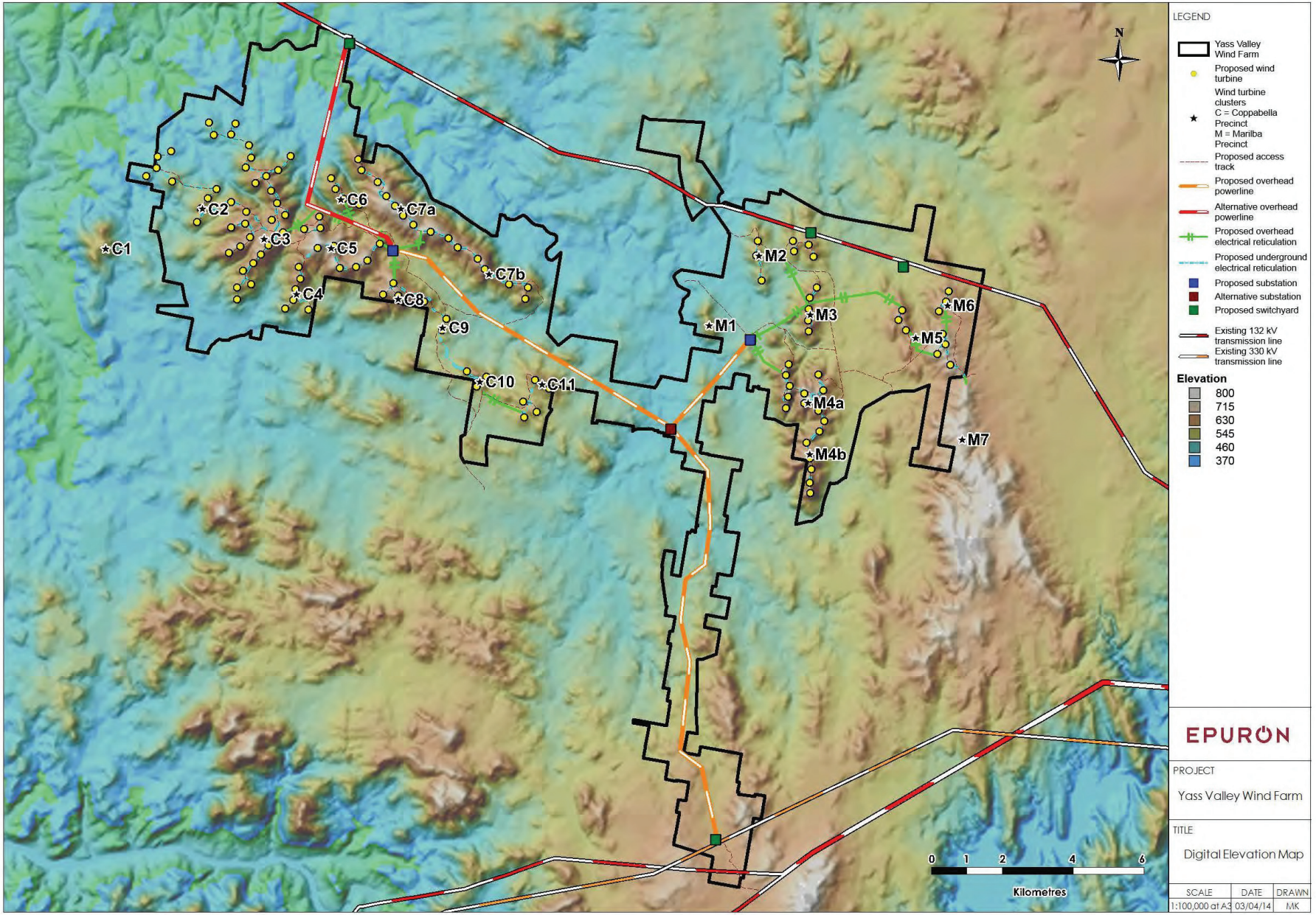


Figure 2-8 Digital elevation map of the proposal

3 Description of the Environment & Matters of National Environmental Significance

3.1 Current Land Use(s) & Adjoining Properties

Yass Local Environment Plan 1987

Yass Valley Council was created by council amalgamation in 2004, and as a result three LEPs (Gunning, Yarrowlumla and Yass) applied in different parts of the local government area. The project is located on land which was subject to Yass LEP 1987, zoned No 1(a) Rural Agriculture. Wind farms were permissible with consent in Zone 1(a) Rural Agriculture.

Since the wind farm project entered the planning process Yass LEP 1987 has been replaced with Yass Valley Local Environmental Plan 2013. The project site is now zoned RU1 (Primary Production).

Wind farms would be prohibited in zone RU1 (Primary Production), however SEPP (Infrastructure) would override the prohibition (clauses 8,33 and 34), resulting in development for the purpose of electricity generating works, such as the proposed wind farm, being permissible with consent.

Harden Local Environment Plan 2011

The part of the project site which is in the area of Harden LEP 2011 is zoned RU1 Rural Landscape. The objectives of Zone RU1 Rural Landscape are as follows:

- to encourage sustainable primary industry production by maintaining and enhancing the natural resource base;
- to encourage diversity in primary industry enterprises and systems appropriate for the area;
- to minimise the fragmentation and alienation of resource lands;
- to minimise conflict between land uses within this zone and land uses within adjoining zones; and
- to encourage the development of non-agricultural land uses that are compatible with the character of the zone.

Similarly to the Draft Yass LEP, wind farms would be prohibited in that zone for the Harden LEP 2011, however State Environmental Planning Policy (Infrastructure) 2007 would override the prohibition, resulting in development.

The project area is characterised by cleared farmland, mostly derived from Box Gum Woodland on the lower slopes and flats. Remnant stands of the original vegetation remain as paddock trees or larger scattered patches of forest/woodland on the lower slopes with more extensive forested areas on certain ridge tops. The pasture ranges from exotic to native species dominated. This pattern of vegetation and land use onsite is common across the locality.The wind farm project infrastructure is located on private property that is primarily used for grazing and agricultural purposes. Once operational the wind farm will have a negligible impact on normal farming operations and the agricultural capacity of the land as it would occupy only a few per cent of land from the involved landowner properties.

3.2 Description of Land Topography

The areas surrounding the proposed Yass Valley Wind Farm are predominately cleared hilly farm land, with existing infrastructure including roads, rail, transmission lines, towers, power lines, and communication towers as well as the typical infrastructure and buildings associated with farming activities.

The proposed Yass Valley Wind Farm is located on low hills and ridgelines on the north and south side of the Hume Highway. The topography within the viewshed can be described as rolling hills, often creating enclosed visual corridors. Typically the hills and valleys have been cleared for farming activities however; much of the existing farmland also contains scattered remnant trees. The Yass Valley Wind Farm is located on hilly areas where the elevation change across the site may vary from 500-820 m.

3.2.1 Description of the Matters of National Environmental Significance

The Department of Environment (DoE) (formally SeWPAC) requested further information on a number of matters of environmental significance in order to be able to assess the relevant impacts of the action. These include:

- White box-Yellow Box Blakely's Red Gum Grassy Woodland and Derived native grassland (Box Gum Woodland)
- Tarengo Leek Orchid *(Prasophyllum petilum)*
- Yass Daisy *(Ammobium craspedioides)*
- Golden Sun Moth *(Synemon plana)*
- Pink-tailed Worm Lizard *(Aprasia parapulchella)*
- Striped legless Lizard *(Delma impar)*
- Superb Parrot *(Polytelis swainsonii)*
- Swift Parrot *(Lathamus discolor)*
- Regent Honeyeater *(Xanthomyza phrygia)*
- Cattle Egret *(Ardea ibis)*
- White-bellied Sea-eagle *(Haliaeetus leucogaster)*
- South-eastern Long eared bat *(Nyctphylis corbeni* (formally *N. timoriensis)*

Table 3-1 lists these species and communities and provides a summary of habitat, known records within the locality, distribution (where known), the likely impact of the proposal on the threatened entity, and if the entity is considered to be 'affected' by the proposal. Species and communities considered to be affected by the proposal are discussed in more detail in Section 3.2.4. This includes one community and five threatened species:

- Box Gum Woodland
- Yass Daisy
- Golden Sun Moth
- Superb Parrot
- Swift Parrot
- Regent Honeyeater

The remainder would not be affected by the proposal. As demonstrated by Table 3-1, these are species where habitat is absent or marginal in the project site or where any potential for impact is minor, such that the proposal would not affect the wider population.

