains Grassy Wetland (EVC 125) and Moderate and High Quality *Heavier-soils* Plains Grassland (EVC 132_61) on public and private land. Low Quality *Heavier-soils* Plains Grassland (EVC 132_61) on public land only.	Small Milkwort Trailing Hop-bush White Sunray Hairy Tails Swamp Fireweed Swamp Everlasting

5.3.3 *Listed ecological communities*

Based on an assessment of native vegetation in the study area against published descriptions and condition thresholds for these communities, the following listed ecological communities were recorded in the study area:

- **Natural Temperate Grassland of the Victorian Volcanic Plain** – Critically Endangered under the EPBC Act – 252.81 hectares (Figure 5)

  252.81 hectares of vegetation within the investigation area met the key diagnostic characteristics and condition thresholds (TSSC 2008a) for the listed community, namely being patches of native grassland bigger than or equal to 0.05 hectares within the Victorian Volcanic Plain in which the dominant native species represent at least 50% of the native species and represent at least 50% of the perennial tussock cover.

- **Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains** – Critically Endangered under the EPBC Act– 4.55 hectares (Figure 5)

  4.55 hectares of vegetation within the investigation area met the key landscape, hydrology and biota diagnostic characteristics and condition thresholds (TSSC 2012) for this community, namely 50% or more of the total cover of plants in the ground layer of the wetland dominated by native species characteristic of the Seasonal Herbaceous Wetlands ecological community, and the wetland was 0.5 ha or larger in size.

- **Grassy Eucalypt Woodland of the Victorian Volcanic Plain** – Critically Endangered under the EPBC Act– 2.80 hectares (Figure 5)

  2.80 hectares of vegetation within the investigation area met the key diagnostic characteristics and condition thresholds (TSSC 2008b) for this community, namely a patch bigger than or equal to 0.5 hectares within the Victorian Volcanic Plain where the projective foliage cover of River Red Gum (Eucalyptus camaldulensis) is more than 5% and 50% or more of the perennial ground layer vegetation comprise native species.

- **Western (Basalt) Plains Grassland** – listed under the FFG Act – 46.46 hectares (Figure 5)

  46.59 hectares of vegetation within the investigation area met the description (SAC 2015) for the listed community, namely patches of open grassland community found mainly on undisturbed, poorly-drained heavy clay soils on the basalt plains of western Victoria. The vegetation is characteristically dominated by perennial native grasses, with very few eucalypts and shrubs, and an almost complete absence of introduced grasses and weeds.

Based on an assessment of native vegetation in the study area against published descriptions and condition thresholds, the following communities were found not to occur in the study area based on the factors described below.

- **Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia** –Endangered under the EPBC Act

  None of the vegetation within the investigation area met the key diagnostic characteristics (TSSC 2010) for the listed community, namely the vegetation structure was not a woodland or open forest in which the most common tree species is (or was previously) Grey Box (Eucalyptus microcarpa).

- **White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically** – Critically Endangered under the EPBC Act

  None of the vegetation within the investigation area met the key diagnostic characteristics (TSSC 2006) for the listed community, namely the vegetation did not have an overstorey dominated or co-dominated by White Box, Yellow Box or Blakely's Red Gum.

5.4 Impacts of the proposed development

The current proposal will involve the construction and operation of the Golden Plains Wind Farm, as described in Section 3.2.

The extent of the area of impact for the current proposal was considered to include the outer-most boundaries of the proposed development layout presented in Figure 4.

5.4.1 *Design response to mitigate impacts on flora and fauna*

The project was designed to meet the strategies outlined in the Guidelines through the adoption of the following specific design measures:

- Turbines have been re-located outside, or removed from large areas of high-quality vegetation where possible;

- Within the 100-metre radius area surveyed for each turbine site, the hard-stand and foundation areas have been located to avoid and minimise the removal of native vegetation as much as possible;
- Where available, tracks have followed existing tracks to minimise the removal of native vegetation;
- Where they pass through native vegetation, track widths have been reduced as much as is possible while still maintaining functionality and safety; and
- The underground cable layout had been designed to avoid native vegetation where possible.

A log of each design change made to avoid and minimise native vegetation removal was kept by WestWind, and is included as Appendix 2.

Further recommendations to mitigate impacts on flora and fauna are presented in Section 5.4.6.

5.4.2 *Residual impacts of proposed development*

Residual impacts have been identified for the proposed development following implementation of the above mitigation measures in the design process. These impacts on ecological values are outlined below and shown in Figure 4 (native vegetation removal) and Figure 5 (impacts on listed ecological communities).

Native vegetation

The current proposal footprint will result in the loss of 81.29 hectares of native vegetation as represented in Figure 4 and documented in the BIOR report produced by DELWP (Appendix 10). This comprised:

- The loss of 81.009 hectares of native vegetation from remnant patches comprising Plains Grassland (EVC 132_61), Plains Grassy Woodland (EVC 55_61), Non-eucalypt Grassy Woodland (EVC 175_61), Stony Knoll Shrubland (EVC 649), Plains Grassy Wetland (EVC 125) and Riparian Woodland (EVC 641). Of these 50.4% were of low quality, 41.3% of moderate and 7.5% of high quality; and
- The loss of four scattered trees. Scattered tree losses have been converted to an extent of loss for the BIOR report (Appendix 10) by multiplying the number of trees by a standard area of 0.070 hectares; equating to a loss of 0.281 hectares.

The total area of native vegetation within the southern section of the wind farm site, where overview mapping was undertaken was 4,933 hectares and another 463 hectares of potential native vegetation (mostly low quality). Therefore, the proposed removal of 65.699 hectares of native vegetation (southern section only) represents a comparatively small proportion (less than two percent) of the vegetation within this portion of the site. In the northern section of the site, overview mapping of native vegetation was not undertaken, with surveys being confined to the development footprint itself. In the northern section, some 15.31 hectares of native vegetation will be removed. As the northern section of the proposed wind farm site supports less extensive areas of native vegetation, it is likely that a similarly small proportion of this vegetation will be affected by the project.

It is assumed that no native vegetation has been approved for removal in the area within the last five years.

5.4.3 *Modelled species important habitat*

The current proposal footprint will have a proportional impact on modelled habitat above the specific offset threshold for the following rare or threatened species listed on DELWP's advisory lists as determined by DELWP and presented in Appendix 10:

- Striped Legless Lizard;
- Adamson's Blown-grass;
- Swamp Sheoak;
- Small Scurf-pea;
- Button Wrinklewort;
- Purple Blown-grass;
- White Sunray;
- Pale Swamp Everlasting;
- Spiny Rice-flower; and

5.4.4 *Listed flora species*

The analysis of the likelihood of occurrence of listed flora species presented in Section 5.3.2 identified that the following species could be impacted by development in the study area:

- Small Milkwort (FFG Act listed);
- Small Scurf-pea (FFG Act listed);
- Tough Scurf-pea (FFG Act listed);
- Small Golden Moths (EPBC Act listed (endangered), FFG Act listed);
- Clumping Golden Moths (FFG Act listed);
- Trailing Hop-bush (EPBC Act listed (vulnerable));
- Clover Glycine (EPBC Act listed (vulnerable), FFG Act listed);
- White Sunray (EPBC Act listed (endangered), FFG Act listed);
- Spiny Rice-flower (EPBC Act listed (critically endangered), FFG Act listed);
- Shelford Leek-orchid (FFG Act listed);
- Fragrant Leek-orchid (EPBC Act listed (endangered), FFG Act listed);
- Hairy Tails (FFG Act listed);
- Button Wrinklewort (EPBC Act listed (endangered), FFG Act listed);
- Large-headed Fireweed (EPBC Act listed (endangered), FFG Act listed);
- Swamp Fireweed (EPBC Act listed (vulnerable));
- Basalt Sun-orchid (FFG Act listed); and

- Swamp Everlasting (EPBC Act listed (vulnerable), FFG Act listed).

The area of impact on potential habitat for each listed species is included in Table 6. Targeted surveys for listed flora species will be undertaken during the appropriate season in these areas to determine the impact of the proposed project in accordance with the locations and timing outlined in Table 5.

Table 6: Area of potential habitat for listed species affected by the project

Common Name	Scientific name	EPBC	FFG	Potential habitat	Area of potential habitat impacted (ha)
Small Milkwort	*Comesperma polygaloides*		L	Moderate and High Quality 55_61 and 132_61 on public land	
Small Scurf-pea	*Cullen parvum*		L	Low to High Quality 55_61 and 132_61 on public land	
Tough Scurf-pea	*Cullen tenax*		L	Moderate and High Quality 55_61 and 132_61 on public land	
Small Golden Moths	*Diuris basaltica*	EN	L	High Quality 132_61	19.4
Clumping Golden Moths	*Diuris gregaria*		L	High Quality 132_61 on public land	
Trailing Hop-bush	*Dodonaea procumbens*	VU		Moderate and High Quality 55_61 and 132_61	49.778
Clover Glycine	*Glycine latrobeana*	VU	L	Moderate and High Quality 55_61 and 132_61	49.778
White Sunray	*Leucochrysum albicans var. tricolor*	EN	L	Moderate and High Quality 132_61	49.206
Spiny Rice-flower	*Pimelea spinescens subsp. spinescens*	CR	L	Moderate and High Quality 132_61	49.206
Shelford Leek-orchid	*Prasophyllum fosteri*		L	High Quality 132_61 on public land	
Fragrant Leek-orchid	*Prasophyllum suaveolens*	EN	L	High Quality 132_61	19.4
Hairy Tails	*Ptilotus erubescens*		L	Moderate and High Quality 55_61 and 132_61 on public land	
Button Wrinklewort	*Rutidosis leptorhynchoides*	EN	L	Moderate and High Quality 132_61	49.206
Large-headed Fireweed	*Senecio macrocarpus*	VU	L	Moderate and High Quality 55_61 and 132_61.	49.778
Swamp Fireweed	*Senecio psilocarpus*	VU		Moderate and High Quality 125	1.593
Basalt Sun-orchid	*Thelymitra gregaria*		L	High Quality 132_61 on public land	
Swamp Everlasting	*Xerochrysum palustre*	VU	L	Moderate and High Quality 125	1.593

5.4.5 *Threatened ecological communities*

The proposed wind farm footprint will result in the loss of 10.08 hectares of the FFG Act listed community Western (Basalt) Plains Grassland (WBPG).

The proposed wind farm footprint will also result in the following losses of EPBC Act listed communities:

- 49.52 hectares of NTGVVP;
- 2.54 hectares of SHWTLP; and
- 0.56 hectares of GEWVVP.

The project will be referred to the federal Department of Environment and Energy under the EPBC Act.

5.4.6 *Further mitigation recommendations*

The following further recommendations for mitigation in the *design phase* would address the 'avoid and minimise' strategies outlined in the Guidelines.

- Where feasible, cables that intersect with high-quality native vegetation, listed communities or watercourses should be installed using directional drilling;
- Ancillary site infrastructure (such as site compounds and amenities) should be located outside areas of native vegetation; and
- The proposed development should be designed in a way that does not alter the site's hydrology in areas that support native vegetation or act as tributaries to rivers, creeks and significant drainage lines.

Implementing these mitigation measures would also reduce the requirements to offset native vegetation removal.

Figure 4: Native vegetation within the investigation area and proposed impacts

See Volume B

Figure 5: Location of, and proposed impacts to, listed ecological communities within the investigation area

See Volume B

5.5 Implications of the proposed development

5.5.1 *Summary of planning implications*

A permit is required for the removal of any vegetation that intersects with ESO2, VPO1 and VPO2. The Responsible Authority will consider the applicable decision guidelines, as detailed in Section 4.3, in their decision to grant a permit.

A planning permit under Clause 52.17 of the Golden Plains Planning Schemes is required for the removal of native vegetation and will form part of the planning permit application.

5.5.2 *Implications under the Biodiversity Assessment Guidelines*

Risk–based assessment pathway for the site

The risk-based assessment pathway is determined based on 'extent risk' and 'location risk'. The extent risk was found to be 81.290 hectares and the area of proposed native vegetation removal contained mapped areas of the following *location risk* categories:

- Location Risk A – covering most this area;
- Location Risk B and Location Risk C – covering a band running north-south in the centre of the wind farm site associated with habitats for several listed species.

Based on the details above and the criteria outlined in Section 4.2.3 the Guidelines stipulate that the proposal will be assessed under the high risk assessment pathway.

The current proposal would trigger a referral to DELWP as it meets the criteria specified in Section 4.2.3; specifically applications where the native vegetation to be removed is 0.5 hectares or more and applications in the high risk-based pathway.

Offset requirements

Offsets required to compensate for the proposed removal of native vegetation from the study area have been determined from DELWP's Biodiversity Impacts and Offset Requirements (BIOR) Report (Appendix 10). A summary of the required offsets is provided below.

- 2.698 *general* biodiversity equivalence units with a minimum strategic biodiversity score of 0.126 within the Corangamite Catchment Management Authority area OR the Colac Otway or Golden Plains Municipal Districts;
- 31.836 *specific* biodiversity equivalence units (SBEUs) of habitat for Brolga;
- 29.935 SBEUs of habitat for Striped Legless Lizard;
- 31.924 SBEUs of habitat for Adamson's Blown-grass;
- 22.319 SBEUs of habitat for Swamp Sheoak;
- 31.099 SBEUs of habitat for Small Milkwort;
- 7.423 SBEUs of habitat for Small Scurf-pea;

- 1.083 SBEUs of habitat for Button Wrinklewort;
- 31.348 SBEUs habitat for Purple Blown-grass;
- 6.348 SBEUs of habitat for White Sunray;
- 31.047 SBEUs of habitat for Pale Swamp Everlasting;
- 30.369 SBEUs of habitat for Spiny Rice-flower; and
- 8.064 SBEUs of habitat for Southern Swainson-pea.

Specific biodiversity equivalence units of habitat can be located within any area of modelled important habitat for the impacted species anywhere in Victoria.

Under the Guidelines *all* offsets must be secured prior to the removal of native vegetation.

Offset strategy

The offset target for the current proposal is likely to be achievable within the wind farm site given the above requirements and the area of native vegetation to be retained.

Third party (offsite) offsets to cover any shortfall have been identified through local landowners.

For an onsite offset to be eligible to meet the offset requirement, it must meet all of the criteria outlined below:

- Offsets must be sited at least 150 metres away from any dwellings and associated buildings on the subject land or adjoining properties covered by a Bushfire Management Overlay (BMO), or at least 50 metres away from these structures on all other land occurring within DELWP-mapped Bushfire Prone Areas (BPA);
- Offsets must be set back at least six metres from property boundaries to allow for firebreaks, boundary fence maintenance, etc.
- Offsets may not be in areas subject to the following encumbrances or constraints, which impede the ability to achieve native vegetation management/revegetation objectives:
    - Incompatible current and/or future land use (where known);
    - Existing offsets or other existing agreements; or
    - Identified threats to native vegetation condition.
- Revegetation offsets (woody vegetation and low risk only) must be at least one hectare in size; have an average width of at least 20 metres; and have a perimeter to area ratio of 1:20.

Offsets must be protected using an appropriate on-title security agreement and managed for the first ten years of establishment to meet specific targets set out in an offset plan and maintained in perpetuity.

The proponent is currently investigating on-site offset opportunities and the final application will set out in detail how the required offsets will be met.

5.5.3 *FFG Act*

The Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) lists threatened and protected species and ecological communities (DELWP 2015a, DELWP 2015b). Any removal of threatened flora species or communities (or protected flora) listed under the FFG Act from public land requires a Protected Flora Permit under the Act, obtained from DELWP.

The FFG Act only applies to private land in relation to the commercial collection of grasstrees, tree-ferns and sphagnum moss.

Several FFG Act values listed as threatened or protected are susceptible to impacts from the proposed development on public land, as detailed in Sections 5.4.4 and 5.4.5.

Targeted surveys will be undertaken for FFG Act listed species during the appropriate season, as outlined in Section 5.4.4 to assess any impacts on these species.

A Protected Flora Permit would be required from DELWP to remove the plant taxa comprising 10.08 hectares of WBPG and any listed threatened flora species or otherwise protected values from public land.

5.5.4 *CaLP Act*

The *Catchment and Land Protection Act 1994* (CaLP Act) requires that land owners (or a third party to whom responsibilities have been legally transferred) must take all reasonable steps on their land to:

- Avoid causing or contributing to land degradation which causes or may cause damage to land of another land owner;
- Conserve soil;
- Protect water resources;
- Eradicate regionally prohibited weeds;
- Prevent the growth and spread of regionally controlled weeds;
- Prevent the spread of, and as far as possible eradicate, established pest animals; and
- Prevent the spread of regionally controlled weeds and established pest animals on a roadside that adjoins the land owner's land.

In accordance with the *Catchment and Land Protection Act 1994*, the noxious weed species listed below, which were recorded in the study area, must be controlled.

- African Box-thorn;
- Bathurst Burr;
- Gorse;
- Horehound;
- Paterson's Curse;
- Serrated Tussock;

- Spear Thistle;
- Spiny Rush; and
- Sweet Briar.

Precision control methods that minimise off-target kills (e.g. spot spraying) should be used in environmentally sensitive areas (e.g. within or near native vegetation, waterways, etc.).

A clear objective of environmental management during construction of the proposed wind farm will be to prevent the establishment and/or spread of these weeds.

6 FAUNA ASSESSMENT

KEY FINDINGS

- The majority of the wind farm site comprises agricultural land which is of low quality for fauna due to its extensive modification and the removal of most habitat elements. Some planted trees, grassland or rocky outcrop, wetlands and creek lines on the wind farm site could provide moderate to high quality habitat for fauna species.
- Based on existing information and an overview assessment in 2016, 56 listed fauna species were identified as having the potential to occur in the radius of investigation.
- Following further investigations, 11 of these species, including seven birds, one mammal, one reptile, one frog and one invertebrate, were considered to have potential to occur within the wind farm site due to the presence of suitable habitat or the species being recorded during the overview assessment or targeted surveys.
- Three *EPBC Act* listed fauna species were detected during the fauna surveys, the Striped Legless Lizard, Growling Grass Frog and Golden Sun Moth.
- No species listed under the *EPBC Act* Migratory Species list have been recorded at the wind farm site.
- Five *FFG Act*-listed fauna species were confirmed as occurring in the study area during fauna assessments: Brolga, Yellow-bellied Sheathtail Bat, Striped Legless Lizard, Growling Grass Frog and Golden Sun Moth.
- The majority of threatened birds recorded or considered likely to occur at the wind farm site are waterbirds. Given the limited availability of wetland habitat on the site and that waterbirds were not common during the BUS, no significant impacts are expected from the proposed wind farm.
- In addition, the Swift Parrot may occasionally forage on flowering Sugar Gum. The infrequency and likely small numbers of this species on the wind farm site make a significant impact from the project highly unlikely.
- The migratory (non-threatened) White-throated Needletail and Gull-billed Tern have the potential to occasionally fly across the wind farm site. White–throated Needletails often fly at rotor swept area heights and occasionally collide in small numbers with turbines. The numbers of birds affected is small and would not significantly affect the wider population of this non-threatened, migratory species. The Gull-billed Tern flies over wetlands and grasslands in search of food. It is unlikely that this species occurs regularly or in significant numbers on the wind farm site so the proposed development is unlikely to pose a significant risk to this species. Furthermore, turbines, tracks and other infrastructure are located at least 30 metres from almost all wetlands and waterways to avoid significant impacts on these habitats.
- One species of migratory shorebird (Latham's Snipe) has the potential to occur in the wind farm site based on this initial investigation due to the presence of suitable habitat. This species spends most of its time in wetlands. The limited extent and quality of wetland habitat within the wind farm site make it highly unlikely that an important population of this species resides on the wind farm site.
- No other migratory shorebirds are expected to regularly occur in the study area.

KEY FINDINGS

- The Yellow-bellied Sheathtail Bat was recorded in very low numbers in the study area during targeted bat surveys. Significant impacts on this species are not expected.
- Targeted Striped Legless Lizard and Fat-tailed Dunnart surveys were undertaken in 2016. These two species were recorded in native grassland habitats in the study area. Impacts on the population of these species in the Golden Plains Wind Farm study area are not expected to be significant as the development footprint is to be confined to a small percentage of the thousands of hectares of habitat in the area. Mitigation measures to avoid any significant impacts upon the species are provided.
- The Growling Grass Frog was recorded from some of the higher quality wetlands in the study area. These wetlands are not to be impacted by the wind farm construction and operation since most of the habitat lies within a turbine exclusion buffer to minimise impacts on Brolga. Four turbines are located within the flood extents and the closest wind turbine is a minimum of 85 metres away from waterways. No infrastructure will be placed within 100 metres of confirmed Growling Grass Frog wetland sites.
- The Golden Sun Moth was recorded in the study area and has the potential to occur throughout in suitable native grassland habitats. These habitats will be avoided where possible, in the case that these habitats are not able to be avoided the amount of habitat to be removed will be minimised and offset.
- Three fish species listed under the EPBC Act and/or FFG Act, Australian Grayling, Dwarf Galaxias and Yarra Pygmy Perch, had potential to occur within the 10 km Radius of Investigation (RoI). None of these species was considered likely to occur on the wind farm site due to a lack of suitable permanent waterway habitat.

6.1 Introduction

This chapter describes indigenous fauna and fauna habitats on the proposed Golden Plains Wind Farm site and the potential and known impacts of the project on them. This is based on reviewing existing information, characterising habitats on the site and assessing the likelihood of occurrence of threatened fauna species. Targeted surveys of threatened fauna species or groups considered likely to occur are described in separate chapters.

6.2 Methods

6.2.1 *Database search*

The presence or likelihood of occurrence on the wind farm site and on the affected site access points of nationally threatened fauna species was obtained from the *EPBC Act* Protected Matters Search Tool (DoEE 2016a). Records of fauna species for the area were obtained from the VBA (DELWP 2016d). This report follows the VBA Fauna taxonomy and nomenclature.

Existing information has been obtained from a wider area, termed the 'radius of investigation' defined for this assessment as the wind farm site plus a 10-kilometre buffer area beyond its boundary.

6.2.2 *Field Assessment*

Fauna assessments commenced in July 2016 and have continued since then. These assessments will continue to collect information to inform the development application. Habitats were assessed for their potential to support fauna species listed as threatened on the EPBC Act and the FFG Act as required under the DELWP policy and planning guidelines for wind farms in Victoria (DELWP 2016b). Records of fauna species observed during the survey were also noted. The wind farm site was surveyed by vehicle. Where indigenous fauna habitat was recorded more detailed observations were undertaken on foot. Targeted species surveys were also undertaken, where required, and the methods for these are described later in the relevant specific sections of this report.

The following techniques were used to detect fauna species in areas of suitable habitat in the study area when inspecting the areas on foot.

- Incidental searches were undertaken for mammal scats, tracks and signs (e.g. diggings, signs of feeding and nests/burrows);
- Turning over rocks and other ground debris for reptiles, frogs and mammals;
- Bird observation during the day; and
- General searches for reptiles and frogs; including listening for frog calls in seasonally wet areas.

The quality of fauna habitat was assessed based on the following three categories.

High: All fauna habitat components, including old-growth trees, fallen timber and leaf litter, where relevant, surface rocks and indigenous ground cover are usually present and habitat linkages to other remnant ecosystems in the landscape are intact.

Moderate: Some fauna habitat components are missing, although linkages with other remnant habitats in the landscape are intact.

Low: Many fauna habitat components have been lost as have linkages with other remnant habitats in the landscape; remnant vegetation possesses few indigenous components.

6.3 Results

6.3.1 *Habitat Assessment – Wind Farm Site*

The wind farm site supported five habitat types, which are described below.

- Agricultural land;
- Planted trees;
- Native grassland;
- Rocky outcrops; and
- Aquatic habitats.

Agricultural Land

Most the wind farm site comprised agricultural land used for both grazing and growing crops. The ground layer and soil profile of this habitat type were highly modified because of historical and present agricultural activity. Some areas have not been used agriculturally including planted trees, higher quality grassland (for example on roadsides) or rocky outcrop, wetlands and creek lines.

Grazed paddocks supported a mixture of indigenous and non-indigenous flora species including weed species, including both native and non-native grassland. Dominant weeds in non-native grassland included Cocksfoot, Phalaris, Wild Oat, Yorkshire Fog and thistles. The paddocks were generally treeless apart from planted shelter belts along fence lines.

Canola and cereal were the dominant crops in the study area. Rocks had been removed in cultivated areas and as a result, numerous piles of rocks occurred throughout the wind farm site. These artificial rock piles offered shelter and basking sites for small mammals and reptiles, as well as perching sites for birds.

This habitat type generally lacked structural diversity and provided few opportunities for fauna. It has been assessed as being of low quality for fauna due to its extensive modification and the removal of most habitat elements.

Planted Trees

Most planted trees occurred along roadsides and fence lines. These were predominantly Sugar Gum, Cypress, Pine, She-oak and paperbark species. Taking into consideration the limited availability of such habitat in the wind farm site, planted trees were considered to be moderate quality habitat for fauna.

Native Grassland

Native grassland of varying quality occurred in some paddocks. This supported a mix of indigenous and introduced plants and provided foraging opportunities for several generalist grassland fauna species. Kangaroo Grass, Windmill Grass, tussock-grasses, wallaby-grasses and spear-grasses were dominant in this habitat.

Whilst this habitat was surrounded by intensive grazing and cropping paddocks, connectivity to similar habitats within the landscape, provided by intact roadside vegetation, increased the value of this grassland to fauna. Overall, this less intensively grazed grassland habitat of the wind farm site was moderate quality habitat for fauna since it retained many original components, such as indigenous ground layer diversity and structure, and dispersal corridors to similar habitats.

Rocky Outcrops

Scattered emergent basaltic rocks occurred throughout much of the wind farm site, in common with much of the Victorian Volcanic Plain bioregion. This habitat was formed by former lava flows and surface rocks have formed as a result. Indigenous grass species, including wallaby-grasses, spear-grasses, Kangaroo Grass and Windmill Grass, had a low to moderate cover within these outcrops and ground cover across most of these areas was dominated by introduced grasses and pasture weeds.

The rocky outcrops were heavily grazed by sheep and only provided scattered native grass cover in a matrix of introduced pasture species. Rocky areas provided shelter and forage for some reptile and frog species. Taking into consideration the connectivity of this habitat to similar habitats and sheltering opportunities for fauna, this habitat was considered to be of moderate quality.

Aquatic Habitat

The wind farm site supported a variety of aquatic habitats, including wetlands, farm dams and creeks.

Ephemeral freshwater wetlands occur throughout the site that filled in the winter and spring then dried out in the summer. These wetlands supported fringing and emergent aquatic vegetation when they held water. A number of stock-watering dams were scattered across the wind farm site that supported fringing and submerged aquatic vegetation. Whilst these wetlands and dams were isolated, they are likely to provide roosting and feeding habitat for a variety of waterbirds as well as breeding habitat for frogs.

There were three ephemeral creeks and associated tributaries and drainage lines across the study area including Kuruc A Ruc Creek (Meadows Creek), Ferrers Creek, Mia Mia Creek and Mount Misery Creek (also known as Little Woady Yallok Creek).

- Kuruc-A-Ruc Creek is lined with River Red-gum trees and the banks have a grassy understory. It flowed in the winter and spring then dried out in summer and autumn. The trees attract foraging and nesting birds.
- Ferrers Creek had some scattered River Red-gum trees in the southern section of the study area but in the northern section it was predominantly treeless. This creek attracts common frogs and small numbers of aquatic birds.
- Mia Mia Creek flowed freshwater in times of high rainfall; when dried out, pools of water became salty. Small numbers of aquatic birds frequent this habitat.

Some aquatic habitats on and near the wind farm site and its vicinity were considered likely to support waterbird and frog species. Taking into consideration the foraging and breeding opportunities for fauna, aquatic habitats were assessed as being of moderate - high quality fauna habitat. Highly modified ephemeral aquatic habitats, such as drainage lines and farm dams were considered low to moderate quality fauna habitat. Due to their ephemeral character, they were not expected to provide habitat for fish species. For more details see the wetland quality assessment in the separate Brolga Report – Report 16064 (2.0) (BL&A 2017).

6.3.2 *Fauna Species*

The overview and targeted assessments indicated the presence or likely occurrence of 201 fauna species, including 149 birds (seven introduced), 24 mammals (seven introduced) with an additional three bat species complexes, ten reptiles, nine frogs and eight fish. One threatened invertebrate species was recorded. Species recorded during the field assessment, and those identified as likely to occur are presented in Appendix 5.

The VBA and the EPBC Act Protected Matters Search Tool (DoEE 2016a) indicate that within the radius of investigation, 56 listed fauna species (42 birds, six mammals, two reptiles, two frogs, three fish and one invertebrate) listed on the EPBC Act and/or FFG Act occur or potentially occur due to records or the presence of suitable habitat in the radius of investigation (10 kilometres around wind farm site boundary).

Following further investigations, 11 of these species, including seven birds, one mammal, one reptile, one frog and one invertebrate, were considered to occur or likely to occur within the wind farm site due to the presence of suitable habitat or the species being recorded during the overview assessment or targeted surveys. The results of this analysis are presented in Table 7, with the species likely to occur or confirmed as present on the wind farm site highlighted. The impacts of the project on these species are considered in Section 6.4.

Birds

The review of existing information and field assessment indicated that 149 bird species (including seven introduced species) occurred or were likely to occur on the wind farm site. Of these, 80 species were recorded during the field assessments (Appendix 5).

A total of seven bird species listed under the EPBC Act and/or FFG Act were considered likely to occur on the wind farm site due to suitable habitat being present and/or their presence being recorded during field surveys as outlined in Table 7 below.

Five of the listed birds that have been recorded or are likely to occur on the wind farm site are waterbirds. In addition, the Swift Parrot and migratory (non-threatened) White-throated Needletail also have the potential to occur there.

The listed waterbird species have the potential to occur in aquatic habitats in and near the wind farm site, but are unlikely to occur in significant numbers on a regular basis on the wind farm site as individual habitats are limited in extent, many are ephemeral and they vary in quality.

Two of these species are EPBC Act listed migratory bird species, namely the Gull-billed Tern and the White-throated Needletail.

Mammals

A total of 24 mammal species (including seven introduced species) occur or are likely to occur within the wind farm site based on the review of existing information and the field assessments. Three introduced and 11 native species (including eight bat species) were recorded during the overview and targeted assessments (Appendix 5).

A total of six mammal species listed under the EPBC Act and/or FFG Act were considered likely to occur in the radius of investigation. Four of these were listed under the *EPBC Act* and two under the *FFG Act* (Table 7). Only one of these listed mammal species is considered likely to occur at the wind farm site due to suitable habitat being present and/or their presence being recorded during field surveys: the Yellow-bellied Sheathtail Bat, recorded a small number of times during bat surveys (see Section 8).

The *Fat-tailed Dunnart* is listed as near threatened under DELWP's advisory list and was recorded in native grassland habitats in the study area during targeted Striped Legless Lizard surveys (see Section 9).

Reptiles

The review of existing information and field assessment indicated that ten reptile species occurred or were likely to occur on the wind farm site. Of these, five species were recorded during assessments in the study area (Appendix 5).

Two reptile species listed under the EPBC Act and/or FFG Act were considered likely to occur in the wind farm site and within the 10-kilometre radius of investigation due to existing records and/or the presence of suitable habitat (see Table 7). One of these threatened reptile species (Striped Legless Lizard) was recorded on the wind farm site (see Section 9). The other threatened species, the Corangamite Water Skink, is unlikely to occur as the study area is outside its usual distribution and there are no records within the Radius of Investigation (RoI) in the VBA.

The Tussock Skink is listed as near-threatened under DELWP's advisory list and was recorded in native grassland habitats in the study area during targeted Striped Legless Lizard surveys.

Frogs

The review of existing information and field assessment indicated that nine frog species occurred or were likely to occur in the wind farm site. Of these, four species were recorded during assessments on the study area (Appendix 5).

Two frog species listed under the EPBC Act and/or FFG Act were considered likely to occur in the wind farm site and within the 10-kilometre radius of investigation due to existing records and/or presence of suitable habitat (see Table 7). One of these threatened frog species (Growling Grass Frog) was recorded on the wind farm site. The other threatened species (Brown Toadlet) is unlikely to occur due to a lack of suitable habitat in the study area.

The Growling Grass Frog was recorded from some of the wetlands and drainage lines within the study area. Suitable habitat for this species includes areas of permanent wetlands with emergent and fringing vegetation and drainage channels (permanent and ephemeral) for dispersing between these areas of suitable habitat. The sites where the Growling Grass Frog were recorded were wetlands 54056, 54073, 54297, a quarry void next to wetland 54077, and wetland 52282. These are shown on Figure 10 in Section 9.

Fish

A total of three fish species listed under the EPBC Act and/or FFG Act were considered likely to occur within the 10-kilometre radius of investigation due to existing records and/or presence of suitable habitat (see Table 7). All three species, Australian Grayling, Dwarf Galaxias and Yarra Pygmy Perch, are listed under the EPBC Act and FFG Act. None of these species was considered likely to occur on the wind farm site due to a lack of suitable permanent waterway habitat.

Invertebrates

One listed species of invertebrate, the Golden Sun Moth, was considered likely to occur in the radius of investigation due to the presence of suitable habitat and 65 records from the VBA (DELWP 2016d) (see Table 7). The Golden Sun Moth was recorded in the study area and in the road reserve along Shelford – Rokewood Road. This species is expected to occur in areas of suitable habitat within the study area. Suitable areas of habitat include plains grassland and rocky outcrops.

