

3 PROJECT DESIGN EVOLUTION FOR AVOIDANCE AND MINIMISATION OF IMPACTS

3.1 Design and Ecological Assessment Methods

The project design methods have been based on an iterative approach with site ecological studies being used to inform the project design to avoid, or minimise where not possible to avoid, impacts on ecological values as the design evolved.

Constraints have been applied to restrict the placement of the wind turbines to ensure that any native terrestrial flora and fauna impacts are avoided by the wind turbine foundation, hardstand and any required fire Asset Protection Zone (APZ). These constraints include (but are not limited to) set-backs of:

- 100 metres from mapped native vegetation (patches or scattered trees);
- 200 metres from named/major waterways; and,
- 20 metres from minor drainage lines.

Siting of permanent and temporary infrastructure associated with the project such as concrete batch plants, temporary construction compounds and visitor information areas has also been undertaken to avoid direct impacts on native vegetation.

Impacts on native vegetation and other ecological communities primarily relate to linear alignments of access roads and underground cabling to connect the wind turbines to the public road and electrical transmission networks.

A summary of the key design iterations for the project is provided below (Table 5), and the design evolution is outlined further in the below sections of this report.

Table 5. Design changes for the Delburn Wind Farm relating to ecological and other considerations.

Layout Version	Plan Release Date	No of WTGs	Key design and assessment changes from previous version	Native Vegetation Impacts
v1.5	April 2019	53	<ul style="list-style-type: none"> - Original concept design, informed areas for initial ecological surveys 	<ul style="list-style-type: none"> - Total (direct and indirect) impact of 64.455 hectares of native vegetation (including 201 large trees) - Strzelecki Gum located within impact area (Clarks Rd)
v2.2	August 2019	35	<ul style="list-style-type: none"> - WTG layout refined to avoid additional telecommunication point-to-point link interference zones, further optimised for noise and shadow flicker impacts on near neighbours - Changes to access tracks, cable routes and road upgrades to avoid additional Strzelecki Gum surveyed 	<ul style="list-style-type: none"> - Direct impact of 15.604 ha (inclusive of 96 trees); and - Total (direct and indirect) impact of 41.412 ha (inclusive of 154 trees).

Layout Version	Plan Release Date	No of WTGs	Key design and assessment changes from previous version	Native Vegetation Impacts
v3.5	August 2020	33	<ul style="list-style-type: none"> - WTG layout refined to avoid additional telecommunication point-to-point link interference zones, further optimised for noise and shadow flicker impacts on near neighbours. - Existing forestry track alignments/footprints confirmed via high resolution georeferenced aerial imagery. - Complete redesign of reticulation strings, with no cable routes using Nursery Track, to minimise impacts on GGF. - Updated access road and cable footprint design assumptions applied (using Vestas cross-sections). - Road upgrade footprint updated to reflect findings of Traffic Impact Assessment, including swept paths and recommendations for upgrade works based on existing conditions. - Removal of new intersection on Strzelecki Highway at Shire Council boundary. - Arborist assessment findings implemented to reduce indirect impacts where patches and/or trees were deemed to remain viable. 	<ul style="list-style-type: none"> - Total (direct and indirect) impact of 12.344 ha (inclusive of 49 large trees).

The initial project design was developed using simplified engineering assumptions to determine the overall impact footprint. These design assumptions and inputs have been refined through a series of iterations as information has been provided by contractors and technical specialists.

3.2 Project Design to inform EES referral

A concept infrastructure layout (Layout v1.5) that comprised 53 wind turbines was used as the basis for determining the scope of the initial field surveys. A total of 64.455 hectares of native vegetation (including 201 large trees) was calculated as potentially being impacted, including some Strzelecki Gum.

Following the results of the preliminary ecological and other environmental, technical and community impact assessments, the infrastructure layout was adjusted to reduce impacts to ecological values across the study area, with a particular focus on areas of native vegetation, amongst other planning and social considerations. A Revised Layout (Layout v2.2) was referred under the *Environmental Effects Act 1978* based on 35 wind turbines and associated infrastructure.

The following design assumptions were applied to the project infrastructure to determine the ground footprint area:

- Wind turbine foundations and hardstands applied based on wind turbine manufacturer specifications (worst case sizing based on several different manufacturer specifications available at the time). A vegetation free zone of a minimum of 50-metre radius was applied for fire protection purposes;
- Existing GIS information (public and HVP datasets) was used to determine the centreline of existing public roads and forestry tracks;
- A 20-metre wide impact footprint (10 metres either side of the centre line) was applied to all public roads, existing forestry tracks to be upgraded, and new access tracks;

- A 10-metre wide impact footprint (5-metres from cable centre line) for underground cable alignments was applied, with cables being aligned 5-metres from track centre lines and 5-metres from other cables (where alignments co-exist); and
- A 5-metre construction impact width added to the proposed actual bench area for temporary and permanent facilities and buildings.

Table 6. Preliminary native vegetation impacts for the Delburn Wind Farm (EES referral).

Scenario	Description	Impact	Offset requirement
1. Direct impact only	Proposed area of direct native vegetation removal and does not account for TPZs for large trees in patches	15.604 ha 96 trees	0.517 GHUs 10.995 SHUs for Strzelecki Gum 96 Large Trees
2. Total impact (direct and indirect)	Accounts for direct native vegetation loss and a 17-metre buffer to accommodate the TPZs for large trees in patches	41.412 ha 154 trees	0.509 GHUs 32.331 SHUs for Strzelecki Gum 7.084 SHUs for Grey Goshawk 154 Large Trees

3.3 Design Refinements to inform a Planning Permit Application

Following the referral under the *Environmental Effects Act 1978*, the project design has evolved to further respond to the outcomes of the detailed technical and planning assessments, and to further avoid and minimise impacts on native vegetation where possible. A preliminary infrastructure layout (Layout v3.5) consisting of 33 wind turbines has been refined with the following design assumptions applied to the necessary infrastructure to determine the updated ground impact area:

- Wind turbine foundations and hardstands applied the largest disturbance footprint from a range of manufacturer specifications and a vegetation free zone of a minimum 50-metre radius was applied for fire protection purposes (Appendix 4);
- The centreline of existing public roads and forestry tracks was confirmed using high-resolution, high accuracy geo-referenced aerial imagery, particularly in areas where native vegetation patches or trees were present;
- Access roads and underground cable alignments and cross-sections were designed according to specifications provided by Vestas (a leading wind turbine manufacturer) for forestry-based wind farm projects (Appendix 4 – Scenarios 1-5), including the following general specifications;
 - Total formed road width of 6-metres (4.5-metre heavy vehicle trafficable width plus shoulders), plus drainage of 3-metres and a 5-metre general construction impact area on either side of the road;
 - Underground cabling construction width of 10-metres, with parallel cables to be spaced 6-metres apart (measured from centrelines);

- Where access or underground cable alignments follow existing forestry roads with native vegetation or scattered trees on one side of the road alignment only (Appendix 4 – NV Scenarios 1-3), the following additional design constraints were applied;
 - New road pavement (as part of the road upgrade works) to be constructed on the plantation side of the existing track only;
 - Underground cabling to be installed on the plantation side of the existing track only;
 - Drainage works on the native vegetation side of the existing tracks to be limited to cleaning out of existing drains, with plant to operate from the existing road surface only;
- Public road upgrade assumptions were informed by the Traffic Impact Assessment (TIA) undertaken by AECOM for the project, which include a 6-metre horizontal and 6-metre vertical clearance for over-dimensional transport deliveries, 6-metre trafficable width requirements (4.5-metre heavy vehicle trafficable width plus shoulders), swept path turns at critical intersections and corners for over-dimensional blade deliveries, and the following specific road treatments:
 - Deans Road (existing approx. 4-metre pavement width) to be graded, re-sheeted and have overtaking bays installed only (at locations which maximise sight distance and minimise impacts on native vegetation);
 - Golden Gully Road (existing approx. 4-metre to 6-metre pavement width) to be graded, re-sheeted and widened by up to 2-metres on one side only (side of road alignment with least impact on native vegetation);
 - Smiths Road (existing approx. 6-metre pavement width) to be graded and re-sheeted only (no new disturbance works other than at intersections);
 - Creamery Road (existing approx. 6-metre pavement width) to be graded and re-sheeted only (no new disturbance works other than at intersections);
- A 5-metre construction impact width added to the proposed bench area for temporary and permanent facilities and buildings.

The updated design footprint avoids both direct and indirect impacts to Strzelecki Gums and impacts to potential Growling Grass Frog habitat have been further minimised to remove any underground cable crossing adjacent to suitable habitat, particularly on Nursery Track.

Where additional creek crossings are necessary to allow access to wind turbine sites, crossing locations have been chosen to avoid Strzelecki Gum and Growling Grass Frog habitat, and also avoid and minimise impacts on native vegetation and aquatic habitat. This has been achieved by careful site selection, in particular, wherever possible, selecting existing forestry road crossings.

A proposed intersection off Strzelecki Highway at the Latrobe and South Gippsland LGA boundary (using existing forestry access north and south of the highway) was removed from the infrastructure design and alternative access arrangements were designed within the plantation area, resulting in a significant reduction in impacts on remnant roadside vegetation along the Strzelecki Highway corridor.