For the location of the survey effort undertaken within the project site, refer to Appendix B. Threatened species have been mapped for the project site (Appendix C) and within 10 km of the project site (Appendix D).

Table 3-1 Details of habitat, known records and impact summary for threatened species and communities requiring further information

For affected species, more detailed survey effort description and impact assessment is provided in the following sections.

Matters of NES	EPBC Status	General Habitat Requirement	Known Records	Survey Method / Effort	Impact Summary	Affected (Yes / No)
Box Gum Woodland	CE	This is a grassy woodland community, with White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*), and Blakely's Red Gum (*E. blakelyi*). This community can contain additional tree species however, shrubs are generally sparse. The groundcover usually contains numerous grasses and forbs (DECC 2008b).	Recorded within the project boundary and known for the region.	Refer Table 3-3.	Potential for impact on this community was noted. This community is discussed further in the following sections.	Yes
Tarengo Leek Orchid	E	Recorded from grassy woodland in Hall cemetery, c. 55km south-east of the site, Booroowa 45km north of the site and Captains Flat, in Natural Temperate Grassland, Box-Gum Woodland or moist grassy flats, with kangaroo grass or wallaby grasses (*Austrodanthonia* spp), in silty clay-loam. The Hall and Captains Flat populations occur in areas with high water tables. Flowers Oct-Nov.	Not known within the 10 km locality of the project boundary.	Habitat assessed during general flora surveys, totalling 158 person hours.	No potential for impact. Natural populations of this species are known from only four sites in NSW. These include Boorowa, Captains Flat, Ilford and Delegate. The orchid is known only from ungrazed remnants of high native species diversity. At the Tarengo TSR, the Tarengo Leek Orchid grows in remnant *Themeda triandra-Bothriochloa macra* grassland (NPWS 2002). All known populations of Tarengo leek orchid occur on Crown land. No populations are yet known from private land. Potential habitat at the subject site was surveyed during the November flowering period for this species (it was flowering at Hall Cemetery during the survey period) and was not recorded. This species is highly susceptible to grazing, only being retained at areas where grazing is in low numbers such as cemeteries. The subject site has been subject to extensive grazing regimes over the years, hindering potential habitat for this species to occur. The potential for its presence elsewhere at the subject site is very low.	No Due to this species not being detected during field surveys and little potential habitat occurring within the subject site, it is considered that this species would not be affected as a result of the proposed wind farm site. Therefore it has not been discussed further.
Yass Daisy	V	Yass Daisy occurs in dry forest, box gum woodland and secondary grassland derived from clearing of these communities. It grows in association with a large range of eucalypts including Blakely's Red Gum (Eucalyptus blakelyi), Apple Box (E. bridgesiana), Broad-leaved Peppermint (E. dives), Long-leaved Box (E. goniocalyx), Red Stringybark (E. macrorhyncha), Brittle Gum (E. mannifera), Yellow Box (E. melliodora), Red Box (E. polyanthemos) and Candlebark (E. rubida). The species tolerates light grazing. Populations persist in some grazed sites.	Recorded within the project boundary and known for the region. Numerous NSW Wildlife Atlas records1 in district including along Black Range Road, Burrinjuck Road and Hume Highway. This species was identified at the proposed site during the initial biodiversity assessment and targeted field surveys in 2009. During the original biodiversity assessment it was noted that the species appeared widespread and the population size was likely to be in the hundreds, potentially thousands at the site Refer to Appendix F for a map of Yass Daisies recorded during field surveys.	Refer Table 3-3.	Potential for impact on this species was noted and this species is discussed further in the following sections.	Yes
Golden Sun Moth	CE	This species is distributed in an area of NSW between Queanbeyan, Gunning, Young and Tumut. NSW populations are found in the area between Queanbeyan, Gunning, Yass, Young and Tumut. The species is reported from 48 sites in NSW, with 32 sites occurring in the ACT (DSEWPaC 2013). Forty-eight Bionet records of the species are known for the Murrumbidgee Catchment region, with the heaviest concentrations north	Golden Sun Moth populations were not known within or nearby the project site when the original assessments were undertaken.	Targeted surveys were undertaken over a five day period at approximately 100 turbine sites across both Coppabella and Marilba precincts. Refer Table 3-3.	Potential for impact on this species has now been noted and this species is discussed further in the following sections.	Yes

[1] NSW Office of Environment and Heritage Wildlife Atlas Bionet records, sourced from http://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx

Matters of NES	EPBC Status	General Habitat Requirement	Known Records	Survey Method / Effort	Impact Summary	Affected (Yes / No)
		of Canberra towards Yass. It occurs in grassy Box-Gum Woodlands and natural temperate grasslands, typically in low, open habitat and dominated by several wallaby grass species. Also may be associated with spear-grasses (Austrostipa spp.) or Kangaroo Grass (Themeda australis). Grasslands dominated by wallaby grass are typically low and open with bare ground evident between the tussocks. This is thought to be an important microhabitat feature as it is typically these areas where the females are observed displaying to attract males. The Golden Sun Moth has shown a preference for natural temperate grasslands or secondary grasslands (derived from Box Gum grassy woodland) that are dominated by a low and open cover of native wallaby grasses (Rytidosperma spp., formerly Austrodanthonia spp.) (OEH 2013). The Golden Sun Moth has also been recorded in degraded and weed infested patches of grasses dominated by Redleg grass (Bothriochloa macra), spear grasses (Austrostipa spp.), weeping grass (Microlaena stipoides) and the introduced Chilean needle grass (Nassella neesiana) (OEH 2013).	However, since the original biodiversity assessments, the species distribution has increased and it is has been recorded north, south and east of the project site. Targeted surveys undertaken in November/December 2013 revealed that this species is present within the Marilba precinct.			
Pink-tailed Worm-lizard	V	Known only from the Central and Southern Tablelands, and the South Western Slopes (Osborne and Jones, 1995). There is a concentration of populations in the Canberra/Queanbeyan Region. Other populations have been recorded near Cooma, Yass, Bathurst, Albury and West Wyalong. This species is also found in the Australian Capital Territory. This species inhabits sloping, open woodland areas with predominantly native grass ground layers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Typically these areas are well-drained, with rocky outcrops or scattered, partially-buried rocks. Commonly found beneath small, partially-embedded rocks in burrows below these rocks; the burrows usually have been constructed by and are often still inhabited by small black ants and termites (Osborne and Jones, 1995). This species feeds on the larvae and eggs of these ants (DECC 2008a).	Not known within the 10 km locality of the project boundary. The closest record is from Boorowa (2001), approximately 35km north of the site.	Representative reptile habitat was surveyed. Searches focused on ridge and slopes with extensive rock outcropping, however woodland, leaf litter, hollow logs, tussocks, and sheets of metal were also searched. Rock-rolling was the primary search method as habitat assessments revealed marginal habitat and access limitations (steep slopes and no vehicle access) which prevented placement of artificial shelters. However all searches were undertaken in areas of potential habitat in known periods of activity (spring and early summer when temperatures were below 25 degrees) and in search areas a search beneath all rocks that could be turned was undertaken. The soil was also raked with a hand rake. **2007:** 9-11 March **2008:** 1-3 and 16-19 September; 6-7 November **2012:** 15-18 October 14 surveys of 20-80 minutes (7.75 person hrs) 25 surveys of 20-90 minutes (11.5 person hrs) 6 surveys of 30 minutes duration (3 person hrs) **Total Effort**: 22.25 person hrs.	Some rocky habitat is present within the project boundary but it is sparse within the site and heavily grazed and degraded. The majority of the project site has either no surface rock or outcropping bedrock. Some limited areas have surface rock and potential habitat with largely exotic forb vegetation cover, but are dominated by large weeds such as Scotch Thistle and European Nettle which provides dense ground level shading and are unlikely to provide suitable habitat for these species. Neither species were detected during extensive targeted searches (rock-rolling) in potential habitat during the survey. An EPBC AoS was undertaken for the Pink-tailed Worm-lizard and Striped Legless Lizard concluding that, given the discrete nature of the development, the marginal habitat on-site and the grazing regime within these areas, and the extent of similar nearby habitat, habitat removal is considered to be a low risk for these species. The action is not likely to result in significant impacts on the species such that the action leads to a long-term decrease in the size of a local population. Management measures to be included in the Construction Environmental Management Plan (CEMP) would be implemented prior to construction to retain the limited areas of potential habitat resources at the site for these two species. These include: Clusters of rocks and boulders should be avoided where possible. Where rocks and boulders cannot be avoided, they should be placed directly adjacent to the works area to preserve the availability of refuge. Where rocks are to be removed, pre-clearance for threatened reptiles should be undertaken by experienced personnel. Standing dead trees, stumps and woody debris should be avoided where possible. Where they require removal to allow for the tracks and hardstand areas, they should be placed adjacent to the impact areas, to retain these refuges in the immediate area. A Biodiversity Management Plan would be prepared within the CEMP to document the implementation of biodiversity measures, sourcing the Biodiversity Assessments prepared for each precinct for area specific measures. This would include construction and operational activities. The plan would include specific additional survey work which would be used to microsite infrastructure, where practical, and offset impacts, where they cannot be avoided. The target features / species include: ...Striped Legless	No
Striped Legless Lizard	V	Populations are known in the Goulburn, Yass, Queanbeyan, Cooma and Tumut areas. It inhabits temperate lowland grasslands, secondary grasslands and occasionally in open Box-Gum Woodland. It has been recorded at sites dominated by introduced species (such as *Phalaris aquatica, Nasella trichotoma* and *Hypocharis radicata*) and sites with a history of grazing and pasture improvement (Smith and Robertson, 1999). Shelters in grass tussocks, thick ground cover, soil cracks, under rocks, spider burrows, and ground debris such as timber. The key to their survival in rural areas may be the availability of shelter during disturbance events (Smith and Robertson, 1999).	Not known within the 10 km locality of the project boundary. This species has been recorded in the region near Yass and south of Gundagai			No Due to these two species not being detected during field surveys and little potential habitat being available within the subject site, it is considered that these species would not be affected as a result of the proposed wind farm site. Therefore they have not been discussed further. Precautionary measures are included in the mitigation measures for the proposal to address uncertainty and retain potential habitat where possible.