Table 7: EPBC and FFG Act listed fauna identified as occurring or potentially occurring in the wind farm site

Species considered likely to occur following targeted surveys or actually recorded during field assessments have been highlighted in grey

Common Name	Scientific name	EPBC-Threat	EPBC-Migratory	FFG	DELWP	Habitat	Number of records	Date of last record	Likelihood of occurrence
Birds									
Australasian Bittern	*Botaurus poiciloptilus*	EN		L	e	Terrestrial wetlands, including a range of wetland types but prefers permanent water bodies with tall dense vegetation, particularly those dominated by sedges, rush, reeds or cutting grass (Marchant and Higgins 1990).	2	18/05/1995	No suitable habitat - **unlikely to occur.**
Australian Bustard	*Ardeotis australis*			L	cr	Inhabits mainly grasslands, low shrublands and lightly timbered open woodlands (Marchant and Higgins 1993).	2	20/05/1954	This species is locally extinct in the region - **unlikely to occur.**
Australian Painted Snipe	*Rostratula australis*	EN		L	cr	Generally inhabits shallow terrestrial freshwater wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum Muehlenbeckia or canegrass or sometimes tea-tree (Melaleuca). Sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber.	None	N/A	No suitable habitat - **unlikely to occur.**
Baillon's Crake	*Porzana pusilla palustris*			L	v	Occurs in a range of ephemeral and permanent wetlands such as swamps, creeks and lakes, with dense vegetation and abundant floating plants, but also in open waters with clumped vegetation (Marchant and Higgins 1993).	None	N/A	Suitable wetland habitat present - **potential to occur.**
Barking Owl	*Ninox connivens connivens*			L	e	Eucalyptus dominated forests and woodlands, commonly near water-bodies, such as streams and rivers, and requires hollow trees for nesting and trees with dense foliage for roosting (Higgins 1999).	1	1/01/1928	No suitable habitat - **unlikely to occur.**
Black-faced Monarch	*Monarcha melanopsis*		M (Bonn)			Rainforests, eucalypt woodlands, coastal scrub and damp gullies (Higgins et al. 2006)	None	N/A	No suitable habitat - **unlikely to occur.**
Black-tailed Godwit	*Limosa limosa*		M (CAMBA, JAMBA, ROKAMBA, Bonn)		v	Mainly coastal species, usually in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats. In Vic. Found mainly round Port Phillip Bay. (Higgins and Davies 1996).	8	29/08/1980	No suitable habitat - **unlikely to occur.**
Blue-billed Duck	*Oxyura australis*			L	e	Terrestrial wetlands and prefers deep permanent, well vegetated water bodies. V (Marchant and Higgins 1990).	4	22/02/1992	No suitable habitat - **unlikely to occur.**
Brolga	*Grus rubicunda*			L	v	Wetlands that include permanent open water and deep freshwater marsh. Between 500 and 700 Brolgas are known to occur in southwestern Victoria. (Marchant and Higgins 1993).	155	5/06/2015	Suitable wetland habitat present - **recorded in the study area.**
Chestnut-rumped Heathwren	*Calamanthus pyrrhopygius*			L	v	Dense heathland and dense understorey or ground-layer in sclerophyll forests and woodlands; also in Box-ironbark forests. Widespread but sparsely distributed. (Higgins and Peter 2002; Tzaros 2005).	None	N/A	No suitable habitat - **unlikely to occur.**
Common Greenshank	*Tringa nebularia*		M (CAMBA, JAMBA, ROKAMBA, Bonn)		v	Inhabits wide range of coastal or inland wetlands with varying levels of salinity; mainly muddy margins or rocky shores of wetlands (Higgins and Davies 1996).	24	22/12/2009	No suitable habitat - **unlikely to occur.**
Curlew Sandpiper	*Calidris ferruginea*	CR	M (CAMBA, JAMBA, ROKAMBA, Bonn)		e	Inhabits wide range of coastal or inland wetlands with varying levels of salinity; mainly muddy margins or rocky shores of wetlands (Higgins and Davies 1996).	12	24/03/1980	No suitable habitat - **unlikely to occur.**
Diamond Dove	*Geopelia cuneata*			L	nt	Mostly arid and semi-arid grassland savannah, often of spinifex and in low open woodlands with grassy understorey; also often in open riparian woodlands (Higgins and Davies 1996).	2	1/03/1999	No suitable habitat - **unlikely to occur.**
Diamond Firetail	*Stagonopleura guttata*			L	nt	Commonly found in box-ironbark forests and woodlands and also occurs along watercourses and in farmland areas. Widespread but scattered. Populations had declined in Victoria since the 1950s. (Emison et al. 1987; Tzaros 2005).	4	1/01/1976	No suitable habitat - **unlikely to occur.**
Double-banded Plover	*Charadrius bicinctus*		M (Bonn)			Inhabits wide range of coastal or inland wetlands with varying levels of salinity; mainly muddy margins or rocky shores of wetlands (Marchant and Higgins 1993).	4	27/04/2005	No suitable habitat - **unlikely to occur.**

Common Name	Scientific name	EPBC-Threat	EPBC-Migratory	FFG	DELWP	Habitat	Number of records	Date of last record	Likelihood of occurrence
Eastern Curlew	*Numenius madagascariensis*	CR	M (CAMBA, JAMBA, ROKAMBA, Bonn)		v	Inhabits sheltered coasts, especially estuaries, embayment, harbours, inlets and coastal lagoons with large intertidal mudflats or sandflats, often with beds of sea grass (Higgins and Davies 1996).	None	N/A	No suitable habitat - **unlikely to occur.**
Eastern Great Egret	*Ardea modesta*			L	v	Occurs in a variety of wetlands including: permanent water bodies on flood plains; shallows of deep permanent lakes, either open or vegetated with shrubs or trees; semi-permanent swamps with tall emergent vegetation (e.g. bulrush) and herb dominated seasonal swamps with abundant aquatic flora (Marchant and Higgins 1990).	24	9/01/2004	Suitbale habitat present - **potential to occur.**
Freckled Duck	*Stictonetta naevosa*			L	e	Terrestrial wetlands; prefer fresh, densely vegetated waters, particularly floodwater swamps and creeks vegetated with lignum or cane grass. During dry seasons or droughts, move off ephemeral breeding swamps and occupy large permanent waters. (Marchant and Higgins 1990).	1	17/02/1979	No suitable habitat - **unlikely to occur.**
Grey Goshawk	*Accipiter novaehollandiae novaehollandiae*			L	v	Inhabit rainforests, open forests, swamp forests, woodlands and plantations; most abundant where forest or woodland provide cover for hunting from perches. in Vic., most common in Otway ranges. (Marchant and Higgins 1993).	2	6/05/2004	No suitable habitat - **unlikely to occur.**
Grey-crowned Babbler	*Pomatostomus temporalis temporalis*			L	e	Inhabits dry woodlands and forests with a shrub layer and a groundcover of leaf litter and fallen timber. In Victoria it is found in woodlands and forests with box-ironbark eucalypt associations and River Red Gums, including narrow remnants along roadsides and streams. Formerly widespread over much of Victoria, but populations has declined and range has contracted markedly, mostly from the south and west since the 1970s. Gregarious, usually found in family group of 3–6 birds. (Higgins and Peter 2002; Tzaros 2005).	3	1/12/1979	No suitable habitat - **unlikely to occur.**
Gull-billed Tern	*Gelochelidon nilotica macrotarsa*		M (CAMBA)	L	e	Shallow freshwater and saline wetlands; intertidal mudflats, also in sheltered inshore marine waters where they roost on sandbars and beaches (Higgins and Davies 1996).	6	4/01/1994	Suitable wetland habitat present - **potential to occur.**
Hooded Robin	*Melanodryas cucullata cucullata*			L	nt	Occur mostly in open Grey Box, White Box, Yellow Box, Yellow Gum and Ironbark woodlands with pockets of saplings or taller shrubs, an open shrubby understorey, sparse grasses and patches of bare ground and leaf-litter, with scattered fallen timber. The population has declined throughout range, especially since the early 1980s. This species typically occurs north of the great divide in shrubland or woodland dominated by acacias. (Higgins and Peter 2002; Tzaros 2005).	4	1/12/1979	No suitable habitat - **unlikely to occur.**
Intermediate Egret	*Ardea intermedia*			L	e	It mainly inhabits terrestrial wetlands; only occasionally visit coastal wetlands and forages amongst aquatic vegetation in shallow water and requires trees for roosting and nesting. It often occurs in wetlands that contain vegetation, including bulrush (Marchant and Higgins 1990).	2	1/01/1976	Due to lack of recent and regular records this species is considered **unlikely to regularly occur.**
Latham's Snipe	*Gallinago hardwickii*		M (JAMBA, ROKAMBA, Bonn)		nt	Occurs in wide variety of permanent and ephemeral wetlands; it prefers open freshwater wetlands with dense cover nearby, such as the edges of rivers and creeks, bogs, swamps, waterholes. The species is wide spread in southeast Australia and most of its population occurs in Vic. Except in the northwest of the state. (Naarding 1983; Higgins and Davies 1996).	52	11/11/1992	This species occurs in a wide variety of wetlands to which there is potential habitat in the study area - **potential to occur.**
Little Bittern	*Ixobrychus minutus dubius*			L	e	Inhabits terrestrial wetlands, mainly in dense emergent vegetation in freshwater swamps, lakes and watercourses (Marchant and Higgins 1990).	1	23/10/1957	No suitable habitat - **unlikely to occur.**
Little Egret	*Egretta garzetta nigripes*			L	e	It occurs in a range of coastal and terrestrial wetlands, including freshwater wetlands with vegetation such as bulrush and requires trees for roosting and nesting (Marchant and Higgins 1990).	1	1/09/1960	No suitable habitat - **unlikely to occur.**
Long-toed Stint	*Calidris subminuta*		M (CAMBA, JAMBA, ROKAMBA, Bonn)		nt	Inhabits a variety of terrestrial wetlands it prefers shallow freshwater or brackish wetlands with areas of muddy shorelines and growth of various vegetation (Higgins and Davies 1996).	4	3/10/1998	No suitable habitat - **unlikely to occur.**

Common Name	Scientific name	EPBC-Threat	EPBC-Migratory	FFG	DELWP	Habitat	Number of records	Date of last record	Likelihood of occurrence
Osprey	*Pandion cristatus*		M (Bonn)			Rare vagrant to Victoria (Marchant & Higgins 1993). Littoral and coastal habitats and terrestrial wetlands. They are mostly found in coastal areas but occasionally travel inland along major rivers (Johnstone & Storr 1998; Marchant & Higgins 1993; Olsen 1995). They require extensive areas of open fresh, brackish or saline water for foraging (Marchant & Higgins 1993).	None	N/A	No suitable habitat - **unlikely to occur.**
Painted Honeyeater	*Grantiella picta*	VU		L	v	Inhabits box-ironbark forests and woodlands and mainly feeds on the fruits of mistletoe. Strongly associated with mistletoe around the margins of open forests and woodlands. Occurs at few localities. Uncommon breeding migrant from further north, arriving in October and leaving in February. (Higgins et al. 2001; Tzaros 2005).	2	1/01/1970	No suitable habitat - **unlikely to occur.**
Pectoral Sandpiper	*Calidris melanotos*		M (JAMBA, ROKAMBA, Bonn)		nt	Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins and Davies 1996).	None	N/A	No suitable habitat - **unlikely to occur.**
Plains-wanderer	*Pedionomus torquatus*	CR		L	cr	This species inhabits native grasslands with sparse cover, preferring grasslands that include wallaby grass and spear grass species (Marchant and Higgins 1993).	5	16/04/1992	Due to lack of recent and regular records this species is considered **unlikely to regularly occur.**
Powerful Owl	*Ninox strenua*			L	v	Open and tall wet sclerophyll forests with sheltered gullies and old growth forest with dense understorey. They are also found in dry forests with box and ironbark eucalypts and River Red Gum. Large old trees with hollows are required by this species for nesting. In Victoria, the Powerful Owl is widespread, having been recorded from most of the state. However, throughout its range it is uncommon and occurs in low densities. (Higgins 1999; Soderquist et al. 2002).	4	1/01/1959	No suitable habitat - **unlikely to occur.**
Red-necked Stint	*Calidris ruficollis*		M (CAMBA, JAMBA, ROKAMBA, Bonn)			Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins and Davies 1996).	36	22/12/2009	No suitable habitat - **unlikely to occur.**
Regent Honeyeater	*Anthochaera phrygia*	CR		L	cr	Inhabits dry box-ironbark eucalypt forests near rivers and creeks on inland slopes of the Great Dividing Range. It could also occur in small remnant patches or in mature trees in farmland or partly cleared agricultural land (Higgins et al. 2001).	None	N/A	No suitable habitat - **unlikely to occur.**
Rufous Fantail	*Rhipidura rufifrons*		M (Bonn)			Primarily found in dense, moist habitats. Less often present in dry sclerophyll forests and woodlands (Higgins et al. 2006).	4	1/01/1976	No suitable habitat - **unlikely to occur.**
Satin Flycatcher	*Myiagra cyanoleuca*		M (Bonn)			Tall forests and woodlands in wetter habitats but not in rainforest (Higgins et al. 2006)	7	1/01/1976	No suitable habitat - **unlikely to occur.**
Sharp-tailed Sandpiper	*Calidris acuminata*		M (CAMBA, JAMBA, ROKAMBA, Bonn)			Inhabit shallow fresh to saline wetlands, usually coastal to near-coastal, but occasionally farther inland. Wetlands often have open fringing mudflats and low emergent or fringing vegetation (Higgins and Davies 1996).	44	22/12/2009	No suitable habitat - **unlikely to occur.**
Speckled Warbler	*Chthonicola sagittatus*			L	v	Inhabits dry eucalypt forests and woodlands, especially those with box-ironbark eucalypt associations. It is also found in River Red Gum woodlands. The species is uncommon; populations have declined since the 1980s. (Higgins and Peter 2002; Tzaros 2005).	9	1/12/1979	No suitable habitat - **unlikely to occur.**
Swift Parrot	*Lathamus discolor*	CR		L	e	Prefers a narrow range of eucalypts in Victoria, including White Box, Red Ironbark and Yellow Gum as well as River Red Gum when this species supports abundant 'lerp'. Breeds in Tasmania and migrates to the mainland of Australia for the autumn, winter and early spring months. It lives mostly north of the Great Dividing Range, passing through two areas of Victoria on migration: the Port Phillip district and Gippsland. (Emison et al. 1987; Higgins 1999; Kennedy and Tzaros 2005).	3	7/08/2003	Potential foraging habitat in planted Sugar Gums - **potential to occur.**

Common Name	Scientific name	EPBC-Threat	EPBC-Migratory	FFG	DELWP	Habitat	Number of records	Date of last record	Likelihood of occurrence
White-bellied Sea-Eagle	*Haliaeetus leucogaster*			L	v	Maritime habitats, terrestrial large wetlands and coastal lands of tropical and temperate Australia and offshore islands, ranging far inland only over large rivers and wetlands. The eagles usually breed on coast and offshore islands and inland beside large lakes or rivers, usually in tall trees in or near water, also in cliffs, rock pinnacles and escarpments. (Marchant and Higgins 1993).	None	N/A	No suitable habitat in the study area - **unlikely to occur.**
White-throated Needletail	*Hirundapus caudacutus*		M (CAMBA, JAMBA, ROKAMBA)		v	Aerial, over all habitats, but probably more over wooded areas, including open forest and rainforest. Often over heathland and less often above treeless areas such as grassland and swamps or farmland (Higgins 1999).	48	20/02/2003	Suitable habitat present - **potential to occur.**
Yellow Wagtail	*Motacilla flava*		M (CAMBA, JAMBA, ROKAMBA)			Extremely uncommon migrant. Few sightings in Victoria. Mostly occurs in well-watered open grasslands on the fringes of wetlands. Roosts in mangroves and other dense vegetation (DotE 2015).	None	N/A	Rare vagrant to Victoria - **unlikely to occur.**
Mammals									
Eastern Barred Bandicoot	*Perameles gunnii*	EN		L	ew	The habitat of the Eastern Barred Bandicoot (mainland) is perennial tussock grassland and eucalypt woodland with a grassy ground layer (Dufty 1994b; Seebeck 1995a, 2001). Drainage lines and areas of high vegetative cover have been identified as prime habitat. The key determining factor for persistence of this species appears to be high structural complexity and heterogeneity within the environment, reflected in its absence from agricultural areas but persistence in rubbish dumps and other variable habitats.	1	1/01/1932	This species is locally extinct in the area - **unlikely to occur.**
Eastern Bentwing Bat	*Miniopterus schreibersii oceanensis*			L	v	Roosts in caves during the day, dispersing over a range of habitats at night. Its feeding areas tend to be associated with major drainage systems (Menkhorst 1995).	0	N/A	The study area is on the far edge of its distribution - **unlikely to occur**.
Greater Glider	*Petauroides volans*	VU		L	v	Forest habitats including peppermint, stringybark, ash and gum dominated (Menkhorst 1995).	None	N/A	No suitable habitat - **unlikely to occur.**
Grey-headed Flying-fox	*Pteropus poliocephalus*	VU		L	v	Brisbane, Newcastle, Sydney and Melbourne are occupied continuously. Elsewhere, during spring, they are uncommon south of Nowra and widespread in other areas of their range. Roosts in aggregations of various sizes on exposed branches. Roost sites are typically located near water, such as lakes, rivers or the coast. Roost vegetation includes rainforest patches, stands of Melaleuca, mangroves and riparian vegetation, but colonies also use highly modified vegetation in urban and suburban.	None	N/A	No suitable habitat - **unlikely to occur.**
Spot-tailed Quoll	*Dasyurus maculatus maculatus*	EN		L	e	Rainforest, wet and dry forest, coastal heath and scrub and River Red-gum woodlands along inland rivers (Menkhorst 1995).	2	1/06/1964	No suitable habitat - **unlikely to occur.**
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*			L	dd	Known to occur from urban, agricultural semi-arid and tall wet forest habitats (Menkhorst 1995).	2	9/07/1905	This species has been **recorded in the study area** during targeted surveys
Reptiles									
Corangamite Water Skink	*Eulamprus tympanum marnieae*	EN		L	cr	Found in grassy open woodland and cleared pastures dotted with ephemeral swamps and lakes, on rocky basaltic soils. The preferred habitat is a geographically peculiar landform comprising basalt ridges and boulder heaps resulting from the collapse of lava tunnels (DoEE 2016 b)	None	N/A	Outside its natural distribution - **unlikely to occur.**
Striped Legless Lizard	*Delma impar*	VU		L	e	Grassland specialist. Known to occur in some areas dominated by introduced species such as *Phalaris aquatica*, Serated Tussock (*Nasella trichotoma*) and *Hypocharis radicata* (Corrigan et al. 1996; Coulson 1990; Hadden 1995; Kukolic 1994; O'Shea 1996; Rauhala 1996; Rauhala et al. 1995) and at sites with a history of grazing and pasture improvement (Coulson 1995; Dorrough 1995; Smith & Robertson 1999). It shelters in grass tussocks, thick ground cover, soil cracks, under rocks, spider burrows, and under ground debris such as timber (Smith & Robertson 1999). The majority of sites in Victoria and NSW occur on cracking clay soils with some surface rock which provide shelter for the species (Cogger et al. 1993; Coulson 1995).	141	11/06/2015	Suitable native grassland habitat present - **recorded in the study area.**

Common Name	Scientific name	EPBC-Threat	EPBC-Migratory	FFG	DELWP	Habitat	Number of records	Date of last record	Likelihood of occurrence
Frogs									
Brown Toadlet	*Pseudophryne bibronii*			L	e	Wet and dry forest, grassy areas besides small creeks, alpine grasslands and mossy bogs (Cogger 2000).	6	16/06/2004	No suitable habitat - **unlikely to occur.**
Growling Grass Frog	*Litoria raniformis*	VU		L	e	Permanent, still or slow flowing water with fringing and emergent vegetation in streams, swamps, lagoons and artificial wetlands such as farm dams and abandoned quarries (Clemann and Gillespie 2004).	8	14/12/2010	Suitable wetland habitat - **recorded in the study area.**
Fish									
Australian Grayling	*Prototroctes maraena*	VU		L	v	Large and small coastal streams and rivers with cool, clear waters with a gravel substrate and altering pools and riffles (Cadwallader and Backhouse 1983).	None	N/A	No suitable habitat - **unlikely to occur.**
Dwarf Galaxias	*Galaxiella pusilla*	VU		L	e	Barwon River to Mitchell River. Vegetated margins of still water, ditches, swamps and backwaters of creeks, both ephemeral and permanent (Allen et al. 2002).	None	N/A	No suitable habitat - **unlikely to occur.**
Yarra Pygmy Perch	*Nannoperca obscura*	VU		L	v	Streams and small lakes, prefers flowing water with abundant aquatic vegetation (Allen et al. 2002).	2	23/04/2008	No suitable habitat - **unlikely to occur.**
Invertebrates									
Golden Sun Moth	*Synemon plana*	CR		L	cr	Areas that are, or have been native grasslands or grassy woodlands. It is known to inhabit degraded grasslands with introduced grasses being dominant, with a preference for the native wallaby grass being present (DEWHA 2009).	65	4/12/2015	Suitable native grassland habitat present - **recorded in the study area.**

Bird species habitat requirements were sourced from Marchant and Higgins (1990, 1993) and Higgins and Davies (1996) unless otherwise stated in text. Mammal habitat requirements were sourced from Menkhorst (1995); please refer to literature cited in text for all other species habitat requirements. Species considered to potentially occur within the wind farm boundary are highlighted in grey.

Abbreviation key: EPBC - Status under *EPBC Act*; **EPBC – migratory –** Status under EPBC Act; **FFG** - Status under *FFG Act*; **DELWP –** Status under DELWP threatened species advisory list; **ew** – extinct in the wild; **CR & cr** - Critically endangered; **EN & e** - Endangered; **VU & v** - Vulnerable; **nt -** near threatened; **L** - Listed on *FFG Act*; **M** - Listed migratory species; **JAMBA** - Japan-Australia Migratory Bird Agreement; **CAMBA** - China-Australia Migratory Bird Agreement; **ROKAMBA** - Republic of Korea-Australia Migratory Bird Agreement; **Bonn** - Bonn Convention.

6.4 Impacts and Implications

6.4.1 *Potential impacts on fauna*

The construction and operation of the Golden Plains Wind Farm may have the following impacts on fauna species.

- Direct removal of fauna habitat;
- Indirect alteration to habitat from runoff from construction areas into adjacent habitat;
- Indirect disturbance to fauna inhabiting the site; and
- Collision of birds and bats by operating turbines.

The total area of the Golden Plains Wind Farm site is 17,345 hectares, and construction of the wind farm will impact on less than 200 hectares, which is less than 1% of the site. The assessment of native vegetation removal indicated that some 81.29 hectares of Plains Grassland and other EVCs would be removed for the project. As the development footprint has been derived in accordance with the 'avoid' and 'minimise' principles, the bulk of the best grassland habitat has been avoided and will be retained. The residual impact, involving the removal of 81.29 hectares, represents less than one percent of the entire area of the wind farm site and less than two percent of the native vegetation on the site.

The impact on the local population of any grassland-dependent fauna is therefore likely to be limited and these populations will persist in the extensive remaining areas of grassland habitat.

Constructions activities have the potential to degrade the quality of adjacent grassland habitat, as well as contribute sediment-laden runoff to nearby wetlands and/or waterways if not properly managed. Serious indirect impacts on remaining habitats can be avoided through the implementation of best practice construction environmental management measures, such as:

- Siting development at least thirty metres from wetlands and waterways;
- Avoiding significant alterations to the site's hydrology from construction works in areas that support native vegetation.
- Temporarily fencing or marking with bunting, and appropriately signposting any retained native vegetation adjacent to construction areas;
- Excluding all machinery, earthworks, lay down areas and stockpiles from these areas;
- Ensuring all machinery enters and exits works sites along defined routes that do not impact on native vegetation or cause soil disturbance and weed spread.
- Requiring all machinery brought onto the site to be weed and pathogen free and requiring wash down between farming properties (this is important for environmental and agricultural protection: soil borne pathogens such as Cinnamon Fungus and livestock diseases can be easily transported by machinery).

During construction, vehicle movements and human activity, as well as site lighting and noise will increase significantly. This has the potential to disturb native fauna. As most activity will occur during daylight hours, nocturnal fauna is not expected to be disrupted significantly near works areas. During daylight hours, a small proportion of grassland

habitat on the site will experience indirect disturbance and some mobile fauna species may be deterred from using these areas. Once construction is complete, the lower level of vehicle traffic and human activity associated with operating the completed wind farm will not disturb fauna in adjacent habitats for long. As construction is temporary and intermittent (estimated to last for short periods at any one works site within the longer project construction period), and operational activity is at a very low level, long-term exclusion of fauna from these disturbed areas is not anticipated.

Noise from wind turbines is usually continuous and does not vary suddenly. Therefore, it is likely that fauna in adjacent habitats will not be significantly disturbed by this.

Impacts and implications of collision with operating wind turbines for birds are discussed in Section 7 and for bats in Section 8 of this report.

The potential for impacts on each listed fauna species from the proposed wind farm are discussed below.

- The *Baillon's Crake* is a small and cryptic waterbird that occurs in wetlands. It has the potential to occur in the freshwater wetlands when they hold water. This habitat is not being significantly impacted by the proposed development as turbines, tracks and other infrastructure are located at least 30 metres from almost all[4] wetlands and waterways.
- The *Brolga* has been recorded in the study area and is discussed in more detail in Report 16064 (2.1), BL&A 2017).
- The *Eastern Great Egret* has been recorded in the radius of investigation and has the potential to occur at the wind farm site due to the presence of suitable wetland habitat. This species wades in shallow water foraging for food. It is unlikely that this species occurs regularly or in significant numbers due to the limited extent and quality of wetland habitat within the wind farm site. Aquatic habitats are not being significantly affected by the proposed development as turbines, tracks and other infrastructure are located at least 30 metres from almost all wetlands and waterways.
- The *Gull-billed Tern* is likely to occur at the study area due to the presence of suitable habitat. This species flies over wetlands and grasslands in search of food. It is unlikely that this species occurs regularly or in significant numbers on the wind farm site so the proposed development is unlikely to pose a significant risk to this species. Furthermore, turbines, tracks and other infrastructure are located at least 30 metres from almost all wetlands and waterways to avoid significant impacts on these habitats.
- The migratory *Latham's Snipe* is likely to occur in the study area due to the presence of suitable wetland habitat in the spring and summer months when it is present in south eastern Australia. This species resides in a wide variety of wetlands from edges of lakes or swamps to small grassy drainage lines. This species spends most of its time in wetlands. The limited extent and quality of wetland habitat within the wind farm site make it highly unlikely that an important population of the species (i.e. 0.1%

[4] Exceptions occur along about 3.9 kilometres of track (2.6 percent of tracks) near wetlands, mostly where they follow existing farm tracks (that require slight widening and upgrading) to minimise impacts on native vegetation compared with the construction of a completely new track. A further 4.2 km of tracks (2.8% of tracks) lie within 100 m of waterways at the 21 waterway crossings required to be constructed.

of the flyway population, or 36 individuals, Bamford et al. 2008) resides on the wind farm site. It is unlikely that the wind farm would have a significant impact on this species as the development footprint will be well away from any extensive wetland habitat in the region.

- The *Swift Parrot* is likely to occur in the study area due to the presence of suitable foraging trees. The Swift Parrot may occasionally forage on flowering Sugar Gum. Shelter belts of Sugar Gum have been planted along fence-lines in the study area. Although this is not considered core habitat for this species, with the principal habitats being further north and east in Victoria (DoEE 2016c), there is potential for it to occur on rare occasions. The infrequency and likely small numbers of this species on the wind farm site make a significant impact from the project highly unlikely.
- The *White-throated Needletail* (listed as migratory under the EPBC Act) is an aerial bird species that spends most of its life on the wing. This species is often observed in south-eastern Australia in the summer, flying ahead of storm fronts, feeding on flying insects. The White-throated Needletail occasionally collides in small numbers with turbines (BL&A, unpubl. data) as it often flies at rotor swept area heights. The numbers of birds affected is small and would not significantly affect the wider population of this non-threatened, migratory species.
- *The Yellow-bellied Sheathtail Bat* was recorded in the study area and is discussed in more detail in Section 8 of this report.
- The *Striped Legless Lizard* was recorded in the study area and is discussed in more detail in Section 9 of this report.
- Impacts on the *Growling Grass Frog* from the proposed wind farm are likely to be insignificant or unlikely. The Growling Grass Frog is a nocturnal ambush predator and is unlikely to forage more than 100 metres from the waterline of wetlands (Heard et al. 2008). Four turbines are located within the flood extents and the closest wind turbine is a minimum of 85 metres away from waterways. No infrastructure will be placed within 100 metres of confirmed Growling Grass Frog wetland sites.
- *Golden Sun Moth* habitat corresponds broadly to Plains Grassland EVC. Impacts on this species have been mitigated through the application of the 'avoid' and 'minimise' principles during the design of the project (see Section 5). As indicated above, 81.29 hectares of native vegetation will be removed, most of which is likely to be habitat for this species. The retention of the remaining habitat (almost 4,000 hectares) will ensure the survival of the local and regional population of the moth in the future. Species-specific EPBC Act offsets will be required for the removal of this habitat, ensuring that habitat known to support this species will be protected and enhanced in perpetuity.

7 BIRD UTILISATION SURVEY

KEY FINDINGS

- Two Bird Utilisation Surveys (BUS) undertaken during summer and autumn 2017 indicated that the most abundant species frequenting the proposed wind farm were common farmland birds as follows.
    - House Sparrow
    - Common Starling
    - Australian Magpie
    - Little Raven and
    - White-plumed Honeyeater.
- Almost all birds counted (97.5%) flew below Rotor Swept Area (RSA) height (RSA height = 40 to 190 metres).
- The number of Wedge-tailed Eagle recorded over the proposed wind farm site was 0.02 percent of all birds recorded. This is comparable with utilisation rates for this species in similar agricultural landscapes in south eastern Australia. This level of activity is not exceptional and risks to this species are therefore considered to be low.
- Raptors made up 1 percent of all individual birds observed during the survey, with Brown Falcon the most abundant species.
- Waterbirds were not common during the BUS, reflecting the limited availability of wetland habitat on the site. They comprised 1.1 percent of all birds recorded.
- The proposed wind farm is unlikely to have a significant impact on the common farmland bird species that dominate the site, or on the raptors and waterbirds that utilise the wind farm site in small numbers.

7.1 Introduction

Two bird utilisation surveys (BUS) were undertaken in 2017, the first during the period 30th January to 4th February (summer survey), and the second survey during 9th to 13th (autumn survey). The surveys were consistent with the requirements for a "Level One" bird risk assessment in accordance with 'Wind Farms and Birds - Interim Standards for Risk Assessment' issued by the Australian Wind Energy Association (AusWEA 2005). This approach has been endorsed in the latest Best Practice Guidelines (Clean Energy Australia 2013).

The bird utilisation surveys were undertaken by an experienced zoologist and were design to set up basic data to use for bird utilization comparisons with post-construction data (BACI model).

This investigation was undertaken by a team from BL&A, comprising Curtis Doughty (Senior Zoologist), Khalid Al-Dabbagh (Senior Zoologist), Bernard O'Callaghan (Senior Ecologist), Inga Kulik (Senior Ecologist & Project Manager), and Brett Lane (Principal Consultant).

7.2 Methods

7.2.1 *Fixed-point bird count method*

The fixed-point bird count method involved an observer stationed at a survey point for 15 minutes, during which time all birds observed within a 200 metre radius were recorded. This represents an area of over 12.5 hectares and is considered sufficient to generate bird data representative of the wind farm area. Eight impact sites and four reference points were surveyed (see Figure 6).

The adequacy of using 15 minutes as an interval to record the presence of birds during bird utilisation surveys was investigated in an earlier study at another wind farm site (Brett Lane and Associates Pty. Ltd., unpublished data). This showed that 82 to 100 percent (average 88 percent) of species actually seen in one hour of surveying were seen in the initial 15 minutes of observation. Based on this result, the period of 15 minutes used in the formal bird utilisation surveys was considered adequate to generate representative data on the bird species in the area during the survey.

During this period, all bird species and numbers of individual birds observed within 200 metres of the survey point were recorded. The species, the number of birds and the height of the bird when first observed were documented. For species of concern (threatened species, waterbirds and raptors), the minimum and maximum heights were recorded.

Flight height is presented as below, at or above rotor swept area height (RSA height) indicated below.

- A = Below RSA (< 40 metres above ground)
- B = At RSA (40 – 190 metres above ground)
- C = Above RSA (> 190 metres above ground).

Table 8 indicates when each point was counted on each survey day. This schedule ensured that all points were visited equally at separate times of day to allow for time-of-day differences in bird movements and activity. Every survey point (impact and reference) was visited eight times over the survey period (see Figure 6).

Table 8: Times when points were counted for each fixed-point bird count survey day

Time	Day 1	Day 2	Day 3	Day 4	Day 5
8:00	1	6	3	7	R1
8:30	2	R2	4	8	5
9:00	3	7	R1	1	6
9:30	4	8	5	2	R2
10:00	R1	1	6	3	7
10:30	5	2	R2	4	8
11:00	6	3	7	R1	1
11:30	R2	4	8	5	2
12:30	7	R1	1	6	3
13:00	8	5	2	R2	4
13:30	1	6	3	7	R1
14:00	2	R2	4	8	5
14:30	3	7	R1	1	6

Time	Day 1	Day 2	Day 3	Day 4	Day 5
15:00	4	8	5	2	R2
15:30	R1	1	6	3	7
16:00	5	2	R2	4	8

Note: See Figure 6 for survey point locations. The prefix 'R' refers to reference point.

7.2.2 *Locations of survey points*

Over the survey period, ten fixed survey points were established; eight impact points and two reference points (Figure 6). Impact points were located near proposed turbine locations and reference points were located at least 500 metres away from impact points and proposed turbines in areas of similar habitat.

The survey points were distributed as evenly as possible (subject to access constraints) across the wind farm to maximise coverage in areas where wind turbines are likely to be sited (Figure 6). Survey points were positioned as far as possible in areas allowing a clear view in all directions (minimum 270-degree view of the count area).

Table 9 below provides a description of the habitats associated with each impact and reference point.

Table 9: Habitat associated with each survey point

Survey Point	Habitat description
1	The site was primarily used for grazing sheep. Mixture of native and introduced grass species. Small area of planted trees including pines, eucalypts and she-oak. A small farm dam was in the search area.
2	Located in agricultural land along a creek. Grazing and cropping in the search area, with the crop being recently harvested (summer). A small farm dam was in the search area and River Red-gum trees lined the creek line.
3	This site consisted of two paddocks used for grazing sheep. The northern half of the search area was grassland dominated by wallaby grasses and the southern half was dominated by introduced pasture species. There were no trees in the search area.
4	There were four paddocks in the search area. Three paddocks were used for grazing sheep and one paddock had been cropped and harvested. A few young planted trees occurred along a fence line; the trees were eucalypts and wattles up to four metres high.
5	This site comprised agricultural land mostly used for grazing; some of the area had been cropped and harvested. Grassland was dominated by spear grasses and *Phalaris* sp. There was a row of planted trees along a fence line comprising Sugar Gum, She-oak and paperbark trees.
6	Agricultural land used for grazing sheep; native grassland species that dominated this area included Kangaroo Grass, wallaby grasses and spear grasses. A row of planted trees was present along one of the fence lines comprising Sugar Gum, she-oak and paperbark trees.
7	Agricultural land used for grazing and cropping; the western half of this site was high quality native grassland. There was a row of planted trees along a fence line comprising Sugar Gum and she-oak trees and also a small patch of mature pine trees in one of the paddocks.
8	Agricultural land used for grazing sheep. A dry wetland was in the search area along with a small farm dam. There were planted cypress trees along a fence line as well as mature planted Sugar Gum trees.

Survey Point	Habitat description
R1	Located in agricultural land primarily used for sheep grazing, there was a mixture of native and introduced grasses. One of the paddocks in the search area had been harvested for hay production. There was a row of trees planted along one of the fencelines that included Sugar Gum and she-oak. There was also a small farm dam in the search area.
R2	Agricultural landscape used for grazing sheep, hay making and cropping. The paddock on the south side had been cut for hay. One of the paddocks in the north had been cropped and harvested. There was a row of planted trees along a fenceline that consisted of Sugar Gum and she-oak.

7.2.3 *Incidental observations*

In addition to the observations during formalised, fixed-point counts, incidental observations of birds of concern (threatened species, raptors) were made whilst travelling throughout the proposed wind farm site. Notes were also made on birds observed in remnant woodlands and any early morning and evening roosting movements. Emphasis was placed on observing birds that were moving through the site at RSA height.

7.2.4 *Limitations*

The flight height data used for this assessment was generated from the height the bird was flying when the observer first sighted the bird. In some instances, the bird would then ascend above RSA height. For example, some Wedge-tailed Eagles were observed flying at RSA height during the assessment though when first observed they were flying below RSA height.

This bird utilisation survey was undertaken during summer and autumn in 2017. At these times, birds were generally flocking and in greater numbers. This survey was timed also to detect any migratory species present in the area.

The results presented in this report therefore provide a sound basis on which to assess the bird risks associated with the proposed Golden Plains Wind Farm.

Figure 6: Map of Golden Plains Wind farm showing the location of bird utilisation survey and bat recording points

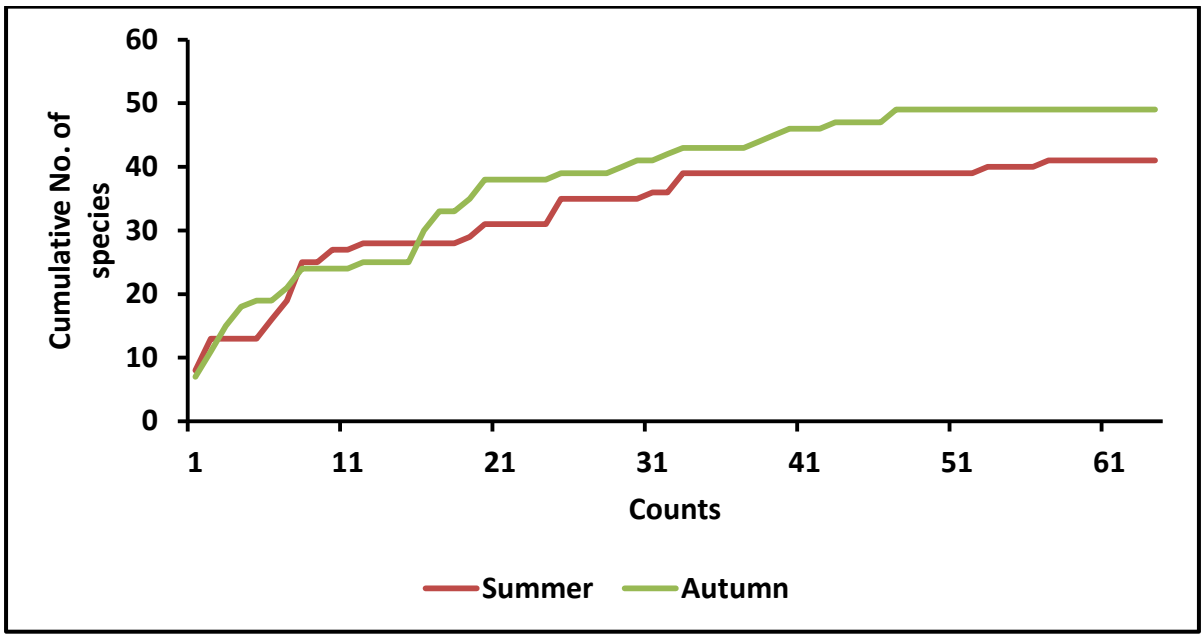
See Volume B

7.3 Results

7.3.1 *Survey Suitability*

The cumulative number of species observed from the consecutive fixed-point bird counts conducted at the impact points during the survey period has been plotted (Figure 7). This shows that the number of species recorded levelled out after 33 to 45 counts. This indicates that the survey effort was sufficient to generate representative data on the bird species in the area.