An Arboricultural assessment (Homewood 2020) (Appendix 6) was undertaken to determine the extent of indirect impacts on the tree protection zones of Large Trees and patches in areas where existing forestry tracks are located adjacent to native vegetation. Large trees which will be directly impacted or with significant TPZ encroachment were not assessed. The assessment concluded that provided the works are undertaken in the

proposed manner, greater than 95% of the assessed patches (and trees located within them) would remain viable.

Table 7. Refined native vegetation impacts for the Delburn Wind Farm (excluding the terminal station).

Scenario	Description	Impact	Offset requirement
1. Direct impact only	Proposed area of direct native vegetation removal and does not account for TPZs for large trees in patches	5.669 ha 20 large trees (in patches and scattered large trees)	2.689 GHUs 20 large trees
2. Total impact (direct and indirect)	Accounts for direct native vegetation loss and a 15-metre buffer to accommodate the TPZs for large trees in patches	12.344 ha 49 large trees (in patches and scattered large trees)	0.375 GHUs for the WEF (i.e. excluding the terminal station option) 9.492 SHUs for Strzelecki Gum 49 Large Trees for the WEF (i.e. excluding the terminal station option)

Note: Buffer reduced from 17-metres to 15-metres per advice from DELWP Gippsland.

3.4 Design and Impact Assessment Comparison

A comparison of design assumptions and native vegetation impacts for the project at and post EES referral are provided below (Table 8).

Table 8. Design assumptions for the Delburn Wind Farm layout evolution (WEF and terminal station).

Description	Simplified Assumptions Layout v2.2	Refined Assumptions Layout v3.5	Changes
Project Infrastructure Footprint			
Wind turbines (WTGs)	35	33	Reduced by 2
Wind turbine foundation and hardstand	Boom crane hardstand sizing for 155-metre rotor wind turbine, plus additional 5-metre construction zone 50-metre radius fire APZ around WTG base	Boom crane hardstand sizing for 162-metre rotor wind turbine, including additional 15-metre construction zone (refer to Appendix 4) 50-metre radius fire APZ around WTG base	Slight increase in area, all impacts located within plantation timber only
Access tracks	20-metre width	22-metre width (refer to Appendix 4)	Slight increase in area. Alignments modified to further avoid and minimize impact

Description	Simplified Assumptions Layout v2.2	Refined Assumptions Layout v3.5	Changes
Underground cable	10-metre width	10-metre width (refer to Appendix 4)	No change in area. Alignments modified to further avoid and minimize impact
Public road upgrades	20-metre width	Consistent with Traffic Impact Assessment, a 6-metre trafficable road surface and 6-metre vertical clearance, swept path turns designed at critical intersections and corners	Significant reduction in impact footprint along native vegetation corridors
Battery energy storage system (BESS) facility	1 x 1.5 ha (Varys Track)	1 x 1 ha (Varys Track)	Microsited to avoid native vegetation impacts
O&M facility	1 x 1 ha (Smiths Road)	1 x 1 ha (Smiths Road)	No change in area, relocated to overlap area with temporary construction disturbance
Visitor information area	1 x 0.5 ha (Smiths Road)	2 x 0.5 ha (Smiths Road)	Increase in area, no increase in native vegetation impacts
Met masts	3 x permanent masts 20-metre width along guy wires, 10-metre width along cable alignments	3 x permanent masts 20-metre width along guy wires, 10-metre width along cable alignments	No change
Temporary construction compounds	1 x 2 ha (Smith Road, primary compound) 2 x 1 ha (Smiths Road, batch plants) 2 x 0.5 ha (Varys Track, BESS and TS)	1 x 2 ha (Smith Road, primary compound) 2 x 1 ha (Smiths Road, batch plants) 2 x 0.5 ha (Varys Track, BESS and TS)	No change
Impact and Offset Assessment			
Impact assessment methodology	Guidelines (DELWP 2017b)	Guidelines (DELWP 2017b), adjusted for 15-metre buffer and outcomes of arboricultural assessment	Refined assessment based on additional information obtained
Direct Impact	15.604 ha 96 trees	5.669 ha 20 large trees	Impact reduction by approx. 2/3
Total (direct and indirect) Impact	41.412 ha 154 trees	12.344 ha 53 large trees	Impact reduction by approx. 2/3

Description	Simplified Assumptions Layout v2.2	Refined Assumptions Layout v3.5	Changes
Total Offset Requirement	0.509 GHUs 32.331 SHUs for Strzelecki Gum 7.084 SHUs for Grey Goshawk 154 Large Trees	1.058 GHUs (0.375 GHUs for the WEF only – i.e. excluding the terminal station option) 9.492 SHUs for Strzelecki Gum 53 Large Trees (49 Large Trees for the WEF only – i.e. excluding the terminal station option)	Significant reduction in SHUs and trees by approx. 2/3

Significant avoidance, of approximately 2/3 of that referred under the *Environment Effects Act*, in direct and indirect impacts on native vegetation has been achieved through design refinements.

3.4.1 Further avoidance and mitigation potential

The current project impact assessment assumes that underground cabling is installed by open trenching or direct bury construction methods, resulting in worst case scenario calculations with respect to impacts on flora and fauna. Installation of cabling by direct drilling, particularly when crossing sensitive waterways and other habitat, and major roadways, may further avoid or minimise impacts of sensitive habitats.

Directional drilling will be undertaken in consultation with drilling engineers and a qualified arborist during the detailed design and construction phases of the project to determine the feasibility of direction drilling locations across the project. It is acknowledged that any additional reductions in native vegetation and habitat impacts following the application to remove native vegetation being lodged will not result in lower offsets being required. They would, however, provide better ecological outcomes for the project, and therefore, the project will continue to seek to further minimise impacts on the local environment wherever possible.

4 RESULTS

A total of 65 flora species (including 51 native species and 14 introduced species), and 111 fauna species (103 native species and eight introduced species) were recorded during the detailed field surveys (Appendix 2.1 and 3.1).

4.1 Vegetation Condition

4.1.1 Patches of Native Vegetation

Two modelled bioregions intersect the study area: Gippsland Plain and Strzelecki Ranges. However, considering the geographic context of the study area, and following native vegetation assessments, there is a high level of confidence that all EVCs surveyed are representative of the Strzelecki Ranges bioregion. A defining characteristic of the Strzelecki Ranges bioregion is that the locality is within the Strzelecki Ranges themselves. The geography of the study area consists of moderate to steep slopes with sandstone, siltstone, shales and swampy alluvial fans in the depressions. The mapped native vegetation includes Damp Forest and Lowland Forest, which are dominant EVCs for this bioregion. In contrast, the Gippsland Plain is comprised of flat low lying coastal and alluvial plains with undulating terrain which is not representative of the study area.

Native vegetation within the study area is representative of seven EVCs, including Aquatic Herbland (EVC 653), Damp Forest (EVC 29), Herb-rich Foothill Forest (EVC 23), Lowland Forest (EVC 16), Swamp Scrub (EVC 53), Swampy Woodland (EVC 937) and Tall Marsh (EVC 821).

This assessment is broadly consistent with (Pre-1750s) DELWP modelled EVCs for the locality, with four modelled EVCs aligning with vegetation mapping: Damp Forest, Herb-rich Foothill Forest, Lowland Forest, Swamp Scrub (Figure 4).

A total of 241.04 hectares of native vegetation (excluding scattered trees) was mapped within the broader study area during the field surveys. In addition, 46.96 hectares of DELWP modelled Current Wetland is also within the study area. The extent of mapped wetlands within and surrounding the study area is shown in Figure 8. Specific details relating to mapped EVCs identified in or adjacent to the impact area during 2018-20 surveys and their Biodiversity Conservation Status (BCS) are provided below, with a summary of the extent of each vegetation type provided below (Table 9).

Table 9. Extent of mapped vegetation type (EVC) and BCS within the surveyed area based on field surveys.

Bioregion	EVC	BCS	Mapped Area (ha)
Strzelecki Ranges	Aquatic Herbland (EVC 653)	Not specified	0.69
	Damp Forest (EVC 29)	Endangered	65.62
	Herb-rich Foothill Forest (EVC 23)	Endangered	115.00
	Lowland Forest (EVC 16)	Vulnerable	44.53
	Swamp Scrub (EVC 53)	Endangered	0.11
	Swampy Woodland (EVC 937)	Endangered	14.34
	Tall Marsh (EVC 821)	Not specified	0.75

4.1.1.1 Aquatic Herbland

Aquatic Herbland is typically a permanent to semi-permanent wetland dominated by submerged or floating to emergent aquatic herbs and sedges. It generally occurs within continuously inundated wetlands and floodplains where creeks and rivers broaden and decrease in flow (Oates and Taranto 2001).

Aquatic Herbland is present within some permanent waterbodies (dams) in the study area, with most patches dominated by one of, or a combination of Tall Spike-sedge *Eleocharis sphacelata*, Common Reed *Phragmites australis* or Rush *Juncus* spp. Although these wetlands have previously been modified and do not constitute natural wetlands, they support a range of indigenous aquatic herbs, sedges and rushes with eucalypts often along the fringes.