Matters of NES	EPBC Status	General Habitat Requirement	Known Records	Survey Method / Effort	Impact Summary	Affected (Yes / No)
					Lizard.	
Superb Parrot	V	Found throughout eastern inland NSW. On the South-western slopes the core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west (DECC, 2008). It inhabits Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. Nesting habitat on SW Slopes is often open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Nests in tree hollows September-January in small colonies, often with more than one nest in a single tree. Blakely's Red Gum is the main source of nesting hollows (Davey 1997). Superb Parrot nest trees tend to be close to watercourses (Webster 1988). The species is faithful to traditional nest sites (Webster 1988). At the micro scale, distribution and abundance is influenced by tree cover and species composition. Nest trees tend to be older, often affected by dieback with little regeneration (Manning 2004). It forages on the ground in grassy woodland, also on fruit, seeds and blossoms of acacias, eucalypts and mistletoes (Pizzey et al. 2006). The species feeds in trees and understorey shrubs and on the ground. Food items are mainly flowers, fruits and seeds. Understorey food species include Common Wallaby-grass (*Austrodanthonia caespitosa*), numerous wattle species, and introduced plants including cereal grains, barley-grasses (DNRE 1992).	Recorded within the project boundary and known for the region. Records within the 10 km locality are primarily located north of the project site near Binalong. This species was recorded 12 times within or near the project boundary.	Refer Table 3-3.	Potential foraging and breeding habitat is present within the development envelope. Potential for impact on this species was noted and this species is discussed further in the following sections.	Yes
Swift Parrot	E, Ma	Breeds in Tasmania, migrating to south and eastern NSW in autumn/winter where it inhabits eucalypt forests and woodlands, particularly Box-Ironbark Forests of central Victoria and southern NSW (Smales, 2005; DECC, 2008). Mostly occurs on the south-west slopes. It feeds on nectar flowers of eucalypts and lerp-insects, also soft fruits and berries sometimes foraging in grass (Pizzey et al 2006). Favoured feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark, and White Box (DECC, 2008).	This species has been recorded near McMahons Reef 8 km north- west of the project site in 1997. However, only one record is known from this area. The Swift Parrot was not identified during any survey events for the Yass Valley Wind farm site.	Refer Table 3-3.	Potential foraging habitat for this species is present at the proposed site and it is possible that this species occurs there during its winter migration. Potential for impact on this species was noted and this species is discussed further in the following sections.	Yes
Regent Honeyeater	E, Mi	Regent Honeyeaters mostly occur in dry Box-Ironbark eucalypt woodland and dry sclerophyll forest associations in areas of low to moderate relief, wherein they prefer moister, more fertile sites available, for example along creek flats, or in broad river valleys and foothills. In NSW, riparian forests containing River Oak (*Casuarina cunninghamiana*), and with Needle-leaf Mistletoe (*Amyema cambagei*), are also important for feeding and breeding. A small number of breeding sites are known in NSW, the most important are: Warrumbungles NP, Pilliga NR, Barraba district, central coast around Gosford, Hunter Valley, and Capertee Valley, with the closest being Capertee Valley approximately 230km north of the site (NPWS, 1999). Wee Jasper Nature Reserve is a 700 hectare reserve located around 30km south of the study area, where the Regent Honeyeater has also been recorded. It is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Yellow Gum, Blakely's Red Gum and White Box (Menkhorst et al., 1999). The species can undertake large-scale nomadic movements in the order of hundreds of kilometres.	This species has been recorded in the region, south of Binalong, approximately 9km north-west of the site.	Refer Table 3-3.	Feed tree species are present within and adjacent to the site, however the habitat is considered marginal given the disturbed and fragmented nature of the woodland patches within the project site which have been subject to long-term grazing. Mistletoe species were generally absent from the project site and clearing impacts do not affect primary habitat for this species which constitutes the more fertile sites such as creek flats or river valleys. Known records indicate the project site does not support a core population of this species. No breeding habitat would be affected. Although potential habitat for this species will not largely be impacted upon by the proposed works due to the low levels of habitat to be impacted, the Regent Honeyeater is a nomadic bird that has the potential for collision impacts. The risk matrix undertaken for both Coppabella and Marilba Biodiversity Assessments scored the Regent Honeyeater as a 9/9 in consideration of collision risk factors alone (occurs locally, flocks, and is migratory). However, considering the likelihood that a population would be adversely affected, the Regent Honeyeater has been given a low to moderate risk rating. Although impacts to potential habitat from the proposal are considered minor, this species is discussed is discussed further in the following sections due to collision risk impacts.	Yes.
Cattle Egret	Mi, Ma	Found in grasslands, woodlands and wetlands. It also utilises pasture lands, paddocks and croplands where drainage is poor, often in association with	Not known within the 10 km locality of the project	Bird census surveys were undertaken for all avifauna in the early morning and late	The presence of this species is possible on lowland pasture and dams. This migratory species may cross the ridges within the study area while migrating	No