Figure 7: The cumulative number of species of birds recorded during consecutive counts of the BUS at impact points on the Golden Plains Wind Farm.



7.3.2 *Species Composition*

A total of 149 species of birds (seven introduced) were recorded for the general area encompassing the wind farm site (VBA database). Of these, 80 species were seen within and close to the wind farm site during BUS and roaming surveys between the proposed turbine impact and reference points.

The diversity of birds during the summer and autumn surveys was very similar with little seasonal variations. During BUS, a total of 62 species were seen in summer and autumn. The distribution of the number of species seen at the impact and reference sites and between the two seasons is shown in Table 10 below:

Table 10: Number of species recorded during BUS at the impact and reference sites.

Season	No. of species at impact sites	No. of species at reference sites	All species
Summer	41	26	44
Autumn	46	29	53

Species recorded were predominantly common farmland species with some records of raptors and waterbirds.

7.3.3 *Bird diversity and abundance*

The species observed utilising the eight impact and two reference points, their abundance and height distribution for each of the two seasons are detailed in the Appendix 1. A summary of the impact and reference point data are presented in Table 11 and Table 12 respectively, including a list of the species observed during the BUS at each of the two seasons of the survey, as well as the number of individuals per species recorded at each of the three height zones (below, at and above RSA height).

The abundance of birds was almost similar between the two seasons of the survey. It was slightly higher during autumn. The difference between the counts is probably related to the ecology of some of the dominant species. Magpies, House Sparrows, starlings and ravens are usually found moving and foraging in large flocks in autumn. In addition, most bird numbers would be higher following the end of the breeding season with the recruitment of the new generation to their populations.

Species composition (diversity) differed between sites and between seasons due basically to different habitat characteristics and changes in seasonal activities.

The five most common species at the impact and reference points are presented below in Table 11.

Table 11: The five most dominant bird species at the impact and reference points

Impact sites		
Summer / Impact sites	**Autumn / Impact sites**	**Both seasons**
House Sparrow	House Sparrow	House Sparrow
Common Starling	Australian Magpie	Common Starling
Australian Magpie	Red Wattle Bird	Australian Magpie
Fairy Martin	White-plumed Honeyeater	Little Raven
Little Raven	Yellow-rumped Thornbill	White-plumed Honeyeater
Reference Sites		
European Goldfinch	Australian Shelduck	Australian Shelduck
House Sparrow	Little Raven	Little Raven
Common Starling	Grey Teal	Australian Magpie
Australian Magpie	Australian Magpie	Grey Teal
Little raven	Pacific Black Duck	European Goldfinch

The dominant species in terms of their abundance were mainly flocking species, including two introduced birds (sparrows and starlings). These five species accounted, on average, for over 52% of birds observed on the wind farm site during the BUS.

On a seasonal basis, there was little difference in the position of the dominant species. In summer, the migratory Fairy Martin was common, but it disappeared by autumn. The native wattlebirds, thornbills and honeyeaters were more abundant in autumn as well. The five most common birds constituted 68% of all birds in summer and 48% in autumn. The higher representation of the dominant species in summer is mainly due to higher numbers of starlings and house sparrows, both introduced species.

The distribution of bird numbers between the eight impact points was rather uneven and influenced by the presence of remnant patches of trees within the counting area (Table 9). Points 2 and 8 recorded the highest number of birds as they were located on the edge of creeks and encompassed large trees and more diverse habitats than other points. Points 3, 5 and 6 were mostly open grazing or cropping paddocks with few trees and supported fewer birds.

Table 12: Number and height distribution of bird species at survey points during the summer season survey

Species	Summer season survey				Autumn season survey				Both seasons combined			
	A	B	Total	% Imp.	A	B	Total	% Imp.	A	B	G. Tot.	% Imp.
House Sparrow	672	0	672	27.5	445	0	445	16.6	1117	0	1117	21.8
Common Starling	390	0	390	16.0	146	0	146	5.5	536	0	536	10.5
Australian Magpie	229	0	229	9.4	239	0	239	8.9	468	0	468	9.1
Little Raven	108	10	118	4.8	169	12	181	6.8	277	22	299	5.8
White-plumed Honeyeater	84	0	84	3.4	198	0	198	7.4	282	0	282	5.5
Superb Fairy-wren	115	0	115	4.7	153	0	153	5.7	268	0	268	5.2
Yellow-rumped Thornbill	69	0	69	2.8	194	0	194	7.2	263	0	263	5.1
Fairy Martin	199	55	254	10.4	2	0	2	0.1	201	55	256	5.0
Red Wattlebird	40	0	40	1.6	204	0	204	7.6	244	0	244	4.8
European Goldfinch	90	0	90	3.7	152	0	152	5.7	242	0	242	4.7
Red-rumped Parrot	61	0	61	2.5	97	0	97	3.6	158	0	158	3.1
Willie Wagtail	29	0	29	1.2	103	0	103	3.8	132	0	132	2.6
Welcome Swallow	25	20	45	1.8	64	4	68	2.5	89	24	113	2.2
Eurasian Skylark	39	0	39	1.6	44	13	57	2.1	83	13	96	1.9
Galah	7	0	7	0.3	74	0	74	2.8	81	0	81	1.6
Magpie-lark	31	0	31	1.3	40	2	42	1.6	71	2	73	1.4
Crested Pigeon	9	0	9	0.4	47	0	47	1.8	56	0	56	1.1
New Holland Honeyeater	10	0	10	0.4	40	0	40	1.5	50	0	50	1.0
Australasian Pipit	14	0	14	0.6	20	0	20	0.7	34	0	34	0.7
Long-billed Corella	27	0	27	1.1	6	0	6	0.2	33	0	33	0.6
White-faced Heron	24	0	24	1.0	5	2	7	0.3	29	2	31	0.6
Brown-headed Honeyeater	0	0	0	0.0	26	0	26	1.0	26	0	26	0.5
Brown Falcon	15	0	15	0.6	7	1	8	0.3	22	1	23	0.4
Grey Teal	0	0	0	0.0	22	0	22	0.8	22	0	22	0.4
Noisy Miner	0	0	0	0.0	22	0	22	0.8	22	0	22	0.4
Horsfield's Bushlark	10	0	10	0.4	11	0	11	0.4	21	0	21	0.4

Species	Summer season survey				Autumn season survey				Both seasons combined			
	A	B	Total	% Imp.	A	B	Total	% Imp.	A	B	G. Tot.	% Imp.
Black-faced Cuckoo- Shrike	1	0	1	0.0	16	0	16	0.6	17	0	17	0.3
White-fronted Chat	2	0	2	0.1	10	0	10	0.4	12	0	12	0.2
Grey Shrike-thrush	3	0	3	0.1	8	0	8	0.3	11	0	11	0.2
Nankeen Kestrel	0	0	0	0.0	7	2	9	0.3	7	2	9	0.2
Common Blackbird	1	0	1	0.0	8	0	8	0.3	9	0	9	0.2
Restless Flycatcher	1	0	1	0.0	8	0	8	0.3	9	0	9	0.2
Golden-headed Cisticola	3	0	3	0.1	6	0	6	0.2	9	0	9	0.2
Little Grassbird	7	0	7	0.3	2	0	2	0.1	9	0	9	0.2
Wedge-tailed Eagle	7	0	7	0.3	1	0	1	0.0	8	0	8	0.2
Brown Thornbill	0	0	0	0.0	6	0	6	0.2	6	0	6	0.1
Crimson Rosella	0	0	0	0.0	6	0	6	0.2	6	0	6	0.1
Flame Robin	0	0	0	0.0	6	0	6	0.2	6	0	6	0.1
Blue-winged Parrot	6	0	6	0.2	0	0	0	0.0	6	0	6	0.1
Purple-crowned Lorikeet	6	0	6	0.2	0	0	0	0.0	6	0	6	0.1
White-necked heron	5	0	5	0.2	0	0	0	0.0	5	0	5	0.1
Grey Fantail	0	0	0	0.0	4	0	4	0.1	4	0	4	0.1
Striated Fieldwren	0	0	0	0.0	4	0	4	0.1	4	0	4	0.1
Australian Hobby	2	0	2	0.1	1	1	2	0.1	3	1	4	0.1
Brown Goshawk	2	0	2	0.1	1	1	2	0.1	3	1	4	0.1
Brown Songlark	4	0	4	0.2	0	0	0	0.0	4	0	4	0.1
Stubble Quail	4	0	4	0.2	0	0	0	0.0	4	0	4	0.1
Australian Wood Duck	0	0	0	0.0	3	0	3	0.1	3	0	3	0.1
Black Kite	0	0	0	0.0	0	3	3	0.1	0	3	3	0.1
Common Bronzewing	0	0	0	0.0	2	0	2	0.1	2	0	2	0.0
Masked Lapwing	0	0	0	0.0	2	0	2	0.1	2	0	2	0.0
Little Eagle	1	0	1	0.0	0	1	1	0.0	1	1	2	0.0
Australian Raven	2	0	2	0.1	0	0	0	0.0	2	0	2	0.0

Species	Summer season survey				Autumn season survey				Both seasons combined			
	A	B	Total	% Imp.	A	B	Total	% Imp.	A	B	G. Tot.	% Imp.
Black-shouldered kite	0	0	0	0.0	1	0	1	0.0	1	0	1	0.0
Straw-necked Ibis	1	0	1	0.0	0	0	0	0.0	1	0	1	0.0
Grand Total	**2355**	**85**	**2440**	**100.0**	**2634**	**42**	**2676**	**100.0**	**4989**	**127**	**5116**	**100.0**

Notes: <RSA = 0 – 39 metres above the ground; RSA = 40 – 190 metres above the ground.

7.3.4 *Flight Heights*

In the bird utilization survey, bird heights were classified as below (0–40 m), at (30–190 m), and above (> 190 m) RSA height. The combined seasonal results shown in Table 13 indicated that the majority of birds were found below RSA heights (97.5%), with 2.5% at RSA heights and none above RSA heights.

The seasonal distribution of bird flight heights were rather similar and not significantly different between the seasons indicating that birds known to fly at RSA were also similar between the seasons (Table 13).

The results are similar to the distribution of bird heights recorded at other Australian wind farms. The average distribution of birds taken from 13 wind farms at various locations in Australia indicated that *c.* 95% flew below, 4.8% at and 0.2% above RSA heights. The RSA heights in these studies were recorded as 35 to 120 metres (BL&A; unpublished data).

Table 13: Summary of birds recorded at the three flight heights

Flight height	Summer		Autumn		Combined seasons	
	No. of birds	% of all birds	No. of birds	% of all birds	No. of birds	% of all birds
Below RSA	2355	96.5	2634	98.4	4989	97.5
At RSA	85	3.5	42	1.6	127	2.5
Above RSA	0	0.0	0	0.0	0	0.0
Total birds recorded	2440	100.0	2676	100.0	5116	100.0

7.3.5 *Species at RSA height*

Table 14 shows the total number of individual birds of those species observed flying at RSA height (for details of birds at RSA height at each survey point see Appendix 1). During the survey period, a total of 127 individual birds of 12 species were observed flying at RSA height at the impact survey points. This equated to approximately 2.5 percent of the total number of birds counted.

The most abundant species observed flying at RSA height were:

- Little Raven;
- Fairy Martin;
- Welcome Swallow;
- Eurasian Skylark; and
- Magpie-lark.

These five species accounted for over 90 percent of the birds counted at RSA height, with Fairy Martin comprising the bulk of these flights (43.3%). All bird species flying at RSA height were common farmland birds.

Ravens usually fly and forage in varying-sized flocks depending on time of year. They usually fly close to the ground when foraging, but at times fly at RSA height when moving long distances between paddocks or to and from their roost sites. Most ravens were observed roosting in the large pine trees scattered across the wind farm site.

Fairy Martin is a common bird of open country around large creeks, where it builds nests under bridges and culverts. These birds were common in the summer survey and as they

normally forage on the wing, a good number of these birds were recorded at RSA height; this species is seasonal in its occurrence, and very few were seen during the autumn survey.

Welcome Swallows are common birds on farms, particularly around dams and buildings. When foraging, they sometimes fly at RSA height.

Eurasian Skylarks are ground birds. They are not usually found flying at RSA height, except during the breeding season (September to February), when males ascend to heights above 40 metres and perform a territorial song flight. Outside the breeding season, skylarks undertake these flights less often.

Common Starlings, similar to ravens, are ground feeding birds that usually feed in flocks. When feeding, they fly close to the ground. When travelling between distant paddocks or to and from their roosting sites, they usually fly at RSA height.

White-faced Herons are large waterbirds frequenting farm dams and wetlands within farms. They usually fly below RSA height, but may also fly high when commuting between these habitats or to and from their tree roost sites.

The remaining species recorded at RSA height were raptors, most of which are known to fly at RSA height; however, most were recorded in comparatively low numbers. The Brown Falcon and the Nankeen Kestrel, were the most abundant raptors during the BUS and the majority of them flew below RSA height.

The Wedge-tailed Eagle is another raptor commonly known to fly at RSA heights and they are known regularly to fatally collide with turbines at wind farms in South-eastern Australia. The eagle was recorded during both summer and autumn surveys, but all sightings were of birds flying below RSA height.

Table 14: Birds flying at RSA heights during summer and autumn BUS surveys.

Species	Summer			Autumn			Combined seasons			% at RSA	% of RSA birds	% RSA of all birds
	A	B	Total	A	B	Tot.	A	B	G. Tot.			
Little Raven	108	10	118	169	12	181	277	22	299	7.4	17.3	0.4
Fairy Martin	199	55	254	2	0	2	201	55	256	21.5	43.3	1.1
Welcome Swallow	25	20	45	64	4	68	89	24	113	21.2	18.9	0.5
Eurasian Skylark	39	0	39	44	13	57	83	13	96	13.5	10.2	0.3
Magpie-lark	31	0	31	40	2	42	71	2	73	2.7	1.6	0.0
White-faced Heron	24	0	24	5	2	7	29	2	31	6.5	1.6	0.0
Brown Falcon	15	0	15	7	1	8	22	1	23	4.3	0.8	0.0
Nankeen Kestrel	0	0	0	7	2	9	7	2	9	22.2	1.6	0.0
Australian Hobby	2	0	2	1	1	2	3	1	4	25.0	0.8	0.0
Brown Goshawk	2	0	2	1	1	2	3	1	4	25.0	0.8	0.0
Black Kite	0	0	0	0	3	3	0	3	3	100	2.4	0.1
Little Eagle	1	0	1	0	1	1	1	1	2	50.0	0.8	0.0
Grand Total	**2355**	**85**	**2440**	**2634**	**42**	**2676**	**4989**	**127**	**5116**	**2.5**	**100**	**2.5**

Notes: A = Below RSA height (below 40 m); B = at RSA height (40-190 m). No birds were recorded above RSA heights

7.3.6 *Birds of concern*

Raptors

Raptor diversity, abundance and flight behaviour is summarized below in Table 15.

The Brown Falcon was the most common raptor and was recorded on 22 occasions in both seasons. The falcon was usually found flying at low heights and only few of the flights in the autumn season were at RSA heights.

The Wedge-tailed Eagle was the most regularly-observed raptor species only during the summer season; in autumn only one eagle was recorded during the formal counts. The eagle was seen throughout the study area. Based on a combination of the BUS, roaming searches and other time spend on the site, it is concluded that the proposed wind farm site lies within the territories of at least three pairs of Wedge-tailed Eagles.

The other common raptor on the wind farm site was the Nankeen Kestrel. It was recorded only during the autumn survey and most flights were below RSA height.

The remaining seven species of raptors were seen only occasionally and in very small numbers.

Raptors in general accounted for a very low percentage (one percent) of birds seen on the wind farm during the BUS. Raptors observed at RSA height comprised only 21 percent of all raptor sightings and only 0.2 percent of all bird sightings.

Raptors usually account for a high percentage of birds recorded at RSA height. During this study no raptors were first observed at RSA height at impact points. However this is not to say that raptors do not fly at RSA height in the study area. For example, the Wedge-tailed Eagle often flew at RSA height and was seen on four occasions in the proposed wind farm flying at RSA height. However, no Wedge-tailed Eagle was observed at RSA height when first seen by the observer.

Waterbirds

Three waterbird species were recorded during the summer surveys, comprising 30 observations, and six species during the autumn survey comprising 32 observations in total. In general, waterbirds comprised only a small portion (0.8%) of total birds seen on the wind farm site (Table 15).

The White-faced Heron utilised the wind farm site more than any other waterbird. It was seen in largest numbers in summer but in much lower numbers in autumn. The heron is a very common farmland waterbird that usually roosts in trees near farm dams and forages in farm dams, watercourse and roadside drains during the day. This species was observed at several farm dams throughout the proposed wind farm site. It was not observed flying at RSA heights during summer but two birds were seen at RSA height in autumn.

The remaining waterbirds recorded at impact points were common species, mostly observed in small numbers except for one small flock of Grey Teal, which was recorded in autumn at one of the impact points.

More waterbird species were recorded at the reference sites, due to the presence of small wetland close to their counting areas or incidentally on small farm dams while traversing between the observation points. Waterbirds seen during the BUS as well as incidentally across the site included Little Pied Cormorant, Hoary-headed Grebe,

Australian Grebe, Masked Lapwing, Banded Lapwing, Black-winged Stilt, Black-fronted Plover, Australian Shelduck, Australian Wood Duck, Pacific Black Duck, Grey Teal, Chestnut Teal, Plumed Whistling Duck and Hardhead. Several of the above species were recorded at the wetlands near the reference points (see Table 12).

The proposed Golden Plains Wind Farm site contained many small farm dams and a small number of naturally- occurring wetlands. Many of the wetlands originally mapped on the site by DELWP have been permanently drained and no longer support wetland ecosystems. Dams generally lacked aquatic vegetation and had bare, trampled edges. There were some ephemeral wetlands that held water in winter and spring that would attract waterbirds but they are not extensive wetlands and they would not support ecologically significant numbers of any waterbird species.

Table 15: Raptor and Waterbird species recorded at impact survey points at Golden Plains Wind Farm

Species / Raptors	Summer survey		Autumn survey		Combined seasons		% of total Rap/Wat flights	% flight at RSA height	% RSA of rapt/Wat RSA birds	Flights recorded at RSA compared with all bird flights at RSA (%)	Flights recorded at RSA compared with all bird flights observed (%)
	Nos	RSA	Nos	RSA	Nos	RSA					
Australian Hobby	2	0	1	1	3	1	6.7	33.3	11.1	2.4	0.0
Black Kite	0	0	0	3	0	3	0.0	0.0	33.3	7.1	0.1
Black-shouldered kite	0	0	1	0	1	0	2.2	0.0	0.0	0.0	0.0
Brown Falcon	15	0	7	1	22	1	48.9	4.5	11.1	2.4	0.0
Brown Goshawk	2	0	1	1	3	1	6.7	33.3	11.1	2.4	0.0
Little Eagle	1	0	0	1	1	1	2.2	100.0	11.1	2.4	0.0
Nankeen Kestrel	0	0	7	2	7	2	15.6	28.6	22.2	4.8	0.0
Wedge-tailed Eagle	7	0	1	0	8	0	17.8	0.0	0.0	0.0	0.0
Totals raptors	**27**	**0**	**18**	**9**	**45**	**9**	**100.0**	**20.0**	**100.0**	**21.4**	**0.2**
Species / Waterbirds											
Australian Wood Duck	0	0	3	0	3	0	4.8	0.0	0.0	0.0	0.0
Grey Teal	0	0	22	0	22	0	35.5	0.0	0.0	0.0	0.0
Masked Lapwing	0	0	2	0	2	0	3.2	0.0	0.0	0.0	0.0
White-faced Heron	24	0	5	2	29	2	46.8	6.9	100.0	4.8	0.0
White-necked Heron	5	0	0	0	5	0	8.1	0.0	0.0	0.0	0.0
Straw-necked Ibis	1	0	0	0	1	0	1.6	0.0	0.0	0.0	0.0
Total waterbirds	**30**	**0**	**32**	**2**	**62**	**2**	**100.0**	**3.2**	**100.0**	**4.8**	**0.0**
Grand Total	**2676**		**2634**	**42**	**5310**	**42**	–	**0.8**	–	–	**0.8**

Notes: < RSA = below rotor swept area (RSA) height (<40 m); **RSA =** at RSA height (40-190 m); **No bird was seen flying >RSA** height (>190 m).

7.4 Conclusions

The conclusions from the BUS of the Golden Plains Wind Farm site are presented below.

- The site largely comprises cleared, agricultural land supporting a low diversity and abundance of common, predominantly farmland birds.
- The Wedge-tailed Eagle and Brown Falcon were common raptor species observed on the site.
- The White-faced Heron was the most common waterbird species observed in the site. The Australian Wood Duck was also observed incidentally at farm dams in good numbers.
- The study area supports very few other raptors or waterbirds, groups considered vulnerable to collision with operating wind turbines and utilisation rates of these species were correspondingly low.
- The Fairy Martin, Welcome Swallow and Little Raven were observed flying at RSA heights within site. The Wedge-tailed Eagle and Brown Falcon were also observed flying at RSA heights at reference points just outside the wind farm boundary and incidentally (i.e. not as part of the formal BUS) within the site.
- Three waterbird species were recorded during the surveys, comprising 30 observations in total (1% of all birds).
- Waterbirds were found to be largely confined to wetlands and farm dams. They occurred in low abundance, with the exception of the Australian Wood Duck, which is a common farmland waterbird.
- No threatened birds were recorded utilising the study area during the bird utilisation survey. Therefore, the collision risk to threatened species from operating turbines is considered low.
- The results from the summer and autumn surveys adequately describe bird life at the proposed wind farm for the purpose of impact assessment.

8 BAT ASSESSMENT

KEY FINDINGS

- A total of 82 nights of bat recordings were made in summer 2017 and 112 in autumn 2017 from seven sampling points across the proposed Golden Plains Wind Farm, totalling 2328 recording-hours.
- Nine species of bats were recorded: seven were common, secure and widespread, and two were threatened bats (Eastern Bent-wing Bat; Yellow-bellied Sheathtail Bat); additionally a further three multi-species complexes were recorded.
- The vast majority of bat activity was attributable to common and widespread species.
- The two threatened species (Yellow-bellied Sheathtail Bat; Eastern Bent-wing Bat) were recorded on very few nights with very low numbers of calls compared with most other species, overall 13 calls of the Yellow-bellied Sheathtail Bat were recorded from both surveys and one call of the Eastern Bent-wing Bat was recorded in summer 2017.
- Species recorded from a height of 45 metres included, the Gould's Wattled Bat, Chocolate Wattled Bat and Long-eared Bat sp. (*Nyctophilus* sp.).
- The vast majority of bat species calls (including threatened species) were recorded from close to the ground, indicating that most of the time, most of these species would avoid collision with operating turbines.
- Furthermore, threatened species were recorded infrequently and not at turbine RSA height. At this low level of activity, collision risk is considered very low for these species and no significant impact is expected on their populations.

8.1 Introduction

Brett Lane & Associates Pty Ltd (BL&A) was commissioned by WestWind Energy Pty Ltd to undertake ultrasonic bat detector surveys during 2017. Two surveys were undertaken, one in summer and one in autumn 2017, as described below.

- The summer 2017 survey was undertaken from late January to early February (16 nights) using seven SongMeter detectors distributed across all habitat types on the proposed wind farm site. Bat recordings were undertaken at six locations, including one site (the wind monitoring mast) using a detector at both ground level and at 45 metres above the ground.
- The autumn 2017 survey was undertaken during April (17 nights) using again seven SongMeter detectors. Bat recordings were undertaken at the same locations as that of the summer including two SongMeters at the wind mast.

The aim of the survey has been to collect information on the biodiversity and abundance of bat species at the wind farm site, including any listed threatened species, using the relative frequency of recording (activity levels) of species at each site.

The work was undertaken by a team from BL&A comprising Khalid Al-Dabbagh (Senior Zoologist), Peter Lansley (Senior Zoologist) and Inga Kulik (Senior Ecologist & Project Manager).

8.2 Methods

During the 2017 bat surveys, automated SongMeter® bat detectors recorded the species-specific echolocation calls of free-flying bats at six sites (site 1 at the wind mast involved two concurrent sub-recording sites, at 45 metres above ground and on the ground) that were representative of the habitat types of GPWF and located near proposed wind turbine locations (see Figure 6). The detectors were programmed to commence operation approximately 30 minutes before dusk, and to cease approximately 30 minutes after dawn.

Each SongMeter unit used an 8GB SDHC card that recorded bat echolocation calls, along with the date and time of each call.

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

8.2.1 *Timing of the Surveys*

Summer 2017 survey: The summer bat survey was conducted over the period from 24th January to 8th February 2017 for 16 consecutive days at six sites (including two units at the wind monitoring mast, see Figure 6).

Autumn 2017 survey: The autumn bat survey was conducted over the period from 8th to 24th April 2017 for 17 consecutive days at the same sites used during the summer survey (Figure 6).

The SongMeter units recorded at or within two metres of the ground at the five ground locations and concurrently at both ground level and 45 metres height at the wind mast location. Recordings at 45 metres height were intended to detect bats utilising airspace at rotor swept area (RSA) height (>40 metres above ground level).

These sites encompassed a variety of habitats present on the wind farm such as windbreaks (linear rows of planted trees), freshwater and/or brackish wetlands and open cropped or grazing paddocks comprising mixed native and introduced grasses.

The schedule of recording at each of the sites, and the number of actual hours of recording are as follows:

- Summer survey: 82 bat-nights (one bat-night = 12 hours) totalling 984 hours; and
- Autumn Survey: 112 bat-nights totalling 1,344 hours of recording.

Bat recording totalled 2,328 hours over 194 bat-nights from seven different recorders at six sites.

8.2.2 *Location and description of recording sites*

The location and characteristics of the recording sites are described below (see Figure 6 for survey site locations).

Site 1: Wind mast – located in the middle of an open field of native grassland without any trees near the mast. This site sampled concurrently at two different heights, at 45 metres and on ground level.

Site 2: Bells Road – located on the side of a road close to farm buildings, also close to trees and overlooking a large dry wetland.

Site 3: Geggies Road – located on a line of trees (windbreak) overlooking open grassland.

Site 4: On a farm off Two Bridges Road – attached to a tree adjacent to a dry creek with old eucalyptus trees surrounding the site and a large open cropped field.

Site 5: Gilletts Road – located near a bridge, close to a dry creek with large trees, pines and open cropping fields.

Site 6: Little Hales Road – located on one of three pine trees in the middle of a large cropping and grazing field.

8.2.1 *Limitations*

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

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

Occasionally recording devices such as those used in the survey experience technical difficulties, which are not uncommon. As a result short periods of time may not be recorded and total hours of recordings vary between the different recorders. At the summer survey, a total of 82 bat-hours were recorded during 16 days of consecutive recordings, and 112 bat-hours were recorded during the 17 consecutive days in autumn.

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

Finally, weather conditions including severe storms during the recording period may at time interfere with the recording process and consequently bat activity levels may vary in response to weather variables such as air temperature, relative humidity, barometric pressure, wind speed, direction & gusts, rain and moonlight. Typically, bats are found to be less active during the following circumstances (G. Richards, pers. comm.):

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

- During moderate to heavy rainfall.

8.3 Results of the survey

8.3.1 *Bat species*

Nine species of bats were recorded during the survey (Table 16).

- Seven of these species were common, widespread and secure bat species that occur in farmland and other habitats throughout south-eastern Australia.
- Two threatened species occurred, the Yellow-bellied Sheathtail Bat (listed threatened species under the FFG Act) and the Eastern Bent-wing Bat (listed as 'Vulnerable' in Victoria (DSE 2013). The latter species was recorded based on one positively identified call during the summer survey, and none during the autumn survey.
- One species, White-striped Freetail Bat, is considered as a species of special interest as it is known to fly at RSA heights.

In addition to the species identified, three complexes of common species of bats were also identified (Table 16).

The vast majority of calls identified were from common species of bats that are not of conservation concern (i.e. are not listed as rare or threatened under any federal or state legislation).

Five of the nine species were of regular occurrence, found in almost all sites and not limited to any particular section of the wind farm, though some species were more common than others (Table 16). The other two species, although common and widespread, were restricted to only a few of the seven recording sites. The two threatened bat species were recorded from very few calls, especially the Eastern Bent-wing Bat, which was recorded from a single call only.

The identification of echolocation calls from microbats in south-eastern Australia is facilitated by the fact that many calls are species-specific; however, not all species can be consistently or reliably identified using this technique. The identification of Eastern Bent–wing Bat calls using ultrasonic bat detectors is difficult and often key salient call characters may not feature prominently in all recordings.

The ultrasonic calls of Long-eared bats (*Nyctophilus* spp.) are difficult to distinguish at a species level, and hence are grouped under their generic name. The species that are likely to occur at Golden Plains Wind Farm are *Nyctophilus geoffroyi* and *N. gouldi*. These species are not listed as threatened.

Similarly, calls of species of Forest Bats (*Vespadelus* spp.) can be difficult to differentiate and therefore some of their calls have been combined into the species complex for the purposes of analysis. None of these species are threatened.

Although several species belonging to the Freetail Bat (*Mormopterus* spp.) have recently been identified (Reardon *et al*. 2014), their calls are still difficult to identify; hence they are grouped together in the analysis. None of these species are threatened.

Table 16: Bat diversity at Golden Plains Wind Farm during 2017 surveys

Common name	*Scientific name*	Conservation status	Sites of occurrence	
			Summer	Autumn
Eastern Bent-wing Bat	*Miniopterus schrebersii oceanensis*	Vulnerable, FFG listed (Vic. Advisory)	S5	–
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*	Threatened, FFG; Data Deficient (Vic. Advisory)	S2, S4,	S6
White-striped Freetail Bat	*Tadarida australis*	Common, secure	S1 (g), S2, S3, S4, S5, S6	S1 (g), S3, S4, S5, S6,
Southern Freetail Bat	*Mormopterus planiceps*	Common, secure	–	S6
Gould's Wattled Bat	*Chalinolobus gouldii*	Common, secure	S1 (50), S1 (g), S2, S3, S4, S5, S6	S1 (g), S3, S4, S5, S6,
Chocolate Wattled Bat	*Chalinolobus morio*	Common, secure	S2, S4, S5, S6	S1 (50), S1 (g), S5, S6,
Eastern falsistrelle	*Falsistrellus tasmaniensis*	Common, secure	S2, S4, S5, S6	S1 (g), S3, S4, S5, S6
Large Forest Bat	*Vespadelus darlingtoni*	Common, secure	S1 (g), S2, S4, S5, S6	S1 (g), S5, S6
Little Forest Bat	*Vespadelus vulturnus*	Common, secure	S5	S3, S4, S5, S6
Species complexes				
Freetail Bat species complex	*Mormopterus planiceps / ridei*	(species complex)	S1 (g), S6	S1 (g), S3, S4, S6
Long-eared Bat species complex	*Nyctophilus sp.*	(species complex)	S1 (50), S5,	S6
Forest Bat species complex	*Vespadelus sp.*	(species complex)	S2, S3, S4, S5, S6	S3, S5, S6

8.3.2 *Bat activity*

Bat activity at the proposed Golden Plains Wind Farm compares well with other wind farms in similar settings (BL&A; unpublished data), with most activity originating from common and widespread species.

The number of bat calls cannot be directly used as a measure of bat density (see limitation section above); therefore other measures of relative abundance have been used to analyse importance of the various species.

Data analysis differed between summer and autumn surveys. In summer, the number of calls was identified for each species, but in autumn, call identification was limited to the threatened species and those of special interest such as the White-striped Freetail Bat and only the presence/absence of the common species was reported. The reduction of effort was justified on grounds that common species calls were very numerous and require arduous effort without actually adding to the knowledge of bat use of the wind farm site.

The presence/absence of all common species was recorded at each site during both summer and autumn and used to express a measure of relative abundance of bats within the wind farm site.

Relative abundance of the common bat species is expressed as frequency of occurrence, the percentage of the number of nights the species called out of the total nights of recording (see Table 17). The table showed that bats were common in most parts of the wind farm with slight differences in their activity between the sites. The active bat species also differed between the two seasons depending on their life cycles and local movements. The three most frequently recorded species on the wind farm during the summer and autumn surveys are listed below (the percentage of recording nights when these species were recorded are given in brackets).

Summer survey

- Gould's Wattled Bat (84.1%)
- White-striped Freetail Bat (39.0%)
- Large Forest Bat (30.5%)

Autumn survey

- White-striped Freetail Bat (56.3%)
- Gould's Wattled Bat (48.2%)
- Eastern Falsistrelle (25.0%)

The two most dominant species were the same with differences in importance between the two seasons. The remaining species were less common and their frequencies of occurrence varied between 1.2–24.1% and 0.0-19.6% in summer and autumn, respectively.

The frequency of occurrence of bats does not reflect on the actual number of calls. During the summer survey, data was based on recognition of over 6000 bat files, while that of the autumn was based on over 8000 bat files. The high frequency of some bat calls, namely Gould's Wattled Bat and White-striped Freetail Bat, might have been a result of swarming or presence of roost sites within the vicinity of the recording sites. It was evident, however, that the high number of bat files recorded was from sites with suitable roosting habitat that included the presence of large eucalyptus trees that can provide roost sites for the swarming bats.

The activity level (or frequency of occurrence) of the species complexes was similar to that of the positively identified species with the Forest Bat complex being the most active species group within the wind farm site. The threatened bat species were rather rare and with little activity (see more details below).

Data on the number of calls of each bat species at each of the recording sites was available for the summer survey, and therefore it was prudent to present this data and expand on our understanding of bat movements and relative abundance within the wind farm site.

Bat calls although not suitable for density estimation, could on the other hand, provide a good measure of the relative abundance of the various bat species (see Table 18).

The three most recorded bat species in summer 2017 based on call numbers were as follows.

- Gould's Wattled Bat;
- Large Forest Bat; and
- White-striped Freetail Bat.

In addition, calls from the Forest Bat complex were also recorded in high numbers.

The first species was highly dominant over the other species and as shown above was the most frequent species at the wind farm site. The remaining species were less common and their average calls per night varied between 0.0–9.4 calls.

Table 17: Percentage of nights of recording (frequency of occurrence) that each bat species was recorded at each site

Bat species	Number of nights on which species was recorded														Tot. nights Jan	Tot. nights Apr	% Freq.* Jan	% Freq.* Apr
	Site 1(50)		Site 1(g)		Site 2		Site 3		Site 4		Site 5		Site 6					
	Jan	Apr	Jan	Apr	Jan	Apr	Jan	Apr	Jan	Apr	Jan	Apr	Jan	Apr				
Eastern Bent-wing Bat											1				1	0	1.2	0.0
Yellow-bellied Sheathtail Bat					3				2					1	5	1	6.1	0.9
White-striped Freetail Bat			8	3	2		1	17	12	17	9	9		17	32	63	39.0	56.3
Southern Freetail Bat															0	1	0.0	0.9
Gould's Wattled Bat	2		15	7	3		4	15	15		15	15	15	17	69	54	84.1	48.2
Chocolate Wattled Bat		3		3	2				2		15	3	1	3	20	12	24.4	10.7
Eastern Falsistrelle				2	1			7		4	8	7	2	8	11	28	13.4	25.0
Large Forest Bat			1	1	4				13		1	4	6	13	25	18	30.5	16.1
Little Forest Bat								11		9	1			2	1	22	1.2	19.6
Species complexes																		
Freetail Bat species complex			1	2				1		8	3		1	4	5	15	6.1	13.4
Long-eared Bat species complex								3				7		2	0	12	0.0	10.7
Forest Bat complex					11		4		13		14		3	14	45	14	54.9	12.5
Total nights of recording	**2**	**14**	**16**	**15**	**12**	**17**	**7**	**17**	**15**	**17**	**15**	**15**	**15**	**17**	**82**	**112**	–	–

* The % frequency (ore relative abundance) is calculated as the percentage of night from the overall recording nights, when a call of this species was recorded.