The tall aquatic species Tall Rush *Juncus procerus* was present in low densities. Submerged and floating aquatic species include Ferny Azolla *Azolla pinnata*, Round Water-starwort *Callitriche muelleri* and Slender Knotweed *Persicaria decipiens*. Species present along the fringes of the waterbodies include Common Spike-sedge *Eleocharis acuta*, Swamp Club-sedge *Isolepis inundata* and Billabong Rush *Juncus usitatus* (Plate 1 and 2).



Plate 1. Aquatic Herbland within the study area (Ecology and Heritage Partners Pty Ltd 22/03/2019).



Plate 2. *Juncus* sp. within the study area (Ecology and Heritage Partners Pty Ltd 22/03/2019).

4.1.1.2 Damp Forest

Damp Forest grows on a wide range of geologies on well-developed generally colluvial soils on a variety of aspects, from sea level to montane elevations. Dominated by a tall eucalypt tree layer to 30m tall over a medium to tall dense shrub layer of broad-leaved species typical of wet forest mixed with elements from dry forest types. The ground layer includes herbs and grasses as well as a variety of moisture-dependent ferns (DELWP 2020c).

Canopy trees observed included Swamp Gum *Eucalyptus ovata* and Mountain Grey Gum *Eucalyptus cypellocarpa* along with midstorey species such as Blackwood *Acacia melanoxylon*, Prickly Moses *Acacia verticillata* and Blanket Leaf *Bedfordia arborescens*. Patches composed of only understorey species were typically dominated by Bracken *Pteridium esculentum*, Common Bulrush *Typha domingensis* and Common Reed *Phragmites australis* (Plate 3 and 4).



Plate 3. Damp Forest within the study area (Ecology and Heritage Partners Pty Ltd 21/03/2019).



Plate 4. Damp Forest within the study area (Ecology and Heritage Partners Pty Ltd 21/03/2019).

4.1.1.3 Herb-rich Foothill Forest

Herb-rich Foothill Forest is typically an open forest with an understorey supporting shrubs and bracken with a diversity of grasses and herbs. The overstorey is typically dominated by Messmate Stringybark *Eucalyptus obliqua* and Narrow-leaf Peppermint *Eucalyptus radiata*, however several other eucalypt species can also occur. It generally occurs on relatively fertile, well-drained soils in foothill areas with moderate rainfall (Oates and Taranto 2001).

Herb-rich Foothill Forest is the dominant EVC within the study area and generally occurs south of the ridge line on the south-facing slopes. Although Messmate Stringybark and Narrow-leaf Peppermint are present, the dominant overstorey species is Mountain Grey-gum *Eucalyptus cypellocarpa*. The understorey component ranges from dominance by shrubs, herbs and native grasses to introduced pasture grasses.

Typical native species present in the understory include Austral Bracken, Hop Goodenia *Goodenia ovata*, Prickly Moses, Weeping Grass *Microlaena stipoides* var. *stipoides*, Wattle Mat Rush *Lomandra filiformis*, Common Heath *Epacris impressa*, Thatch Saw-sedge *Gahnia radula*, and Dusty Miller *Spyridium parvifolium*.



Plate 5. Herb-rich Foothills Forest within the study area (Ecology and Heritage Partners Pty Ltd 22/03/2019).



Plate 6. Herb-rich Foothills Forest within the study area (Ecology and Heritage Partners Pty Ltd 14/11/2018).

4.1.1.4 Lowland Forest

Lowland Forest is typically an open forest dominated by Messmate Stringybark and Narrow-leaf Peppermint with an understorey of shrubby ericoid species, saw-sedges and wire-grasses. It generally occurs within lowland plains and lower foothill slopes on moderately fertile soils (Oates and Taranto 2001).

Lowland Forest generally occurs within the drier areas on north and east-facing slopes within the far eastern and far western portion of the study area (Figure 2; Figure 3). It is generally dominated by Messmate Stringybark, Narrow-leaf Peppermint and Silverleaf Stringybark *Eucalyptus cephalocarpa*. However, Lowland Forest also supports Mountain Grey-gum *Eucalyptus cypellocarpa* and Manna Gum *Eucalyptus viminalis* subsp. *viminalis* (Plate 7 and 8). In most cases, areas containing Lowland Forest vegetation are contiguous with remnant vegetation in adjoining properties to the east and west of the study area (Figure 2; Figure 3).

The understorey within Lowland Forest mapped within the study area is generally of high quality, supporting a high cover of indigenous shrubs, sedges, herbs and grasses including Blackwood Wattle, Prickly Tea-tree *Leptospermum continentale*, Trailing Ground-berry *Acrotriche prostrata*, Tall Sundew *Drosera auriculata*, Common Raspwort *Gonocarpus tetragynus*, Shining Pennywort *Hydrocotyle sibthorpiodes*, Common Heath, and Weeping Grass.



Plate 7. Lowland Forest within the study area (Ecology and Heritage Partners Pty Ltd 22/03/2019).



Plate 8. Lowland within the study area (Ecology and Heritage Partners Pty Ltd 13/11/2018).

4.1.1.5 Swamp Scrub

Swamp Scrub typically occurs at low elevations along nutrient rich streams or on poorly drained sites. It is generally dominated by thickets of Swamp Paperbark *Melaleuca ericifolia* which out-compete other species. Ground cover often consists of herbaceous species and moss/lichen/liverworts. Swamp Scrub occurs as small pockets in gullies and natural depressions within the study area.

4.1.1.6 Swampy Woodland

Swampy Woodland generally occupies streambanks within the foothills and plains, and typically comprised of a combination of shrubs and tussock grasses underneath a eucalypt canopy (DELWP 2020c).

Swampy Riparian Woodland is located throughout the impact area in association with creeklines (Figure 2; Figure 3). A total of five habitat zones are present, with most zones supporting a Swamp Gum overstorey, with Woolly Tea-tree *Leptospermum lanigerum* and Prickly Tea-tree *Leptospermum continentale* dominating the shrub layer. Tussock grasses and other graminoids were typically absent from this EVC (Plate 9 and 10).



Plate 9. Swampy Woodland within the study area (Ecology and Heritage Partners Pty Ltd 22/03/2019).



Plate 10. Swampy Woodland within the study area (Ecology and Heritage Partners Pty Ltd 21/03/2019).

4.1.1.7 Tall Marsh

Tall Marsh (EVC 821) occurs primarily on estuarine sands, peaty soils and silty clays in areas with an average rainfall of approximately 600mm. Occurring close to open grasslands, Tall Marsh is generally dominated by Common Reed *Phragmites australis* and Cumbungi *Typha* spp.

Small patches of native vegetation identified as Tall Marsh were identified across the study area in both the northern and southern sections (Plate 11 and 12).



Plate 11. Tall Marsh within the study area (Ecology and Heritage Partners Pty Ltd 22/03/2019).



Plate 12. Tall Marsh within the study area (Ecology and Heritage Partners Pty Ltd 22/03/2019).

4.1.2 Large Trees and Scattered Trees (including Hollow-bearing Trees)

A total of 379 large trees in patches (excluding Strzelecki Gum) were recorded in or adjacent to the impact area (Appendix 2.3). Eighty-one large scattered trees and 41 small scattered trees (excluding Strzelecki Gums) were recorded. The most common species recorded were Mountain Grey Gum, Messmate and Manna Gum.

A total of 178 Strzelecki Gums (including three large scattered trees) were identified. All impacts to Strzelecki Gum have been avoided through design refinements (Appendix 2.3).

When a 15-metre buffer is applied to the impact area to account for the Tree Protection Zones (TPZs) of large trees in patches, 49 large trees (within patches and scattered trees) are proposed to be impacted. Of the trees proposed to be impact approximately 26 trees support hollows or fissures (Appendix 2.3).



Plate 13. Strzelecki Gum scattered tree (Ecology and Heritage Partners Pty Ltd 06/08/2019).



Plate 14. Large tree within patch in study area (Ecology and Heritage Partners Pty Ltd 22/03/2019).

4.1.3 Introduced and Planted Vegetation

4.1.3.1 Introduced Vegetation

Current land uses such as forestry operations and agriculture have resulted in the introduction of non-native vegetation, particularly in road reserves. Disturbed areas are dominated by environmental weeds such as Cocksfoot *Dactylis glomerata* and Paspalum *Paspalum* spp.

Noxious weeds are present throughout the study area, with scattered occurrences of Soursob *Oxalis pes-caprae* and Spear Thistle *Cirsium vulgare*, along with the Weeds of National Significance (WONS): African Boxthorn *Lycium ferocissimum* and Blackberry *Rubus fruticosus* spp. agg.

4.1.3.2 Planted Vegetation

Planted vegetation within the study area is dominated by Pine *Pinus radiata* plantation coupes. Tasmanian Blue gum *Eucalyptus globulus* plantations are also present.