Matters of NES	EPBC Status	General Habitat Requirement	Known Records	Survey Method / Effort	Impact Summary	Affected (Yes / No)
		cattle and other stock; wetlands, tidal mudflats and drains (Pizzey et al., 2006). Nests in swamp woodlands in groups. Originally found in Africa, Europe and Asia, the Cattle Egret is now found on nearly every continent. Occurs on the north and east coast of Australia. Partially migratory.	boundary, but the species has been recorded near Murrumbidgee River west of the site approximately 35 km south west of the subject site.	afternoon. All birds seen or heard were recorded, including at height they were observed. Opportunistic records were recorded throughout the day. All bird species were recorded however, surveys focused particularly on threatened and migratory birds, raptors, flocking species and wetland birds. **2008:** 1-3 and 16-19 September; 6-7 November. **2009:** March 9-11. Bird census of 20-90 person mins duration: 25 surveys Transects of 20-30 mins duration: 17 surveys **Total Effort:** 24.5 person hrs	from larger wetland systems in the west to wetlands on the coast, or between Lake Burrinjuck and wetlands in the north, and therefore be at risk of blade-strike. However given that wetland habitats do not occur locally, bird movements across the site are likely to be diffuse and irregular. Long-distance migratory birds are likely to have attained a travelling altitude greater than the turbine height. Further, water birds are more likely to follow riparian corridors, rather than travel over ridge systems in agricultural land. The ridges do not directly bisect large water bodies therefore do not fragment or isolate areas of habitat. The population estimate for Australia, New Guinea and New Zealand is 100 000 birds (Maddock & Geering 1994), with a trend that suggests an ongoing increase in range and population. The species is widely distributed globally, with the range of the bird continuing to expand, particularly around the Pacific basin.	The Cattle Egret usually inhabits lowland areas, away from ridge tops. When migrating it is likely that this species would follow riparian corridors or fly at a height well above the blade of a turbine. Considering its range and abundance, this species has not been considered to be affected by the proposal.
White-bellied Sea Eagle	Mi, Ma	Resident from India through southeast Asia to Australia. The species is found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, and the sea). Birds have been recorded in (or flying over) a variety of terrestrial habitat.	This species has been recorded along the Murrumbidgee River system near the site at Burrinjuck Dam and Yass.	Bird census surveys were undertaken for all avifauna in the early morning and late afternoon. All birds seen or heard were recorded, including at height they were observed. Opportunistic records were recorded throughout the day. All bird species were recorded however, surveys focused particularly on threatened and migratory birds, raptors, flocking species and wetland birds. **2008:** 1-3 and 16-19 September; 6-7 November. **2009:** March 9-11. Bird census of 20-90 person mins duration: 25 surveys Transects of 20-30 mins duration: 17 surveys **Total Effort:** 24.5 person hrs	Habitat is not available onsite. This migratory species may cross the ridges within the study area while migrating from larger wetland systems in the west to wetlands on the coast, or between Lake Burrinjuck and wetlands in the north, and therefore be at risk of blade-strike. However given that wetland habitats do not occur locally, bird movements across the site are likely to be diffuse and irregular, rather than concentrated and seasonal. It is expected any long-distance movements would follow riparian or wetland corridors and thereby predominantly avoiding the site. Therefore, the proposed action is unlikely to have a significant impact on the White-bellied Sea-eagle.	No Habitat for this species is not present. It is unlikely to use a flight path across the site. As such this species has not been considered to be affected by the proposal.
South-eastern Long Eared Bat	V	The South-eastern Long Eared bat inhabits a variety of vegetation types including Mallee, Bulloke (*Allocasuarina leuhmanni*) and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. It is distributed throughout inland NSW except in the north-west area which is dominated by treeless plains. It can be found in the Hunter Valley, extending from central NSW to the eastern Hunter Valley coast. Records also indicate populations in River Red Gum, Eucayptus camaldulensis, forests along the Murray River (Law & Anderson 1999). In Queensland, the South-eastern Long-eared Bat is mainly recorded in the Brigalow Belt South Bioregion, extending eastwards to the Bunya Mountains National Park. It has been recorded as far north as the Expedition Range and Dawson River areas. Its westerly range extends into the Mulgalands Bioregion and west of Bollon. There are limited records in Victoria, with patchy distributions in the Northern Plains and Mallee regions (Koehler 2006; Lumsden 1994). It will roost in tree hollows, crevices, and under loose bark. This species is a slow flying agile bat, utilising the understorey to hunt non-flying prey - especially caterpillars and beetles - and will even hunt on the ground. Foraging activities are concentrated around patches of trees in the	This species has not been recorded in the region and the closest records are located south of Tumut more than 70 km from the site. Other records for this species are located near Canowindra, about 120kms north of the subject site in 2006. The South-eastern Long-eared Bat was not identified on site during surveys.	Microbat echolocation call Anabat detectors were placed at potential habitat areas for this species. Anabats were recorded for approximately 12 hours each night. **Marilba Precinct** Anabats were placed at dam sites, along forest remnants and within lowland woodland remnants **2007:** 9-11 March **2008:** 17-18 September; 6-7 November **2009**: January 19-23, October 13-16 **Coppabella Precinct** Anabat surveys were undertaken at Jugiong Creek, along Whitefields Road and at a dam in the valley between sites 5 and	This species has not been recorded within the subject site and the closet record is over 70kms away. Studies have shown that this species is known to roost up to 7kms away, which suggests current records of this species would not roost or travel in close proximity to the subject site. The action is not likely to result in significant impacts on the species such that the action leads to a long-term decrease in the size of a local population. An adaptive Bird and Bat Monitoring program would be developed prior to construction and would include the collection of baseline (pre-operational) as well as operational monitoring data. This program would be implemented in consultation with Office of Environment and Heritage (OEH) and Department of Environment (DoE). Wind is a significant and growing alternative energy source for Australia and other countries, with areas in southern Australia identified as suitable sites for wind farms. Wind farms around the world are however known to affect some birds and bats by striking wind turbine blades or possibly from barotrauma (rapid changes in air pressures associated with the moving blades). Barotrauma largely affects bat species rather than birds. A bats lungs are balloon like, with two-way airflow ending in thin flexible sacs surrounded by capillaries. When the outside pressure drops, those sacs can over-expand, bursting the capillaries around them, resulting in barotrauma. Bird lungs are	No This species has not been recorded within the subject site. The nearest records are over 70kms away.

Matters of NES	EPBC Status	General Habitat Requirement	Known Records	Survey Method / Effort	Impact Summary	Affected (Yes / No)
		landscape. Individuals appear to have defined foraging areas which they return to; they do not defend foraging areas and many individual from different species may share the same area. Mating takes place in autumn with one or two young born in late spring to early summer. Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. In a recent roosting study individuals were found to move large distances on a nightly basis. Roost sites were on average 1.89 ± 1.61 km (range 0.34–7.06 km) from the capture point. Individuals used a number of different roost sites within the time they were tracked. Most roosts were used for just a single day (1.3 ± 0.6 days) before the individual moved to a new roost site. In contrast to other species of long-eared bats which move regularly between a number of roosts that are close together (e.g. within 300 m; Lumsden & Bennett 2006), South-eastern Long-eared Bats moved large distances 1.91 ± 1.86 km (range 25 m–5.88 km) between consecutive roosts.		7a, west end 7a and middle of 10. **2008**: 16-18 September **2009**: January 19-23, October 13-16.	more rigid and tube-like, with one-way circular airflow passing over and around capillaries. That rigid system can more easily withstand sudden drops in air pressure. Birds can fly through the pressure differentials and because of their skeletal features and anatomy; they are better able to withstand that pressure gradient. Most bird species that are found dead near turbines are a result of blunt force trauma and not barotrauma. A commitment to an operational bird and bat management plan will address the uncertainty and provide a mechanism for operational management, if required.	

KEY: CE – Critically Endangered, **E** – Endangered, **V** – Vulnerable, **Mi** – Migratory, **Ma** – Marine.

NOTE: Information on habitat and populations has been sourced from the Species Profile and Threats Database (SEWPaC 2012). Available at: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

3.2.2 Discussion of survey methodologies

Best practice guidelines were referenced for the Yass Valley wind farm site surveys. These include:

1. Survey Guidelines for Australia Threatened Birds: Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Published 2010.
2. Survey Guidelines for Australia Threatened Reptiles: Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Published 2011
3. Survey Guidelines for Australia Threatened Bats: Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Published 2010.

Each guideline specifies survey timing, effort and methods to be implemented for certain threatened species. The table below summaries the best practice survey guidelines for the affected species.

Table 3-2: Summary of survey guidelines for listed species

Species	*Recommended Survey Timing*	*Recommended Survey Technique*	*Recommended Survey Effort*
Birds			
Superb Parrot	Active and conspicuous, though quiet in the heat of the day. Can be difficult to detect when quietly feeding in canopy. Voice distinctive; contact call usually uttered in flight (Higgins 1999). Make regular seasonal movements from breeding areas, though the relationship between breeding and non-breeding ranges is speculative. No strong evidence to differentiate dispersal from migration (Higgins 1999).	**Area Searches** (in areas <50ha) Area searches or transect surveys of suitable habitat, preferably in the early morning (sunrise to 10 am) and evening (4 pm to sunset). Morning surveys may be of greater value as the species' movements is more coordinated at this time. Detection by sighting or call, usually of flying birds. Vehicle-based transects appropriate in areas where most habitat is restricted to roadside remnants. Survey effort will need to be increased outside the breeding season, as dispersal makes the species more difficult to detect. **Targeted Searches** As above	**Area Searches** 12 hours over 4 days **Targeted Searches** 12 hours over 4 days
Regent Honeyeater	Can be conspicuous in the breeding season and when larger groups form at good nectar sources. At other times are often inconspicuous, calling quietly and being difficult to locate in the crowns of trees (Higgins et al.2001; D. Geering pers. comm.). Detection usually by call, although calls appear to differ between birds in south and north of range (D. Geering pers. comm.). May mimic calls of other birds (Higgins et al. 2001). Respond to playback calls immediately before and during the breeding season (Geering 1997).	**Area Searches** (in areas <50ha) Area searches in suitable habitat, preferably in the morning but other times may also be appropriate. Detection by call is possible when birds are most vocal (outside the breeding season). Otherwise, detection is by sighting. **Targeted Searches** Targeted searches of woodland patches with heavily flowering trees is useful, especially around water points such as dams and creek lines. Also check among flocks of other blossom nomads such as lorikeets and other honeyeaters. Broadcast surveys immediately before and during the breeding season may also be useful.	**Area Searches** 20 hours over 10 days **Targeted Searches** 20 hours over 5 days
Swift Parrot	Timing: surveys on the mainland should be conducted between March and July. Often noisy, active and conspicuous but can feed silently and become quite cryptic especially in the middle of the day (Kennedy & Tzaros in press). Typically allows close approach when feeding in trees. Often associates with lorikeets and honeyeaters at abundant food sources (Higgins 1999).	**Area Searches** (in areas <50ha) Area searches or transect surveys of suitable habitat, preferably in the early morning and afternoon when birds are most active and vocal. Detection by sighting or call. Slow-moving vehicle transects also effective in expansive areas, detecting loud, distinctive 'clinking' call that can be heard over noise of engine. **Targeted Searches** Targeted surveys of patches of heavily flowering eucalypts may be useful.	**Area Searches** 20 hours over 8 days **Targeted Searches** 20 hours over 8 days
Bats			