Table 18: Number of calls of each bat species/spp. complexes recorded during summer survey, 2017.

Species - common name	site 1A(50)	site 1(g)	site 2	site 3	site 4	site 5	site 6	total	Av. calls/night*
Yellow-bellied Sheathtail Bat			5		6			11	0.1
White-striped Freetail Bat		34	3	1	177	23	6	244	3.0
Gould's Wattled Bat	3	55	20	17	2672	1070	697	4534	55.3
Chocolate Wattled Bat			2		2	71	4	79	1.0
Eastern False Pipistrelle			1		22	22	2	47	0.6
Large Forest Bat		2	37		136	583	16	774	9.4
Little Forest Bat						1		1	0.0
species complexes									
Forest Bat spp			109	11	73	148	3	344	4.2
Eastern Bent-wing/Forest Bats						1		1	0.0
Freetail Bat spp		2					1	3	0.0
Long-eared Bat spp	1					3		4	0.0
TOTALS	4	93	177	29	3088	1922	729	6042	73.7

*Total number of nights = 82

8.3.3 *Height distribution of bats*

The height distribution of bats was studied by placing the SongMeter microphones at different heights utilising the wind monitoring mast for this purpose. Microphones were placed at the following heights:

1) At 45 metres with the microphone facing up (site 1[45m])
2) On the ground beneath the wind mast with the microphone facing up (representing a range of about 25 metres) (site 1[g]).

Records were made over 18 nights at the first height and over 30 days on ground (including both of the seasonal surveys).

The distribution of bats at the two heights is presented in Table 19. The results show that most of the bat calls were recorded from ground level. The following observations were made.

- Most of the common bat species were recorded at the ground level.
- The Wattled Bats were the only species at heights, Gould's in summer and Chocolate Wattled Bats in autumn.
- No threatened bat species were recorded either at heights or on the ground at the wind mast site.
- The foregoing indicates that only a small proportion of bats on the site would actually be exposed to collision risk from operating turbines.
- In contrast to other studies wind farms, the widely known White-striped Freetail Bat was not found to fly at height despite its abundance or level of activity at the ground level. Instead, Gould's and Chocolate Wattled Bats were recorded in this current survey at heights; these species were hardly recorded at these heights in other studied wind farms (BL&A, unpubl. data).
- Taking into account the non-threatened status of the White-striped Freetail Bat and the Gould's Wattled Bat and their widespread occurrence in Australia, impacts on their populations from the proposed Golden Plains Wind Farm are considered to be insignificant.

Table 19: The distribution of flight heights of bats recorded at the wind mast

Species of bat	Number of bat calls			
	Summer survey		Autumn survey*	
	S1 (45m)	S1(g)	S1 (45m)	S1(g)
White-striped Freetail Bat	0	34	0	10
Gould's Wattled Bat	3	55	0	26
Chocolate Wattled Bat	0	0	6	25
Eastern Falsistrellus	0	0	0	2
Large Forest Bat	0	2	0	1
Species complexes				
Freetail Bat species complex	0	2	0	2
Long-eared Bat species complex	1	0	0	0
Total calls	**4**	**93**	**6**	**66**

* Number of bat calls was estimated from number of files recorded at each site.

8.3.4 *Threatened species*

Eastern Bent-wing Bat

The Eastern Bent-wing Bat occurs widely across the eastern seaboard of Australia from Cape York to the Goldfields region (Ballarat – Bendigo) and Otway Range area of western Victoria. Another Bent-wing Bat subspecies, namely the Southern Bent-wing Bat (*M. s. bassani*), is recorded farther west in Victoria and into south-east South Australia (Churchill 2008). It naturally roosts in caves, however it has adapted to use mine shafts or tunnels if suitable as roosting sites. At night this bat disperses over a range of habitats. In Victoria, it usually forages over forested areas above treetop height (Churchill 2008) but it has also been recorded on the sparsely-treed Volcanic Plain (Menkhorst 1995). In more open habitats it flies at lower heights, up to six metres above the ground (Churchill 2008).

In late spring and summer, this species congregates in "maternity caves" where the females give birth to and raise their young. In autumn and winter, after the young are weaned, these bats disperse over a larger region, usually up to 300 kilometres or so (once as far as 1,300 kilometres) from the maternity caves. Small numbers of this species have been found roosting during the day in inland and coastal cliff caves, as well as disused mine shafts (Menkhorst 1995; Duncan *et al*. 1999).

Only a few known large maternity caves of the Eastern Bent-wing Bat are known from Victoria; it is believed that most individuals in eastern Victoria in spring and summer, including those in the Eildon area and close to Melbourne, use Nowa Nowa cave in east Gippsland, with some coming from Wee Jasper in the southern Tablelands of New South Wales (Menkhorst 1995). Smaller numbers use other caves, mine shafts or tunnels for maternity purposes. It moves into more widely dispersed caves for winter.

There are few records of the Eastern Bent-wing Bat from wind farms in western Victoria, as the Golden Plains Wind Farm is close to the edge of this taxons' recorded range (DELWP 2016d).

As one possible call was recorded, it is not considered that this species occurs consistently on the GPWF site and significant impacts on it are considered highly unlikely.

Yellow-bellied Sheathtail Bat

The Yellow-bellied Sheathtail Bat is a wide-ranging species through tropical and sub-tropical Australia. In Victoria, the species is considered to be a rare visitor in late summer and autumn (NSW Office of Environment & Heritage 2016).

Many of the Victorian specimens have been found in exposed situations in an exhausted condition (e.g. hanging from the outside wall of buildings in broad daylight), which might suggest that they have been unintentionally driven south by adverse wind conditions. 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 (Menkhorst 1995, Churchill 2008; NSW Environment & Heritage 2016).

There is no information on the numbers of Yellow-bellied Sheathtail Bats that visit Victoria as it has only been recorded rarely and irregularly. The numbers of individuals that occur in Victoria are not known but the low numbers recorded, 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.

The Yellow-bellied Sheathtail Bat 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. The Yellow-bellied Sheathtail Bat was recorded 11 times at ground level at site 2 (five calls) and site 4 (six calls). It was not recorded at height.

Relative abundance of threatened species

The activity of the two threatened bat species at the proposed Golden Plains Wind Farm site is summarised in Table 20. Very few calls were recorded at only one and two sites, respectively, out of the six survey sites.

The call of the Eastern Bent-wing Bat was recorded at one of the six sites during the summer with an overall average of 0.01 calls per night. The call attributed to this species was recorded from site 5 (one call). Site 5 comprised a dry creek with large trees, pines and cropping fields nearby. It was considered a high bat activity site as it attracted a greater diversity of bats (see Table 20).

The Yellow-bellied Sheathtail Bat was comparably rare, and its calls were recorded at two of the six sites during the summer and only at one site during autumn surveys. Their calls averaged at 0.13 calls per night in summer and only 0.02 calls per night in autumn.

The above findings indicated that very low numbers of the threatened bat species are likely to use the wind farm site.

Table 20: Summary of number of threatened bat species calls recorded

Threatened species	Total number calls recorded		Average number of calls recorded per night*	
	summer	Autumn	summer	Autumn
Yellow-bellied Sheathtail Bat	11	2	0.13	0.02
Eastern Bent-wing Bat	1	0	0.01	0

* Number of total recorded bat nights was 82 in summer and 112 in autumn.

Impacts of the Golden Plains Wind Farm on threatened bats

Given the low number of the threatened Bat calls recorded; the implications of the proposed Golden Plains Wind Farm for the population of these species are considered to be negligible. The proposed wind farm is highly unlikely to cause a significant impact to these species as only a small fraction of their population occurs in or around the wind farm site. It is unlikely the low risk of a collision by the species with turbines in the proposed wind farm will compromise the future survival of the species.

In conclusion, the construction of the Golden Plains Wind Farm would not have a significant impact on the populations of the two threatened bat species due to their very low level of use of the proposed wind farm site.

8.3.5 *Species of special concern*

Bat species vary in their flight heights; while some forage by flying close to the ground or within and under tree canopies, others, such as the White-striped Freetail Bat, are known to fly at heights up to 45 metres above ground or even higher and therefore can fatally collide with operating turbines when foraging within wind farm sites (BL&A, unpubl. data).

The White-striped Freetail Bat is considered as a species of special concern and warranted a more detailed study of their numbers and use of the various sections of the

wind farm site (see Table 17 & 18). The frequency of occurrence of these bats (Table 17) was among the highest in both of the seasonal surveys. Similarly, when the number of positively identified calls was considered from the summer survey (Table 18), they recorded the third highest level of calls from species at the seven recording sites. Notably, the species was not recorded at RSA heights, which suggests that in the open, cleared habitats that cover much of the proposed wind farm site, and in which most turbines will be located, this species may fly mostly at heights where interaction with turbines is avoided.

Notwithstanding their comparatively high activity levels on the proposed wind farm site, experience elsewhere, based on bat surveys and collision monitoring at wind farms in southern Australia over the last 15 years (BL&A, unpubl. data), indicates that this species was always recorded at RSA heights, collide in small numbers with wind turbines, and in some wind farms they were the only species recorded flying at RSA heights. The loss of a small number of these bats on the proposed Golden Plains Wind Farm may have small local population impacts but is unlikely to result in any regional or larger scale impacts on these species' populations.

8.3.6 *Weather observations*

Recordings of bats at the wind farm site (or relative abundance) could have been affected by weather conditions as bats usually avoid nights with poor weather conditions (see limitation in method section above).

During the summer survey; weather conditions were suitable for bat activity for most of the nights of recording. Apart from rainfall on one day, there were no noticeable differences between recording conditions in January or February 2017.

Similarly, weather conditions during autumn were suitable apart from one or two nights of rainfall that did not seem to have affected the recording process at the recording sites. These generally dry conditions probably favoured bat activity.

8.4 Summary and Conclusions

Bat activity at the proposed Golden Plains Wind Farm compares well with other wind farm sites in similar, largely agricultural settings (BL&A, unpubl. data). Survey effort and findings from this survey are summarised below.

- Two bat surveys were conducted; first during summer (24th January to 8th February 2017) and the second during autumn (8th to 24th April 2017). During the survey period, seven SongMeter recording units were operated concurrently at six recording sites. This included two detectors set up at the wind monitoring mast from the ground underneath the mast, and at 45 metres above the ground).
- A total of 82 bat-nights in summer and 112 bat-nights of recordings were made from seven sampling points across the proposed Golden Plains Wind Farm, totalling 2328 recording-hours.
- Nine species of bats were recorded: seven were common, secure and widespread, and two were threatened bats (Eastern Bent-wing Bat; Yellow-bellied Sheathtail Bat); additionally a further three multi-species complexes were recorded.
- The vast majority of bat activity was attributable to common and widespread species.
- The threatened species were recorded on very few nights with very low numbers of calls compared with most other species – a total of 12 calls were attributable to

threatened species out of over 6,000 files in summer (11 to the Yellow-bellied Sheathtail Bat and one to the species complex that included the Eastern Bentwing Bat) and only two calls of the Yellow-bellied Sheathtail Bat over 8000 files in autumn.

- Species recorded from a height of 45 metres included, the Gould's Wattled Bat, Chocolate wattled Bat and Long-eared Bat sp. (*Nyctophilus* sp.).
- The vast majority of bat species calls (including threatened species) were recorded from close to the ground, indicating that most of the time, most of these species would avoid collision with operating turbines.
- Furthermore, threatened species were recorded infrequently and not at turbine RSA height. At this low level of activity, collision risk is considered very low and no significant impact is expected on their populations.

9 STRIPED LEGLESS LIZARD SURVEY

KEY FINDINGS AND CONCLUSIONS

- An established population of the EPBC Act listed Striped Legless Lizard was detected across the proposed wind farm during tile grid surveys in 2016. A total of 45 observations of Striped Legless Lizard were recorded during the tile grid survey with at least one observation occurring at every tile grid location. The species was observed at each tile grid, along with additional vertebrate species, such as Tussock Skink and Fat-tailed Dunnart (both listed as *Lower Risk - Near Threatened* on DELWP's threatened species advisory list).
- Impacts on the population of this species in the Golden Plains Wind Farm study area are not expected to be significant as the development footprint is to be confined to a small percentage of the thousands of hectares of habitat in the area. Mitigation measures to avoid any significant impacts upon the species are provided. The application of the 'avoid' and 'minimise' principles in relation to native vegetation removal for the project (see Section 5) have greatly assisted in reducing the area of habitat affected by the project.
- Consideration should be given to implementing a salvage protocol to translocate individuals to adjacent, retained areas of grassland habitat in areas of higher quality habitat to be removed during construction of the proposed wind farm.

9.1 Introduction

In view of the presence of potentially suitable habitat in areas of remnant native grassland, it was considered that there was potential for the Striped Legless Lizard (*Delma impar*) to occur within the proposed Golden Plains Wind Farm site. Accordingly, a targeted survey program was instigated.

The aim of this survey was to identify areas of native and non-native vegetation that support the EPBC Act listed Striped Legless Lizard within the proposed Golden Plains Wind Farm study area. A targeted survey using the tile grid method was undertaken to verify the presence or absence of this species in the study area.

This section of the report presents information on the species' biology then the methods and results of this survey, followed by a discussion of the implications of the findings for the project.

9.2 Species Biology

Description

The Striped Legless Lizard is a member of the family Pygopodidae, the legless or flap footed lizards (Cogger 2000). The key distinguishing features of this species include the following.

- Visible ear openings
- A rounded tongue and
- Presence of scaly hind limb flaps.

While it shows considerable variation in colour and pattern, this species of legless lizard is usually pale grey-brown above and cream on the ventral surface, with a series of longitudinal dark brown or black stripes along the length of the body that breaks into rows of spots on the tail (Cogger 2000). It is slightly thicker than a pencil and grows up to approximately 30 centimetres in length (Webster *et al*. 1992).

Habitat

The Striped Legless Lizard inhabits dense native grasslands, often with rocky rises, that were once extensive on the volcanic plains of south western Victoria (Webster *et al.* 1992). It utilises rocks, soil cracks, burrows and grass tussocks for sheltering (Smith and Robertson 1999). Work on the species has found that it can also occur in grasslands dominated by introduced species, in secondary grasslands (Dorrough and Ash 1999, Koehler 2004, O'Shea 2004) and in habitats where rocks are absent but deep cracking clay soil is present (Coulson 1990).

Little is known about the movements of Striped Legless Lizards; however studies have shown that the species can move approximately 20 metres in one day (Smith and Robertson 1999).

Distribution

The species is primarily found in Victoria (Figure 8), with some populations being present in eastern South Australia and southern New South Wales.

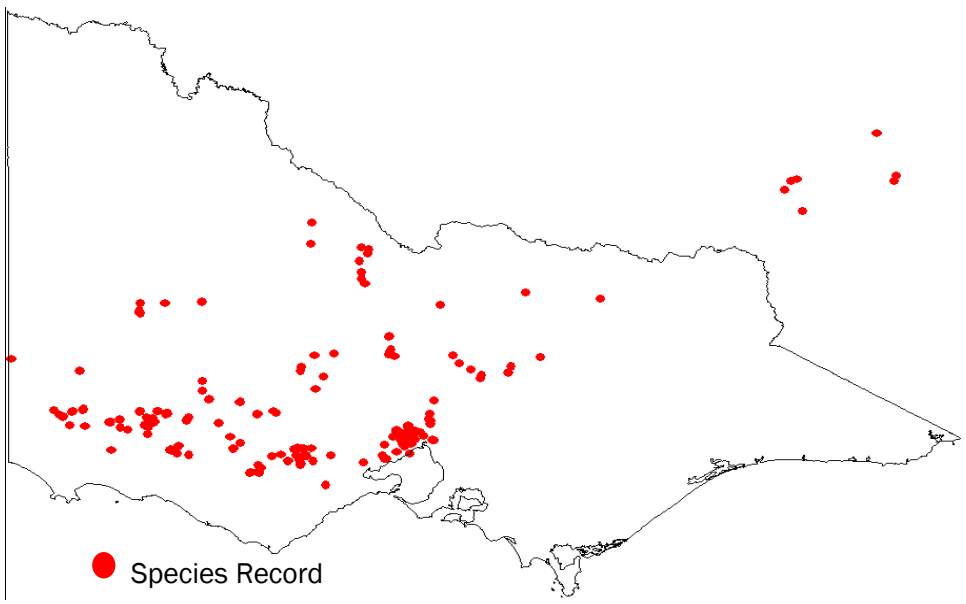


Figure 8: Distribution of Striped Legless Lizard in Victoria (Source: Viridians 2011)

Threats

The main threats to the species are habitat loss, degradation and fragmentation. In particular agricultural practices, such as cultivation and cropping, have resulted in a significant population decline and in some cases local extinctions (Coulson 1990).

Legislative protection

The Striped Legless Lizard is listed as *vulnerable* under the EPBC Act, listed as threatened under the FFG Act and listed as *endangered* on the DELWP threatened species advisory list (DSE 2013).

9.3 Sources of information

9.3.1 *Existing Information*

Existing information has been obtained from a wider area, termed the 'radius of investigation' defined for this assessment as a ten-kilometre radius from the proposed Golden Plains Wind Farm boundary.

A list of the Striped Legless Lizard records in the radius of investigation was obtained from the Victorian Biodiversity Atlas (VBA), a database administered by DELWP (Victorian Biodiversity Atlas 2016).

The online *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (DoEE 2016a) was consulted and it indicated potential for the species to occur, based on existing records and habitat modelling.

The Department of Environment, Land, Water and Planning issued survey standards outlined in the "Biodiversity Precinct Planning Kit" in early 2010. The current targeted survey was therefore undertaken on the basis of these survey guidelines (DSE 2010). The survey was also undertaken based on the survey guidance in the EPBC Act Policy Statement No. 3.28 (DSEWPAC 2011).

9.3.2 *Habitat Assessment*

The targeted survey was undertaken in sites identified as being potentially suitable Striped Legless Lizard habitat by an experienced zoologist, with a good cover of basaltic surface rock, cracking soils and dense tussock-forming grasses. The vegetation type, structure and habitat quality were examined as important habitat components influencing the distribution of threatened Striped Legless Lizard for each chosen survey site.

Three main habitat quality categories were used and described below.

High: Habitat components listed below are usually all present.

- High-density native tussock grassland present (e.g. Kangaroo Grass - *Themeda triandra,* wallaby grass - *Austradanthonia* spp. and spear grass - Stipa)
- Large, extensive and continuous areas of native tussock grassland
- High proportions of surface and embedded rocks, and cracking soil
- Connectivity with other areas of suitable habitat.

Moderate: Some fauna habitat components are often missing although linkages with other remnant habitats in the landscape are usually intact.

- Some native tussock grassland present
- Large, extensive and continuous areas of mixed native and exotic grassland
- Some surface and embedded rocks, and cracking soil
- Some connectivity.

Low: Many habitat elements have been lost and habitat fragmented.

- Low density and small areas of native tussock grassland present
- Native tussock grassland species may be absent
- Surface and embedded rocks are often absent
- Isolated and little to no connectivity
- Showing signs of disturbance (such as soil erosion and compaction and/or grazing pressures).

9.3.3 *Field Methodology*

The Striped Legless Lizard survey was undertaken using methods consistent with the DELWP Biodiversity Precinct Planning Kit (DSE 2010) and the EPBC Act Referral guidelines (DSEWPAC 2011), including using the tile grid method, previously used successfully to survey for Striped Legless Lizard in the basalt plains grasslands of Melbourne (O'Shea 2004). In addition, according to the current EPBC Act survey guidelines for Striped Legless Lizard, areas greater than 30 hectares in size require a minimum of ten tile survey grids (DSEWPC 2011).

In each grid, 50 grooved terracotta or concrete roof tiles were placed in a 20 x 45 metre grid configuration, with tiles spaced five metres apart. The north-west corner of the grid was recorded using a handheld GPS.

The tile grids were laid out on 25th July 2016 and monitored in spring-summer at fortnightly intervals. The first monitoring took place on 5th September, with the last check on 12th December 2016. Each grid was checked a total of six times.

The grids were checked between approximately 9am and 1pm. The time of grid checking was randomised, to eliminate time-of-day differences between grids in detection. The weather conditions during the checks ranged from cool to warm and varied from overcast to clear skies. These conditions were considered suitable for detecting the Striped Legless Lizard using the tile grid method.

All field work undertaken in the study area was conducted in accordance with the *Wildlife Act 1975* (Permit number: 10005410).

9.3.4 *Limitations of field assessment*

The timing of the Striped Legless Lizard survey, its duration and the weather conditions were considered suitable for detecting the species. The tiles, which were used as the main method for detecting this species in the study area, do not trap the animals. Hence, it is important to time the monitoring to maximise the chances of detecting this species while the animals are utilising the tiles. Every effort was made during the current survey to ensure that monitoring took place under suitable conditions in the morning to detect the species.

The wind farm site boundary was altered to include a greater area extending north-west after the commencement of this survey. As such the additional area was not included in the survey. However, it is considered likely that detection of a significant population within the initial study area will be indicative of the species presence within suitable habitat in the extended area.

The overall survey effort (3,000 tiles checked) was considered sufficient to detect significant populations of Striped Legless Lizard in the study area.

9.4 Results

9.4.1 *Existing Information*

The VBA shows 144 recent records of Striped Legless Lizard (SLL) from 1995 to 2015 in various locations within 10 kilometres of the wind farm site (Appendix 8). These records were located on road reserves as well as private land.

Figure 10 shows the location of records in the surrounding area. SLL observations occur in dense clusters at three locations within the study area; south of Rokewood; on private land to the east; and to the south, outside of the wind farm, close to the Hamilton Highway. These record clusters likely indicate survey efforts targeted in these areas and not an absence of SLL in other areas within the radius of investigation.

9.4.2 *Habitat Assessment*

The study area has been used for grazing and other agriculture purposes over a long period and contains a mixture of native and introduced grass species. Native tussock grasses, rocks and cracking soils were present throughout the areas chosen for this targeted survey. Habitat condition at each tile grid is described in detail below (Table 21).

Table 21: Tile grid habitat assessment

Grid number	Quality	Site description	Public/ Private tenure
1	Low	Heavily grazed exotic grassland, lacking tussocks, minimal rocky areas. Limited connectivity	Private
2	Low	Landholder has cleared rocky areas where possible. Grassland is exotic and heavily grazed, contains some tussock grasses. Limited connectivity.	Private
3	Moderate	Grazing land with some tussock cover and mostly exotic pasture grass. Some connectivity to nearby rocky areas.	Private
4	Moderate	Grazing land with some tussock cover and mostly exotic pasture grass. Moderate to good ground cover. Connectivity to nearby rocky areas present.	Private
5	Moderate	Located on a rocky rise with good tussock, native and exotic grass cover. Connectivity to nearby rocky areas. Limited grazing.	Private
6	Moderate	Located on a rocky rise with moderate tussock and native and exotic grass cover. Connectivity to nearby rocky areas. Limited grazing.	Private
7	Moderate	On previous grazing farmland, currently not used for grazing. Tall grass and some tussock cover. Large rocky areas. Some connectivity to nearby rocky areas.	Private
8	Moderate	Regenerating grassland with native species and dense tussocks over rocky areas. Bordered by grazed farmlands, limited connectivity. Stone fences may provide a corridor for SLL movement.	Public
9	Low	Grazing land with some tussock cover and mostly exotic pasture grass. Connectivity to nearby rocky areas limited.	Private
10	Moderate	Regenerating grassland with native species and dense tussocks over some rocky areas. Some grazing occurring. Connectivity to other habitat available.	Private

Notes: Refer to Figure 9 for grid locations.

Figure 9: Location of tile grids in the study area

See Volume B

Figure 10: Historical and current records of Striped Legless Lizard and Growling Grass Frog in and near the proposed Golden Plains Wind Farm site.

See Volume B

9.4.3 *Survey Results*

A total of 45 observations of SLL were recorded during the tile grid survey with at least one observation occurring at every tile grid location. Grid four had the highest abundance, with 13 individuals detected during the survey period. Grids one and eight each had one observation during the survey period (Table 22), the lowest number detected. The highest number of individuals detected at any one time was three (found at Grids 3, 4 and 10).

Figure 11: Striped Legless Lizard found beneath a tile at GPWF

Striped Legless Lizards were recorded under tiles with temperatures ranging between 17.2°C and 27.9°C. Two SLL observations were also recorded at over 30°C, these were underneath tiles burrowed into cracks in the dried soil beneath.

An additional three fauna species were recorded in the study area during the targeted survey. Species include Tussock Skink (*Pseudemoia pagenstecheri*), Fat-tailed Dunnart (*Sminthopsis crassicaudata*) (both listed on DELWP's Advisory List) and Little Whip Snake (*Parasuta flagellum*).

Table 22: Results of Striped Legless Lizard tile grid survey

Date	Visibility	Wind Direction	Wind Strength	Temperature	Cloud Cover (%)	Rain	Grid Number	Time	Temp ambient (°C)	Humidity ambient (%)	Temp below (°C)	Humidity below (%)	Species
23/09/2016	Good	SE	Gentle	Mild	20-30	None	2	9:15	12.9	56	17.8	68	-
							1	9:30	13.3	56	19.3	64	-
							9	9:39	13.9	60	16	70	Tussock Skink
							8	9:50	13.8	61	18	74	Tussock Skink
							10	9:58	16.4	56	17.2	64	Striped Legless Lizard
							7	10:20	13.5	62	22.6	79	-
							3	10:21	17.6	57	18.6	70	Striped Legless Lizard
							4	10:42	17	60	19.2	63	Striped Legless Lizard
							6	11:02	17.7	54	18.1	66	Striped Legless Lizard
							5	11:20	18.8	63	18.2	70	Striped Legless Lizard
6/10/2016	Good	NE	Gentle	Warm	20	None	2	9:10	16.2	60	16.9	70	-
							1	9:27	17.4	60	17.1	68	-
							8	9:37	17.3	65	18.4	78	Tussock Skink
							7	10:00	20	57	21	76	-
							9	10:35	20.2	56	20.9	70	-
							10	10:47	20.5	59	21.2	75	Striped Legless Lizard x 2
							3	11:04	20.8	55	20.9	67	Striped Legless Lizard
							4	11:13	21.4	52	22.9	67	Striped Legless Lizard x 2
							6	11:26	21	54	21	68	Little Whip Snake
							5	11:39	21.7	54	21	61	-
25/10/2016	Good	N	Strong	Warm	10	None	2	9:40	19	48	20.5	83	-
							1	10:05	19.5	37	20.5	63	-
							8	10:20	20	37	23	65	Fat-tailed Dunnart x 2
							3	10:27	21	38	21.6	40	Striped Legless Lizard
							4	10:38	22	38	24.3	43	Striped Legless Lizard x 3
							6	10:53	21.9	36	21.3	50	Striped Legless Lizard
							7	10:55	24	33	24.7	77	Striped Legless Lizard
							5	11:07	22.6	39	23.4	49	Little Whip Snake
							10	11:26	22.8	41	23.9	50	Striped Legless Lizard x 3
							9	11:46	21.7	39	23.8	63	Tussock Skink x 2
8/11/2016	Good	SW	Gentle	Warm	40	None	2	9:22	18	53	17.3	68	-
							1	9:40	16.2	40	18.5	67	Tussock Skink
							8	9:51	16.6	38	19	61	Little Whip Snake x 2, Striped Legless Lizard
							7	10:32	16.6	36	19	54	Striped Legless Lizard x 2, Little Whip Snake
							9	11:00	15.6	38	20	76	Striped Legless Lizard x 2, Tussock Skink
							10	11:21	17.2	36	22	66	Fat-tailed Dunnart x 2
							3	11:42	17.4	31	22.2	65	Striped Legless Lizard
							4	11:52	18.8	41	23.6	77	Striped Legless Lizard x 3
							6	12:08	17.8	42	20.5	62	Striped Legless Lizard x 2
							5	12:26	16.2	45	21.3	72	Striped Legless Lizard

Date	Visibility	Wind Direction	Wind Strength	Temperature	Cloud Cover (%)	Rain	Grid Number	Time	Temp ambient (°C)	Humidity ambient (%)	Temp below (°C)	Humidity below (%)	Species
24/11/2016	Good	SW	Fresh	Cool	80	None	6	10:00	16.5	49	19.6	72	Fat-tailed Dunnart x 2
							5	10:40	16.7	46	22.7	67	Striped Legless Lizard
							3	11:05	15.5	49	18.9	68	Striped Legless Lizard x 3
							4	11:20	16.5	46	22.1	68	Striped Legless Lizard x 2
							10	11:45	19	35	24.6	71	Striped Legless Lizard
							9	2:24	18.2	35	24.6	67	Striped Legless Lizard x 2
							2	9:35	15.2	62	19.6	85	Tussock Skink
							1	10:05	16.2	58	21	81	Fat-tailed Dunnart, Little Whip Snake
							8	10:20	17.8	50	23.7	81	Little Whip Snake
							7	11:00	17.5	46	23.6	47	-
30/11/2016	Good	SE	Fresh	Mild	70	None	9	9:10	17.4	64	19	66	Tussock Skink
							10	9:37	18.7	51	20.4	53	-
							3	10:04	19.1	43	21.7	63	-
							4	10:21	19.7	48	22	63	Striped Legless Lizard x 2
							6	10:41	23	41	24.7	51	Striped Legless Lizard x 2
							5	11:18	23.5	38	26	48	-
							8	12:00	22.9	43	27.9	63	Striped Legless Lizard, Little Whip Snake
							1	12:22	21.7	49	26	74	Striped Legless Lizard
							2	12:45	22.5	48	34	58	Striped Legless Lizard x 2
							7	13:24	23	45	32.6	38	-

Notes: Temp ambient (°C) = Air Temperature; Humidity ambient (%) = Air Humidity; Temp below (°C) = Temperature under tile; Humidity below (%) = Humidity under tile.

9.5 Impacts and Implications

The Striped Legless Lizard is listed as vulnerable under the EPBC Act and was observed during the current assessment. The population is an important population, according to the referral guidelines for SLL (DSEWPC 2011), and well-established considering its wide distribution and abundance in areas of suitable habitat.

Impacts on the Striped Legless Lizard resulting from the proposed wind farm will include the removal of suitable habitat. As this species' habitat corresponds broadly to Plains Grassland EVC, impacts on the species can be mitigated through the application of the 'avoid' and 'minimise' principles during the design of the project. Detailed consideration of this is provided in the vegetation assessment chapter (see Section 5).

Impacts on the population of this species in the Golden Plains Wind Farm area are expected to be low as the actual development footprint will be confined to less than 2% of the native vegetation in the wind farm site.

The Striped Legless Lizard is listed as threatened under the FFG Act. The majority of the study area is private land however some of the access tracks will need to cross roadside reserves that are public land and it is likely if these areas support suitable habitat Striped Legless Lizards will be present and affected. The extent of removal required for access points on public roads however represents a small proportion of the available habitat on such road reserves, which in many cases are extensively vegetated.

Consideration should be given to implementing a salvage protocol to translocate individuals to adjacent, retained areas of grassland habitat should any habitat of high quality be removed during construction of the proposed wind farm.

9.6 Mitigation Measures

To maximise the effectiveness of mitigation measures to avoid significant impacts on the threatened Striped Legless Lizard and other grassland species, the mitigation measures described below should be considered.

- Where possible, avoid impacting upon areas of suitable habitat consisting of basaltic surface rock, cracking soils and dense tussock-forming grasses of native and/or introduced species. Negative impacts to areas of native vegetation should be avoided by micro-siting turbines and associated infrastructure away from these areas
- Where possible, continuity between areas of native vegetation should be maintained to accommodate Striped Legless Lizard movements
- Ensure that surface and embedded rocks are not removed from the site and where possible reintroduce or increase the cover of surface rocks where they are removed temporarily
- Maintain existing habitat corridors of a minimum of 30 metres width
- Preparation and implementation of a salvage and translocation protocol approved by DELWP in the event that a Striped Legless Lizard is found during construction works.

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Appendix 1: Details of the Guidelines assessment process

Native Vegetation Information Management system (NVIM)

The online Native Vegetation Information Management system (NVIM) is an interactive mapping tool, which provides some of the information required to accompany a permit to remove native vegetation. It does not replace the application process.

The information provided by NVIM can include the following (described in more detail below):

- The *location risk* of the native vegetation;
- The *condition* of the native vegetation – used for the low-risk assessment pathway only;
- The *strategic biodiversity score* of the native vegetation proposed to be removed; and
- The *native vegetation offset* requirement – used for the low risk assessment pathway only.

Biodiversity assessment guidelines

Guidelines objective

As set out in *Permitted clearing of native vegetation – Biodiversity assessment guidelines* ('the Guidelines') the objective for permitted clearing of native vegetation in Victoria is 'No net loss in the contribution made by native vegetation to Victoria's biodiversity'. The key strategies for ensuring this outcome when considering an application to remove native vegetation are:

- Avoiding the removal of native vegetation that makes a significant contribution to Victoria's biodiversity;
- Minimising impacts on Victoria's biodiversity from the removal of native vegetation; and
- Where native vegetation is permitted to be removed, ensuring it is offset in a manner that makes an equivalent contribution to Victoria's biodiversity made by the native vegetation to be removed.

Note: if native vegetation does not meet the definition of either a remnant patch or scattered trees, the Guidelines are not required to be applied.

Risk-based assessment pathways

The first step in determining the type of assessment required for any site in Victoria is to determine the risk to biodiversity associated with the proposed native vegetation removal and therefore the risk-based assessment pathway for the proposed native vegetation removal. There are three risk-based pathways for assessing an application to remove native vegetation, below.

- Low risk
- Moderate risk
- High risk

This risk-based assessment pathway is determined by two factors, outlined below.

Extent risk – the area in hectares proposed to be removed *or* the number of scattered trees. *Note:* extent risk also includes any native vegetation clearing for which permission has been granted in the last five years.

Location risk – the likelihood that removing native vegetation in a location will have an impact on the persistence of a rare or threatened species classified into three categories: Location A, Location B and Location C.

The risk-based pathway for assessing an application to remove native vegetation is determined by the following matrices for remnant patches and scattered trees:

Extent (remnant patches)	Location A	Location B	Location C
< 0.5 hectares	Low	Low	High
≥ 0.5 hectares and < 1 hectare	Low	Moderate	High
≥ 1 hectare	Moderate	High	High
Extent (scattered trees)	**Location A**	**Location B**	**Location C**
< 15 scattered trees	Low	Moderate	High
≥ 15 scattered trees	Moderate	High	High

All native vegetation within any subdivision plot of less than 0.4 hectares is deemed to be lost; For applications with combined removal of both remnant patch and scattered trees, the extent of the scattered trees is converted to an area by assigning a standard area of 0.070 hectares per tree – the total extent is then used to determine the risk-based pathway.

The presence of any Location B or Location C risk categories within an area of proposed native vegetation removal means this whole area of removal is considered to belong to that category for the purpose of determining the risk-based assessment pathway.

Strategic biodiversity score

The strategic biodiversity score generated by NVIM acts as a measure of the site's importance for Victoria's biodiversity relative to other locations across the landscape. It is calculated based on a weighted average of scores across an area of native vegetation proposed for removal on a site.

Habitat importance

Habitat importance mapping produced by DELWP is based on one or a combination of habitat importance models, habitat distribution models or site record data. It identifies the following:

- *Habitat importance for dispersed species* – based on habitat distribution models and assigned a habitat importance score ranging from 0 to 1; and
- *Highly localised habitats* – considered to be equally important for a particular species and assigned a habitat importance score of 1.

Habitat importance mapping is used to determine the type of offset required under the moderate and high risk assessment pathways.

Biodiversity equivalence

Biodiversity equivalence scores are used to quantify losses in the contribution to Victoria's biodiversity from removing native vegetation and gains in this contribution from a native vegetation offset.

There are two types of biodiversity equivalence scores depending on whether or not the site makes a contribution to the habitat of a Victorian rare or threatened species.