4.1.4 Fauna Habitat

The study area contains patches of remnant native vegetation with a high density of large trees, which provide important habitat for an array of native species. Arboreal mammals such as gliders and many species of birds (i.e. parrots, owls) utilise tree hollows for nesting and/or denning. The largest patch (320 hectares in area) adjoining the eastern boundary of the study area is referred to as the Darlimurla Forest Block (Biosis 1998). Sayers Trig Bushland Reserve (north) and Mirboo North Regional Park (south) are also directly adjacent to the study area and combined with remnant vegetation in road reserves (e.g. large trees), enhance connectivity and act as dispersal corridors for fauna. While the native vegetation within the study area is patchy, there is connectivity along road reserves, to riparian corridors or to larger patches of native vegetation within reserves or regional/state parks bordering the study area.

Riparian habitat acts as important dispersal corridors for native flora and fauna. The Morwell River to the east connects with Stony Creek which passes through the study area. Such connectivity is important in a landscape that has largely been cleared for agricultural purposes. Wildlife corridors and 'stepping stones' of vegetation have numerous benefits to native flora and fauna populations, particularly in modified landscapes where much of the surrounding vegetation is restricted to linear strips along roadsides.

Fauna of interest (non-threatened) recorded in the study area during the site surveys include Wedge-tailed Eagle *Aquila audax*, Koala and Yellow-tailed Black-Cockatoo *Calyptorhynchus funereus*. Koala was observed in remnant forest patches within the study area during nocturnal spotlighting surveys (Figure 7). It was also heard during nocturnal surveys. It is not expected that the proposed wind farm will have an impact on the local Koala population(s), as the area of native vegetation proposed to be removed is primarily restricted to existing tracks or cleared areas (i.e. pine plantations) and does not intersect any larger forest patches. It is understood that the *National Koala Conservation and Management Strategy 2009 – 2014* (DEWHA 2009b) will be referred to during the final planning stages of the proposed wind farm. It is understood that removal of native vegetation within the study area will be conducted by HVP contractors and therefore HVP's Koala Protocols will apply.

4.2 Avifauna and Bat Surveys

4.2.1 Bird Utilisation

Overview

Seventy-five (75) bird species were recorded, consisting of 1,947 individuals, during the fixed-point bird counts. Three other species were identified to generic level (i.e. Raven species, either Little Raven *Corvus mellori* or Australian Raven *C. coronoides* as well as Cuckoo and Honeyeater species). Three introduced species were recorded, including Blackbird, Indian Mynas and Starlings. No national or state significant species were recorded within the study area. The most commonly recorded species were Australian Magpie *Gymnorhina tibicen* (recorded during 62% of surveys), Crimson Rosella *Platycercus elegans* (60%), and Grey Fantail *Rhipidura albiscapa* (67%).

A total of 57% of bird observations made during the point counts were of individuals that were either on the ground or flying at or below the Rotor Swept Area. A further 42% did not have their height recorded as they were obscured from vision. Birds observed flying at Rotor Swept Area include Yellow-tailed Black Cockatoo *Calyptorhynchus funereus*, Little or Australian Raven, Common Bronzewing *Phaps chalcoptera* and Pied Currawong *Strepera graculina*. All species observed within the Rotor Swept Area were common birds and not listed as threatened on DELWP's Advisory list or listed under the EPBC Act or FFG Act. No birds recorded

during the bird utilisation surveys or recorded during the detailed field surveys are defined as ‘species or interest’ as outlined in Lumsden *et al.* (2019) (see Section 6.5).

A number of other bird species were also recorded (see Appendix 3.1 for full species list), including:

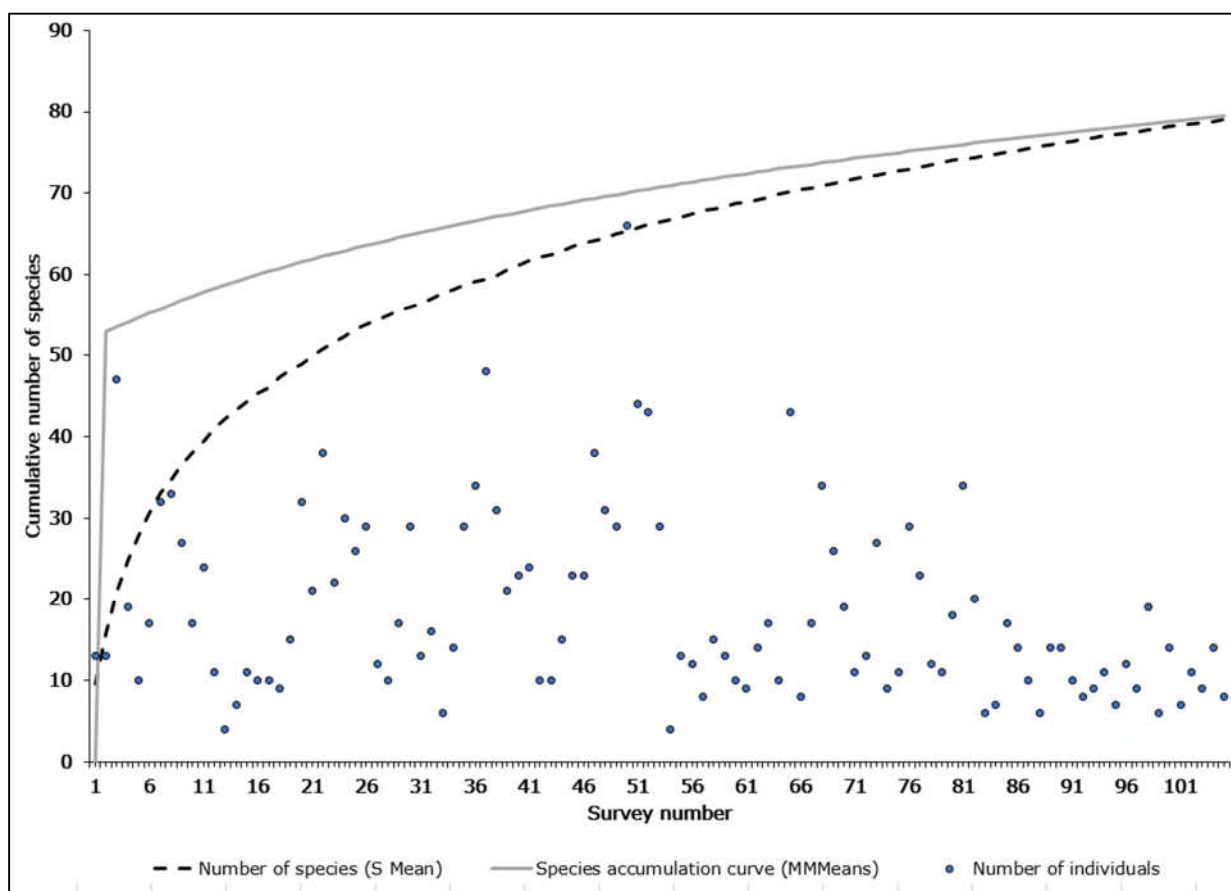
- Generalist bird species common in disturbed areas, such as Noisy Miner *Manorina melanocephala*, Australian Magpie and Australian Raven;
- Woodland bird species using larger patches of native and non-native vegetation around the site such as Yellow-faced Honeyeater *Lichenostomus chrysops*, Brown Thornbill *Acanthiza pusilla*, Grey Shrike Thrush *Colluricincla harmonica*, Yellow-tailed Black Cockatoo *Calyptorhynchus funereus* and Superb Lyrebird *Menura novaehollandiae*;
- Water bird species using dams and streams in the study area including Sacred Kingfisher *Todiramphus sanctus*, Australian Wood-duck *Chenonetta jubata*, Australian White Ibis *Threskiornis moluccus* and Cormorant species;
- Raptors foraging over open areas, roadsides and the creek lines, including Black-shouldered Kite *Elanus axillaris*, Wedge-tailed Eagle *Aquila audax*, and Nankeen Kestrel *Falco cenchroides*; and,
- Exotic species including Starlings, Indian Myna and Blackbird which were widespread across the landscape.

The incidental records include a number of bird species of a similar diversity to species recorded in point bird counts with the addition of two raptor species – Wedge-tailed Eagle in the south-western section of the study area, Black-shouldered Kite *Elanus axillaris* – as well as woodland species Flame Robin *Petroica phoenicea* and large flocks of Yellow-tailed Black Cockatoo.

Species Richness

The predicted species richness estimate for the point count surveys was 80 species, which converts to a completeness of 98% and means that approximately 1-2 unknown species were present in the study area during the study period, but not recorded during this survey. As such, the study appears to reach asymptote (or plateau) after six months of survey. The results show a clear relationship between effort and the number of species detected. While fewer individuals were detected late in the survey period, this may be an indication of varied species richness, habitat type, time of year studied and potentially other factors (such as inclement weather reducing presence of species).

Graph 1. Species accumulation curve across the entire survey period.