Species	*Recommended Survey Timing*	*Recommended Survey Technique*	*Recommended Survey Effort*
South-eastern Long eared bat	Survey best conducted on warm nights from October through to April.	**Harp Traps/Mist Nets** Mistnets and harp traps should be placed in woodland, mallee and forest, given that the species forages below the tree canopy, often to ground level. Equipment should be placed both in open fly-ways and within cluttered vegetation. If open water bodies (earth dams, fire dams, open top tanks and watercourses) occur in or near the project area, then significant effort should be given to mist-netting or harp trapping over the water. For project sites where there is no surface water, mistnets can be set over temporary water pools specifically constructed for the purpose of the survey. **Acoustic Detection** Bat detectors can be used to identify areas used by long-eared bats, even if they cannot be identified to species level. Acoustic detection can then be followed up with an appropriate level of trapping.	**Harp Traps/Mist Nets** 20 trap nights recommended with a minimum of five nights.
Invertebrates			
Golden Sun Moth	Throughout the cooler parts of the Golden Sun Moth's range, the flying season can vary between early November to mid-December and late November to early January. In warmer areas, such as the Wimmera area in western Victoria, adults may first appear in late October and fly until late November (Douglas 2004). In years with a cold, wet spring, adult moths may not start flying until early December and continue through until mid to late January (DEC 2007). Because of the variability in the timing of the flying season, a known occupied reference site near the study site should be monitored to indicate the start and duration of the local flying season.	Both fixed point (or "spot count") and transect surveys may be useful for detecting Golden Sun Moth. **Fixed point method** Best suited to very small sites or sites which harbour a small population (DEC 2007). Observer chooses a reference point typically on the edge of the site (or area of activity) from which the whole site can be observed. Using a hand counter and stopwatch the observer records the number of moths seen in a given time period taking care not to record the same individual twice. If the whole area cannot be surveyed from a single position the observer may alternate positions between successive counts (DEC 2007). **Transect method** Most commonly used method for monitoring butterfly populations (Pollard 1997 cited in DEC 2007). Particularly suited to large sites with extensive populations (DEC 2007). Observer walks a number of transects recording all individuals seen using a hand counter and a recording device (e.g. a portable electronic note taker).	At least four suitable days during the flying season of the species. Recommended that detection surveys be staggered at least a week apart to increase the likelihood that at least some members of the population are observed (Gibson & New 2007). **Fixed point method** Typically three to six minutes. Repeat point count as many times as necessary (e.g. three to five) with a five minute

Species	*Recommended Survey Timing*	*Recommended Survey Technique*	*Recommended Survey Effort*
		Transects are typically marked along the long axis of the site, and should be between 5 and 100 m apart, depending on the size and topography of the site. At very large sites 200 m intervals may be needed in order to cover the whole site in a reasonable time (i.e. while moths are active). Surveys conducted using the fixed point or transect method can also be used to estimate the relative abundance of the species on a site, although this may require an increase in search effort (see Gibson & New 2007).	interval between counts. **Transect method** Observer walks for 100 m, recording the number of moths seen per 100 m, taking care not the count the same individual twice. On large sites multiple observers may be required starting at opposite sides of the site. Two observers walking transects 200 m apart would require about two hours to survey a 100 ha site (Clarke & Dunford 1999).
Reptiles			
Pink-tailed Worm Lizard	Search success appears to be highest in spring and early summer on warm but not hot days, after a period of rainfall extending over several days. This species can be found throughout the year by searching under rocks, however, it appears to be more difficult to detect during hot dry periods (Osborne et al. 1991). Peak activity is likely to be late spring and early summer under warm, but not overly dry, conditions. It is not active on the ground surface by day and would only be active between sheltering sites at night.	The following survey methodology was adopted by Osborne and colleagues (1991): Searches restricted to an area of relatively homogeneous habitat within each site and a search beneath all rocks that can be turned is made. During summer months surveys are carried out in the mornings or on cloudy days when soil temperatures beneath the rocks are not too high. During late autumn and winter surveys are carried out on clear sunny days as warming of the rocks appears to attract individuals to the soil surface beneath the rocks.	Rock cover density rather than fixed area size determines a plot, and 150–200 rocks need to be turned to be reasonably confident of determining the species' presence.
Striped Legless Lizard	Surveys for the striped legless lizard are primarily undertaken during the active period of the species (between September and May). Some survey techniques (such as active searching) may be undertaken during the cooler	The striped legless lizard is a cryptic species and may not be detected by surveys even when present at a site. Reference sites may need to be monitored during the expected active period of the species and used to guide survey timing at the target site(s).	**Rock Rolling** Dorrough and colleagues (1996) reported a success rate for locating the species

Species	*Recommended Survey Timing*	*Recommended Survey Technique*	*Recommended Survey Effort*
	months of the year, but often with less success. This species shows strong seasonal activity, with most pitfall trap records coming from the period October to November (Osborne et al. 1993). They have also been collected from under basalt rocks in the Cooma area during the same time (Dorrough et al. 1996). Other individuals collected opportunistically by hand have been found during cooler months (April to August) when they have apparently been hibernating (Coulson 1990; Husband 1995). This interpretation accords with the observations on captive animals in outdoor enclosures in the Melbourne area (Banks et al. 1999), which were rarely observed during the period May to September.	**Rock Rolling** In areas with surface rock, artificial shelter site surveys or rock turning should be the primary technique (with supplementary techniques employed as appropriate). However, rock turning can be detrimental to striped legless lizard populations, especially when undertaken regularly. Therefore, this method should be used only when other methods are unavailable and it should never be employed for long-term monitoring. Active searching (checks under surface rock and debris and around tussocks) can generally be undertaken throughout the year as long as any limitations with respect to this survey technique are clearly outlined. This technique has a low success rate and usually leads to disturbance of refuge sites. It should only be used where necessary. **Artificial Shelters / Pitfalls** In areas with little to no rocky habitat (such as the ACT), artificial shelter site surveys or pitfall trapping should be used in conjunction with hand searches around tussocks. Detection rates using artificial shelter sites are nearly double that of pitfalling when undertaken during spring. Artificial shelter sites should be installed at least three months prior to the initial survey/checks (that is, by June). They should typically be placed in vegetated areas (not bare ground). Pitfall trapping is typically conducted in vegetated areas (not bare ground), and is undertaken in warmer months (September to January).	of approximately one individual per 150 rocks. **Artificial Shelters** In Victoria, the Department of Sustainability and Environment recommends at least six months of survey. **Pitfalls** Each pitfall should have a minimum drift line of 5 metres. Various pitfall configurations can be used, but should include up to five pits per configuration. As a minimum, two pitfall configurations should be used for sites less than 25 hectares in size, with a minimum of 10 pitfall traps. At least 50 pitfall configurations should be used for sites greater than 25 hectares. Daily checks should be conducted for at least 10 days, though a longer survey period (28 days) is preferable to detect populations at low abundance.