- A *general* biodiversity equivalence score is a measure of the contribution native vegetation on a site makes to Victoria's biodiversity overall and applies when no habitat importance scores are applicable according to the equation:

General biodiversity equivalence score =
habitat hectares x strategic biodiversity score

- A *specific* biodiversity equivalence score is a measure of the contribution that native vegetation on a site makes to the habitat of a particular rare or threatened species – calculated for each such species for which the site provides important habitat (using habitat importance scores provided by DELWP) according to the equation:

Specific biodiversity equivalence score =
habitat hectares x habitat importance score

Offset requirements

A native vegetation offset is required for the approved removal of native vegetation. Offsets conform to one of two types and each type incorporates a risk factor to address the risk of offset failing:

- A *general* offset applies if the removal of native vegetation impacts Victoria's overall biodiversity and has an offset risk factor of 1.5 applied according to the equation:

General risk-adjusted offset requirement =
general biodiversity equivalence score (clearing site) x 1.5

- A *specific* offset applies if the native vegetation makes a significant impact to habitat for a rare or threatened species determined by a *specific-general offset test*. It applies to each species impacted and has an offset risk factor of 2 applied according to the equation:

Specific risk-adjusted offset requirement =
specific biodiversity equivalence score (clearing site) x 2

Note: if native vegetation does not meet the definition of either a remnant patch or scattered trees an offset is not required.

Summary of the Guidelines assessment process

Decision guidelines	Offset requirements
Low-risk assessment pathway	
An application for removal cannot be refused on biodiversity grounds (unless it is not in accordance with any property vegetation plan that applies to the site). *Note: this guideline also applies to native vegetation that does not meet the definition of either a remnant patch or scattered trees.*	General offset applies: ▪ General offset = general biodiversity equivalence score (clearing site) x 1.5 ▪ Offset must be located in the same CMA^ or Local Government Area as the removal ▪ Offset must have a strategic biodiversity score at least 80% of the native vegetation removed Offsets must be secured before the removal of native vegetation.
Moderate-risk assessment pathway	
The responsible authority will consider: ▪ The strategic biodiversity score and habitat importance score of the native vegetation proposed to be removed ▪ Any property vegetation plan that applies to the site ▪ Whether reasonable steps have been taken to ensure that impacts of the proposed removal of native vegetation on biodiversity have been minimised with regard to the contribution to biodiversity made by the native vegetation to be removed and the native vegetation to be retained ▪ Whether an offset has been identified that meets the requirements ▪ The need to remove native vegetation to create defendable space to reduce the risk of bushfire	If the proportional impact on modelled habitat for a rare or threatened species is above a predetermined threshold, a specific offset applies for that species: ▪ Specific offset = specific biodiversity equivalence score (clearing site) x 2 ▪ Offset must be located in the same species habitat anywhere in Victoria as determined by DELWP habitat importance mapping General offsets apply where the specific offset threshold is not exceeded. Offsets must be secured before the removal of native vegetation.

High-risk assessment pathway	
In addition to the considerations for the moderate pathway the responsible authority will determine whether the native vegetation to be removed makes a significant contribution to Victoria's biodiversity. This includes considering: ▪ Impacts on important habitat for rare or threatened species, particularly highly localised habitat ▪ Proportional impacts on remaining habitat for rare or threatened species ▪ If the removal of the native vegetation will contribute to a cumulative impact that is a significant threat to the persistence of a rare or threatened species ▪ The availability of, and potential for, gain from offsets	As for the moderate pathway

*** Habitat hectares = condition score (out of 1) x extent (hectares)**

^ Catchment Management Authority

Note: All applications must provide information about the vegetation to be removed such as location and address of the property, description of the vegetation, maps and recent dated photographs.

Appendix 2: Details of the application of the avoid and minimise process

Summary of design approaches to avoid and minimise impact on NV

Version Date	Design Considerations
17.11.16	WTG locations (WTG Layout Nov2016). Minimising activity area. Existing landholder laneways/tracks. Existing landholder access points (gates, creek crossings). Minimising impact to agricultural operations. Landholder opinion (4thQ2016).
5.12.16	All previous considerations, plus; Revised WTG locations (WTG Layout 02Dec2016). Revised landholder opinion.
6.12.16	All previous considerations, plus; Revised WTG locations (WTG Layout 02Dec2016 updated). Revised landholder opinion (4thQ2016). Minimising native vegetation removal (BLA overview mapping Aug-Sep2016). WTG hardstand and hillock locations (Senvion) Transport turning radii (Senvion) Traffic management/safe access points (in-house).
2.2.17	All previous considerations, plus; Revised WTG locations (WTG Layout 02Feb2017). Further minimising native vegetation removal (BLA overview mapping Aug-Sep2016). Minimised impact to crown land, ensured zero access tracks or cable routes ran along crown land access ways. Allowed tracks and cable routes to cross crown land if required.
16.2.17	All previous considerations, plus; Revised landholder opinion (discussions commenced 16Feb2017).
18.2.17	All previous considerations, plus; Revised landholder opinion (discussions commenced 16Feb2017).
2.3.17	All previous considerations, plus; Revised WTG locations (WTG Layout 02Feb2017) (change made to WTG nearest Parkinson house). Revised landholder opinion (completed).
15.3.17	All previous considerations, plus; Jacobs Transport Assessment considered (transport approach directions).
20.3.17	All previous considerations, plus; Design responses to BLA native vegetation habitat hectare mapping as of 17Mar2017
27.3.17	All previous considerations, plus; Removal of WTG's (2 turbines on Property ID 3, 2 turbines on Property ID 25) to minimise impact on high quality native vegetation and in response to cultural heritage constraints.
30.3.17	All previous considerations, plus; Track alterations/additons in response to WTG layout changing from 234 to 231.

Appendix 3: Scattered trees in the investigation area

Tree no.	Common name	Scientific name	DBH (cm)	Radius of TRZ (m)	Remove/ Retain
1	River Red-gum	*Eucalyptus camaldulensis*	122	14.64	Retained
2	River Red-gum	*Eucalyptus camaldulensis*	178	15	Retained
3	River Red-gum	*Eucalyptus camaldulensis*	147	15	Retained
4	River Red-gum	*Eucalyptus camaldulensis*	130	15	Retained
5	River Red-gum	*Eucalyptus camaldulensis*	33	3.96	Removed
6	River Red-gum	*Eucalyptus camaldulensis*	44	5.28	Removed
7	River Red-gum	*Eucalyptus camaldulensis*	75	9	Removed
8	Yellow Box	*Eucalyptus melliodora*	63	7.56	Removed

Notes:

DBH = Diameter at breast height (130 cm from the ground);

TRZ = Tree Retention Zone (see below)

DELWP guidelines (DSE 2010) provide definitions regarding tree losses. These are outlined below, and it is considered that they should be applied to scattered trees and edges of treed remnant patches when determining the proximity of development to retained native vegetation.

Any tree is deemed lost when:

- Earthworks encroach on more than 10% of its Tree Retention Zone (TRZ) during construction activities. Tree Retention Zones:
    - Are defined as the area from the respective tree within a radius of 12 times the DBH of the respective tree, including the area above and below ground, notwithstanding it can be a minimum of two metres and a maximum of 15 metres radius around the respective tree
- Directional drilling within its TRZ occurs at less than 600 millimetres below the surface, or is not confirmed to be appropriate (including considerations concerning bore hole width) by a qualified arborist
- Lopping removes more than 1/3 of its crown

Appendix 4: Flora species recorded in the study area

Origin	Common name	Scientific name	EPBC	FFG-T	FFG-P	DELWP	CaLP Act
	Lightwood	*Acacia implexa*					
	Black Wattle	*Acacia mearnsii*			p		
	Hedge Wattle	*Acacia paradoxa*					
	Golden Wattle	*Acacia pycnantha*			p		
	Sheep's Burr	*Acaena echinata*					
	Bidgee-widgee	*Acaena novae-zelandiae*					
	Australian Sheep's Burr	*Acaena ovina*					
*	Sheep Sorrel	*Acetosella vulgaris*					
	Honey-pots	*Acrotriche serrulata*			p		
*	Brown-top Bent	*Agrostis capillaris*					
	Bent/Blown Grass	*Agrostis s.l. spp.*					
*	Hair Grass	*Aira spp.*					
	Black Sheoak	*Allocasuarina littoralis*					
	Drooping Sheoak	*Allocasuarina verticillata*					
	Southern Swamp Wallaby-grass	*Amphibromus neesii*					
	Common Swamp Wallaby-grass	*Amphibromus nervosus*					
	Swamp Wallaby-grass	*Amphibromus spp.*					
	Common Wheat-grass	*Anthosachne scabra s.l.*					
*	Sweet Vernal-grass	*Anthoxanthum odoratum*					
*	Cape weed	*Arctotheca calendula*					
	Chocolate Lily	*Arthropodium strictum s.s.*					
	Common Woodruff	*Asperula conferta*					
	Cranberry Heath	*Astroloma humifusum*			p		
	Kneed Spear-grass	*Austrostipa bigeniculata*					
	Supple Spear-grass	*Austrostipa mollis*					
	Fine-head Spear-grass	*Austrostipa oligostachya*					
	Tall Spear-grass	*Austrostipa pubinodis*					
	Rough Spear-grass	*Austrostipa scabra subsp. falcata*					
	Spear Grass	*Austrostipa spp.*					
	Quizzical Spear-grass	*Austrostipa stuposa*					
*	Oat	*Avena spp.*					
	Pale Twig-sedge	*Baumea acuta*					
	Salt Club-sedge	*Bolboschoenus caldwellii*					
	Club Sedge	*Bolboschoenus spp.*					
*	Rape	*Brassica X napus*					
*	Large Quaking-grass	*Briza maxima*					
*	Lesser Quaking-grass	*Briza minor*					
*	Great Brome	*Bromus diandrus*					
*	Soft Brome	*Bromus hordeaceus subsp. hordeaceus*					
	Brome	*Bromus spp.*					
	Milkmaids	*Burchardia umbellata*					

Origin	Common name	Scientific name	EPBC	FFG-T	FFG-P	DELWP	CaLP Act
	Sweet Bursaria	*Bursaria spinosa subsp. spinosa*					
	Blue Grass-lily	*Caesia calliantha*					
	Cypress-pine	*Callitris spp.*					
	Lemon Beauty-heads	*Calocephalus citreus*			p		
	Milky Beauty-heads	*Calocephalus lacteus*			p		
	Common Grass-sedge	*Carex breviculmis*					
	Sedge	*Carex spp.*					
*	Centaury	*Centaurium spp.*					
*	Slender Centaury	*Centaurium tenuiflorum*					
	Glaucous Goosefoot	*Chenopodium glaucum*					
	Windmill Grass	*Chloris truncata*					
	Common Everlasting	*Chrysocephalum apiculatum s.l.*			p		
*	Thistle	*Cirsium spp.*					
*	Spear Thistle	*Cirsium vulgare*					R
	Small Milkwort	*Comesperma polygaloides*		L	p	v	
	Blushing Bindweed	*Convolvulus angustissimus*					
	Pink Bindweed	*Convolvulus erubescens s.l.*					
	Bindweed	*Convolvulus spp.*					
*	Flaxleaf Fleabane	*Conyza bonariensis*					
*	Water Buttons	*Cotula coronopifolia*					
	Sieber Crassula	*Crassula sieberiana s.l.*					
*	Couch	*Cynodon dactylon var. dactylon*					
	Sweet Hound's-tongue	*Cynoglossum suaveolens*					
*	Rough Dog's-tail	*Cynosurus echinatus*					
*	Cocksfoot	*Dactylis glomerata*					
*	Heath Grass	*Danthonia decumbens*					
	Wallaby Grass	*Danthonia s.l. spp.*					
	Southern Tick-trefoil	*Desmodium gunnii*					
	Black-anther Flax-lily	*Dianella revoluta var. revoluta s.l.*					
	Flax Lily	*Dianella spp.*					
	Common Plume-grass	*Dichelachne rara*					
	Kidney-weed	*Dichondra repens*					
*	South African Orchid	*Disa bracteata*					
#	Trailing Hop-bush	*Dodonaea procumbens*	VU			v	
#	Clammy Goosefoot	*Dysphania pumilio*					
*	Paterson's Curse	*Echium plantagineum*					C
	Nodding Saltbush	*Einadia nutans*					
	Common Spike-sedge	*Eleocharis acuta*					
	Tall Spike-sedge	*Eleocharis sphacelata*					
*	Goose-grass	*Eleusine indica*					
*	American Crows-foot Grass	*Eleusine tristachya*					
	Hairy Willow-herb	*Epilobium hirtigerum*					
	Willow Herb	*Epilobium spp.*					
	Common Love-grass	*Eragrostis brownii*					
*	Common Heron's-bill	*Erodium cicutarium*					

Origin	Common name	Scientific name	EPBC	FFG-T	FFG-P	DELWP	CaLP Act
	Blue Devil	*Eryngium ovinum*					
	Eryngium	*Eryngium spp.*					
	Prickfoot	*Eryngium vesiculosum*					
	River Red-gum	*Eucalyptus camaldulensis*					
*	Sugar Gum	*Eucalyptus cladocalyx*					
	Swamp Gum	*Eucalyptus ovata*					
	Eucalypt	*Eucalyptus spp.*					
	Cudweed	*Euchiton spp.*			p		
#	Flat Spurge	*Euphorbia drummondii*					
	Common Eutaxia	*Eutaxia microphylla*					
	Knobby Club-sedge	*Ficinia nodosa*					
	Soft Crane's-bill	*Geranium potentilloides*					
	Grassland Crane's-bill	*Geranium retrorsum s.l.*					
	Crane's Bill	*Geranium spp.*					
	Australian Sweet-grass	*Glyceria australis*					
	Glycine	*Glycine spp.*					
	Common Raspwort	*Gonocarpus tetragynus*					
	Varied Raspwort	*Haloragis heterophylla*					
	Jersey Cudweed	*Helichrysum luteoalbum*			p		
*	Ox-tongue	*Helminthotheca echioides*					
*	Yorkshire Fog	*Holcus lanatus*					
*		*Hordeum marinum*					
	Small St John's Wort	*Hypericum gramineum spp. agg.*					
*	Smooth Cat's-ear	*Hypochaeris glabra*					
*	Flatweed	*Hypochaeris radicata*					
	Tassel Rope-rush	*Hypolaena fastigiata*					
*	Tiny Flat-sedge	*Isolepis levynsiana*					
*	Spiny Rush	*Juncus acutus subsp. acutus*					R
	Hollow Rush	*Juncus amabilis*					
	Toad Rush	*Juncus bufonius*					
	Gold Rush	*Juncus flavidus*					
	Pale Rush	*Juncus pallidus*					
	Rush	*Juncus spp.*					
	Common Blown-grass	*Lachnagrostis filiformis s.s.*					
	Blown Grass	*Lachnagrostis spp.*					
*	Prickly Lettuce	*Lactuca serriola*					
	Sword Sedge	*Lepidosperma spp.*					
	Scaly Buttons	*Leptorhynchos squamatus*			p		
	Native Flax	*Linum marginale*					
	Poison Lobelia	*Lobelia pratioides*					
	Lobelia	*Lobelia spp.*					
*	Rye Grass	*Lolium spp.*					
	Wattle Mat-rush	*Lomandra filiformis*					
	Dwarf Mat-rush	*Lomandra nana*					
	Mat-rush	*Lomandra spp.*					

Origin	Common name	Scientific name	EPBC	FFG-T	FFG-P	DELWP	CaLP Act
*	Tall Wheat-grass	*Lophopyrum ponticum*					
*	African Box-thorn	*Lycium ferocissimum*					C
*	Pimpernel	*Lysimachia arvensis*					
	Small Loosestrife	*Lythrum hyssopifolia*					
	Loosestrife	*Lythrum spp.*					
*	Horehound	*Marrubium vulgare*					C
	Common Nardoo	*Marsilea drummondii*			p		
*	Medic	*Medicago spp.*					
#	Swamp Paperbark	*Melaleuca ericifolia*					
	Tree Violet	*Melicytus dentatus s.l.*					
	Weeping Grass	*Microlaena spp.*					
	Onion Orchid	*Microtis spp.*			p		
	Creeping Monkey-flower	*Mimulus repens*					
	White Purslane	*Montia australasica*					
*	Serrated Tussock	*Nassella trichotoma*					C
	Grassland Wood-sorrel	*Oxalis perennans*					
	Wood Sorrel	*Oxalis spp.*					
*	Paspalum	*Paspalum dilatatum*					
*	Toowoomba Canary-grass	*Phalaris aquatica*					
*	Canary Grass	*Phalaris spp.*					
	Common Rice-flower	*Pimelea humilis*					
	Woolly Rice-flower	*Pimelea octophylla*					
	Spiny Rice-flower	*Pimelea spinescens subsp. spinescens*	CR	L	p	e	
	Rice Flower	*Pimelea spp.*					
*	Radiata Pine	*Pinus radiata*					
*	Buck's-horn Plantain	*Plantago coronopus*					
	Narrow Plantain	*Plantago gaudichaudii*					
*	Ribwort	*Plantago lanceolata*					
	Variable Plantain	*Plantago varia*					
	Common Tussock-grass	*Poa labillardierei*					
	Tussock Grass	*Poa spp.*					
	Grass	*Poaceae spp.*					
*	Prostrate Knotweed	*Polygonum aviculare s.l.*					
	Hogweed	*Polygonum spp.*					
	Feather Heads	*Ptilotus macrocephalus*					
	Pussy Tails	*Ptilotus spathulatus*					
*	Onion Grass	*Romulea rosea*					
*	Sweet Briar	*Rosa rubiginosa*					C
	Slender Dock	*Rumex brownii*					
*	Clustered Dock	*Rumex conglomeratus*					
*	Curled Dock	*Rumex crispus*					
	Wiry Dock	*Rumex dumosus*					
	Dock	*Rumex spp.*					
	Common Wallaby-grass	*Rytidosperma caespitosum*					

Origin	Common name	Scientific name	EPBC	FFG-T	FFG-P	DELWP	CaLP Act
	Short Wallaby-grass	*Rytidosperma carphoides*					
	Brown-back Wallaby-grass	*Rytidosperma duttonianum*					
	Slender Wallaby-grass	*Rytidosperma racemosum var. racemosum*					
	Bristly Wallaby-grass	*Rytidosperma setaceum*					
*	Wild Sage	*Salvia verbenaca*					
	Creeping Brookweed	*Samolus repens var. repens*					
	Beaded Glasswort	*Sarcocornia quinqueflora*					
*	Slender Pigeon Grass	*Setaria parviflora*					
	Smooth Solenogyne	*Solenogyne dominii*			p		
*	Common Sow-thistle	*Sonchus oleraceus*					
	Sorghum	*Sorghum spp.*					
*	Rat-tail Grass	*Sporobolus africanus*					
	Swamp Starwort	*Stellaria angustifolia*					
	Austral Seablite	*Suaeda australis*					
	Sun Orchid	*Thelymitra spp.*			p		
	Kangaroo Grass	*Themeda triandra*					
	Yellow Rush-lily	*Tricoryne elatior*					
*	Narrow-leaf Clover	*Trifolium angustifolium var. angustifolium*					
*	Clover	*Trifolium spp.*					
*	Subterranean Clover	*Trifolium subterraneum*					
*	Woolly Clover	*Trifolium tomentosum var. tomentosum*					
	Streaked Arrowgrass	*Triglochin striata*					
*	Gorse	*Ulex europaeus*					C
	Speedwell	*Veronica spp.*					
	Ivy-leaf Violet	*Viola hederacea sensu Willis (1972)*					
*	Squirrel-tail Fescue	*Vulpia bromoides*					
*	Fescue	*Vulpia spp.*					
	Tufted Bluebell	*Wahlenbergia communis s.l.*					
	Sprawling Bluebell	*Wahlenbergia gracilis*					
	Bronze Bluebell	*Wahlenbergia luteola*					
	Bluebell	*Wahlenbergia spp.*					
	Rigid Panic	*Walwhalleya proluta*					
*	Bathurst Burr	*Xanthium spinosum*					C

Notes:

EPBC = threatened species status under EPBC Act
CR = critically endangered; EN = endangered; VU = vulnerable;

FFG-T = threatened species status under the FFG Act: L = listed as threatened under the FFG Act;

FFG-P = protected species status under the FFG Act: p = listed as protected;

DELWP = status under DELWP's Advisory List (DEPI 2014); cr = critically endangered; e = endangered; v = vulnerable; r = rare; k = insufficiently known;

CaLP Act = declared noxious weeds status under the CaLP Act; S = State Prohibited Weeds (any infestations are to be reported to DELWP. DELWP is responsible for control of State Prohibited Weeds); P = Regionally Prohibited Weeds (Land owners must take all reasonable steps to eradicate regionally prohibited weeds on their land); C = Regionally Controlled Weeds (Land owners have the responsibility to take all reasonable steps to prevent the growth and spread of Regionally controlled weeds on their land); R = Restricted Weeds (Trade in these weeds and their propagules, either as plants, seeds or contaminants in other materials is prohibited);

X = recorded in the study area

* = introduced to Victoria

= Victorian native taxa occurring outside their natural range

Appendix 5: Terrestrial vertebrate fauna species recorded and species that have the potential to occur in the study area

Common Name	Scientific Name	EPBC-threat	EPBC-migratory	FFG	DELWP	Recorded
Birds						
Australasian Grebe	*Tachybaptus novaehollandiae*					X
Australasian Pipit	*Anthus novaeseelandiae*					X
Australasian Shoveler	*Anas rhynchotis*				v	
Australian Hobby	*Falco longipennis*					X
Australian Magpie	*Gymnorhina tibicen*					X
Australian Owlet-nightjar	*Aegotheles cristatus*					
Australian Pelican	*Pelecanus conspicillatus*					X
Australian Raven	*Corvus coronoides*					X
Australian Shelduck	*Tadorna tadornoides*					X
Australian Spotted Crake	*Porzana fluminea*					
Australian White Ibis	*Threskiornis molucca*					X
Australian Wood Duck	*Chenonetta jubata*					X
Baillon's Crake	*Porzana pusilla palustris*			L	v	
Banded Lapwing	*Vanellus tricolor*					X
Black Falcon	*Falco subniger*				v	
Black Swan	*Cygnus atratus*					X
Black Kite	*Milvus migrans*					X
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*					X
Black-fronted Dotterel	*Elseyornis melanops*					X
Black-shouldered Kite	*Elanus axillaris*					
Black-tailed Native-hen	*Gallinula ventralis*					
Black-winged Stilt	*Himantopus himantopus*					X
Blue-winged Parrot	*Neophema chrysostoma*					X
Brolga	*Grus rubicunda*			L	v	X
Brown Falcon	*Falco berigora*					X
Brown Goshawk	*Accipiter fasciatus*					X
Brown Songlark	*Cincloramphus cruralis*					X
Brown Thornbill	*Acanthiza pusilla*					X
Brown-headed Honeyeater	*Melithreptus brevirostris*					X
Buff-banded Rail	*Gallirallus philippensis*					

Common Name	Scientific Name	EPBC-threat	EPBC-migratory	FFG	DELWP	Recorded
Buff-rumped Thornbill	*Acanthiza reguloides*					
Cattle Egret	*Ardea ibis*					X
Chestnut Teal	*Anas castanea*					X
Clamorous Reed Warbler	*Acrocephalus stentoreus*					X
Collared Sparrowhawk	*Accipiter cirrhocephalus*					
Common Blackbird	*Turdus merula*				*	X
Common Bronzewing	*Phaps chalcoptera*					X
Common Myna	*Acridotheres tristis*				*	X
Common Starling	*Sturnus vulgaris*				*	X
Crested Pigeon	*Ocyphaps lophotes*					X
Crimson Rosella	*Platycercus elegans*					X
Darter	*Anhinga novaehollandiae*					
Dusky Moorhen	*Gallinula tenebrosa*					
Dusky Woodswallow	*Artamus cyanopterus*					
Eastern Great Egret	*Ardea modesta*			L	v	
Eastern Rosella	*Platycercus eximius*					X
Eastern Spinebill	*Acanthorhynchus tenuirostris*					
Eurasian Coot	*Fulica atra*					X
European Goldfinch	*Carduelis carduelis*					X
European Greenfinch	*Carduelis chloris*				*	
European Skylark	*Alauda arvensis*				*	X
Fairy Martin	*Petrochelidon ariel*					X
Fan-tailed Cuckoo	*Cacomantis flabelliformis*					
Flame Robin	*Petroica phoenicea*					
Galah	*Eolophus roseicapilla*					X
Golden Whistler	*Pachycephala pectoralis*					
Golden-headed Cisticola	*Cisticola exilis*					X
Great Cormorant	*Phalacrocorax carbo*					X
Grey Butcherbird	*Cracticus torquatus*					
Grey Currawong	*Strepera versicolor*					
Grey Fantail	*Rhipidura albiscarpa*					
Grey Shrike-thrush	*Colluricincla harmonica*					X
Grey Teal	*Anas gracilis*					X
Gull-billed Tern	*Gelochelidon nilotica macrotarsa*		M (CAMBA)	L	e	

Common Name	Scientific Name	EPBC-threat	EPBC-migratory	FFG	DELWP	Recorded
Hardhead	*Aythya australis*				v	X
Hoary-headed Grebe	*Poliocephalus poliocephalus*					X
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*					
Horsfield's Bushlark	*Mirafra javanica*					X
House Sparrow	*Passer domesticus*				*	X
Latham's Snipe	*Gallinago hardwickii*		M (JAMBA, CAMBA, ROKAMBA, Bonn A2H)		nt	
Laughing Kookaburra	*Dacelo novaeguineae*					X
Little Black Cormorant	*Phalacrocorax sulcirostris*					X
Little Button-quail	*Turnix velox*				nt	
Little Corella	*Cacatua sanguinea*					
Little Eagle	*Hieraaetus morphnoides*					X
Little Grassbird	*Megalurus gramineus*					X
Little Lorikeet	*Glossopsitta pusilla*					
Little Pied Cormorant	*Microcarbo melanoleucos*					X
Little Raven	*Corvus mellori*					X
Long-billed Corella	*Cacatua tenuirostris*					X
Magpie-lark	*Grallina cyanoleuca*					X
Masked Lapwing	*Vanellus miles*					X
Mistletoebird	*Dicaeum hirundinaceum*					
Musk Lorikeet	*Glossopsitta concinna*					
Nankeen Kestrel	*Falco cenchroides*					X
New Holland Honeyeater	*Phylidonyris novaehollandiae*					X
Noisy Miner	*Manorina melanocephala*					
Pacific Barn Owl	*Tyto javanica*					
Pacific Black Duck	*Anas superciliosa*					X
Pallid Cuckoo	*Cuculus pallidus*					
Peregrine Falcon	*Falco peregrinus*					
Pied Currawong	*Strepera graculina*					
Pink-eared Duck	*Malacorhynchus membranaceus*					
Plumed Whistling Duck	*Dendrocygna eytoni*					X
Purple Swamphen	*Porphyrio porphyrio*					X
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*					X

Common Name	Scientific Name	EPBC-threat	EPBC-migratory	FFG	DELWP	Recorded
Red Wattlebird	*Anthochaera carunculata*					X
Red-browed Finch	*Neochmia temporalis*					
Red-kneed Dotterel	*Erythrogonys cinctus*					
Red-rumped Parrot	*Psephotus haematonotus*					X
Restless Flycatcher	*Myiagra inquieta*					X
Rock Dove	*Columba livia*				*	
Rufous Songlark	*Cincloramphus mathewsi*					
Rufous Whistler	*Pachycephala rufiventris*					
Sacred Kingfisher	*Todiramphus sanctus*					
Scarlet Robin	*Petroica boodang*					
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*					
Silver Gull	*Chroicocephalus novaehollandiae*					X
Silvereye	*Zosterops lateralis*					X
Southern Boobook	*Ninox novaeseelandiae*					
Spotless Crake	*Porzana tabuensis*					
Spotted Harrier	*Circus assimilis*				nt	
Spotted Pardalote	*Pardalotus punctatus*					
Straw-necked Ibis	*Threskiornis spinicollis*					X
Striated Fieldwren	*Calamanthus fuliginosus*					
Striated Pardalote	*Pardalotus striatus*					
Striated Thornbill	*Acanthiza lineata*					
Stubble Quail	*Coturnix pectoralis*					X
Sulphur-crested Cockatoo	*Cacatua galerita*					X
Superb Fairy-wren	*Malurus cyaneus*					X
Swamp Harrier	*Circus approximans*					
Swift Parrot	*Lathamus discolor*	CR		L	e	
Tawny Frogmouth	*Podargus strigoides*					
Tree Martin	*Petrochelidon nigricans*					
Varied Sittella	*Daphoenositta chrysoptera*					
Wedge-tailed Eagle	*Aquila audax*					X
Weebill	*Smicrornis brevirostris*					
Welcome Swallow	*Petrochelidon neoxena*					X
Whiskered Tern	*Chlidonias hybridus javanicus*				nt	X
Whistling Kite	*Haliastur sphenurus*					X
White-browed Scrubwren	*Sericornis frontalis*					

Common Name	Scientific Name	EPBC-threat	EPBC-migratory	FFG	DELWP	Recorded
White-browed Woodswallow	*Artamus superciliosus*					
White-eared Honeyeater	*Lichenostomus leucotis*					
White-faced Heron	*Egretta novaehollandiae*					X
White-fronted Chat	*Epthianura albifrons*					X
White-naped Honeyeater	*Melithreptus lunatus*					
White-necked Heron	*Ardea pacifica*					X
White-plumed Honeyeater	*Lichenostomus penicillatus*					X
White-throated Needletail	*Hirundapus caudacutus*		M (JAMBA, CAMBA, ROKAMBA)		v	
White-throated Treecreeper	*Cormobates leucophaeus*					
White-winged Chough	*Corcorax melanorhamphos*					
White-winged Triller	*Lalage sueurii*					
Willie Wagtail	*Rhipidura leucophrys*					X
Yellow Thornbill	*Acanthiza nana*					X
Yellow-billed Spoonbill	*Platalea flavipes*					
Yellow-faced Honeyeater	*Lichenostomus chrysops*					
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*					X
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*					X
Zebra Finch	*Taeniopygia guttata*					
Mammals						
Black Rat	*Rattus rattus*				*	
Black Wallaby	*Wallabia bicolor*					X
Brown Rat	*Rattus norvegicus*				*	
Cat	*Felis catus*				*	
Chocolate Wattled Bat	*Chalinolobus morio*					X
Common Brushtail Possum	*Trichosurus vulpecula*					
Common Ringtail Possum	*Pseudocheirus peregrinus*					
Eastern Bentwing Bat	*Miniopterus schreibersii oceanensis*			L	v	U
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*					X
Eastern Grey Kangaroo	*Macropus giganteus*					X
European Hare	*Lepus europeaus*				*	X
European Rabbit	*Oryctolagus cuniculus*				*	X

Common Name	Scientific Name	EPBC-threat	EPBC-migratory	FFG	DELWP	Recorded
Fat-tailed Dunnart	*Sminthopsis crassicaudata*				nt	X
Gould's Wattled Bat	*Chalinolobus gouldii*					X
House Mouse	*Mus musculus*				*	
Large Forest Bat	Vespadelus darlingtoni					X
Lesser Long-eared Bat	*Nyctophilus geoffroyi*					X
Little Forest Bat	*Vespadelus vulturnus*					X
Red Fox	*Vulpes vulpes*				*	X
Short-beaked Echidna	*Tachyglossus aculeatus*					
Swamp Rat	*Rattus lutreolus*					
Water Rat	*Hydromys chrysogaster*					
White-striped Freetail Bat	*Tadarida australis*					X
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*			L	dd	X
Reptiles						
Blotched Blue-tongued Lizard	*Tiliqua nigrolutea*					
Common Blue-tongued Lizard	*Tiliqua scincoides*					X
Eastern Three-lined Skink	*Acritoscincus duperreyi*					
Garden Skink	*Lampropholis guichenoti*					
Little Whip Snake	*Parasuta flagellum*					X
Lowland Copperhead	*Austrelaps superbus*					
Striped Legless Lizard	*Delma impar*	VU		L	e	X
Stumpy-tailed Lizard	*Tiliqua rugosa*					
Tiger Snake	*Notechis scutatus*					X
Tussock Skink	*Pseudemoia pagenstecheri*				v	X
Frogs						
Common Froglet	*Crinia signifera*					X
Common Spadefoot Toad	*Neobatrachus sudelli*					
Growling Grass Frog	*Litoria raniformis*	VU		L	e	X
Plains Froglet	*Crinia parinsignifera*					
Southern Brown Tree Frog	*Litoria ewingii*					X
Southern Bullfrog	*Limnodynastes dumerilii*					
Spotted Marsh Frog	*Limnodynastes tasmaniensis SCR*					X
Striped Marsh Frog	*Limnodynastes peronii*					

Common Name	Scientific Name	EPBC-threat	EPBC-migratory	FFG	DELWP	Recorded
Victorian Smooth Froglet	*Geocrinia victoriana*					
Fish						
Australian Smelt	*Retropinna semoni*					
Brown Trout	*Salmo trutta*				*	
Carp	*Cyprinus carpio*				*	
Common Galaxias	*Galaxias maculatus*					
Eastern Gambusia	*Gambusia holbrooki*				*	
Short-finned Eel	*Anguilla australis*					
Southern Pygmy Perch	*Nannoperca australis*					
Tench	*Tinca tinca*				*	
Invertebrates						
Golden Sun Moth	*Synemon plana*	CR		L	cr	X

Notes: **EPBC-Threat** = threatened species status under EPBC Act; CR = critically endangered; VU = vulnerable; **EPBC-Migratory** = migratory status under the EPBC Act; M = listed migratory taxa; Bonn Convention (A2H) - Convention on the Conservation of Migratory Species of Wild Animals – listed as a member of a family; Bonn Convention (A2S) - Convention on the Conservation of Migratory Species of Wild Animals - species listed explicitly; CAMBA - China- Australia Migratory Birds Agreement; JAMBA - Japan-Australia Migratory Birds Agreement; ROKAMBA - Republic of Korea Australia Migratory Birds Agreement; **FFG** = threatened species status under the FFG Act: L = listed as threatened under the FFG Act; **DELWP** = status under DELWP's Advisory List (DSE 2013); cr = critically endangered; e = endangered; v = vulnerable; nt = lower risk near threatened; dd = data deficient. X = recorded during current investigations; U= unconfirmed occurrence.