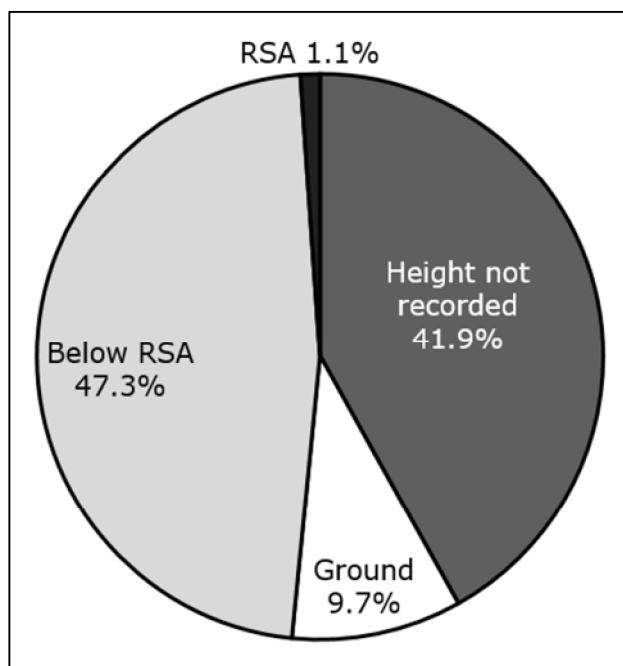
Flight Heights

The majority of bird species observed (57%) during the point counts were either recorded on the ground or flying below the RSA. Only 1.1% of bird species were in the RSA, including Yellow-tailed Black Cockatoo and Pied Currawong. No raptors were observed in the RSA. Bird point count survey locations were distributed fairly evenly across the study area and capture a representative sample of vegetation and habitat type. Given the majority of the study area is eucalypt and pine forest, most bird point count survey locations are situated in forested areas. This may be a factor in the low number of birds observed in the RSA, with birds predominantly moving between canopy trees at no greater than canopy height.

Table 10. Summary of birds recorded at the varying flight heights.

Flight Height	# of birds	% of birds
Height not recorded (heard only)	833	41.9%
Ground (0-1 metres)	193	9.7%
Below RSA (1-40m)	941	47.3%
RSA (40-250m)	22	1.1%
Above RSA (>250m)	0	0.0%

Graph 2. Percentage of birds recorded below (RSA), at or, above rotor swept area (RSA) height (40 – 250 metres), during the survey period. Note no species were recorded above RSA, although several parrot and raptor species are likely to utilise heights within and above RSA.



While not observed at RSA height, Wedge-tailed Eagles *Aquila audax* were recorded within the study area and are likely to fly at and above RSA when foraging. Large parrots, including Gang Gang Cockatoo *Callocephalon fimbriatum* and Sulphur-crested Cockatoos *Cacatua galerita*, whilst recorded below RSA, may also fly in the RSA as they move daily between roosts and feeding areas. No significant wetlands are present in or near the study area, however some waterbird species recorded during point count surveys – such as White-faced Heron *Egretta novaehollandiae* – may fly in the RSA when moving between habitat areas. The study area was driven extensively and very few water birds likely to fly in the RSA were identified flying overhead.

Generally, non-passerine birds such as raptors, wetland/waterbirds and parrots generally have flight characteristics that make them prone to collisions with wind turbines. These species are usually larger, less mobile, occur in flocks (particularly parrots) and forage in more open areas. Some minor changes in local distribution and abundance of these species may be expected as a consequence of ongoing operation of the turbines. However, these impacts are not expected to be significant (i.e. localised). A summary of species recorded during point count surveys and associated flying heights against RSA is provided in (Table 8).

Table 11. Number of instances of bird species recorded in Point Count Surveys classified according to the RSA at which they were detected (excluding incidental records).

Species	Height not observed	Below RSA	Ground	RSA	Total
Australian King Parrot	6	0	4	0	10
Australian Magpie	52	23	73	0	148
Australian Raven	21	4	31	1	57
Australian White Ibis	0	0	1	0	1
Australian Wood Duck	18	13	21	0	52
Bell Miner	3	0	0	0	3

Species	Height not observed	Below RSA	Ground	RSA	Total
Black-faced Cuckoo Shrike	0	0	2	0	2
Brown Thornbill	25	10	87	0	122
Common Blackbird	6	9	9	0	24
Common Bronzewing	2	0	1	1	4
Crescent Honeyeater	2	0	16	0	18
Crested Shrike-tit	1	0	0	0	1
Crested Pigeon	0	0	3	0	3
Crimson Rosella	69	0	154	0	223
Cuckoo	1	0	1	0	2
Eastern Rosella	6	0	8	0	14
Eastern Spinebill	12	0	2	0	14
Eastern Whipbird	34	1	1	0	36
Eastern Yellow Robin	14	0	5	0	19
Eurasian Coot	3	0	0	0	3
Welcome Swallow	0	0	20	0	20
Fan-tailed Cuckoo	6	0	0	0	6
Flame Robin	0	0	2	0	2
Galah	7	0	8	0	15
Gang Gang Cockatoo	1	0	3	0	4
Golden Whistler	17	0	4	0	21
Grey Butcherbird	11	0	1	0	12
Grey Currawong	11	3	12	0	26
Grey Fantail	41	5	25	0	71
Grey Shrike Thrush	45	1	15	0	61
Hoary-headed Grebe	0	1	1	0	2
Indian Myna	1	6	8	0	15
Intermediate Egret	2	0	0	0	2
Laughing Kookaburra	22	5	19	0	46
Little Black Cormorant	1	0	3	0	4
Little Corella	3	0	0	0	3
Little Pied Cormorant	2	0	4	0	6
Little Raven	9	1	26	1	37
Little Wattlebird	0	0	1	0	1
Magpie Lark	23	14	15	0	52
Nankeen Kestrel	0	0	1	0	1
New Holland Honeyeater	1	0	0	0	1
Noisy Miner	8	0	7	0	15
Pacific Black Duck	4	0	6	0	10
Peaceful Dove	1	0	0	0	1
Pied Currawong	22	3	17	1	43
Purple Swamp-hen	0	1	2	0	3
Rainbow Lorikeet	0	0	2	0	2
Raven	1	0	0	0	1
Red Wattlebird	25	0	14	0	39

Species	Height not observed	Below RSA	Ground	RSA	Total
Red-browed Finch	0	2	0	0	2
Rufous Whistler	17	0	1	0	18
Sacred Kingfisher	0	0	1	0	1
Silvereye	0	0	1	0	1
Spotted Dove	2	0	0	0	2
Spotted Pardalote	31	0	2	0	33
Starling	0	0	2	0	2
Straw-necked Ibis	0	0	3	0	3
Striated Pardalote	4	0	0	0	4
Striated Thornbill	1	0	20	0	21
Sulphur-crested Cockatoo	2	0	0	0	2
Superb Fairy-wren	24	61	48	0	133
Superb Lyrebird	19	15	15	0	49
Thornbill	1	0	0	0	1
Unknown honeyeaters	0	0	3	15	18
Weebill	7	0	4	0	11
White-browed Scrub-wren	29	8	17	0	54
White-faced Heron	0	0	3	0	3
White-plumed Honeyeater	13	1	4	0	18
White-throated Treecreeper	33	0	20	0	53
Willie Wagtail	5	2	2	0	9
Wonga Pigeon	2	0	0	0	2
Yellow Thornbill	10	1	28	0	39
Yellow-faced Honeyeater	18	0	7	0	25
Yellow-rumped Thornbill	0	0	23	0	23
Yellow-tailed Black Cockatoo	76	3	101	3	183

Note. Ground 0-1 metres; Below RSA – 1-39 metres; RSA 40-250 metres; Above RSA > 250 metres.

Raptors

No raptors were observed flying in the RSA. However, several raptors species were observed in or near the study area, including Black-shouldered Kite, Wedge-tailed Eagle, Black-shouldered Kite and Nankeen Kestrel (Appendix 3.1). While not observed at RSA height, Wedge-tailed Eagle was recorded flying overhead within the study area and are likely to fly at and above RSA when foraging. Based on the results of the bird utilisation surveys, the proposed wind farm footprint may be located within the territory of at least one pair of Wedge-tailed Eagles.

Raptors in general accounted for a low percentage (<1%) of birds recorded within and adjacent to the wind farm during the bird surveys.

4.2.2 Bat Surveys

Desktop Review

The database search of the VBA (DELWP 2019a) contained records for 12 microbat species; including Large Bent-wing *Miniopterus orianae oceanensis*, Gould's Wattled Bat *Chalinolobus gouldii*, Chocolate Wattled Bat *Chalinolobus morio*, White-striped Freetail Bat *Tadarida australis*, Lesser Long-eared Bat *Nyctophilus geoffroyi* and Little Forest Bat *Vespadelus vulturnus* within a 20 kilometre radius of the study area (Table 9). No significant bat species have previously been recorded within 10 kilometres of the study area (DELWP 2019a).

Table 12. Microbat species previously recorded within the wind farm locality (DELWP 2019a).