3.2.3 Species / communities affected by the proposal

One EPBC listed community and five EPBC listed threatened species were deemed to have potential to be 'affected' by the construction and/or operation of the Yass Valley Wind Farm (refer to Table 3-1). These include:

- Box Gum Woodland
- Yass Daisy
- Golden Sun Moth
- Superb Parrot
- Swift Parrot
- Regent Honeyeater

3.2.4 Assessment of affected species

Table 3-3 details the survey effort (location, methods and timing) undertaken for each affected species, the location and extent of known populations or individuals within the project site and locality, and the habitat to be affected by the proposal. The type of impact relevant to each species is identified in Table 3-3; however further discussion is presented in Section 4.

Table 3-3 Details of survey effort, distribution and habitat of affected species

Survey Effort (refer Appendix B)			Distribution (refer Appendix C)			Habitat			Type of Impact	Distance of species to proposed works (within 500m)
Species	**Effort and Methods[A]**	**Timing**	**Location and extent of species in project site**	**Number of Individuals located**	**Known populations within 10 km radius (see Figure)**	**Habitat within site (detail ha)**	**Extent of habitat impacted and quality (ha)**	**Habitat within region (general)**		
Box Gum Woodland CEEC	Quadrats: 8 Random meanders: 21 Inspections: 12 **Total Effort[B]**: 155 person hours	**Marilba BA:** **2008:** 16-22 September; 7 November. **2009:** 10-11 March. **Coppabella BA:** **2008:** 16-19 September; 8-9 November. **2009:** 19-23 January; 9-10 March. **SER:** **2012:** 15-18 October	**Marilba BA:** Remnant to the east of cluster 3, large fenced portion on the western side of clusters 4a and 4b, grassland west of cluster 7, SW side of cluster 6, grazed woodland near clusters 2 and 4. **Coppabella BA:** Remnant on the flat north of cluster 10, small patches on the lower slopes of cluster 7a and in the valley between clusters 5 and 7a (15 ha within the original development envelope). *Note: Location of Box Gum CEEC is provided in Appendix E.*	N/A	N/A	Box Gum Woodland generally located on ridge crests, saddles, gentler slopes and valleys, on volcanics and sediments, all elevations. Vegetation communities and condition classes are quantified and mapped in BAs. **Marilba BA:** 253.14 ha moderate-good, 9.09 ha good floristic condition BGW in assessment area. 2.05 ha moderate-good floristic condition Dry Grass Forest (Long-leaved Box) in assessment area. **Coppabella BA:** 16.15 ha moderate-good, 165.90 ha good floristic condition BGW in assessment area. 4.03 ha moderate-good, 29.59 ha good floristic condition Dry Grass Forest in assessment area. **SER:** Additional 10.27 ha moderate-good ha in good floristic condition BGW in assessment area. Maximum potential impact area of moderate-good floristic condition BGW in new assessment areas is 1.25 ha	The proposal has been modified to ensure that CEEC areas would not be significantly impacted and impact is mostly attributed to impacts associated with the overhead powerline. 1.75 ha mod-good condition 0.28 ha good condition TOTAL: 2.03 ha	The extent of CEEC quality vegetation in the region not known. However, the community is more likely to remain within public land reserves, roadsides, or on lightly grazed or grazing restricted properties.	Clearing of CEEC	As well as direct clearing impacts, indirect impacts may result as CEEC occurs within 10 metres of infrastructure at some sites.
Yass Daisy	**Marilba and Coppabella BAs:** Yass Daisy recorded during general flora survey, with broad observations regarding extent and abundance to assist project design. **Total Effort –** Quadrats: 8 Random meanders: 21 Inspections: 12 Total Effort2: 155 person hours. **nghenvironmental (2009c):** Mapped broad area of occupancy and potential habitat at Marilba cluster 7.	**Marilba BA:** **2008:** 16-22 September; 7 November. **2009:** 10-11 March. **Coppabella BA:** **2008:** 16-19 September; 8-9 November. **2009:** 19-23 January; 9-10 March. **SER:** **2012:** 15-18 October	**Marilba BA:** Recorded near clusters 4, 6 and 7; Full extent outside envelope not determined. At cluster 4, a few plants had colonised grazing land within 10 m of the source population in a fenced woodland remnant. **Coppabella BA:** Recorded near clusters 7a and 10. Full extent outside envelope not determined. **nghenvironmental (2009c)**: Mapped broad area of occupancy and potential habitat based on plant records and extent of good quality (*Themeda* dominated) grassland at Marilba cluster 7. Potential habitat on involved property is at least 50 ha.	**Marilba BA:** Populations not counted during general survey. At each site, colonies were sizeable (at least hundreds). **Coppabella BA:** Populations not counted during general survey. Recorded near clusters 7a and 10 (at least hundreds). **SER:** Additional survey to verify numbers within colonies. At the Marilba cluster 7 site, 325 plants in 14	Records are scattered around the project site and appear to be more concentrated to the east near Conroys Gap and to the south within Burrinjuck Nature Reserve. The Yass Daisy was also observed to be scattered in roadside remnants and in a TSR beside Black Range Road south of the subject site, east from GDA 661089 6143407.	Better quality Dry Forest, Box Gum Woodland and Derived Grassland, indicating lighter grazing/fertiliser history. **Marilba BA:** 253.14 ha moderate-good, 9.09 ha good floristic condition BGW in assessment area. 2.05 ha moderate-good floristic condition Dry Grass Forest (Long-leaved Box) in assessment area. **Coppabella:** 16.15 ha moderate-good, 165.90 ha good floristic condition BGW in assessment area. 4.03 ha moderate-good, 29.59 ha good floristic condition Dry Grass Forest in assessment area. **SER:**	All known populations avoided.	Yass Daisy is associated with a range of forest and woodland communities and secondary grasslands, usually sites with a light grazing regime (NPWS 2002). The extent of habitat within the region is unknown; however, at a minimum habitat is would be linked to the distribution of Box Gum Woodland and native grasslands (refer to Box Gum Woodland above).	Nil Impact to existing populations. Possible loss of habitat to one area identified as 'potential habitat' at Marilba Precinct near cluster 7.	Yass Daisy confirmed habitat (mapped as records with a 5m buffer) within 500m of a turbine = 0.13 ha. Works may come within 10 m of Yass Daisy plants at some sites. Measures to prevent peripheral or indirect impacts would be applied, including fencing, erosion and sedimentation control, restoration and induction of staff.

Survey Effort (refer Appendix B)			Distribution (refer Appendix C)			Habitat			Type of Impact	Distance of species to proposed works (within 500m)
Species	*Effort and Methods*[A]	*Timing*	*Location and extent of species in project site*	*Number of Individuals located*	*Known populations within 10 km radius (see Figure)*	*Habitat within site (detail ha)*	*Extent of habitat impacted and quality (ha)*	*Habitat within region (general)*		
	Targeted searches at 3 other CEEC sites – nil result. **SER:** Targeted surveys for threatened species at 4 good condition Box Gum Woodland sites, as part of general survey. Marilba cluster 7 targeted search and mapping for Yass Daisy; 3-5 m wide transects in potential development area. **Total Effort** – 3 person hours for targeted survey.		**SER:** Cluster 7 targeted searches and mapping within potential development area identified local distribution boundary to minimise impact. Potential habitat on involved property is at least 50 ha (refer **nghenvironmental** 2009). The population continues to the south, into the neighbouring property. *Note: Location of Yass Daisy populations are provided in Appendix F.*	colonies were recorded and mapped in the 1 ha (30 m x 340 m) search area. The population continues to the south.		Maximum potential impact area of moderate-good and good floristic condition BGW in new assessment areas is 1.25 ha, total within broader assessment area is not known.				
Superb Parrot	**Marilba and Coppabella BAs:** Bird census of 20-90 person mins duration: 25 surveys Transects of 20-30 mins duration: 17 surveys **Total Effort:** 24.5 person hrs Note: Surveys for all avifauna. However, surveys focused particularly on threatened and migratory birds, raptors, flocking species and wetland birds (all considered of higher risk for wind farm development).	**2008:** 1-3 and 16-19 September; 6-7 November. **2009:** March 9-11.	Recorded on a midslope west of Marilba cluster 4b and flying in a flock of 10 over the woodland patch to the north of Coppabella cluster 10. Also observed on numerous occasions within mature woodland beside Illalong Road 3 km west of the project site; however, the species was not recorded within the vicinity of proposed turbine sites.	12	Records primarily north of the project site near Binalong or east of project site.	Remnant and regrowth Box-Gum Woodland and dry grass forest patches with a relatively continuous over storey cover	Moderate-good, good condition Box Gum Woodland. TOTAL: 2.03 ha	The extent of habitat within the region is unknown; however, at a minimum habitat would be linked to the distribution of Box Gum Woodland and native grasslands (refer to Box Gum Woodland above).	Loss of foraging habitat, minor loss of potential breeding habitat Low collision risk	Potential foraging habitat (as mapped, Appendix J) within 500m of a turbine totals 743 ha. Recorded on cusp of cluster 10 (Coppabella precinct) and existing record near cluster 4b (Marilba precinct). Both ~ 450-500m from turbines.
Swift Parrot			Not recorded in project site.	N/A	This species has been recorded near McMahons Reef north-west of the project site within 8 km of the project site. However, only one record is known.	Remnant and regrowth Box-Gum Woodland with a relatively continuous over storey cover	Moderate-good, good condition Box Gum Woodland and Long-leaved Box Dry Grass Forest TOTAL: 3.09 ha		Loss of foraging habitat and potential roosting habitat. This species only breeds in Tasmania; therefore breeding habitat would not be impacted upon. Low collision risk	Not recorded in project site Potential foraging habitat (as mapped, Appendix J) within 500m of a turbine totals 743 ha.
Regent Honeyeater			Not recorded in project site.	N/A	This species has been recorded in the region, south of Binalong, approximately 9km north of the site.	Primarily Box Gum Woodland	Moderate-good, good condition Box Gum Woodland. TOTAL: 2.032 ha		Minor loss of foraging habitat Low collision risk	Not recorded in project site Potential foraging habitat (as mapped, Appendix J) within 500m of a turbine totals 743 ha.