Appendix 6: Raw BUS data for summer at Golden Plains Wind Farm

A. Impact sites.

Site	1		2		3		4		5		6		7		8		Total impact points		% Imp.
Species/Height Class	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
Australasian Pipit	5		2				5				2						14	0	**14**
Australian Hobby	1														1		2	0	**2**
Australian Magpie	25		19		24		15		19		14		91		22		229	0	**229**
Australian Raven											2						2	0	**2**
Black-faced Cuckoo- Shrike											1						1	0	**1**
Blue-winged Parrot													6				6	0	**6**
Brown Falcon							4		3		1		6		1		15	0	**15**
Brown Goshawk			2														2	0	**2**
Brown Songlark	1				1		1				1						4	0	**4**
Brown Thornbill																	0	0	**0**
Brown-headed Honeyeater																	0	0	**0**
Common Blackbird															1		1	0	**1**
Common Starling	187				20		15								168		390	0	**390**
Crested Pigeon			2						4						3		9	0	**9**
European Goldfinch	10								6		3		17		54		90	0	**90**
European Skylark					2		35						2				39	0	**39**
Fairy Martin			190	55					9								199	55	**254**
Galah					3										4		7	0	**7**
Golden-headed Cisticola															3		3	0	**3**
Grey Shrike-thrush			2								1						3	0	**3**
Horsfield's Bushlark							8						2				10	0	**10**
House Sparrow			310				41		12		1		8		300		672	0	**672**

Site	1		2		3		4		5		6		7		8		Total impact points		% Imp.
Species/Height Class	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
Little Eagle							1										1	0	**1**
Little Grassbird															7		7	0	**7**
Little Raven	61	1			2		22			6			1	3	22		108	10	**118**
Long-billed Corella															27		27	0	**27**
Magpie-lark	4				1				2		4				20		31	0	**31**
New Holland Honeyeater			2												8		10	0	**10**
Purple-crowned Lorikeet									2						4		6	0	**6**
Red Wattlebird			12						3		2				23		40	0	**40**
Red-rumped Parrot			19		5						2		7		28		61	0	**61**
Restless Flycatcher															1		1	0	**1**
Straw-necked Ibis															1		1	0	**1**
Stubble Quail							4										4	0	**4**
Superb Fairy-wren	38		30						21				4		22		115	0	**115**
Wedge-tailed Eagle											3		4				7	0	**7**
Welcome Swallow									8						17	20	25	20	**45**
Whistling Kite																	0	0	**0**
White-faced Heron	3		1						1						19		24	0	**24**
White-fronted Chat															2		2	0	**2**
White-necked heron	5																5	0	**5**
White-plumed Honeyeater			41						8		11				24		84	0	**84**
Willie Wagtail	1		11						2		5		4		6		29	0	**29**
Yellow-rumped Thornbill	27						8						24		10		69	0	**69**
Grand Total	**368**	**1**	**643**	**55**	**58**		**159**		**100**	**6**	**53**		**176**	**3**	**798**	**20**	**2355**	**85**	**2440**

B. Reference sites

Species	R1		R2		Totals		Grand Total
	A	B	A	B	A	B	
Australasian Pipit			5		5		5
Australian Hobby							0
Australian Magpie	21		16		37		37
Australian Raven							0
Black-faced Cuckoo- Shrike							0
Blue-winged Parrot							0
Brown Falcon	1		2	1	3	1	4
Brown Goshawk							0
Brown Songlark							0
Brown Thornbill	2				2		2
Brown-headed Honeyeater	4				4		4
Common Blackbird	2				2		2
Common Starling			40		40		40
Crested Pigeon							0
European Goldfinch	30		62		92		92
European Skylark			28		28		28
Fairy Martin			3		3		3
Galah			1		1		1
Golden-headed Cisticola					0		0
Grey Shrike-thrush							0
Horsfield's Bushlark			1		1		1
House Sparrow			40		40		40
Little Eagle							0
Little Grassbird							0
Little Raven	2		28		30		30
Long-billed Corella							0
Magpie-lark	1				1		1
New Holland Honeyeater			4		4		4
Purple-crowned Lorikeet							0
Red Wattlebird	4				4		4
Red-rumped Parrot							0
Restless Flycatcher							0
Straw-necked Ibis							0
Stubble Quail							0
Superb Fairy-wren	16				16		16
Wedge-tailed Eagle			2	2	2	2	4
Welcome Swallow			11		11		11
Whistling Kite	1				1		1
White-faced Heron	3				3		3
White-fronted Chat			17		17		17
White-necked heron							0
White-plumed Honeyeater	13				13		13
Willie Wagtail	1				1		1
Yellow-rumped Thornbill	18		2		20		20
Grand Total	**119**		**262**	**3**	**381**	**3**	**384**

Appendix 7: Raw data for BUS for autumn at Golden Plains Wind Farm

A. Impact sites

Species	1		2		3		4		5		6		7		8		Total		Grand Total
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
Australasian Pipit	5		6				2		3		4		2				22	0	22
Australian Hobby															1	1	1	1	2
Australian Magpie	37		25		30		27		28		22		38		32		239	0	239
Australian Shelduck																	0	0	0
Australian Wood Duck							3										3	0	3
Black Kite								3									0	3	3
Black-faced Cuckoo-shrike							4		1		5		4		2		16	0	16
Black-shouldered kite													1				1	0	1
Brown Falcon	2	1					2		1				2				7	1	8
Brown Goshwak		1			1												1	1	2
Brown Thornbill	4														2		6	0	6
Brown-headed Honeyeater											26						26	0	26
Common Blackbird					2		2						2		2		8	0	8
Common Bronzewing													2				2	0	2
Common Starling							136						10				146	0	146
Crested Pigeon									4		17		11		15		47	0	47
Crimson Rosella			4												2		6	0	6
Eurasian Skylark							9	2	12	7	15	3	6	1	2		44	13	57
European Goldfinch	54						50		20						28		152	0	152
Fairy Martin							2										2	0	2
Flame Robin															6		6	0	6
Galah					16								56		2		74	0	74
Golden-headed Cisticola			2				2								2		6	0	6

Species	1		2		3		4		5		6		7		8		Total		Grand Total
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
Grey Fantail			2												2		4	0	4
Grey Shrike-thrush	2		3								2				1		8	0	8
Grey Teal			20										2				22	0	22
Hoary-headed Grebe																	0	0	0
Horsfield's Bushlark											7		4				11	0	11
House Sparrow	28		80		10		221		22		12		38		34		445	0	445
Little Eagle		1															0	1	1
Little Grassbird															2		2	0	2
Little Pied Cormorant																	0	0	0
Little Raven	18	4	12		12	6	70		8	2	14		17		18		169	12	181
Long-billed Corella					6												6	0	6
Magpie-lark	4				4		4		2		6		8		12	2	40	2	42
Masked Lapwing													2				2	0	2
Nankeen Kestrel				1			1		1		2		2	1	1		7	2	9
New Holland Honeyeater							4						36				40	0	40
Noisy Miner					20						2						22	0	22
Pacific Black Duck																	0	0	0
Red Wattlebird	34		32		2		8				14		96		18		204	0	204
Red-rumped Parrot	3		38								24		26		6		97	0	97
Restless Flycatcher													6		2		8	0	8
Striated Fieldwren													4				4	0	4
Superb Fairy-wren	9		40						25		23		29		27		153	0	153
Wedge-tailed Eagle			1														1	0	1
Welcome Swallow			20		8								16		20	4	64	4	68
Whistling Kite																	0	0	0
White-faced Heron	1				2				1				1	2			5	2	7

Species	1		2		3		4		5		6		7		8		Total		Grand Total
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
White-fronted Chat													10				10	0	10
White-necked Heron																	0	0	0
White-plumed Honeyeater	10		64		4		6				18		70		26		198	0	198
Willie Wagtail	18		16		16		5		4		12		14		18		103	0	103
Yellow-rumped Thornbill	28		38				42		28		10		20		28		194	0	194
Grand Total	257	7	403	1	133	6	600	5	160	9	235	3	535	4	311	7	2634	42	2676

B. Reference sites

Species	R1		R2		Totals		Grand total
	A	B	A	B	A	Tot.	
Australasian Pipit							0
Australian Hobby							0
Australian Magpie	74		27	2	101	2	103
Australian Shelduck	142	10	30		172	10	182
Australian Wood Duck	3		20		23	0	23
Black Kite					0	0	0
Black-faced Cuckoo-shrike			2		2	0	2
Black-shouldered kite			2		2	0	2
Brown Falcon					0	0	0
Brown Goshwak					0	0	0
Brown Thornbill					0	0	0
Brown-headed Honeyeater	20				20	0	20
Common Blackbird					0	0	0
Common Bronzewing					0	0	0
Common Starling			42		42	0	42
Crested Pigeon	5		9		14	0	14
Crimson Rosella					0	0	0
Eurasian Skylark	2	4	6		8	4	12
European Goldfinch					0	0	0
Fairy Martin					0	0	0
Flame Robin					0	0	0
Galah	10		10		20	0	20
Golden-headed Cisticola					0	0	0
Grey Fantail					0	0	0
Grey Shrike-thrush					0	0	0
Grey Teal	55	2	62		117	2	119
Hoary-headed Grebe			4		4	0	4
Horsfield's Bushlark			2		2	0	2
House Sparrow	20		20		40	0	40
Little Eagle					0	0	0
Little Grassbird					0	0	0
Little Pied Cormorant	6				6	0	6
Little Raven	79	4	43	4	122	8	130
Long-billed Corella					0	0	0
Magpie-lark	14		2		16	0	16
Masked Lapwing	10				10	0	10
Nankeen Kestrel		1	1	1	1	2	3
New Holland Honeyeater					0	0	0
Noisy Miner					0	0	0
Pacific Black Duck	26		32		58	0	58
Red Wattlebird	36		10		46	0	46

Species	R1		R2		Totals		Grand total
	A	B	A	B	A	Tot.	
Red-rumped Parrot			10		10	0	10
Restless Flycatcher					0	0	0
Striated Fieldwren					0	0	0
Superb Fairy-wren	4				4	0	4
Wedge-tailed Eagle					0	0	0
Welcome Swallow			12		12	0	12
Whistling Kite			1		1	0	1
White-faced Heron			4		4	0	4
White-fronted Chat			4		4	0	4
White-necked Heron			2		2	0	2
White-plumed Honeyeater	20		14		34	0	34
Willie Wagtail	3		8		11	0	11
Yellow-rumped Thornbill					0	0	0
Grand Total	**529**	**21**	**379**	**7**	**908**	**28**	**936**

Appendix 8: Striped Legless Lizard (SLL) from 1995 to 2015 in various locations within 10 kilometres of the wind farm site

Date	Total Count	Survey/ Observation ID	Site Location Description	Survey method	Observer	Type of Record	Lat GDA94	Long GDA94	Accuracy	Site ID	Site Name
11/06/2015	1	1096371	Rokewood	General observations	Donna McMaster	Captured and released	-37.912	143.72	5	762971	Rokewood Common Nature Conservation Reserve
11/11/2014	3	1095788	Agricultural land near Warrambine	Targeted search	Curtis Doughty	Observation	-37.943	143.85	50	762021	Shelford - Rokewood Rd, Warrambine
29/10/2014	1	1095787	Agricultural land near Warrambine	Targeted search	Curtis Doughty	Observation	-37.943	143.85	50	762021	Shelford - Rokewood Rd, Warrambine
23/10/2014	2	1095786	Agricultural land near Warrambine	Targeted search	Curtis Doughty	Observation	-37.943	143.85	50	762021	Shelford - Rokewood Rd, Warrambine
9/10/2014	1	1095785	Agricultural land near Warrambine	Targeted search	Curtis Doughty	Observation	-37.943	143.85	50	762021	Shelford - Rokewood Rd, Warrambine
2/12/2010	1	1042144	Rokewood	Artificial Substrate	Garry Peterson	Captured and released	-37.909	143.72	100	675980	Rokewood Common
19/10/2010	3	1041953	Cressy	Artificial Substrate	Garry Peterson	Captured and released	-38.024	143.63	100	676534	Cressy Trotting Track
27/09/2010	2	1042104	Cressy	Artificial Substrate	Garry Peterson	Captured and released	-38.052	143.75	100	676190	North Poorneet Rd #2
13/09/2010	1	1041952	Cressy	Artificial Substrate	Garry Peterson	Captured and released	-38.024	143.63	100	676133	Cressy Flora Reserve
16/02/2010	1	1023012	furtherest north	Artificial Substrate	Cath Grant	Captured and released	-37.994	143.74	100	675963	Geggies Rd, Cressy #1
16/02/2010	2	1022972	Cressy	Artificial Substrate	Cath Grant	Captured and released	-38.024	143.63	100	676534	Cressy Trotting Track
16/02/2010	2	1023168	Cressy	Artificial Substrate	Cath Grant	Indirect evidence	-38.052	143.75	100	676190	North Poorneet Rd #2
15/02/2010	1	1023017	furtherest south	Artificial Substrate	Cath Grant	Indirect evidence	-38.01	143.74	100	675964	Geggies Rd, Cressy #2
15/09/2009	1	1023209	Rokewood	Artificial Substrate	Cath Grant	Captured and released	-37.909	143.72	100	675980	Rokewood Common
14/09/2009	1	1023169	Cressy	Artificial Substrate	Cath Grant	Captured and released	-38.052	143.75	100	676190	North Poorneet Rd #2

Date	Total Count	Survey/ Observation ID	Site Location Description	Survey method	Observer	Type of Record	Lat GDA94	Long GDA94	Accuracy	Site ID	Site Name
7/09/2009	2	1022971	Cressy	Artificial Substrate	Cath Grant	Captured and released	-38.024	143.63	100	676534	Cressy Trotting Track
16/12/2008	2	998926	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	50	659513	Cressy Trotting Track
15/12/2008	1	998987	Geggies Rd, Cressy #1 (furtherest north)	Tile (roof) census	Cath Grant	Captured and released	-37.994	143.74	50	659527	Geggies Rd, Cressy #1
15/12/2008	2	998995	Geggies Rd, Cressy #2 (furtherest south)	Tile (roof) census	Cath Grant	Captured and released	-38.01	143.74	50	659528	Geggies Rd, Cressy #2
27/11/2008	2	998986	Geggies Rd, Cressy #1 (furtherest north)	Tile (roof) census	Cath Grant	Captured and released	-37.994	143.74	50	659527	Geggies Rd, Cressy #1
27/11/2008	3	998994	Geggies Rd, Cressy #2 (furtherest south)	Tile (roof) census	Cath Grant	Captured and released	-38.01	143.74	50	659528	Geggies Rd, Cressy #2
26/11/2008	1	999020	Rokewood-Shelford Rd	Tile (roof) census	Cath Grant	Captured and released	-37.911	143.77	50	659534	Rokewood-Shelford Rd
24/11/2008	3	998925	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	50	659513	Cressy Trotting Track
27/10/2008	1	999019	Rokewood-Shelford Rd	Tile (roof) census	Cath Grant	Captured and released	-37.911	143.77	50	659534	Rokewood-Shelford Rd
23/10/2008	1	998985	Geggies Rd, Cressy #1 (furtherest north)	Tile (roof) census	Cath Grant	Captured and released	-37.994	143.74	50	659527	Geggies Rd, Cressy #1
23/10/2008	1	998993	Geggies Rd, Cressy #2 (furtherest south)	Tile (roof) census	Cath Grant	Captured and released	-38.01	143.74	50	659528	Geggies Rd, Cressy #2
23/10/2008	2	999005	North Poorneet Rd, Cressy #2 (middle)	Tile (roof) census	Cath Grant	Captured and released	-38.052	143.75	50	659531	North Poorneet Rd #2
22/10/2008	1	998924	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	50	659513	Cressy Trotting Track
16/09/2008	1	998992	Geggies Rd, Cressy #2 (furtherest south)	Tile (roof) census	Cath Grant	Captured and released	-38.01	143.74	50	659528	Geggies Rd, Cressy #2

Date	Total Count	Survey/ Observation ID	Site Location Description	Survey method	Observer	Type of Record	Lat GDA94	Long GDA94	Accuracy	Site ID	Site Name
6/06/2008	4	998922	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	50	659513	Cressy Trotting Track
8/05/2008	1	998983	Geggies Rd, Cressy #1 (furtherest north)	Tile (roof) census	Cath Grant	Captured and released	-37.994	143.74	50	659527	Geggies Rd, Cressy #1
8/05/2008	2	999003	North Poorneet Rd, Cressy #2 (middle)	Tile (roof) census	Cath Grant	Captured and released	-38.052	143.75	50	659531	North Poorneet Rd #2
7/02/2008	3	998982	Geggies Rd, Cressy #1 (furtherest north)	Tile (roof) census	Cath Grant	Captured and released	-37.994	143.74	50	659527	Geggies Rd, Cressy #1
7/02/2008	2	998990	Geggies Rd, Cressy #2 (furtherest south)	Tile (roof) census	Cath Grant	Captured and released	-38.01	143.74	50	659528	Geggies Rd, Cressy #2
1/02/2008	1	999002	North Poorneet Rd, Cressy #2 (middle)	Tile (roof) census	Cath Grant	Captured and released	-38.052	143.75	50	659531	North Poorneet Rd #2
23/01/2008	1	998921	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	50	659513	Cressy Trotting Track
21/01/2008	1	998886	Urches Rd, Wilgul	Tile (roof) census	Cath Grant	Captured and released	-37.907	143.53	50	659504	Urches Rd #2
17/01/2008	2	998977	Cressy-Shelford Rd #2 (middle)	Tile (roof) census	Cath Grant	Captured and released	-38.027	143.73	50	659525	Cressy-Shelford Rd #2
27/11/2007	1	998972	Rokewood Common	Tile (roof) census	Cath Grant	Captured and released	-37.909	143.72	50	659524	Rokewood Common
13/11/2007	6	998920	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	50	659513	Cressy Trotting Track
8/11/2007	3	998981	Geggies Rd, Cressy #1 (furtherest north)	Tile (roof) census	Cath Grant	Captured and released	-37.994	143.74	50	659527	Geggies Rd, Cressy #1
8/11/2007	1	998989	Geggies Rd, Cressy #2 (furtherest south)	Tile (roof) census	Cath Grant	Captured and released	-38.01	143.74	50	659528	Geggies Rd, Cressy #2
8/11/2007	5	998976	Cressy-Shelford Rd #2 (middle)	Tile (roof) census	Cath Grant	Captured and released	-38.027	143.73	50	659525	Cressy-Shelford Rd #2
1/11/2007	1	999043	Cressy-Shelford Rd #3 (closest to Shelford)	Tile (roof) census	Cath Grant	Captured and released	-38.019	143.88	50	659540	Cressy-Shelford Rd #3

Date	Total Count	Survey/ Observation ID	Site Location Description	Survey method	Observer	Type of Record	Lat GDA94	Long GDA94	Accuracy	Site ID	Site Name
1/11/2007	1	999001	North Poorneet Rd, Cressy #2 (middle)	Tile (roof) census	Cath Grant	Captured and released	-38.052	143.75	50	659531	North Poorneet Rd #2
4/05/2007	1	999000	North Poorneet Rd, Cressy #2 (middle)	Tile (roof) census	Cath Grant	Captured and released	-38.052	143.75	50	659531	North Poorneet Rd #2
26/02/2007	1	940053	Cressy-Shelford Rd #3 (closest to Shelford)	Tile (roof) census	Cath Grant	Captured and released	-38.019	143.88	100	613350	
22/02/2007	1	940052	Mount Mercer-Shelford Rd #2 (middle)	Tile (roof) census	Cath Grant	Captured and released	-37.894	143.91	100	613349	
19/02/2007	1	940045	Urches Rd, Wilgul	Tile (roof) census	Cath Grant	Captured and released	-37.919	143.53	100	613342	
30/01/2007	1	940035	Rokewood-Skipton Rd, Lismore-Scarsdale Rd intersection	Tile (roof) census	Cath Grant	Captured and released	-37.807	143.58	100	613332	
30/01/2007	1	940034	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	613331	
30/01/2007	2	940034	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	613331	
18/01/2007	2	940018	Geggies Rd, Cressy #2 (furtherest south)	Tile (roof) census	Cath Grant	Captured and released	-38.01	143.74	100	613315	
18/01/2007	2	940015	Cressy-Shelford Rd #1 (closest to Cressy)	Tile (roof) census	Cath Grant	Captured and released	-37.995	143.74	100	613312	Cressy-Shelford Rd #1 (closest to Cressy)
18/01/2007	1	940017	Geggies Rd, Cressy #1 (furtherest north)	Tile (roof) census	Cath Grant	Captured and released	-37.995	143.74	100	613314	
18/01/2007	1	940016	Cressy-Shelford Rd #2 (middle)	Tile (roof) census	Cath Grant	Captured and released	-38.026	143.72	100	613313	
18/01/2007	1	940019	North Poorneet Rd, Cressy #2 (middle)	Tile (roof) census	Cath Grant	Captured and released	-38.053	143.75	100	613316	
15/01/2007	5	940014	Rokewood-Shelford Rd	Tile (roof) census	Cath Grant	Captured and released	-37.911	143.77	100	613311	

Date	Total Count	Survey/ Observation ID	Site Location Description	Survey method	Observer	Type of Record	Lat GDA94	Long GDA94	Accuracy	Site ID	Site Name
6/11/2006	3	939989	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	613286	
6/11/2006	2	939989	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	613286	
3/11/2006	1	939982	Rokewood Common	Tile (roof) census	Cath Grant	Captured and released	-37.915	143.72	100	613279	
24/10/2006	1	939956	Geggies Rd, Cressy #2 (furtherest south)	Tile (roof) census	Cath Grant	Captured and released	-38.01	143.74	100	613253	
24/10/2006	2	939955	Geggies Rd, Cressy #1 (furtherest north)	Tile (roof) census	Cath Grant	Captured and released	-37.995	143.74	100	613252	
6/04/2006	6	933454	North Poorneet Rd; Cressy #2	Tile (roof) census	Cath Grant	Indirect evidence	-38.052	143.75	900	606657	
15/01/2006	2	927080	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	600207	
14/01/2006	1	926815	Rokewood-Shelford Rd	Tile (roof) census	Cath Grant	Captured and released	-37.911	143.77	100	599942	
14/01/2006	1	926825	Cressy Trotting Track	Tile (roof) census	Cath Grant	Indirect evidence	-38.024	143.63	100	599952	
9/12/2005	1	933196	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	900	606399	
7/12/2005	1	933195	Cressy Trotting Track	Tile (roof) census	Cath Grant	Indirect evidence	-38.024	143.63	900	606398	
7/12/2005	3	933406	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	900	606609	
20/11/2005	1	926824	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	599951	
19/11/2005	1	926823	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	599950	
18/11/2005	2	927076	Rokewood Common	Tile (roof) census	Cath Grant	Captured and released	-37.909	143.72	100	600203	
18/11/2005	1	926812	Rokewood-Shelford Rd	Tile (roof) census	Cath Grant	Captured and released	-37.911	143.77	100	599939	
18/11/2005	1	926845	Geggies Rd; Cressy	Tile (roof)	Cath Grant	Captured and	-38.01	143.74	100	5999	

Date	Total Count	Survey/ Observation ID	Site Location Description	Survey method	Observer	Type of Record	Lat GDA94	Long GDA94	Accuracy	Site ID	Site Name
			#2	census		released				72	
18/11/2005	1	926822	Cressy Trotting Track	Tile (roof) census	Cath Grant	Indirect evidence	-38.024	143.63	100	599949	
18/11/2005	5	927196	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	600323	
10/11/2005	2	927086	North Poorneet Rd; Cressy #2	Tile (roof) census	Cath Grant	Captured and released	-38.052	143.75	1000	600213	
23/10/2005	1	926821	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	599948	
22/10/2005	1	926820	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	599947	
21/10/2005	1	926819	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	599946	
20/10/2005	1	926818	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	599945	
19/10/2005	2	927075	Rokewood Common	Tile (roof) census	Cath Grant	Captured and released	-37.909	143.72	100	600202	
19/10/2005	1	926841	Geggies Rd; Cressy #2	Tile (roof) census	Cath Grant	Captured and released	-38.01	143.74	100	599968	
19/10/2005	3	927151	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	600278	
1/10/2005	1	933194	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	900	606397	
30/09/2005	1	926817	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	599944	
28/09/2005	2	927085	Geggies Rd; Cressy #2	Tile (roof) census	Cath Grant	Captured and released	-38.01	143.74	1000	600212	
18/08/2005	1	926816	Cressy Trotting Track	Tile (roof) census	Cath Grant	Captured and released	-38.024	143.63	100	599943	
3/05/2005	1	933199	Geggies Rd; Cressy #1	Tile (roof) census	Cath Grant	Captured and released	-37.994	143.74	900	606402	
3/05/2005	1	933199	Geggies Rd; Cressy #1	Tile (roof) census	Cath Grant	Captured and released	-37.994	143.74	900	606402	
3/05/2005	1	920185	Geggies Rd: Cressy 1	Incidental	Cath Grant	Indirect evidence	-37.994	143.74	100	592180	

Date	Total Count	Survey/ Observation ID	Site Location Description	Survey method	Observer	Type of Record	Lat GDA94	Long GDA94	Accuracy	Site ID	Site Name
3/05/2005	1	920185	Geggies Rd: Cressy 1	Tile (roof) census	Cath Grant	Captured and released	-37.994	143.74	100	592180	
31/03/2005	3	920180	Cressy Trotting Track	Incidental	Garry Peterson	Indirect evidence	-38.024	143.63	100	592175	
31/03/2005	1	920180	Cressy Trotting Track	Tile (roof) census	Garry Peterson	Captured and released	-38.024	143.63	100	592175	
31/03/2005	15	920190	North Poorneet Rd: Cressy 2	Incidental	Garry Peterson	Indirect evidence	-38.052	143.75	100	592185	
14/10/2004	1	920171	Two Bridges Rd: Rokewood	Tile (roof) census	Cath Grant	Captured and released	-37.917	143.69	100	592166	
14/10/2004	2	920175	Rokewood Common	Tile (roof) census	Cath Grant	Captured and released	-37.909	143.72	100	592170	
14/10/2004	1	920178	Rokewood-Shelford Rd	Tile (roof) census	Cath Grant	Captured and released	-37.911	143.77	100	592173	
12/10/2004	1	920183	Cressy-Shelford Rd 3	Tile (roof) census	Cath Grant	Captured and released	-38.019	143.88	100	592178	
12/10/2004	4	920183	Cressy-Shelford Rd 3	Tile (roof) census	Cath Grant	Captured and released	-38.019	143.88	100	592178	
26/01/2004	3	488706	Geggies Rd 9km East of Creesy	General observations	Garry Peterson	Captured and released	-38.011	143.74	100	487390	
11/06/2003	1	520160	Geggies Rd Between Cressy-Shelford Rd & Potters Rd	Herp census - active	Philip Du Guesclin	Captured and released	-38.013	143.75	1000	487392	
19/06/2002	2	470906	Poorneet North Rd 12km E of Cressy	Herp census - active	Philip Du Guesclin	Indirect evidence	-38.043	143.76	100	487448	
24/07/2000	1	462650	North Pornect Rd 10km East Of Creny	Herp census - active	Philip Du Guesclin	Indirect evidence	-38.053	143.76	1000	487440	
24/07/2000	1	462650	North Pornect Rd 10km East Of Creny	Herp census - active	Philip Du Guesclin	Captured and released	-38.053	143.76	1000	487440	
6/07/1999	7	460417	Poorneet & Station North Road: 10 km E of Cressy	Herp census - active	Philip Du Guesclin	Captured and released	-38.054	143.76	100	487439	

Date	Total Count	Survey/ Observation ID	Site Location Description	Survey method	Observer	Type of Record	Lat GDA94	Long GDA94	Accuracy	Site ID	Site Name
14/04/1999	1	514943	Poornett North Road: 10 km E Cressy	Herp census - active	Philip Du Guesclin	Seen	-38.054	143.76	100	487438	
2/10/1998	1	514412	CRESSY - GEELONG RAILWAY	General observations	Kellie Baker	Seen	-38.058	143.75	1000	487418	
27/07/1998	1	514018	Rokewood Golf Course	Herp census - active	Philip Du Guesclin	Captured and released	-37.913	143.73	100	487816	
27/07/1998	1	514052	Rokewood Golf Course	Herp census - active	Susan Hadden	Seen	-37.912	143.73	1000	487812	
5/06/1998	3	451906	Poornett North Road: 12 km E of Cressy	Herp census - active	Philip Du Guesclin	Captured and released	-38.054	143.76	100	487437	
5/06/1998	1	451906	Poornett North Road: 12 km E of Cressy	Herp census - active	Philip Du Guesclin	Captured and released	-38.054	143.76	100	487437	
23/07/1997	5	450333	11 km E of Cressy	Herp census - active	Philip Du Guesclin	Captured and released	-38.053	143.75	100	487428	
28/02/1997	1	449234	Cressy	General observations	Philip Du Guesclin	Captured and released	-37.978	143.81	100	487925	
28/02/1997	2	449234	Cressy	General observations	Philip Du Guesclin	Seen	-37.978	143.81	100	487925	
20/11/1996	1	511512	WITHIN 2 KM OF CRESSY	General observations	Philip Du Guesclin	Captured and released	-38.024	143.63	100	487217	
20/11/1996	2	511512	WITHIN 2 KM OF CRESSY	General observations	Philip Du Guesclin	Seen	-38.024	143.63	100	487217	
19/11/1996	1	448521	Wingeel	Herp census - active	Philip Du Guesclin	Captured and released	-37.974	143.81	100	487918	
19/11/1996	1	448522	Wingeel	Herp census - active	Philip Du Guesclin	Captured and released	-37.973	143.8	100	487912	
21/06/1996	1	447877	12 km E of Cressy	Herp census - active	Philip Du Guesclin	Captured and released	-38.054	143.76	100	487436	
27/10/1995	2	509468	near Cressy	General observations	Philip Du Guesclin	Seen	-38.054	143.76	100	487435	
27/06/1995	3	444506	Dashwood: 15 km WNN of Shelford	Herp census - active	Philip Du Guesclin	Captured and released	-37.974	143.8	100	487911	

Date	Total Count	Survey/ Observation ID	Site Location Description	Survey method	Observer	Type of Record	Lat GDA94	Long GDA94	Accuracy	Site ID	Site Name
26/06/1995	2	444504	12 km E of Cressy	Herp census - active	Philip Du Guesclin	Captured and released	-38.051	143.76	100	487441	
26/06/1995	2	444504	12 km E of Cressy	Herp census - active	Philip Du Guesclin	Captured and released	-38.051	143.76	100	487441	
1/01/1995	2	451396	Dashwood	General observations	Susan Hadden	Captured and released	-37.98	143.8	100	487902	
1/01/1995	1	451398	Warrambine	General observations	Susan Hadden	Captured and released	-37.902	143.86	1000	487959	
1/12/1994	20	508263	ROUGHLY 3 KM E OF TARALEA HILL	General observations	Robert Humphries	Captured and released	-37.98	143.81	100	487917	
4/08/1994		506964	11 km E of Cressy	General observations	Philip Du Guesclin	Seen	-38.051	143.75	100	487431	
4/08/1994	1	506965	11 km E of Cressy	General observations	Philip Du Guesclin	Seen	-38.051	143.75	100	487431	
4/08/1994	2	443268	11 km E of Cressy	Herp transect	Philip Du Guesclin	Captured and released	-38.051	143.75	100	487430	
4/11/1992	2	501671	Cressy Trotting Track	General observations	Murray McIntyre	Captured and released	-38.024	143.63	1000	487216	
29/07/1992	1	500985	Poorneet	General observations	Steve Smith	Captured and released	-38.059	143.75	1000	487417	
2/07/1992	2	500575	Dashwood: 4.5 km SE of Warrambine	General observations	Philip Du Guesclin	Captured and released	-37.974	143.81	100	487923	
15/04/1992	1	499917	'Dashwood': Shelford	General observations	Philip Du Guesclin	Captured and released	-37.974	143.8	100	487910	
15/04/1992	3	499916	Poorneet N Road: 1.5 km N of Hamilton Highway	General observations	Philip Du Guesclin	Captured and released	-38.05	143.76	100	487442	
18/01/1992	1	433430	Rokewood Golf Course	Herp census - active	Susan Hadden	Seen	-37.907	143.73	900	469528	
18/01/1992	1	433430	Rokewood Golf Course	Pitfall with drift fence	Susan Hadden	Captured and released	-37.907	143.73	900	469528	
18/01/1992	1	433428	Rokewood: Ledwell's Lane	Pitfall with drift fence	Susan Hadden	Captured and released	-37.974	143.71	900	469531	
3/12/1991	1	499236	E of Cressy	General observations	Philip Du Guesclin	Captured and released	-38.05	143.76	1000	487454	

Date	Total Count	Survey/ Observation ID	Site Location Description	Survey method	Observer	Type of Record	Lat GDA94	Long GDA94	Accuracy	Site ID	Site Name
10/09/1991	2	497833	Porreet North Road: 12 km E of Cressy	General observations	Philip Du Guesclin	Captured and released	-38.048	143.76	100	487444	
13/06/1991	5	497126	12 km E of Cressy	General observations	Philip Du Guesclin	Captured and released	-38.055	143.75	100	487427	
8/09/1986		558280	Wilgul	Incidental	Not Supplied	Museum specimen	-37.974	143.58	900	457053	
8/09/1986		558279	Wilgul	Incidental	Not Supplied	Museum specimen	-37.974	143.58	900	457053	

Appendix 9: EVC benchmarks

Victorian Volcanic Plain Bioregion:

Swamp Scrub (EVC 53)

Plains Grassy Woodland (EVC 55_61)

Creekline Grassy Woodland (EVC 68)

Plains Grassy Wetland (EVC 125)

Heavier-soils Plains Grassland (EVC 132_61)

Non-eucalypt Grassy Woodland (EVC 175)

Riparian Woodland (EVC 641)

Stony Knoll Shrubland (EVC 649)

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Victorian Volcanic Plain bioregion

EVC 53: Swamp Scrub

Description:

Closed scrub to 8 m tall at low elevations on alluvial deposits along streams or on poorly drained sites with high nutrient and water availability. Soils vary from organic loams to fine silts and peats which are inundated during the wetter months of the year and is dominated by either Woolly Tea-tree *Leptospermun lanigerum* or Swamp Paperbark *Melaleuca ericifolia* which often form a dense impenetrable thicket, out-competing other species. Emergent trees (eg. Swamp Gum *Eucalyptus ovata*) may some times be present. Where light penetrates to ground level, a moss/lichen/liverwort herbaceous ground cover is often present.

Canopy Cover:

% cover	Character Species	Common Name
60%	*Leptospermum lanigerum*	Woolly Tea-tree
	Melaleuca squarrosa	Scented Paperbark
	Acacia melanoxylon	Blackwood

Understorey:

Life form	# Spp	% Cover	LF code
Large Herb	5	10%	LH
Medium Herb	13	30%	MH
Small or Prostrate Herb	2	5%	SH
Large Tufted Graminoid	9	15%	LTG
Large Non-tufted Graminoid	1	1%	LNG
Medium to Small Tufted Graminoid	7	15%	MTG
Bryophytes/Lichens	na	20%	BL

LF Code		Species typical of at least part of EVC range	Common Name
LH		*Persicaria decipiens*	Slender Knotweed
LH		*Villarsia reniformis*	Running Marsh-flower
LH		*Epilobium pallidiflorum*	Showy Willow-herb
MH		*Hydrocotyle pterocarpa*	Wing Pennywort
MH		*Lilaeopsis polyantha*	Australian Lilaeopsis
MH		*Hydrocotyle muscosa*	Mossy Pennywort
SH		*Lobelia pedunculata s.l.*	Matted Pratia
SH		*Crassula helmsii*	Swamp Crassula
LTG		*Juncus procerus*	Tall Rush
LTG		*Gahnia clarkei*	Tall Saw-sedge
LTG		*Deyeuxia quadriseta*	Reed Bent-grass
LTG		*Amphibromus recurvatus*	Dark Swamp Wallaby-grass
MTG		*Schoenus maschalinus*	Leafy Bog-sedge
MTG	k	*Lachnagrostis filiformis (perennial variety)*	Wetland Blown-grass
MTG		*Juncus planifolius*	Broad-leaf Rush

Recruitment:

Continuous

Organic Litter:

20% Cover

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	*Rumex crispus*	Curled Dock	high	low
MH	*Lotus suaveolens*	Hairy Bird's-foot Trefoil	high	high
MH	*Leontodon taraxacoides ssp. taraxacoides*	Hairy Hawkbit	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
LNG	*Holcus lanatus*	Yorkshire Fog	high	high
MTG	*Juncus bulbosus*	Bulbous Rush	high	high

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Victorian Volcanic Plain bioregion

EVC 55_61: Plains Grassy Woodland

Description:
An open, eucalypt woodland to 15 m tall. Occupies poorly drained, fertile soils on flat or gently undulating plains at low elevations. The understorey consists of a few sparse shrubs over a species-rich grassy and herbaceous ground layer. This variant occupies areas receiving approximately 500 – 700 mm annual rainfall.

Large trees:

Species	DBH(cm)	#/ha
Eucalyptus spp.	80 cm	8 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
10%	*Eucalyptus camaldulensis*	River Red Gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	1	5%	T
Medium Shrub	3	10%	MS
Small Shrub	2	1%	SS
Prostrate Shrub	1	1%	PS
Large Herb	3	5%	LH
Medium Herb	8	15%	MH
Small or Prostrate Herb	3	5%	SH
Large Tufted Graminoid	2	5%	LTG
Medium to Small Tufted Graminoid	12	45%	MTG
Medium to Tiny Non-tufted Graminoid	2	5%	MNG
Bryophytes/Lichens	na	10%	BL
Soil Crust	na	10%	S/C

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Acacia pycnantha*	Golden Wattle
MS	*Acacia paradoxa*	Hedge Wattle
SS	*Pimelea humilis*	Common Rice-flower
PS	*Astroloma humifusum*	Cranberry Heath
PS	*Bossiaea prostrata*	Creeping Bossiaea
MH	*Oxalis perennans*	Grassland Wood-sorrel
MH	*Gonocarpus tetragynus*	Common Raspwort
MH	*Acaena echinata*	Sheep's Burr
SH	*Dichondra repens*	Kidney-weed
SH	*Hydrocotyle laxiflora*	Stinking Pennywort
LTG	*Austrostipa mollis*	Supple Spear-grass
LTG	*Austrostipa bigeniculata*	Kneed Spear-grass
MTG	*Themeda triandra*	Kangaroo Grass
MTG	*Elymus scaber* var. *scaber*	Common Wheat-grass
MTG	*Austrodanthonia setacea*	Bristly Wallaby-grass
MTG	*Austrodanthonia racemosa* var. *racemosa*	Stiped Wallaby-grass
MNG	*Microlaena stipoides* var. *stipoides*	Weeping Grass

Recruitment:
Continuous

Organic Litter:
10 % cover

Logs:
10 m/0.1 ha.