Microbat species	Victorian Biodiversity Atlas
White-striped Freetail Bat <i>Tadarida australis</i>	✓
Southern Forest Bat <i>Vespadelus regulus</i>	✓
Gould's Wattled Bat <i>Chalinolobus gouldii</i>	✓
Chocolate Wattled Bat <i>Chalinolobus morio</i>	✓
Little Forest Bat <i>Vespadelus vulturnus</i>	✓
Lesser Long-eared Bat <i>Nyctophilus geoffroyi</i>	✓
Large Bent-wing Bat <i>Miniopterus orianae oceanensis</i>	✓
Eastern Broad-nosed Bat <i>Scotorepens orion</i>	✓
Eastern False Pipistrelle <i>Falsistrellus tasmaniensis</i>	✓
Gould's Long-eared Bat <i>Nyctophilus gouldi</i>	✓
Large Forest Bat <i>Vespadelus darlingtoni</i>	✓
Southern Myotis <i>Myotis macropus</i>	✓

Bat Survey Results

Five native bat species (all common in the local area) were detected during the Anabat surveys, including White-striped Freetail Bat, Eastern False Pipistrelle *Falsistrellus tasmaniensis*, Gould's Wattled Bat, Chocolate Wattled Bat and Little Forest Bat (Table 9). With the exception of White-striped Freetail Bat, which is known to regularly fly within Rotor Swept Area, the remainder are expected to forage at lower heights around vegetation and waterbodies.

Nocturnal and Bat detector surveys were undertaken across the study area over several nights. While the study area falls within the distribution of, and supports potential habitat (eucalypt forests) for, Large Bent-winged Bat, no significant species (e.g. Grey-headed Flying-fox *Pteropus poliocephalus*, Large Bent-wing Bat or Yellow-bellied Sheath-tail-Bat *Saccolaimus flaviventris*) were detected within, or adjacent to the study area. A number of calls detected during surveys could not be identified to species level, including one call attributed to White-striped Freetail Bat or – less likely – Yellow-bellied Sheath-tail Bat (Table 10).

Table 13. Bat species detected across the study area during Anabat surveys.

Site	BS-01	BS-02	BS-05	BS-06
Number of Detections	330	11,277	16,496	14,052
Species				
White-striped Freetail Bat <i>Tadarida australis</i>				-
Eastern False Pipistrelle <i>Falsistrellus tasmaniensis</i>	-			
Gould's Wattled Bat <i>Chalinolobus gouldi</i>				
Chocolate Wattled Bat <i>Chalinolobus morio</i>	-	-		
Little Forest Bat <i>Vespadelus vulturnus</i>				
Not identified to species level				
White-striped Freetail Bat or Yellow-bellied Sheath-tail Bat <i>Tadarida australis</i> / <i>Saccolaimus flaviventris</i>	-	-		-
Nyctophilus spp. <i>Nyctophilus geoffroyi</i> / <i>Nyctophilus gouldi</i>	-			-
Forest Bat spp. <i>Vespadelus darlingtoni</i> / <i>V. Regulus</i>				
Eastern False Pipistrelle or Eastern Broad-nosed Bat	-	-		

4.2.3 Forest Owls

Although nocturnal surveys and active searching for evidence of the targeted forest owl species (i.e. pellets, white-wash, prey remains and/or use of hollows) in suitable habitats was undertaken across suitable habitats within the study area none of the targeted owls were detected. There is a moderate to high likelihood that Powerful Owl uses native vegetation within the study area for foraging and roosting activities, as it's known to occur in nearby areas such as Mirboo North Regional Park. The other owl species are less likely to occupy habitat within the study area.

4.3 Terrestrial Fauna Surveys

4.3.1 Habitat Connectivity

Adjoining the eastern boundary of the study area is approximately 320 hectares of remnant vegetation, referred to as the Darlimurla Forest Block. Sayers Trig Bushland Reserve (north), Mirboo North Regional Park (south west) and Mount Worth State Park (west) are also located several kilometres outside of the study area. Although these areas are not directly connected to the study area, there is a potential for more mobile fauna (e.g. birds and mammals) to move between these larger consolidated areas of habitat and the study area (e.g. through remnant native vegetation along roadsides). While the native vegetation within the study area largely occurs as isolated patches, some are connected to riparian corridors or vegetation within road reserves (e.g. Strzelecki Highway) or larger areas of forest adjoining the study area.

Riparian habitat acts as important dispersal corridors for native flora and fauna. The Morwell River to the east connects with Stony Creek which passes through the study area. Such connectivity is important in a landscape that has largely been cleared for agricultural purposes. Wildlife corridors and 'stepping stones' of vegetation have numerous benefits to native flora and fauna populations, particularly in modified landscapes where much of the surrounding vegetation is restricted to linear strips along roadsides. Some of the key benefits of habitat

patches and wildlife corridors associated with the maintenance of biodiversity on a local and landscape level include:

- Protection and ongoing maintenance of ecosystem functionality through the reduction of threatening processes (erosion, weed spread, hydrological alterations);
- Protection for populations of threatened species, or disturbance sensitive species (e.g. orchids) that may have been lost from the surrounding landscape;
- Provision of habitat (refuge, shelter, breeding opportunities) for a range of fauna either residing within corridors, or moving through the landscape;
- Maintenance of species richness and diversity;
- A source of seed dispersal for flora species sensitive to moderate levels of disturbance;
- Immigration of animals to supplement declining populations, thus reducing the likelihood of local extinctions;
- Availability of habitat for reintroduction following extinction events;
- Prevent demographic changes occurring in populations that may result from prolonged isolation from other populations of the same species by aiding gene flow, thus enhancement of genetic variation and prevention of inbreeding; and,
- Facilitating fauna movement through modified landscapes to more optimal habitats.

4.3.2 Ground-dwelling Fauna and Arboreal Mammals

Incidental records of common bird and mammal species were recorded during field assessments (Appendix 3.1). Species include Swamp Wallaby *Wallabia bicolor*, Koala *Phascolarctos cinereus*, and Short-beaked Echidna *Tachyglossus aculeatus*. A variety of common ground-dwelling species, including Common Wombat *Vombatus ursinus* and Common Brushtail Possum *Trichosurus vulpecula* were detected during camera trapping, while arboreal mammals (Sugar Glider *Petaurus breviceps*, Common Brushtail Possum and Common Ring-tailed Possum *Pseudocheirus peregrinus*) were also detected during spotlighting surveys.

While targeted surveys for Greater Glider were undertaken in potentially suitable habitat, under suitable survey conditions (warm, still nights, with no rain, fog or bright moonlight), the species was not recorded within the study area.

4.3.3 Growling Grass Frog Surveys

Two Growling Grass Frogs were observed during nocturnal surveys on the 14 November 2018 near a small pool/creekline in the centre of the study area (Plate 15) (Figure 7). They were recorded on either side of an existing dirt track, on the grassy banks of a small pool with fringing vegetation during call playback and spotlighting surveys. On the night when Growling Grass Frog was detected, it was a clear sky, ambient air temperature of 20.3°C, slight wind (25.9 kph), 55% relative humidity and no rainfall. A large chorus of Growling Grass Frog was also heard on 2 October 2019 at Luxford Pond (Figure 7).

Other common species, including Common Froglet *Crinia signifera*, Striped Marsh Frog *Limnodynastes peronii*, Peron's Tree Frog *Litoria peronii* and Eastern Banjo Frog *Limnodynastes dumerilii* (Plate 16) were recorded at several survey locations (e.g. wetlands, depressions, dams, creeklines) within the study area during site surveys (Plate 16).



Plate 15. Growling Grass Frog within the study area (Ecology and Heritage Partners Pty Ltd 14/11/2018).



Plate 16. Eastern Banjo Frog within the study area (Ecology and Heritage Partners Pty Ltd 15/11/2018).

4.3.4 Aquatic Fauna Habitat

Natural creeklines and pools exist throughout the study area. Artificial wetlands are also present and have been created by either being dug out or by damming a section of the catchment. The majority of dams provide moderate to high quality habitat to a diversity of aquatic fauna, including common native fish species. Artificial dams within and adjacent to the study area support a varying cover of aquatic habitat features (i.e. aquatic vegetation and good water quality) and have limited connectivity to downstream waterways which is likely to restrict the movement of aquatic species. The Morwell River flows in a northerly direction and is located to the east of the study area, while a number of wetlands (formed from natural depressions) are present within and surrounding the study area.

4.4 Nationally Significant Values

Matters of National Environmental Significance (NES) are listed and protected under the EPBC Act. Matters of NES relating to biodiversity are discussed below and are based on the results of the PMST (DAWE 2020), the review of literature and the results of field surveys.

4.4.1 Flora

The VBA contains records of four nationally significant species previously recorded within 10 kilometres of the study area (DELWP 2020d) (Table 14) (Appendix 2.4) (Figure 9). The PMST nominated an additional five nationally significant species which have not been recorded in the locality but have the potential to occur (DAWE 2020; Appendix 2.4). Strzelecki Gum was recorded at multiple locations throughout the study area (Figure 6). All records were associated with Herb-rich Foothill Forest and Swampy Woodland. As part of the design phase of the project, all Strzelecki Gums and their Tree Protection Zones (TPZs) have been avoided through the adjustment of the development footprint.

Of the nine nationally significant flora species that are known or predicted to occur within the locality, four were considered to have a low to moderate likelihood of occurrence within the study area (Appendix 2.4) (Table 14).