Survey Effort (refer Appendix B)			Distribution (refer Appendix C)			Habitat			Type of Impact	Distance of species to proposed works (within 500m)
Species	*Effort and Methods*[A]	*Timing*	*Location and extent of species in project site*	*Number of Individuals located*	*Known populations within 10 km radius (see Figure)*	*Habitat within site (detail ha)*	*Extent of habitat impacted and quality (ha)*	*Habitat within region (general)*		
Golden Sun Moth	Golden Sun moth surveys were undertaken over a five day period (20, 25, 26 November and 2 and 3 December 2013) at 96 proposed turbine sites (this included several sites south of the Hume Highway, which are no longer part of this project). 48 turbine sites were not visited due to time constraints and restricted access. All sites were surveyed using a random meander method or point count method in accordance with prescribed survey techniques outlined in Survey Guidelines for Golden Sun Moth (Conservation Planning and Research, ACT Government, November 2010). The exception is that multiple site visits were not undertaken during this survey period.		No Golden Sun Moths were recorded within the Coppabella Precinct. The Golden Sun Moth was recorded at 33 separate locations within the Marilba precinct site. It was observed at 10 proposed turbine sites with the remaining observations recorded between turbine site areas and in surrounding lowland areas. The highest densities were recorded near the existing 132kV transmission line at waypoint 652498E, 6155096N on the 26 November at 11.40am with over 100 individual males observed within a 7-8ha paddock. Densities across the site ranged from low (1-9 individuals) near clusters M2, M3, M4a, M4b and M5 , moderate (10-49 individuals) near clusters M4a and M4b and high (above 50 individuals) near the transmission line.	244 males and 1 female. The single female moth was recorded at waypoint 657236E, 6151196N near cluster M5.	Species recorded at the Marilba site. Refer to Appendix H. Refer to the Golden Sun Moth *(Synemon plana)* surveys – Yass Valley Wind farm report prepared by Blue Gum Ecological Consulting, Appendix H.	The species is generally known from grassland/woodland mosaics. As understorey varies and intergrades between exotic-dominated and native-dominated species composition, mapping potential habitat with accuracy is very difficult. Given the broad habitat preference of this species, potential habitat was estimated as all Box Gum Woodland Derived Native Grassland in any condition (poor to good). This equals approximately 291 ha within these vegetation types across the Yass Valley project area. As an alternate means to calculate habitat for this species within the site, an additional map has been provided, Appendix H, which extrapolates from the survey information to estimate potential habitat. It is based on the location of each GSM search point and the assessment of habitat provided in the survey data. We have extrapolated 100m radius from each search point, this seeming a reasonable distance given the variation in understorey condition. We have also shown the results of the broader proposed Yass Valley Wind Farm site, for context. This provides the following estimates[2]: • Low potential habitat: no records, not suitable, very poor to poor potential habitat (94.2 ha) • Moderate habitat: no records, poor – moderate potential habitat (131.9 ha) • High potential habitat: confirmed habitat (91.1ha)	Box Gum Woodland, Derived Native Grasslands, and native pasture. Moths were observed in a variety of topographic situations including broad grassy valleys, low rolling grassy hills, mid slopes and rock hill top areas. All observations correlated with grassland that was either dominated or comprised a high proportion of Wallaby Grass. Majority of observations were recorded where no infrastructure is proposed such as north of Marilba (near transmission line). This area is proposed for offsetting. TOTAL: Areas of Box Gum woodland to be impacted upon. Majority is in a degraded poor condition. Total area is 2.03 ha of moderate to good box gum woodland and approximately 16ha. Unknown until pre-construction surveys completed; however ~ 136.8 ha impacted by existing infrastructure. A management plant including further surveys would be undertaken to inform this.		Minor loss of habitat due to the pattern on infrastructure location (linear, discrete turbine footings). There is potential to minimise impacts further via preclearance surveys and the implementation of a management plan to microsite infrastructure where possible and offset impact.	Based on the mapping provided in Appendix H, confirmed habitat within 500m of a turbine totals 65.9 ha (High potential habitat) and potential habitat totals 128.7 ha (Moderate habitat).

KEY: Marilba BA – Marilba Hills Precinct Biodiversity Assessment (2009); **Coppabella BA** – Coppabella Hills Precinct Biodiversity Assessment (2009); **nghenvironmental (2009c)** – targeted Yass Daisy surveys; **SER** – Supplementary Ecology Report (2012).

[A] survey methods and outputs are consistent with the Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft (DEC 2004) B total person hours expended on flora survey covering all vegetation communities and condition classes

[2] The result so far is conservative in that survey data show that the GSM was not found in all areas of potential habitat. Additional survey and impact area calculation is required to address gaps in survey (where infrastructure is proposed but surveys were not undertaken) and to provide an accurate area of impact on the final infrastructure layout to ensure appropriate offsets are provided, if required.

4 Relevant Impacts

Note on terminology:

The Coppabella and Marilba BA terminology is outlined in Section 2 of each report. From p.3 of the Marilba BA:

> *The 'subject site' refers to all areas directly affected by the proposal. 'Direct impacts' are those that directly affect flora and fauna values, and may include trampling, pollution, vegetation clearing and soil disturbance.*
>
> *The term 'study area' includes the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area extends as far as is necessary to take all potential impacts into account…*

4.1 Impact Summary - Including Collision and Barotrauma

4.1.1 White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

The EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community ('Box Gum Woodland CEEC') was recorded at the site. In terms of floristic condition, the extent of this CEEC corresponds to vegetation mapped as Box Gum Woodland in moderate to good and good condition (5 class condition categorisation; nghenvironmental 2012).

The proposal has been modified to avoid impacts to vegetation belonging to the CEEC with the exception of site 13 of the newly assessed areas (documented in the SER which shows the most up to date infrastructure layout for the project[3] , refer figure below[4]), where power line infrastructure would be micro-sited with input from an ecologist to minimise impacts on CEEC. Associated access tracks in this area will be located to avoid the CEEC. A Statement of Commitment ensures that this will be a condition of development in this area. The extent of impact is therefore now 2.032 ha, it being overestimated in the impact area calculations provided in the SER which did not reflect the fact the substation had been moved to minimise impacts on CEEC.

The proposal would impact a maximum of 2.032 ha Box Gum Woodland CEEC, consisting of 1.748 ha of BGW in mod-good condition and 0.284 ha in good condition. Appendix E details the location of Box Gum Woodland CEEC impact areas.

[3] Site numbers are shown on the Results Maps and Constraints Maps, provided in SER Appendix E.2 and E.3, respectively. Site 13 is shown on Map 6 of each of these map sets (maps 1-9).