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Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MS	*Lycium ferocissimum*	African Box-thorn	high	high
LH	*Cirsium vulgare*	Spear Thistle	high	high
LH	*Sonchus oleraceus*	Common Sow-thistle	high	low
LH	*Plantago lanceolata*	Ribwort	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
LNG	*Holcus lanatus*	Yorkshire Fog	high	high
MTG	*Vulpia bromoides*	Squirrel-tail Fescue	high	low
MTG	*Romulea rosea*	Onion Grass	high	low
MTG	*Briza minor*	Lesser Quaking-grass	high	low
MTG	*Briza maxima*	Large Quaking-grass	high	low

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Victorian Volcanic Plain bioregion

EVC 68: Creekline Grassy Woodland

Description:
Eucalypt-dominated woodland to 15 m tall with occasional scattered shrub layer over a mostly grassy/sedgy to herbaceous ground-layer. Occurs on low-gradient ephemeral to intermittent drainage lines, typically on fertile colluvial/alluvial soils, on a wide range of suitably fertile geological substrates. These minor drainage lines can include a range of graminoid and herbaceous species tolerant of waterlogged soils, and are presumed to have sometimes resembled a linear wetland or system of interconnected small ponds.

Large trees:

Species	DBH(cm)	#/ha
Eucalyptus spp.	80 cm	15 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
15%	*Eucalyptus camaldulensis*	River Red-gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	2	10%	T
Medium Shrub	5	10%	MS
Small Shrub	1	1%	SS
Large Herb	2	5%	LH
Medium Herb	6	10%	MH
Small or Prostrate Herb	3	5%	SH
Large Tufted Graminoid	2	10%	LTG
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	10	25%	MTG
Medium to Tiny Non-tufted Graminoid	3	10%	MNG
Scrambler or Climber	3	10%	SC
Bryophytes/Lichens	na	10%	BL

LF Code	Species typical of at least part of EVC range	Common Name
T	*Acacia melanoxylon*	Blackwood
T	*Acacia retinodes*	Wirilda
MS	*Hymenanthera dentata s.l.*	Tree Violet
SS	*Rubus parvifolius*	Small-leaf Bramble
SS	*Enchylaena tomentosa var. tomentosa*	Ruby Saltbush
MH	*Oxalis perennans*	Grassland Wood-sorrel
SH	*Azolla filiculoides*	Pacific Azolla
SH	*Lemna disperma*	Common Duckweed
LTG	*Austrostipa bigeniculata*	Kneed Spear-grass
LTG	*Poa labillardierei*	Common Tussock-garss
LNG	*Phragmites australis*	Common Reed
MTG	*Austrodanthonia racemosa var. racemosa*	Stiped Wallaby-grass
MTG	*Austrodanthonia caespitosa*	Common Wallaby-grass
MNG	*Microlaena stipoides var. stipoides*	Weeping Grass
SC	*Glycine clandestina*	Twining Glycine

EVC 68: Creekline Grassy Woodland - Victorian Volcanic Plain bioregion

Recruitment:
Continuous

Organic Litter:
40 % cover

Logs:
20 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
T	*Salix fragilis*	Crack Willow	high	high
MS	*Lycium ferocissimum*	African Box-thorn	high	high
MS	*Genista monspessulana*	Montpellier Broom	high	high
MS	*Rosa rubiginosa*	Sweet Briar	high	high
MS	*Rubus sp. aff. armeniacus*	Blackberry	high	high
LH	*Plantago lanceolata*	Ribwort	high	low
LH	*Sonchus oleraceus*	Common Sow-thistle	high	low
LH	*Hirschfeldia incana*	Buchan Weed	high	high
LH	*Verbena bonariensis s.l.*	Purple-top Verbena	high	high
LH	*Rumex crispus*	Curled Dock	high	high
LH	*Rumex conglomeratus*	Clustered Dock	high	high
LH	*Conium maculatum*	Hemlock	high	high
LH	*Helminthotheca echioides*	Ox-tongue	high	low
LH	*Aster subulatus*	Aster-weed	high	low
LH	*Sonchus asper s.l.*	Rough Sow-thistle	high	low
LH	*Solanum nigrum sensu Willis (1972)*	Black Nightshade	high	high
MH	*Brassica fruticulosa*	Twiggy Turnip	high	high
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Foeniculum vulgare*	Fennel	high	high
SH	*Modiola caroliniana*	Red-flower Mallow	high	low
LTG	*Phalaris aquatica*	Toowoomba Canary-grass	high	high
LTG	*Piptatherum miliaceum*	Rice Millet	high	high
MTG	*Ehrharta erecta var. erecta*	Panic Veldt-grass	high	high
MTG	*Paspalum dilatatum*	Paspalum	high	high
MTG	*Bromus catharticus*	Prairie Grass	high	low
MTG	*Romulea rosea*	Onion Grass	high	low
MTG	*Bromus diandrus*	Great Brome	high	low
MTG	*Briza maxima*	Large Quaking-grass	high	low
MTG	*Agrostis capillaris s.l.*	Brown-top Bent	high	high
MNG	*Dactylis glomerata*	Cocksfoot	high	high
MNG	*Paspalum distichum*	Water Couch	high	high
SC	*Tradescantia fluminensis*	Wandering Jew	high	high

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Victorian Volcanic Plain bioregion

EVC 125: Plains Grassy Wetland

Description:
This EVC is usually treeless, but in some instances can include sparse River Red Gum *Eucalyptus camaldulensis* or Swamp Gum *Eucalyptus ovata*. A sparse shrub component may also be present. The characteristic ground cover is dominated by grasses and small sedges and herbs. The vegetation is typically species-rich on the outer verges but is usually species-poor in the wetter central areas.

Life Forms:

Life form	#Spp	%Cover	LF code
Large Herb	5	5%	LH
Medium Herb	6	10%	MH
Small or Prostrate Herb	3	10%	SH
Large Tufted Graminoid	3	15%	LTG
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	8	30%	MTG
Medium to Tiny Non-tufted Graminoid	2	10%	MNG
Bryophytes/Lichens	na	10%	BL

LF Code	Species typical of at least part of EVC range	Common Name
LH	*Epilobium billardierianum*	Variable Willow-herb
LH	*Villarsia reniformis*	Running Marsh-flower
LH	*Epilobium billardierianum ssp. cinereum*	Grey Willow-herb
MH	*Potamogeton tricarinatus s.l.*	Floating Pondweed
MH	*Lilaeopsis polyantha*	Australian Lilaeopsis
MH	*Utricularia dichotoma s.l.*	Fairies' Aprons
SH	*Eryngium vesiculosum*	Prickfoot
SH	*Neopaxia australasica*	White Purslane
SH	*Lobelia pratioides*	Poison Lobelia
LTG	*Juncus flavidus*	Gold Rush
LTG	*Deyeuxia quadriseta*	Reed Bent-grass
LTG	*Amphibromus nervosus*	Common Swamp Wallaby-grass
LTG	*Poa labillardierei*	Common Tussock-grass
MTG	*Triglochin procerum s.l.*	Water Ribbons
MTG	*Glyceria australis*	Australian Sweet-grass
MTG	*Juncus holoschoenus*	Joint-leaf Rush
MTG	*Austrodanthonia duttoniana*	Brown-back Wallaby-grass
MNG	*Eleocharis acuta*	Common Spike-sedge
MNG	*Eleocharis pusilla*	Small Spike-sedge

Recruitment:
Episodic/Flood. Desirable period between disturbances is 5 years.

Organic Litter:
20% cover

Logs:
5 m/0.1 ha.(where trees are overhanging the wetland)

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	*Cirsium vulgare*	Spear Thistle	high	high
MH	*Leontodon taraxacoides ssp. taraxacoides*	Hairy Hawkbit	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
LTG	*Phalaris aquatica*	Toowoomba Canary-grass	high	high
LNG	*Holcus lanatus*	Yorkshire Fog	high	high
MTG	*Briza minor*	Lesser Quaking-grass	high	low
MTG	*Romulea rosea*	Onion Grass	high	low
TTG	*Cyperus tenellus*	Tiny Flat-sedge	high	low

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Victorian Volcanic Plain bioregion

EVC 132_61: *Heavier-soils* Plains Grassland

Description:
Treeless vegetation mostly less than 1 m tall dominated by largely graminoid and herb life forms. Occupies fertile cracking basalt soils prone to seasonal waterlogging in areas receiving at least 500 mm annual rainfall.

Life Forms:

Life form	#Spp	%Cover	LF code
Large Herb	2	5%	LH
Medium Herb	12	20%	MH
Small or Prostrate Herb	4	5%	SH
Large Tufted Graminoid	1	5%	LTG
Medium to Small Tufted Graminoid	13	40%	MTG
Medium to Tiny Non-tufted Graminoid	4	5%	MNG
Bryophytes/Lichens and Soil Crust*	na	20%	BL

* Note: treat as one life form in this EVC

LF Code	Species typical of at least part of EVC range	Common Name
SS	*Pimelea humilis*	Common Rice-flower
LH	*Rumex dumosus*	Wiry Dock
MH	*Calocephalus citreus*	Lemon Beauty-heads
MH	*Acaena echinata*	Sheep's Burr
MH	*Leptorhynchos squamatus*	Scaly Buttons
MH	*Eryngium ovinum*	Blue Devil
SH	*Solenogyne dominii*	Smooth Solenogyne
SH	*Lobelia pratioides*	Poison Lobelia
LTG	*Austrostipa bigeniculata*	Kneed Spear-grass
LTG	*Dichelachne crinita*	Long-hair Plume-grass
MTG	*Themeda triandra*	Kangaroo Grass
MTG	*Austrodanthonia caespitosa*	Common Wallaby-grass
MTG	*Elymus scaber* var. *scaber*	Common Wheat-grass
MTG	*Schoenus apogon*	Common Bog-sedge
MNG	*Microlaena stipoides* var. *stipoides*	Weeping Grass
MNG	*Thelymitra pauciflora* s.l.	Slender Sun-orchid
MNG	*Microtis unifolia*	Common Onion-orchid
SC	*Convolvulus erubescens*	Pink Bindweed

Recruitment:
Episodic/Fire or Grazing. Desirable period between disturbances is 5 years.

Organic Litter:
10% cover

EVC 132_61: *Heavier-soils* Plains Grassland - Victorian Volcanic Plain bioregion

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
LH	*Plantago lanceolata*	Ribwort	high	low
LH	*Cirsium vulgare*	Spear Thistle	high	high
LH	*Sonchus oleraceus*	Common Sow-thistle	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Leontodon taraxacoides* ssp. *taraxacoides*	Hairy Hawkbit	high	low
MH	*Trifolium subterraneum*	Subterranean Clover	high	low
MH	*Plantago coronopus*	Buck's-horn Plantain	high	low
MH	*Trifolium striatum*	Knotted Clover	high	low
MH	*Trifolium dubium*	Suckling Clover	high	low
LTG	*Phalaris aquatica*	Toowoomba Canary-grass	high	high
LNG	*Holcus lanatus*	Yorkshire Fog	high	high
MTG	*Romulea rosea*	Onion Grass	high	low
MTG	*Vulpia bromoides*	Squirrel-tail Fescue	high	low
MTG	*Briza minor*	Lesser Quaking-grass	high	low
MTG	*Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome	high	low
MTG	*Briza maxima*	Large Quaking-grass	high	low
MTG	*Lolium rigidum*	Wimmera Rye-grass	high	low
MTG	*Lolium perenne*	Perennial Rye-grass	high	low
MTG	*Nassella neesiana*	Chilean Needle-grass	high	high
MNG	*Cynosurus echinatus*	Rough Dog's-tail	high	low
MNG	*Juncus capitatus*	Capitate Rush	high	low

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Victorian Volcanic Plain bioregion

EVC 175: Grassy Woodland

Description:

A variable open eucalypt woodland to 15 m tall or occasionally Sheoak/Acacia woodland to 10 m tall over a diverse ground layer of grasses and herbs. The shrub component is usually sparse. It occurs on sites with moderate fertility on gentle slopes or undulating hills on a range of geologies.

[+] *eucalypt woodland only components (ignore when assessing non-eucalypt areas)*

Large trees:

Species	DBH(cm)	# / ha
Eucalyptus spp.	70 cm	15 / ha
Allocasuarina spp.	40 cm	
Acacia spp.	30 cm	

Tree Canopy Cover:

% cover	Character Species	Common Name
15%	*Eucalyptus ovata*	Swamp Gum
	Eucalyptus radiata s.l.	Narrow-leaf Peppermint
	Eucalyptus viminalis	Manna Gum
	Allocasuarina verticillata	Drooping Sheoak
	Acacia implexa	Lightwood
	Acacia mearnsii	Black Wattle

Understorey:

Life form	# Spp	% Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub[+]	2	10%	T
Medium Shrub	2	10%	MS
Small Shrub	2	1%	SS
Prostrate Shrub	2	5%	PS
Large Herb	2	5%	LH
Medium Herb	8	20%	MH
Small or Prostrate Herb	3	5%	SH
Large Tufted Graminoid	1	1%	LTG
Medium to Small Tufted Graminoid	8	45%	MTG
Medium to Tiny Non-tufted Graminoid	1	5%	MNG
Scrambler or Climber	1	1%	SC
Bryophytes/Lichens	na	10%	BL

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Bursaria spinosa*	Sweet Bursaria
MS	*Cassinia arcuata*	Drooping Cassinia
MS	*Acacia pycnantha*	Golden Wattle
MS	*Hymenanthera dentata* s.l.	Tree Violet
SS	*Pimelea humilis*	Common Rice-flower
PS	*Atriplex semibaccata*	Berry Saltbush
MH	*Acaena echinata*	Sheep's Burr
MH	*Einadia nutans* ssp. *nutans*	Nodding Saltbush
MH	*Gonocarpus tetragynus*	Common Raspwort
SH	*Crassula sieberiana*	Sieber Crassula
SH	*Dichondra repens*	Kidney-weed
MTG	*Lomandra filiformis*	Wattle Mat-rush
MTG	*Austrostipa scabra*	Rough Spear-grass
MTG	*Austrodanthonia caespitosa*	Common Wallaby-grass
MTG	*Dianella revoluta* s.l.	Black-anther Flax-lily
MNG	*Microlaena stipoides* var. *stipoides*	Weeping Grass
SC	*Clematis microphylla*	Small-leaved Clematis

Victoria The Place To Be

Recruitment:
Continuous

Organic Litter:
20 % cover

Logs:
15 m/0.1 ha.

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MS	*Lycium ferocissimum*	African Box-thorn	high	high
MH	*Leontodon taraxacoides* ssp. *taraxacoides*	Hairy Hawkbit	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Arctotheca calendula*	Cape Weed	high	low
MTG	*Briza maxima*	Large Quaking-grass	high	low
MTG	*Romulea rosea*	Onion Grass	high	low
MTG	*Ehrharta erecta* var. *erecta*	Panic Veldt-grass	high	high
MTG	*Ehrharta longiflora*	Annual Veldt-grass	high	low
MTG	*Nassella neesiana*	Chilean Needle-grass	high	high
MTG	*Nassella trichotoma*	Serrated Tussock	high	high

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Department of Sustainability and Environment

EVC/Bioregion Benchmark for Vegetation Quality Assessment

Victorian Volcanic Plain bioregion

EVC 641: Riparian Woodland

Description:
Occurs beside permanent streams, typically on narrow alluvial deposits. Woodland to 15 m tall generally dominated by *Eucalyptus camaldulensis* over a tussock grass-dominated understorey. Tall shrubs may be present and amphibious herbs may occur in occasional ponds and beside creeks. While flooding may be common, sites are rarely inundated for lengthy periods.

Large trees:

Species	DBH(cm)	# / ha
Eucalyptus spp.	80 cm	15 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
20%	*Eucalyptus camaldulensis*	River Red-gum

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	2	10%	T
Medium Shrub	2	10%	MS
Small Shrub	1	5%	SS
Large Herb	4	15%	LH
Medium Herb	5	10%	MH
Small or Prostrate Herb	1	5%	SH
Large Tufted Graminoid	3	10%	LTG
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	4	20%	MTG
Medium to Tiny Non-tufted Graminoid	2	5%	MNG
Scrambler or Climber	1	5%	SC
Bryophytes/Lichens	na	10%	BL

LF Code	Species typical of at least part of EVC range	Common Name
T	*Acacia melanoxylon*	Blackwood
MS	*Bursaria spinosa* ssp. *spinosa*	Sweet Bursaria
MS	*Viminaria juncea*	Golden Spray
SS	*Rubus parvifolius*	Small-leaf Bramble
LH	*Wahlenbergia gracilis* s.s.	Sprawling Bluebell
LH	*Senecio quadridentatus*	Cottony Fireweed
LH	*Myriophyllum crispatum*	Upright Water-milfoil
MH	*Rumex brownii*	Slender Dock
MH	*Oxalis perennans*	Grassland Wood-sorrel
MH	*Mentha australis*	River Mint
MH	*Acaena novae-zelandiae*	Bidgee-widgee
SH	*Dichondra repens*	Kidneyweed
LTG	*Poa labillardierei*	Common Tussock-grass
LTG	*Carex appressa*	Tall Sedge
LNG	*Phragmites australis*	Common Reed
MTG	*Lachnagrostis filiformis* var. *filiformis*	Common Blown-grass
MTG	*Triglochin procerum* s.l.	Water-ribbons
MNG	*Eleocharis acuta*	Common Spike-sedge
SC	*Calystegia sepium*	Large Bindweed

Victoria The Place To Be

Recruitment:
Continuous

Organic Litter:
30% cover

Logs:
20m / 0.1 ha

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MS	*Rosa rubiginosa*	Sweet Briar	high	high
LH	*Sonchus oleraceus*	Common Sow-thistle	high	low
LH	*Cirsium vulgare*	Spear Thistle	high	high
LH	*Plantago lanceolata*	Ribwort	high	low
LH	*Helminthotheca echioides*	Ox-tongue	high	low
LH	*Rumex crispus*	Curled Dock	high	low
LH	*Aster subulatus*	Aster-weed	high	low
LH	*Rorippa palustris*	Marsh Yellow-cress	high	high
MH	*Leontodon taraxacoides* ssp. *taraxacoides*	Hairy Hawkbit	high	low
MH	*Hypochoeris radicata*	Cat's Ear	high	low
LTG	*Phalaris aquatica*	Toowoomba Canary-grass	high	high
LNG	*Holcus lanatus*	Yorkshire Fog	high	high
MTG	*Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome	high	low
MTG	*Anthoxanthum odoratum*	Sweet Vernal-grass	high	high
MNG	*Paspalum distichum*	Water Couch	high	high
SC	*Galium aparine*	Cleavers	high	low

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EVC/Bioregion Benchmark for Vegetation Quality Assessment

Victorian Volcanic Plain bioregion

EVC 649: Stony Knoll Shrubland

Description:
Stony Knoll Shrubland is a shrubland to 3 m tall or low non-eucalypt woodland to 8 m tall with a grassy understorey. It occurs on low stony rises on basalt flows. The soils are fertile and well drained but shallow with out cropping rock, causing severe summer dryness.

[+] woodland only components (ignore when assessing treeless areas and standardise final score as appropriate)

Canopy Cover[+]:

%cover	Character Species	Common Name
15%	*Allocasuarina verticillata*	Drooping Sheoak
	Bursaria spinosa	Sweet Bursaria

Understorey:

Life form	#Spp	%Cover	LF code
Medium Shrub	3	10%	MS
Prostrate Shrub	1	1%	PS
Large Herb	2	1%	LH
Medium Herb	11	10%	MH
Small or Prostrate Herb	4	5%	SH
Medium to Small Tufted Graminoid	10	25%	MTG
Tiny Tufted Graminoid	2	5%	TTG
Medium to Tiny Non-tufted Graminoid	2	5%	MNG
Ground Fern	2	5%	GF
Bryophytes/Lichens	na	10%	BL
Soil Crust	na	10%	S/C
Total understorey projective foliage cover		**85%**	

LF Code	Species typical of at least part of EVC range	Common Name
MS	*Hymenanthera dentata* s.l.	Tree Violet
MS	*Acacia paradoxa*	Hedge Wattle
PS	*Kennedia prostrata*	Running Postman
LH	*Senecio quadridentatus*	Cotton Fireweed
LH	*Senecio glomeratus*	Annual Fireweed
MH	*Oxalis perennans*	Grassland Wood-sorrel
MH	*Rumex brownii*	Slender Dock
MH	*Hypericum gramineum*	Small St John's Wort
MH	*Acaena ovina*	Australian Sheep's Burr
SH	*Dichondra repens*	Kidneyweed
SH	*Hydrocotyle laxiflora*	Stinking Pennywort
SH	*Crassula sieberiana*	Sieber Crassula
MTG	*Themeda triandra*	Kangaroo Grass
MTG	*Poa sieberiana*	Grey Tussock-grass
MTG	*Austrodanthonia caespitosa*	Common Wallaby-grass
MTG	*Austrodanthonia setacea*	Bristly Wallaby-grass
TTG	*Carex breviculmis*	Short-stem Sedge
MNG	*Microlaena stipoides* var. *stipoides*	Weeping Grass
GF	*Pteridium esculentum*	Austral Bracken
GF	*Adiantum aethiopicum*	Common Maidenhair
SC	*Convolvulus erubescens* spp. agg.	Pink Bindweed

Recruitment:
Continuous

Organic Litter:
20 % cover

Logs+:
5 m/0.1 ha. (note: large log class does not apply)

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
T	*Schinus molle*	Pepper Tree	high	high
MS	*Lycium ferocissimum*	African Box-thorn	high	high
MS	*Genista monspessulana*	Montpellier Broom	high	high
SS	*Marrubium vulgare*	Horehound	high	high
LH	*Sonchus oleraceus*	Common Sow-thistle	high	low
LH	*Helminthotheca echioides*	Ox-tongue	high	low
LH	*Lactuca serriola*	Prickly Lettuce	high	low
LH	*Sisymbrium officinale*	Hedge Mustard	high	low
LH	*Sonchus asper* s.l.	Rough Sow-thistle	high	low
LH	*Verbascum thapsus* ssp. *thapsus*	Great Mullein	high	high
LH	*Echium plantagineum*	Paterson's Curse	high	high
LH	*Centaurium tenuiflorum*	Slender Centaury	high	low
LH	*Foeniculum vulgare*	Fennel	high	high
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Trifolium arvense* var. *arvense*	Hare's-foot Clover	high	low
MH	*Trifolium subterraneum*	Subterranean Clover	high	low
MH	*Trifolium campestre* var. *campestre*	Hop Clover	high	low
MH	*Trifolium angustifolium* var. *angustifolium*	Narrow-leaf Clover	high	low
MH	*Lotus suaveolens*	Hairy Bird's-foot Trefoil	high	low
MH	*Cerastium glomeratum* s.l.	Common Mouse-ear Chickweed	high	low
SH	*Medicago polymorpha*	Burr Medic	high	low
SH	*Trifolium glomeratum*	Cluster Clover	high	low
SH	*Modiola caroliniana*	Red-flower Mallow	high	low
SH	*Aptenia cordifolia*	Heart-leaf Ice-plant	high	high
LTG	*Phalaris aquatica*	Toowoomba Canary-grass	high	high
LNG	*Holcus lanatus*	Yorkshire Fog	high	high
LNG	*Avena fatua*	Wild Oat	high	low
MTG	*Nassella trichotoma*	Serrated Tussock	high	high
MTG	*Ehrharta longiflora*	Annual Veldt-grass	high	low
MTG	*Briza maxima*	Large Quaking-grass	high	low
MTG	*Bromus hordeaceus* ssp. *hordeaceus*	Soft Brome	high	low
MTG	*Sporobolus africanus*	Rat-tail Grass	high	high
MTG	*Vulpia bromoides*	Squirrel-tail Fescue	high	low
MTG	*Romulea rosea*	Onion Grass	high	low
MTG	*Pentaschistis airoides* ssp. *airoides*	False Hair-grass	high	low
MTG	*Lolium perenne*	Perennial Rye-grass	high	low
MTG	*Dactylis glomerata*	Cocksfoot	high	high
MTG	*Vulpia myuros*	Rat's-tail Fescue	high	low
MTG	*Bromus rubens*	Red Brome	high	low
MTG	*Avena barbata*	Bearded Oat	high	low
MTG	*Aira caryophyllea*	Silvery Hair-grass	high	low
SC	*Vicia sativa* ssp. *sativa*	Common Vetch	low	low

Published by the Victorian Government Department of Sustainability and Environment May 2004

Appendix 10: Biodiversity assessment report (DELWP)

Biodiversity impact and offset requirements report

This report **does not represent an assessment by DELWP** of the proposed native vegetation removal. It provides additional biodiversity information to support moderate and high risk-based pathway applications for permits to remove native vegetation under clause 52.16 or 52.17 of planning schemes in Victoria.

Date of issue: **28/04/2017**
Time of issue: **9:57 am**

DELWP ref: BLA_0476

Project ID	BLA_231_GPWF

Summary of marked native vegetation

Risk-based pathway	**High**
Total extent	81.290 ha
Remnant patches	81.009 ha
Scattered trees	4 trees
Location risk	C

Strategic biodiversity score of all marked native vegetation	0.278

Offset requirements if a permit is granted

If a permit is granted to remove the marked native vegetation, a requirement to obtain a native vegetation offset will be included in the permit conditions. The offset must meet the following requirements:

Offset type	**General offset**
General offset amount (general biodiversity equivalence units)	2.698 general units
General offset attributes	
Vicinity	Corangamite Catchment Management Authority (CMA) **or** Colac Otway Shire, Golden Plains Shire Council
Minimum strategic biodiversity score	0.126[1]
Offset type	**Specific offset(s)**
Specific offset amount (specific biodiversity equivalence units) and attributes	31.836 specific units of habitat for Brolga 29.935 specific units of habitat for Striped Legless Lizard 31.924 specific units of habitat for Adamson's Blown-grass 22.319 specific units of habitat for Swamp Sheoak 31.099 specific units of habitat for Small Milkwort 7.423 specific units of habitat for Small Scurf-pea 1.083 specific units of habitat for Button Wrinklewort 31.348 specific units of habitat for Purple Blown-grass 6.348 specific units of habitat for White Sunray 31.047 specific units of habitat for Pale Swamp Everlasting 30.369 specific units of habitat for Spiny Rice-flower 8.064 specific units of habitat for Southern Swainson-pea

See Appendices 1 and 2 for details in how offset requirements were determined.

NB: values presented in tables throughout this document may not add to totals due to rounding

[1] Minimum strategic biodiversity score is 80 per cent of the weighted average score across habitat zones where a general offset is required

Next steps

Any proposal to remove native vegetation must meet the application requirements of the high risk-based pathway and it will be assessed under the high risk-based pathway.

If you wish to remove the marked native vegetation you are required to apply for a permit from your local council. Council will then refer your application to DELWP for assessment, as required. **This report is not a referral assessment by DELWP.**

The biodiversity assessment report from NVIM and this biodiversity impact and offset report should be submitted with your application for a permit to remove native vegetation you plan to remove, lop or destroy.

The Biodiversity assessment report generated by the tool within NVIM provides the following information:

- The location of the site where native vegetation is to be removed.
- The area of the patch of native vegetation and/or the number of any scattered trees to be removed.
- Maps or plans containing information set out in the *Permitted clearing of native vegetation – Biodiversity assessment guidelines*
- The risk-based pathway of the application for a permit to remove native vegetation

This report provides the following information to meet application requirements for a permit to remove native vegetation:

- Confirmation of the risk-based pathway of the application for a permit to remove native vegetation
- The strategic biodiversity score of the native vegetation to be removed
- Information to inform the assessment of whether the proposed removal of native vegetation will have a significant impact on Victoria's biodiversity, with specific regard to the proportional impact on habitat for any rare or threatened species.
- The offset requirements should a permit be granted to remove native vegetation.

Additional application requirements must be provided with an application for a permit to remove native vegetation in the moderate or high risk-based pathways. These include:

- A habitat hectare assessment report of the native vegetation that is to be removed
- A statement outlining what steps have been taken to ensure that impacts on biodiversity from the removal of native vegetation have been minimised
- An offset strategy that details how a compliant offset will be secured to offset the biodiversity impacts of the removal of native vegetation.

Refer to the *Permitted clearing of native vegetation – Biodiversity assessment guidelines* and for a full list and details of application requirements.

Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

For more information contact the DELWP Customer Service Centre 136 186

Biodiversity impact and offset requirements report

Appendix 1 – Biodiversity impact of removal of native vegetation

Habitat hectares

Habitat hectares are calculated for each habitat zone within your proposal using the extent and condition scores in the GIS data you provided.

Habitat zone	Site assessed condition score	Extent (ha)	Habitat hectares
XX	X.XXX	X.XXX	X.XXX
XX	X.XXX	X.XXX	X.XXX
XX	X.XXX	X.XXX	X.XXX
TOTAL			**X.XXX**

Refer to accompanying Excel spreadsheet, which must be included with this report in any application – 'Habitat hectares' tab

Impacts on rare or threatened species habitat above specific offset threshold

The specific-general offset test was applied to your proposal. The test determines if the proposed removal of native vegetation has a proportional impact on any rare or threatened species habitats above the specific offset threshold. The threshold is set at 0.005 per cent of the total habitat for a species. When the proportional impact is above the specific offset threshold a specific offset for that species' habitat is required.

The specific-general offset test found your proposal has a proportional impact above the specific offset threshold for the following rare or threatened species' habitats.

Species number	Species common name	Species scientific name	Species type	Area of mapped habitat (ha)	Proportional impact (%)
XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	X.XXX	X.XXX
XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	X.XXX	X.XXX
XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	X.XXX	X.XXX

Refer to accompanying Excel spreadsheet, which must be included with this report in any application – 'Impacts on VROTS' tab

Clearing site biodiversity equivalence score(s)

Where a habitat zone requires specific offset(s), the specific biodiversity equivalence score(s) for each species in that habitat zone is calculated by multiplying the habitat hectares of the habitat zone by the habitat importance score for each species impacted in the habitat zone.

Habitat zone	Habitat hectares	Habitat for rare or threatened species					Specific biodiversity equivalence score (SBES)
		Proportion of habitat zone with specific offset	Species number	Species common name	Species scientific name	Habitat importance score	
XX	X.XXX	X.XXX %	XXXXXX	XXXXXXXX	XXXXXXXX	X.XXX	X.XXX
XX	X.XXX	X.XXX %	XXXXXX	XXXXXXXX	XXXXXXXX	X.XXX	X.XXX
XX	X.XXX	X.XXX %	XXXXXX	XXXXXXXX	XXXXXXXX	X.XXX	X.XXX
XX	X.XXX	X.XXX %	XXXXXX	XXXXXXXX	XXXXXXXX	X.XXX	X.XXX
XX	X.XXX	X.XXX %	XXXXXX	XXXXXXXX	XXXXXXXX	X.XXX	X.XXX

Refer to accompanying Excel spreadsheet, which must be included with this report in any application – 'SBES by zone' tab

There are habitat zones in your proposal which are not habitat for the species above. A general offset is required for the(se) habitat zone(s).

The general biodiversity equivalence score for the habitat zone(s) is calculated by multiplying the habitat hectares by the strategic biodiversity score.

Habitat zone	Habitat hectares	Proportion of habitat zone with general offset	Strategic biodiversity score	General biodiversity equivalence score (GBES)
XX	X.XXX	XX.XXX %	X.XXX	X.XXX
XX				X.XXX
XX				X.XXX
XX				X.XXX
XX	X.XXX	XX.XXX %	X.XXX	X.XXX

Refer to accompanying Excel spreadsheet, which must be included with this report in any application – 'GBES by zone' tab

Mapped rare or threatened species' habitats on site

This table sets out the list of rare or threatened species' habitats mapped at the site beyond those species for which the impact is above the specific offset threshold. These species habitats do not require a specific offset according to the specific-general offset test.

Species number	Species common name	Species scientific name
XXXXX	XXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX
XXXXX	XXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX
XXXXX	XXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX
XXXXX	XXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX
XXXXX		
XXXXX		
XXXXX	XXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX
XXXXX	XXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX
XXXXX	XXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX

Refer to accompanying Excel spreadsheet, which must be included with this report in any application – 'Mapped VROTS habitat' tab

Appendix 2 – Offset requirements detail

If a permit is granted to remove the marked native vegetation the permit condition will include the requirement to obtain a native vegetation offset.

To calculate the required offset amount required the biodiversity equivalence scores are aggregated to the proposal level and multiplied by the relevant risk multiplier.

Offsets also have required attributes:

- General offsets must be located in the same Catchment Management Authority (CMA) boundary or Local Municipal District (local council) as the clearing and must have a minimum strategic biodiversity score of 80 per cent of the clearing.[2]
- Specific offsets must be located in the same species habitat as that being removed, as determined by the habitat importance map for that species.