Table 14. Nationally significant flora within the study area.

Species	Suitable habitat within the study area	Known records
Strzelecki Gum <i>Eucalyptus strzeleckii</i>	Targeted surveys recorded the species along watercourses and wetter areas of Swampy Woodland and Herb-rich Foothill Forest (Ecology and Heritage Partners 2019, 2020a).	Several records of this species are located along roadsides and watercourses in the centre of the study area (Figure 6). The impact area avoids areas containing Strzelecki Gum (i.e. no trees are proposed to be impacted).
River Swamp Wallaby-grass <i>Amphibromus fluitans</i>	The species is associated with wetland, and low-lying swampy habitat. There is potentially suitable habitat for this species in very small areas within the impact area (i.e. low-lying drainage lines and waterbodies).	Not recorded within the study area during recent surveys. There have been recent records (dated 2003) of this species approximately 750 metres to the north east of Turbine 25 and south of Stocks Road (DELWP 2020d) (Figure 9). This species has a low-moderate likelihood of occurring within the proposed impact area.
Matted Flax-lily <i>Dianella amoena</i>	The species typically occurs in native grassland areas, outside of the Strzelecki Ranges (study area) across the low-lying grassland plains.	Not recorded within the study area during recent surveys. This species has a low-moderate likelihood of occurring within the proposed impact area.
Dwarf Cypress-pine <i>Callitris oblonga</i> subsp. <i>oblonga</i>	This species is not considered indigenous to Victoria as its natural population is limited to disjunct sites in north-eastern Tasmania and in NSW on the eastern edge of the New England Tablelands and on the Corang River near Nerriga (DEWHA 2008). As such, there is no suitable habitat for this species within the study area.	Not recorded within the study area during recent surveys. There are two previous records (dated 1998) within the study area (Figure 9). This species has a low-moderate likelihood of occurring within the proposed impact area.

4.4.2 Fauna

The VBA contains records of seven nationally significant fauna species previously recorded within 10 kilometres of the study area (DELWP 2020d) (Appendix 3.2). The PMST nominated an additional 11 nationally significant species which have not been previously recorded but have the potential to occur in the locality (DAWE 2020). The majority of these species are located in areas of relatively high quality, undisturbed habitat (i.e. Morwell National Park and Mirboo North Regional Park), or waterways and roadsides outside of the study area (Figure 10).

Of the 18 nationally significant fauna species that are known to, or are predicted to occur within the locality (DAWE 2020), a resident population of one species (Growling Grass Frog) is present within the study area (i.e. Luxford Pond and other waterbodies) (Figure 7). Two additional species have a high (Grey-headed Flying-fox) or moderate (Greater Glider) likelihood of occurring / using habitat resources within the study area (Appendix 3.2) (Table 11). The likelihood of additional nationally significant fauna occurring within or adjacent to the impact area is considered low as a result of the field surveys and due to the absence of suitable habitat (Appendix 3.2).

Table 15. Nationally significant fauna within the study area.

Species	Suitable habitat within the study area	Known records
Growling Grass Frog <i>Litoria raniformis</i>	<p>The species was recorded at a pool in the centre of the study area, just south of Clarks Road (Figure 7).</p>	<p>A resident Growling Grass Frog population was recorded at multiple sites (e.g. Luxford Pond and other waterbodies) within study area during the 2019/20 breeding period (Figure 7). The species has previously been recorded (1997) from Luxford Pond (DELWP 2020d) (Figure 10).</p>
Greater Glider <i>Petauroides volans</i>	<p>The species is not common within the Gippsland Plain and requires large hollows to nest and den (Menkhorst 1995). While stands of large trees with varying sized hollows are present within the study area (often in the form of isolated patches of forest), most are located within road reserves. There are no large patches of consolidated habitat for the species within the study area.</p>	<p>Greater Glider was not detected during targeted surveys undertaken within the study area. There are several documented records of Greater Glider approximately 300 metres east of the study area (Figure 10). Resident populations occur to the south and south west of the study area (i.e. Mirboo North Regional Park and comparatively larger consolidated forest habitat south of Creamery Road along Stony Creek and remnants south of the creek) (DELWP 2020d). There is a potential for the species to occur in isolated, semi-connected patches of forest, although the proposed development will not result in the removal of suitable habitat (including suitable hollow-bearing trees or large mature trees that may support suitable den sites in the future).</p>
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	<p>The species was formerly an autumn-winter visitor to areas throughout Victoria; however, it has now established permanent and seasonal colonies throughout the state. The species is capable of nightly flights of up to 50 kilometres from roost sites to forage on the nectar and pollen of native and introduced plant species. Flowering eucalypts provide potentially suitable habitat for the species within the study area.</p>	<p>Grey-headed Flying-fox was not detected during field surveys (including nocturnal surveys that were undertaken over several nights within the study area). Although the species has not been documented as occurring within 10- kilometres of the study area, there are several records from within 20 kilometres of the study area (DELWP 2020d). There is a high likelihood that small numbers of the species would fly over the study area on an infrequent or occasional basis during dispersal between camps between Melbourne and East Gippsland.</p>
Southern Brown Bandicoot <i>Isodon obesulus</i>	<p>Southern Brown Bandicoot occupies a variety of habitats and prefers areas which contain dense understorey vegetation (e.g. Swamp Scrub, heath, dense blackberry and/or Gorse thickets) where individuals can seek cover. There is marginal habitat for this species within the study area.</p>	<p>Southern Brown bandicoot was not detected during field surveys (including targeted surveys within the study area). The species has previously been recorded in the study area (1973) along Silver Creek, north of Smiths Road (Figure 10). The most recent record is from outside of the study area (VBA record in 1978). The species is considered to have a low likelihood of occurring in the study area based on the results of the site surveys (including targeted surveys) time since last record, and the lack of highly suitable habitat for the species.</p>
Dwarf Galaxias <i>Galaxiella pusilla</i>	<p>There is potential suitable habitat for this species in low-lying drainage lines and water courses. However, there is not suitable habitat within the proposed impact area.</p>	<p>Targeted surveys for Dwarf Galaxias were not undertaken given that species is considered to have a low likelihood of occurrence based on the lack of available habitat. The species has not previously been recorded within the study area and there is one documented record (2012) approximately 14 kilometres north-east of the study area (DELWP 2020d).</p> <p>While the proposed development will involve the removal of some native vegetation along existing tracks, it is unlikely to impact or disturb creeklines, swamps or riparian habitats.</p>

4.4.2.1 Ramsar Wetlands and Migratory Species

The closest Ramsar wetland is the Corner Inlet, located approximately 35 kilometres to the south of the study area. The proposed development will not impact this Ramsar site or any other Ramsar wetlands.

Migratory species listed under the EPBC Act are those protected under international agreements to which Australia is a signatory. These include the Japan Australia Migratory Bird Agreement (JAMBA), the China Australia Migratory Bird Agreement (CAMBA), the Republic of Korea Migratory Bird Agreement (ROKAMBA), and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Migratory species are considered matters of NES under the EPBC Act and species recorded in the local area are provided below (Appendix 3.3.).

While migratory bird species (e.g. Latham's Snipe *Gallinago hardwickii*) may occasionally inhabit the study area, the study area is not considered to be classed as an 'important habitat' as defined under the EPBC Act Policy Statement 1.1 Principal Significant Survey Guidelines (DoE 2013), in that it does not contain:

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species;
- Habitat utilised by a migratory species which is at the limit of the species range; or,
- Habitat within an area where the species is declining.

Several EPBC Act-listed migratory species have previously been recorded within a 10-kilometre radius of the study area (DELWP 2020d) (Appendix 3.3). Suitable habitat within the study area for EPBC Act migratory species is limited to the small low-lying areas (drainage lines and creeks) that would be inundated periodically, and the primary species that would use these habitats include Latham's Snipe. The main areas of suitable habitat for migratory species is located approximately 35 kilometres to the south of the study area (i.e. in intertidal areas along the coast and throughout Corner Inlet and also Gippsland Lakes Ramsar sites). The project is highly unlikely to impact any migratory or marine species listed under the EPBC Act.

In addition, as outlined in DoEE (2017):

'Important habitats in Australia for migratory shorebirds under the EPBC Act include those recognised as nationally or internationally important. The widely accepted and applied approach to identifying internationally important shorebird habitat throughout the world has been through the use of criteria adopted under the Ramsar Convention on Wetlands. According to this approach, wetland habitat should be considered internationally important if it regularly supports:

*1 per cent of the individuals in a population of one species or subspecies of waterbird OR
a total abundance of at least 20 000 waterbirds.*

Nationally important habitat for migratory shorebirds can be defined using a similar approach to these international criteria, i.e. if it regularly supports:

*0.1 per cent of the flyway population of a single species of migratory shorebird OR
2000 migratory shorebirds OR
15 migratory shorebird species'.*

Based on the criteria outlined above no habitat within or immediately adjacent to the study area constitutes important habitat for migratory species. In addition, whilst individuals or small numbers of Latham's Snipe may occupy habitats on an occasional basis, there is no important or limiting habitat for this species within study area. Latham's Snipe does not commonly aggregate in large flocks or use the same habitats as many

other migratory shorebird species. Consequently, habitat important to this species is not regularly identified by applying the criteria outlined above, and different criteria are applied (DoEE 2017).