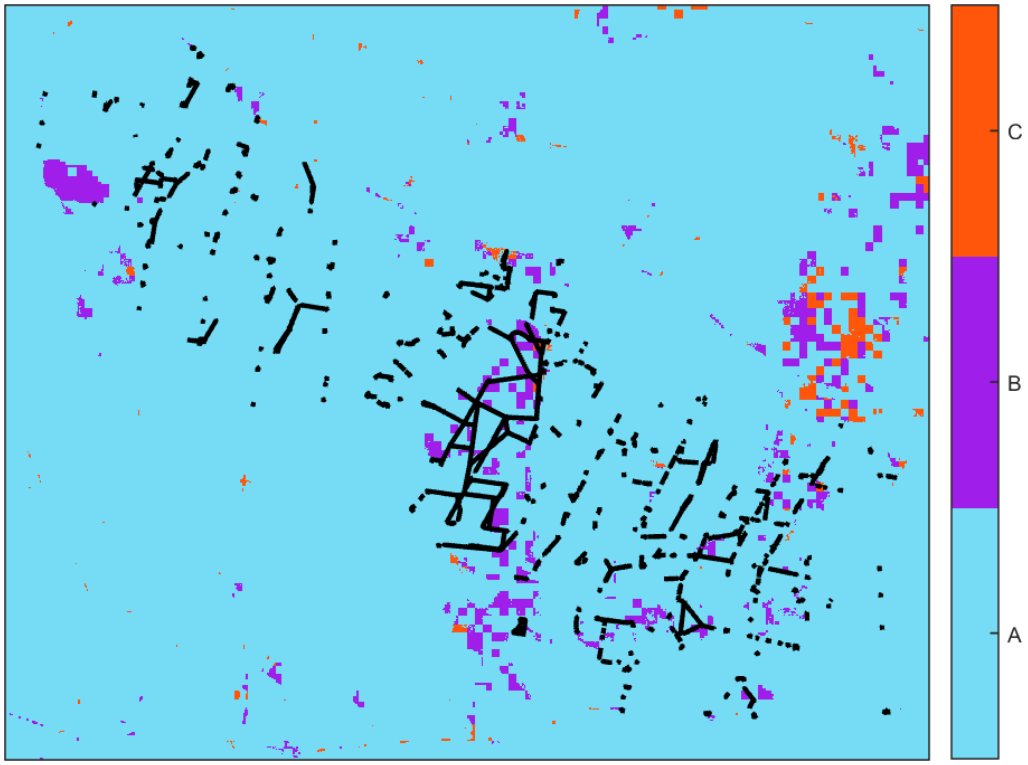
The offset requirements for your proposal are as follows:

Offset type	Clearing site biodiversity equivalence score	Risk multiplier	Offset requirements	
			Offset amount (biodiversity equivalence units)	Offset attributes
Specific	15.918 SBES	2	31.836 specific units	Offset must provide habitat for 10177, Brolga, Grus rubicunda
Specific	14.967 SBES	2	29.935 specific units	Offset must provide habitat for 12159, Striped Legless Lizard, Delma impar
Specific	15.962 SBES	2	31.924 specific units	Offset must provide habitat for 500148, Adamson's Blown-grass, Lachnagrostis adamsonii
Specific	11.160 SBES	2	22.319 specific units	Offset must provide habitat for 500682, Swamp Sheoak, Casuarina obesa
Specific	15.550 SBES	2	31.099 specific units	Offset must provide habitat for 500798, Small Milkwort, Comesperma polygaloides
Specific	3.712 SBES	2	7.423 specific units	Offset must provide habitat for 502773, Small Scurf-pea, Cullen parvum
Specific	0.541 SBES	2	1.083 specific units	Offset must provide habitat for 502982, Button Wrinklewort, Rutidosis leptorhynchoides
Specific	15.674 SBES	2	31.348 specific units	Offset must provide habitat for 504206, Purple Blown-grass, Lachnagrostis punicea subsp. punicea
Specific	3.174 SBES	2	6.348 specific units	Offset must provide habitat for 504581, White Sunray, Leucochrysum albicans var. tricolor
Specific	15.523 SBES	2	31.047 specific units	Offset must provide habitat for 504655, Pale Swamp Everlasting, Coronidium scorpioides 'aff. rutidolepis (Lowland Swamps)' variant
Specific	15.185 SBES	2	30.369 specific units	Offset must provide habitat for 504823, Spiny Rice-flower, Pimelea spinescens subsp. spinescens
Specific	4.032 SBES	2	8.064 specific units	Offset must provide habitat for 504944, Southern Swainson-pea, Swainsona behriana
General	1.799 GBES	1.5	2.698 general units	Offset must be within Corangamite CMA or Colac Otway Shire, Golden Plains Shire Councils Offset must have a minimum strategic biodiversity score of 0.126

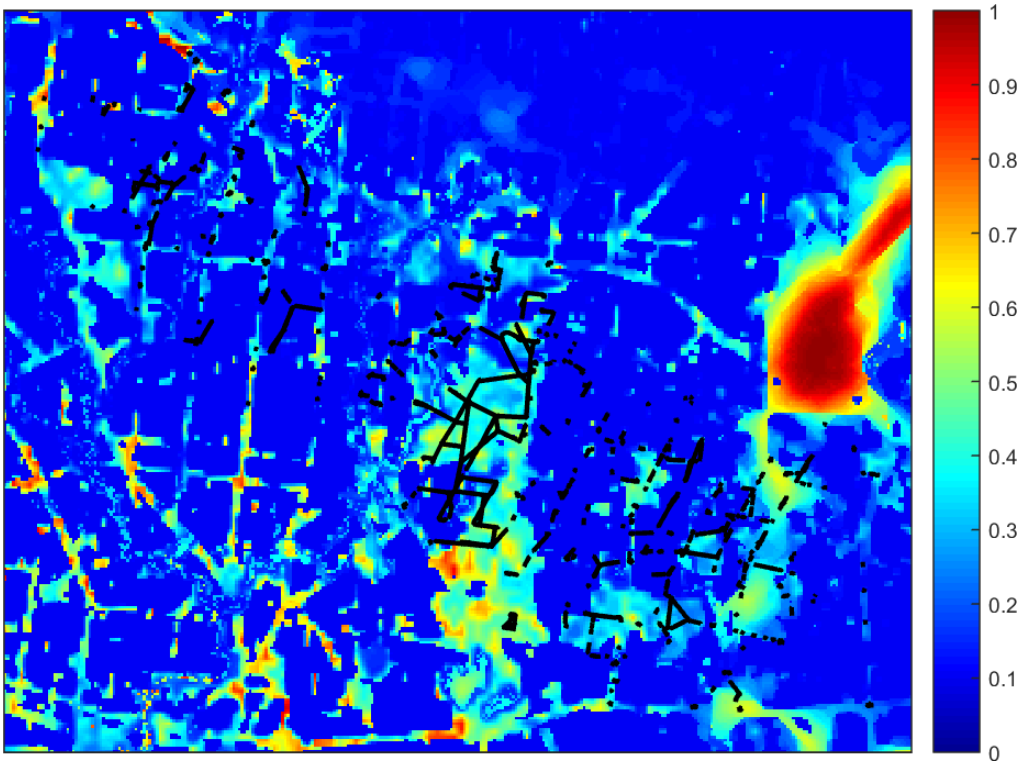
[2] Strategic biodiversity score is a weighted average across habitat zones where a general offset is required

Appendix 3 – Images of marked native vegetation

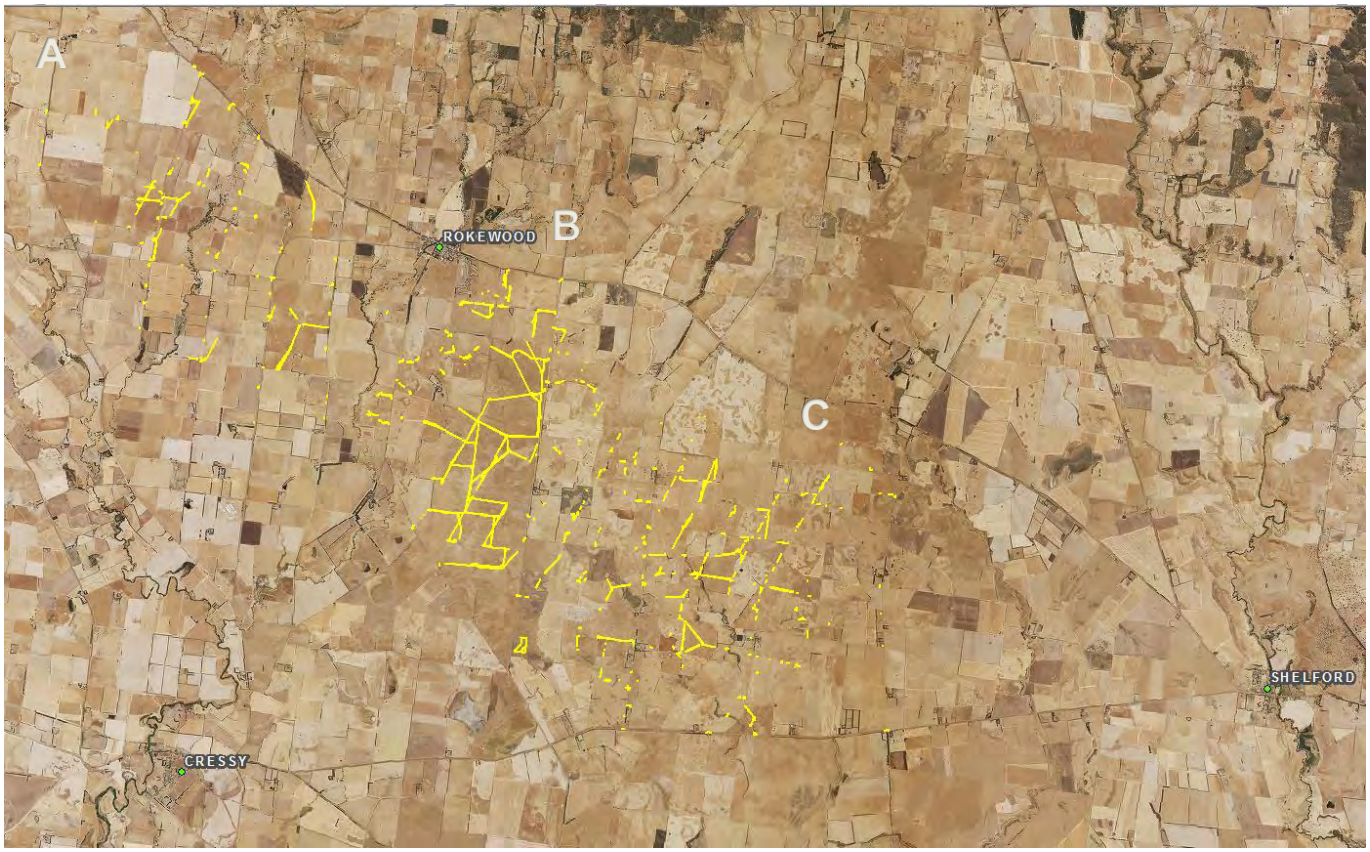
1. Native vegetation location risk map



2. Strategic biodiversity score map

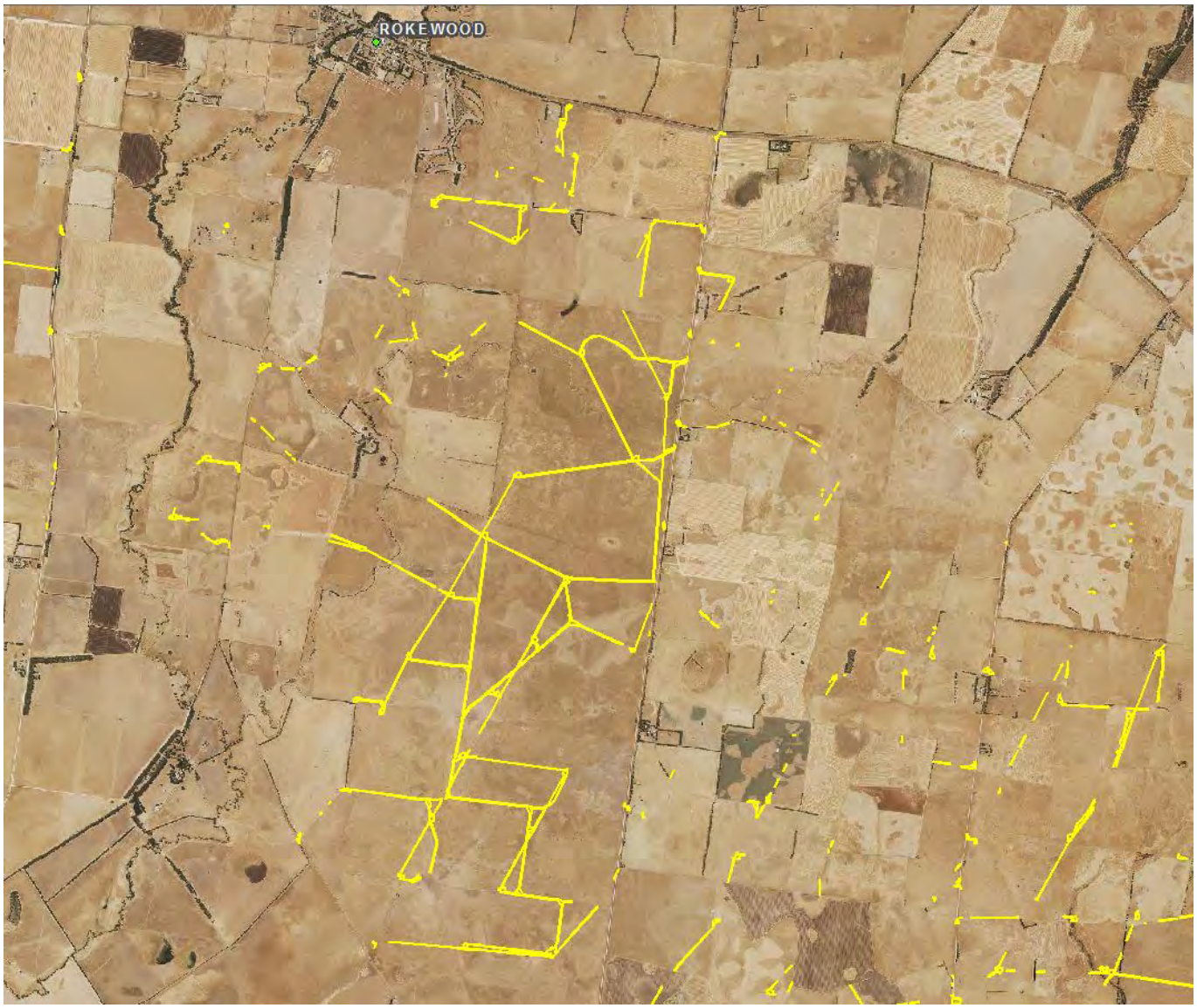


3. Aerial photograph showing marked native vegetation

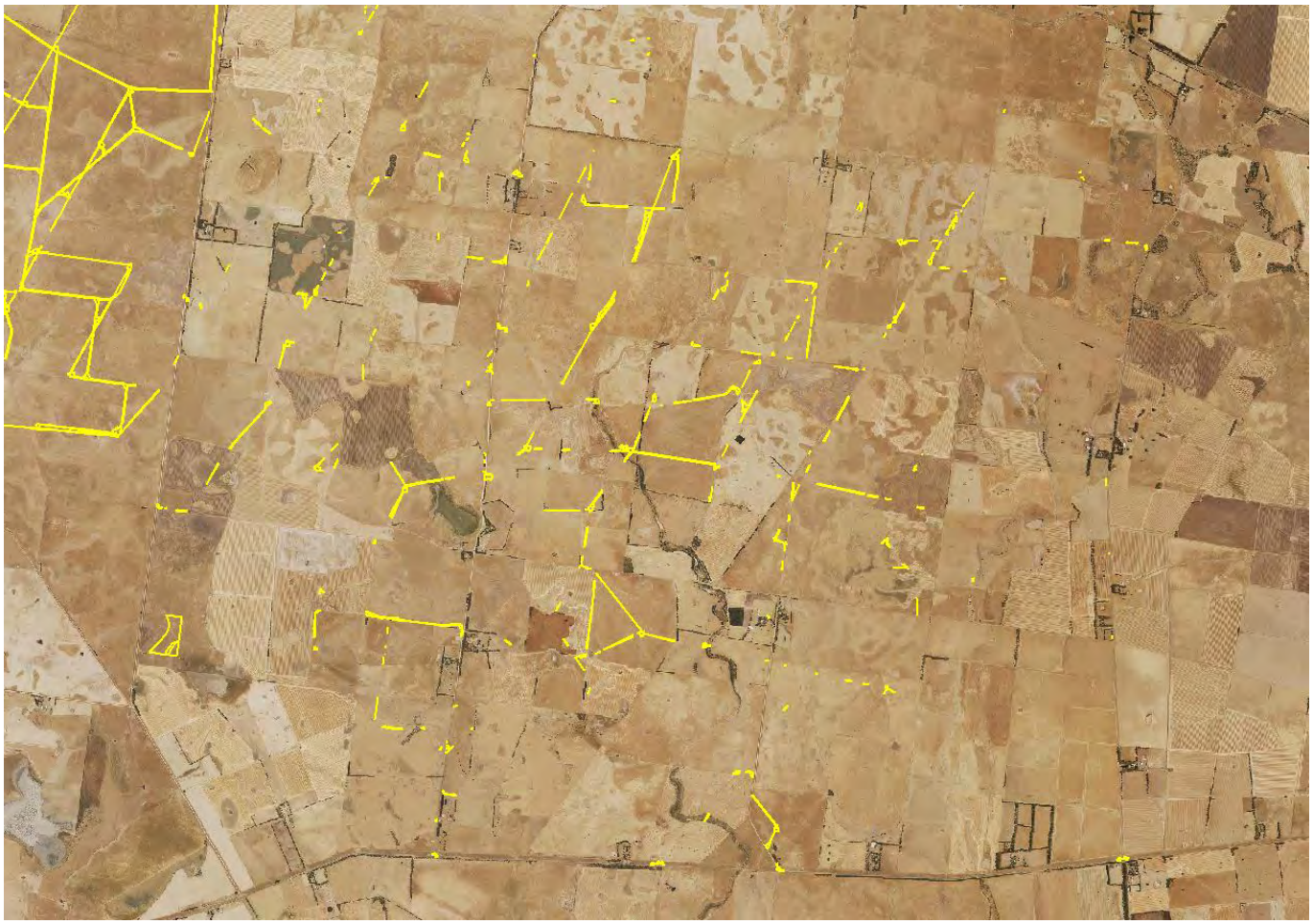


A

B

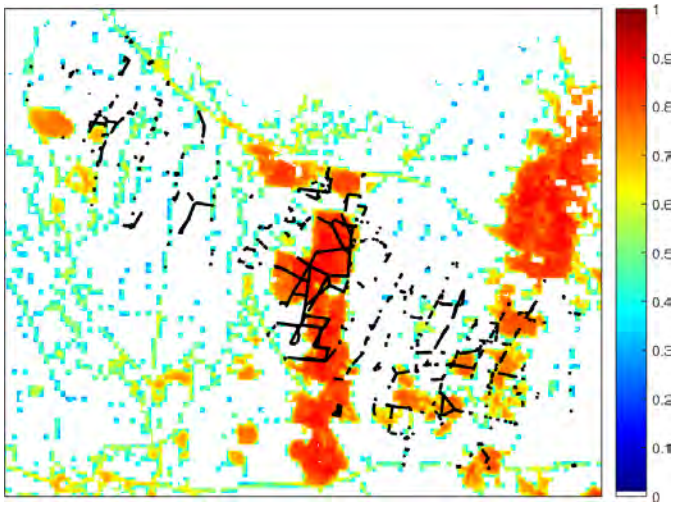


C

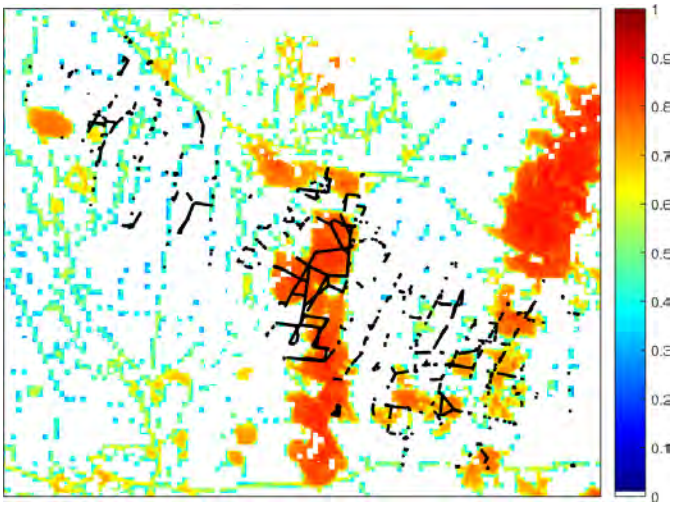


4. Habitat importance maps

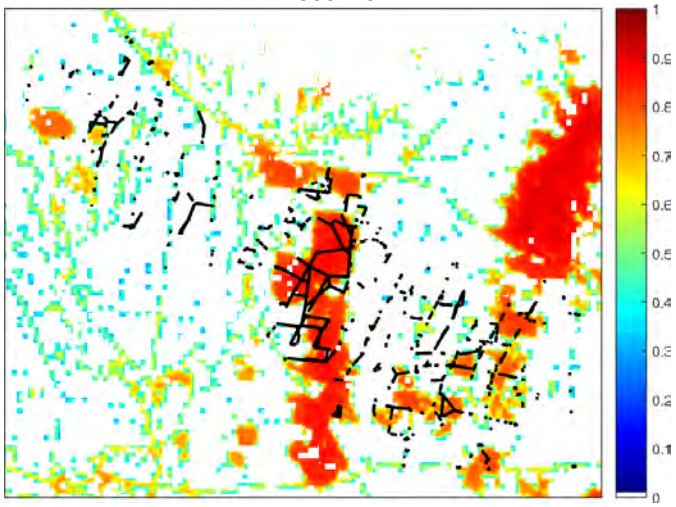
Brolga
Grus rubicunda
10177



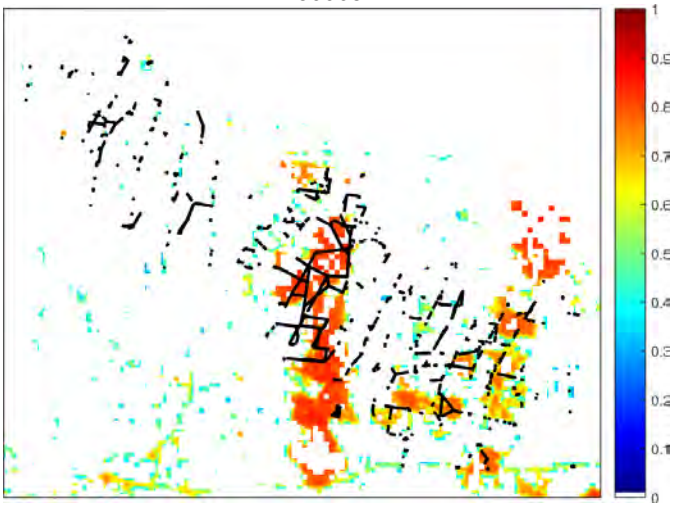
Striped Legless Lizard
Delma impar
12159



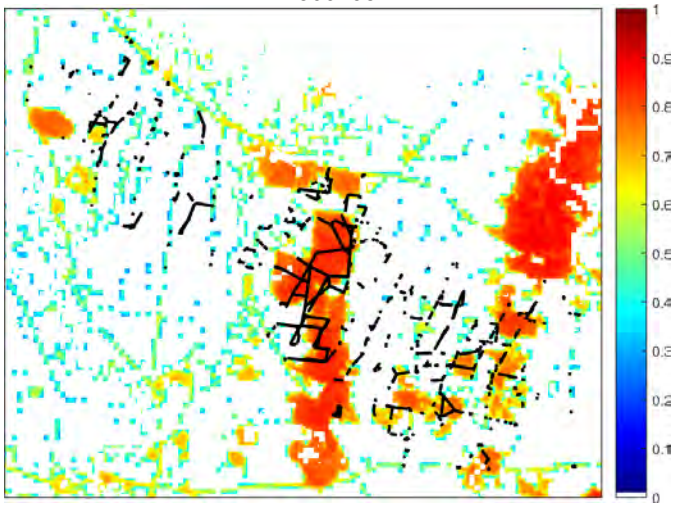
Adamson's Blown-grass
Lachnagrostis adamsonii
500148



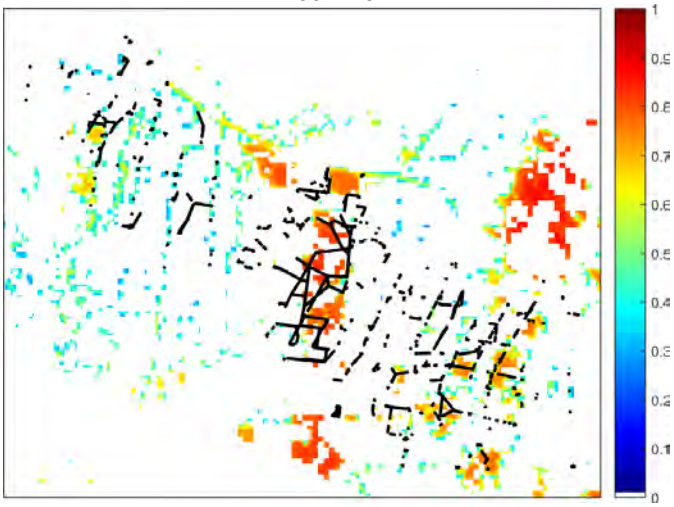
Swamp Sheoak
Casuarina obesa
500682



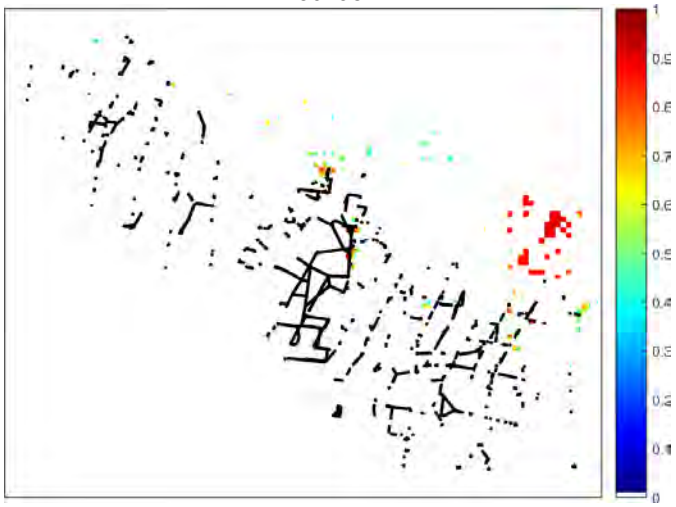
Small Milkwort
Comesperma polygaloides
500798



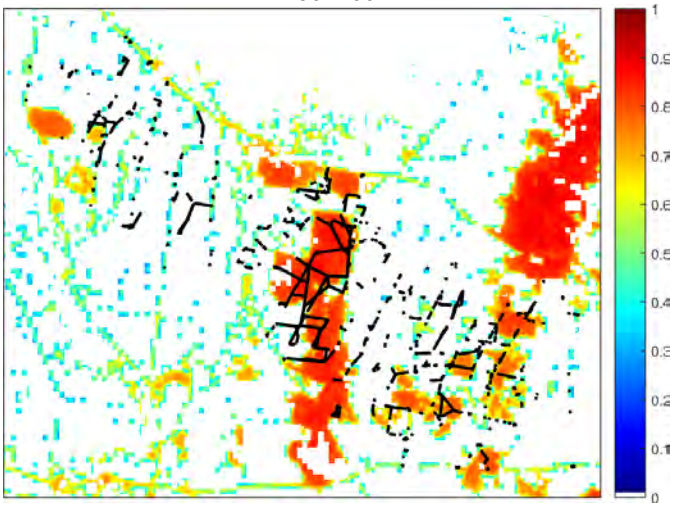
Small Scurf-pea
Cullen parvum
502773



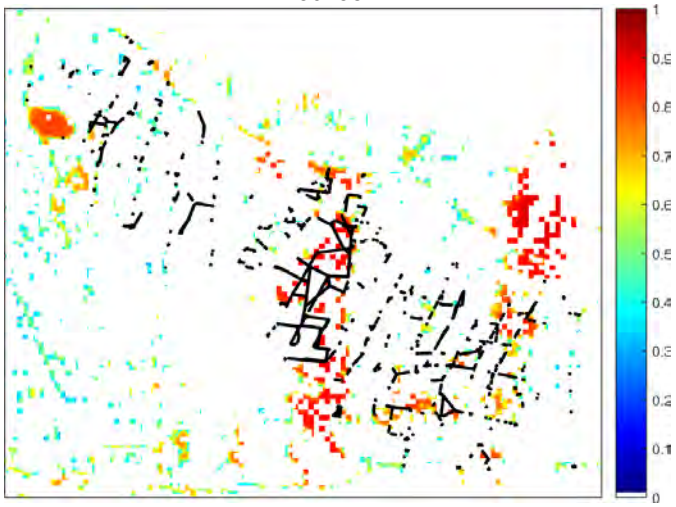
Button Wrinklewort
Rutidosis leptorhynchoides
502982



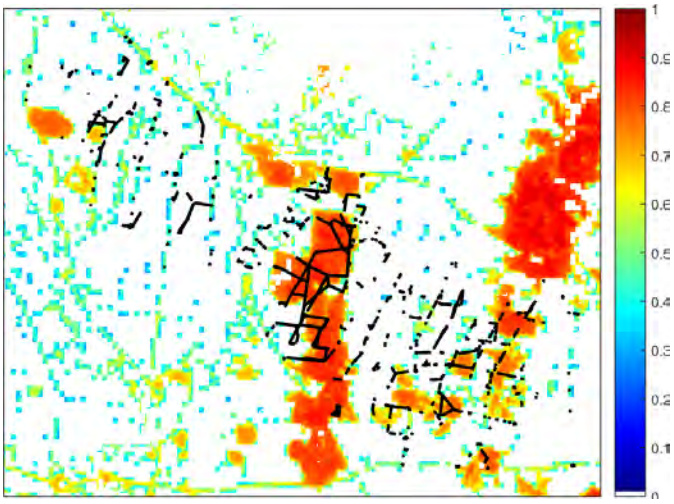
Purple Blown-grass
Lachnagrostis punicea subsp. punicea
504206



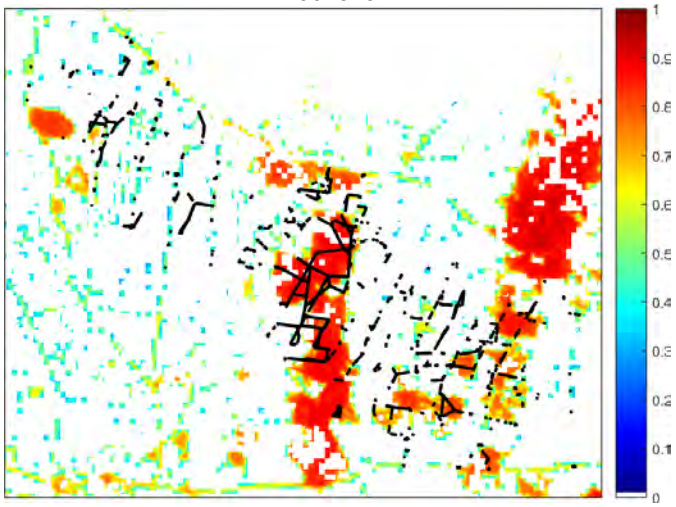
White Sunray
Leucochrysum albicans var. tricolor
504581



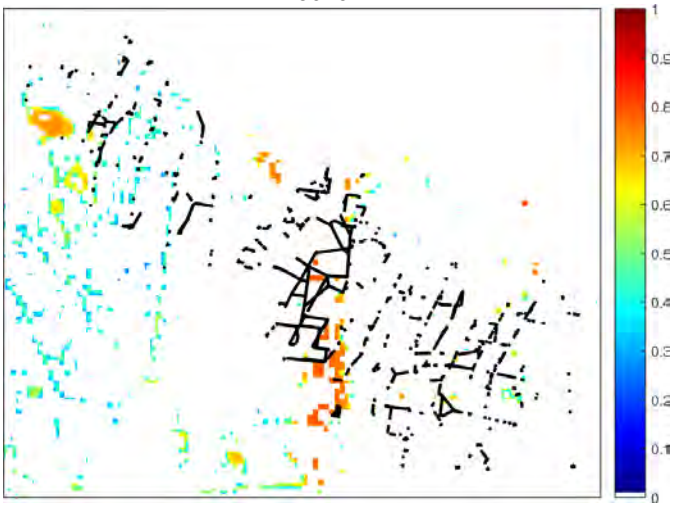
Pale Swamp Everlasting
Coronidium scorpioides 'aff. rutidolepis (Lowland Swamps)' variant
504655



Spiny Rice-flower
Pimelea spinescens subsp. spinescens
504823



Southern Swainson-pea
Swainsona behriana
504944



Glossary

Condition score

This is the site-assessed condition score for the native vegetation. Each habitat zone in the clearing proposal is assigned a condition score according to the habitat hectare assessment method. This information has been provided by or on behalf of the applicant in the GIS file.

Dispersed habitat

A dispersed species habitat is a habitat for a rare or threatened species whose habitat is spread over a relatively broad geographic area greater than 2,000 hectares.

General biodiversity equivalence score

The general biodiversity equivalence score quantifies the relative overall contribution that the native vegetation to be removed makes to Victoria's biodiversity. The general biodiversity equivalence score is calculated as follows:

$$\boldsymbol{General\ biodiversity\ equivalence\ score} = \boldsymbol{habitat\ hectares} \times \boldsymbol{strategic\ biodiversity\ score}$$

General offset amount

This is calculated by multiplying the general biodiversity equivalence score of the native vegetation to be removed by the risk factor for general offsets. This number is expressed in general biodiversity equivalence units and is the amount of offset that is required to be provided should the application be approved. This offset requirement will be a condition to the permit for the removal of native vegetation.

$$\boldsymbol{Risk\ adjusted\ general\ biodiversity\ equivalence\ score} = \boldsymbol{general\ biodiversity\ equivalence\ score\ clearing} \times \mathbf{1.5}$$

General offset attributes

General offset must be located in the same Catchment Management Authority boundary or Municipal District (local council) as the clearing site. They must also have a strategic biodiversity score that is at least 80 per cent of the score of the clearing site.

Habitat hectares

Habitat hectares is a site-based measure that combines extent and condition of native vegetation. The habitat hectares of native vegetation is equal to the current condition of the vegetation (condition score) multiplied by the extent of native vegetation. Habitat hectares can be calculated for a remnant patch or for scattered trees or a combination of these two vegetation types. This value is calculated for each habitat zone using the following formula:

$$\boldsymbol{Habitat\ hectares} = \boldsymbol{total\ extent\ (hectares)} \times \boldsymbol{condition\ score}$$

Habitat importance score

The habitat importance score is a measure of the importance of the habitat located on a site for a particular rare or threatened species. The habitat importance score for a species is a weighted average value calculated from the habitat importance map for that species. The habitat importance score is calculated for each habitat zone where the habitat importace map indicates that species habitat occurs.

Habitat zone

Habitat zone is a discrete contiguous area of native vegetation that:

- is of a single Ecological Vegetation Class
- has the same measured condition.

Highly localised habitat

A highly localised habitat is habitat for a rare or threatened species that is spread across a very restricted area (less than 2,000 hectares). This can also be applied to a similarly limited sub-habitat that is disproportionately important for a wide-ranging rare or threatened species. Highly localised habitats have the highest habitat importance score (1) for all locations where they are present.

Minimum strategic biodiversity score

The minimum strategic biodiversity score is an attribute for a general offset.

The strategic biodiversity score of the offset site must be at least 80 per cent of the strategic biodiversity score of the native vegetation to be removed. This is to ensure offsets are located in areas with a strategic value that is comparable to, or better than, the native vegetation to be removed. Where a specific and general offset is required, the minimum strategic biodiversity score relates only to the habitat zones that require the general offset.

Offset risk factor

There is a risk that the gain from undertaking the offset will not adequately compensate for the loss from the removal of native vegetation. If this were to occur, despite obtaining an offset, the overall impact from removing native vegetation would result in a loss in the contribution that native vegetation makes to Victoria's biodiversity.

To address the risk of offsets failing, an offset risk factor is applied to the calculated loss to biodiversity value from removing native vegetation.

$$\boldsymbol{Risk\ factor\ for\ general\ offsets} = \mathbf{1.5}$$

$$\boldsymbol{Risk\ factor\ for\ specific\ offset} = \mathbf{2}$$

Offset type

The specific-general offset test determines the offset type required.

When the specific-general offset test determines that the native vegetation removal will have an impact on one or more rare or threatened species habitat above the set threshold of 0.005 per cent, a specific offset is required. This test is done at the permit application level.

A general offset is required when a proposal to remove native vegetation is not deemed, by application of the specific-general offset test, to have an impact on any habitat for any rare or threatened species above the set threshold of 0.005 per cent. All habitat zones that do not require a specific offset will require a general offset.

Proportional impact on species

This is the outcome of the specific-general offset test. The specific-general offset test is calculated across the entire proposal for each species on the native vegetation permitted clearing species list. If the proportional impact on a species is above the set threshold of 0.005 per cent then a specific offset is required for that species.

Specific offset amount

The specific offset amount is calculated by multiplying the specific biodiversity equivalence score of the native vegetation to be removed by the risk factor for specific offsets. This number is expressed in specific biodiversity equivalence units and is the amount of offset that is required to be provided should the application be approved. This offset requirement will be a condition to the permit for the removal of native vegetation.

$$\boldsymbol{Risk\ adjusted\ specific\ biodiversity\ equivalence\ score} = \boldsymbol{specific\ biodiversity\ equivalence\ score\ clearing} \times \mathbf{2}$$

Specific offset attributes

Specific offsets must be located in the modelled habitat for the species that has triggered the specific offset requirement.

Specific biodiversity equivalence score

The specific biodiversity equivalence score quantifies the relative overall contribution that the native vegetation to be removed makes to the habitat of the relevant rare or threatened species. It is calculated for each habitat zone where one or more species habitats require a specific offset as a result of the specific-general offset test as follows:

$$\textbf{Specific biodiversity equivalence score} = \textbf{habitat hectares} \times \textbf{habitat importance score}$$

Strategic biodiversity score

This is the weighted average strategic biodiversity score of the marked native vegetation. The strategic biodiversity score has been calculated from the *Strategic biodiversity map* for each habitat zone.

The strategic biodiversity score of native vegetation is a measure of the native vegetation's importance for Victoria's biodiversity, relative to other locations across the landscape. The *Strategic biodiversity map* is a modelled layer that prioritises locations on the basis of rarity and level of depletion of the types of vegetation, species habitats, and condition and connectivity of native vegetation.

Total extent (hectares) for calculating habitat hectares

This is the total area of the marked native vegetation in hectares.

The total extent of native vegetation is an input to calculating the habitat hectares of a site and in calculating the general biodiversity equivalence score. Where the marked native vegetation includes scattered trees, each tree is converted to hectares using a standard area calculation of 0.071 hectares per tree. This information has been provided by or on behalf of the applicant in the GIS file.

Vicinity

The vicinity is an attribute for a general offset.

The offset site must be located within the same Catchment Management Authority boundary or Local Municipal District as the native vegetation to be removed.

GOLDEN PLAINS WIND FARM

EES REFERRAL
FLORA AND FAUNA ASSESSMENT
VOLUME B: FIGURES

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