While it is possible that small numbers of migratory birds could fly over the site during migration, it has been well documented that shorebirds typically fly between 0.5 and six kilometres in elevation during migration, well above the tip of the proposed turbines (Williams *et al.* 1981; Piersma *et al.* 1990; Tulp *et al.* 1994). It is therefore considered that the likelihood of migratory bird mortality through turbine collisions is low and that the proposed wind farm is unlikely to have a significant impact on any migratory species.

4.4.3 Communities

One nationally listed ecological community Gippsland Red Gum (*Eucalyptus tereticornis* subsp. *mediana*) Grassy Woodland and Associated Native Grassland is a listed ecological community that is predicted to potentially occur within the study area (DAWE 2020). Due to the absence of Gippsland Red-gum (Plains Grassy Woodland EVC) and other key indicator species, Gippsland Red Gum Grassy Woodland and Associated Native Grassland is not present within the study area.

4.4.4 Other Matters of NES

The study area does not support any other features corresponding with matters of NES protected under the EPBC Act (e.g. World or National Heritage Areas) (DAWE 2020). The closest Ramsar wetland is the Corner Inlet Ramsar site approximately 35 kilometres to the south of the study area.

4.5 State Significant Values

State significant matters present within the study area that are considered of significance to the State of Victoria are outlined below.

4.5.1 Flora

The VBA contains records of 35 State significant flora species within 20 kilometres of the study area (DELWP 2020d) (Appendix 2.4) (Figure 9). The majority of these species are located in areas of relatively high quality, undisturbed habitat (i.e. Morwell National Park) or waterways and roadsides (Figure 9). In addition to the nationally significant flora species (Section 3.41), there is suitable habitat for 16 species within the study area (Appendix 2.4). One State significant species (Yarra Gum) was recorded during the general and targeted surveys within the study area. No additional State significant species were detected within the study area despite active searching during appropriate times of the year and based on the habitat type and vegetation quality throughout the study area there are varying degrees of likelihood for each of these species within the study area (Appendix 2.4).

Eleven common flora species listed as 'protected' (not State significant species) under the FFG Act were recorded within the study area (Appendix 2.1).

Based on the results of the targeted surveys, habitat assessments and landscape context, the remaining state significant fauna species previously recorded, or considered as having potential habitat within the project locality have been assessed as having a low likelihood of occurrence within the study area. This determination is based on the results of the targeted surveys within areas of suitable habitat conducted over multiple years.

4.5.2 Fauna

The VBA contains records of 36 State significant fauna species previously recorded within 20 kilometres of the study area (DELWP 2020d) (Figure 10) (Appendix 3.2). The majority of these species are located in areas of high quality, undisturbed habitat (i.e. Morwell National Park and Mirboo North Regional Park), or waterways and roadsides.

No state significant fauna species were identified within the study area. However, of the 36 State significant fauna species that are known or predicted to occur within the locality (DELWP 2020d), a number of species have a moderate or high likelihood of occurrence within the study area (likelihood of occurrence for each species is provided in Appendix 3.2), including:

- Five waterbirds (Australasian Shoveler *Anas rhynchos*, Blue-billed Duck *Oxyura australis*, Hardhead *Aythya australis*, Musk Duck *Biziura lobata* and Eastern Great Egret *Ardea modesta*) that are likely to visit the study area on a frequent or occasional basis (e.g. Luxford Pond and artificial waterbodies such as farm dams) for foraging or breeding on a frequent or occasional basis. However, higher quality habitat that is known to be used by these species is present at the Morwell Wetlands, located approximately 4.5 kilometres north east of the study area (Figure 10).
- Six waterbirds (Freckled Duck *Stictonetta naevosa*, Intermediate Egret *Ardea intermedia*, Lewin's Rail *Lewinia pectoralis pectoralis*, Little Bittern *Ixobrychus minutus dubius*, Gull-billed Tern *Gelochelidon nilotica macrotarsa* and Little Egret *Egretta garzetta nigripes*) that may temporarily reside within the study area (e.g. Luxford Pond and artificial waterbodies such as farm dams) on rare occasions.
- Three diurnal raptors (White-bellied Sea-eagle *Haliaeetus leucogaster*, Black Falcon *Falco subniger* and Grey Goshawk *Accipiter novaehollandiae novaehollandiae*) for which there are a small number of documented records of these three species within the local area (Figure 10). White-bellied Sea-eagle is likely to fly across the study area on occasions (small numbers of individuals) between more optimal habitats (e.g. large waterbodies such as Morwell Wetlands, Lake Narracan and Hazelwood Pondage lake system several kilometres to the north and east of the study area). However, Black Falcon and Grey Goshawk are expected to be vagrant or rare visitors to the study area.
- Three nocturnal raptors (Powerful Owl, Sooty Owl and Masked Owl). There have been several documented records of Powerful Owl [known breeding pair(s)] within the local area (DSE 2013b; Willig 2014, 2016, 2017). Powerful Owl is known to occur in larger consolidated forest habitat approximately 300 metres east of the study area (Figure 10). A breeding pair is known to occur to the south and south west of the study area (i.e. Mirboo North Regional Park and comparatively larger consolidated forest habitat south of Creamery Road along Stony Creek and remnants south of the creek) (DELWP 2020d). While the study area may form part of the home-range of at least one breeding pair, habitat use is expected to be concentrated to dense forest habitat (e.g. along gullies) where there is sufficient prey (e.g. Common Ring-tailed Possum, Common Brush-tailed Possum). Powerful Owl has been recorded adjacent to the study area in Darlimurla Forest Block (Biosis 1998), Toora-Gunyah Road to the north of the study area, and Morwell National Park to the south (Willig and Atkins 2014, 2016, 2017).

Despite extensive targeted forest owl surveys been undertaken over several years, Sooty Owl and Masked Owl have not previously been recorded within, or in close proximity to the study area (DSE 2013b; Willig 2014, 2016, 2017). Neither of these species were detected during the recent targeted surveys across the study area.

- One swift species (White-throated Needletail *Hirundapus caudacutus*) is non-breeding migrant in Australia, and flocks of birds are known to visit the local area during its migration period (i.e. spring and summer).
- Two woodland birds species (Hooded Robin *Melanodryas cucullata cucullata* and White-brown Treecreeper *Climacteris affinis*) that are unlikely to use habitats within the study area as the study area is outside the known range of both species.
- Three reptile species (Lace Monitor *Varanus varius*, Glossy Grass Skink *Pseudemoia rawlinsoni* and Swamp Skink *Lissolepis coventryi*). There have been a small number of documented records of these species within the local area. It is likely that Lace Monitor currently occupies remnant native vegetation within the study area, while Glossy Grass Skink and Swamp Skink may also occur around the edges of Luxford Pond and/or along or adjacent to low-lying drainage lines across the study area. Lower quality habitat for Glossy Grass Skink and Swamp Skink occurs along the small number of drainage lines that are proposed to be disturbed by the proposed development (i.e. the upgrade and construction of existing access tracks).
- One amphibian (Southern Toadlet *Pseudophryne semimarmorata*) which could potentially occur in small numbers in low-lying ephemeral drainage lines within the study area. The species has previously been recorded (seven records) within the local area, with the nearest record occurring adjacent to the Morwell River (north of the Princes Highway), approximately 4.5 kilometres to the north east of the study area (Figure 10). There is potential habitat for this species at Luxford Pond or along drainage lines within the study area.
- Four freshwater crayfish (Gippsland Burrowing Crayfish *Engaeus hemicirratulus*, South Gippsland Spiny Crayfish *Euastacus neodiversus*, Strzelecki Burrowing Crayfish *Engaeus rostrigaleatus* and Narracan Burrowing Crayfish *Engaeus phyllocercus*). There is potentially suitable habitat in the study area for Narracan Burrowing Crayfish (DSE 2003), Strzelecki Burrowing Crayfish and Gippsland Burrowing Crayfish. These species are associated with riparian habitat where they build burrows along the banks of a river or creek.

It is highly unlikely that any other State significant species would use habitat within the study area given the lack of suitable habitat.

4.5.3 Communities

The native vegetation within and adjacent to the impact area did not meet the descriptive characteristics of Herb-rich Plains Grassy Wetland (West Gippsland) Community, which is an FFG Act-listed ecological community. As such, this listed FFG Act-listed ecological community, or any other listed communities do not occur within the study area (DELWP 2019a).

4.6 Regionally Significant Values

The VBA contains records of an additional nine regionally significant fauna species previously recorded within the study area (DELWP 2020d) (Appendix 3.2). Of these species, three (Azure Kingfisher *Alcedo azurea*, Latham's Snipe and Nankeen Night Heron *Nycticorax caledonicus hillii*) are considered to have a moderate to high likelihood of occurring within the study area (Appendix 3.2). There is habitat for a small number of additional regionally significant fauna (e.g. Eastern Long-necked Turtle *Chelodina longicollisi*) within the study area.