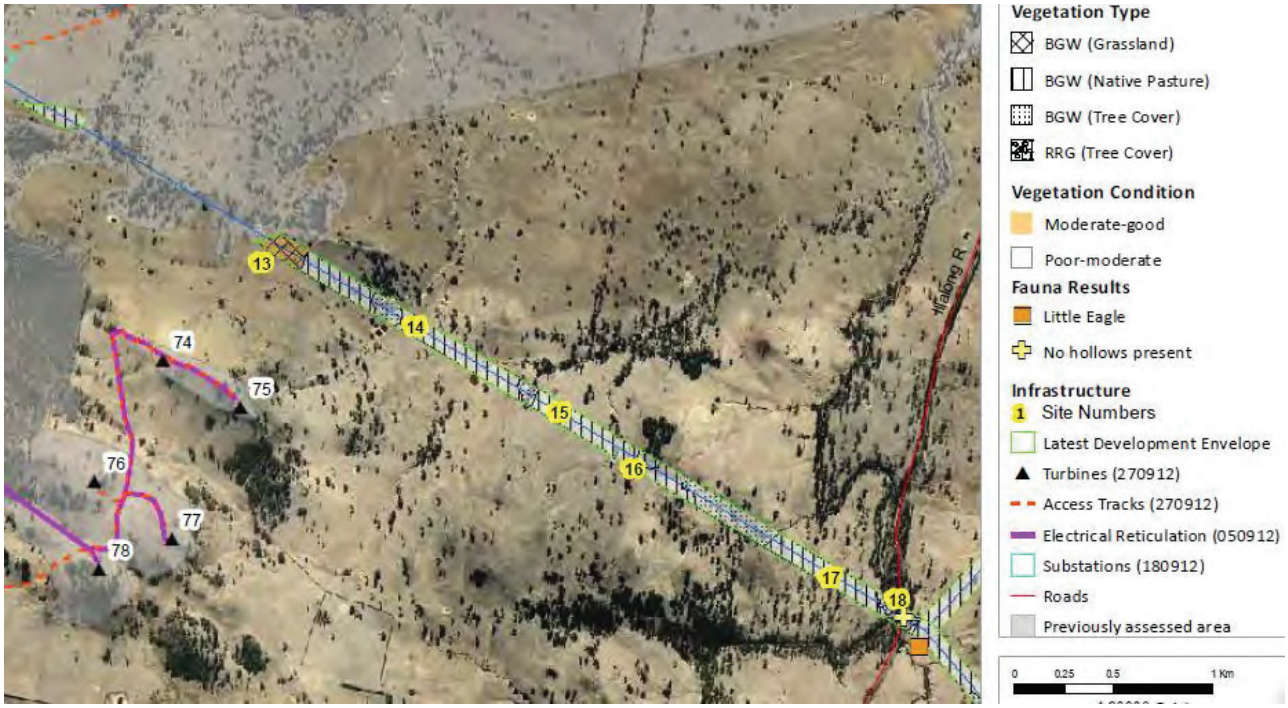


Figure 4-1 Site 13, assessed in the SER, located on the transmission line easement, approximately 900m north-east of Turbine 74

Impact Summary

An EPBC assessment of significant impact was undertaken for this CEEC, with results indicating that:

- The proposal would not significantly add to existing fragmentation in the study area[5].
- The project would avoid impacts to the CEEC as far as possible; the proposed action has been revised to avoid and minimise development in these areas.
- The majority of works would be undertaken in poor-moderate condition native pasture, representing highly degraded and modified habitat, of which does not belong to the Box Gum Woodland CEEC.
- The works would require site levelling in discrete areas and drainage which would affect soils, hydrology and ecological functions outside the CEEC. However, these impacts are expected to be highly localised, and are not expected to significantly affect the CEEC beyond the works boundaries.
- Weed control, fire prevention protocols and soil and water protection measures would ensure that impacts beyond the works sites are not significant, and do not cause a substantial change in species composition in the CEEC outside the site.
- Soil disturbance undertaken in non-EEC areas may stimulate germination of weeds, posing a risk to nearby CEEC, however considered manageable using best practice weed management which form a part of the project's Statements of Commitment.

It is considered that with the implementation of specific measures the proposed action is unlikely to have a significant impact on this community (refer Section 5 for management measures).

[5] With reference to fragmentation of the study area, several references occur in sections of the BAs to existing levels of fragmentation in the study area and on the subject site, a result of clearing for grazing and the effects of dryland salinity. This existing context of fragmentation and the prevalence of infrastructure on ridgetops already cleared of remnant vegetation ensure that the proposal would not significantly add to existing fragmentation of the study area.

4.1.2 Yass Daisy – loss of habitat

Known records and population

The threatened Yass Daisy was identified at the proposed site during the initial biodiversity assessment and targeted field surveys in 2009. During the original biodiversity assessment it was noted that the species appeared widespread and the population size was likely to be in the hundreds, potentially thousands at the site (Refer Table 3-3). Additional surveys, undertaken October 2009 (documented within Section 2.2.3 of the SER - nghenvironmental 2012) for new areas of development did not identify this species in the additional areas added to the project. The location of existing populations within the project site and the general number of individuals was verified to provide greater detail on this issue. These are listed in Table 2-2 and defined in Appendix F.

Impact summary:

An EPBC assessment of significant impact was carried out for this species in the Marilba and Coppabella BAs (nghenvironmental 2009a and 2009b respectively). Measures were developed to protect this species from significant impact, largely the undertaking of additional surveys, mapping and avoidance of known populations. The latter has now been accomplished, and is documented within the SER (nghenvironmental 2012). As a result the proposal will not impact any known populations of this species. Specific modifications to avoid impacts to the Yass Daisy at Coppabella and Marilba are detailed below. Careful management of impacts in areas near Yass Daisy populations is also included in the management measures for the project, to manage indirect impacts on this species.

Coppabella precinct

This species was found in two broad locations, neither of them within the proposed turbine cluster development envelope; the slope south-west of Cluster 7a and below the saddle which joins Clusters 6 and 7a, in Long-leaved Box forest. In both these areas the plant appears widespread and the population size is likely to number in the hundreds, if not thousands.

Infrastructure would be micro-sited away from areas where the Yass Daisy occurs to avoid significant impacts to this species. The species was also recorded in the large woodland remnant on flats north of Cluster 10; this area would not be impacted by the proposal.

Marilba precinct

At Marilba, the Yass Daisy was recorded near clusters 4 and 6.

The originally proposed track and cable route through BGW CEEC and Yass Daisy population between clusters 4a and 4b has been removed from the proposal.

The cluster 6 turbine works would be sited outside the woodland remnant and Yass Daisy habitat at this site, and micro-sited to avoid impact to individual plants.

The cluster 4 track and cable route on the eastern side of the fenced woodland remnant and Yass Daisy habitat would also be micro-sited to avoid impact to individual Yass Daisy plants. The fenced woodland in this area would not be impacted by the proposal.

4.1.3 Golden Sun Moth – loss of habitat

Known records and population

Golden Sun Moth populations were not known within or nearby the project site when the original assessments were undertaken. However, in the intervening period since the original biodiversity assessments for the Coppabella and Marilba precincts (2009), the species distribution has increased and it is has been recorded north, south and east of the project site. The closest record is approximately 2 km south of the proposed powerline alignment (Appendix C). Targeted surveys were undertaken for this species over a five day period (20, 25, 26 November and 2 and 3 December 2013) at 96 proposed turbine sites. 48 turbine sites were not visited due to time constraints and restricted access.

All sites were surveyed using a random meander method or point count method in accordance with prescribed survey techniques outlined in Survey Guidelines for Golden Sun Moth (Conservation Planning and Research, ACT

Government, November 2010. However the exception is that multiple site visits were not undertaken during this survey period.

The Golden Sun Moth's NSW populations are found in the area between Queanbeyan, Gunning, Yass, Young and Tumut. The species is reported from 48 sites in NSW, with 32 sites occurring in the ACT (DSEWPaC 2013). Forty-eight Bionet records of the species are known for the Murrumbidgee Catchment region, with the heaviest concentrations north of Canberra towards Yass. In the intervening period since the original biodiversity assessments for the Coppabella and Marilba precincts (2009), the species distribution of the Golden Sun Moth has increased and it is has been recorded north, south and east of the project site. Targeted surveys for this species have revealed its presence at the Marilba precinct. Surveys did not find the species at Coppabella, however potential habitat is present.

Habitat loss impacts

The Golden Sun Moth has shown a preference for natural temperate grasslands or secondary grasslands (derived from Box Gum grassy woodland) that are dominated by a low and open cover of native wallaby grasses (*Rytidosperma spp.*, formerly *Austrodanthonia spp*.) (OEH 2013b). The Golden Sun Moth has also been recorded in degraded and weed infested patches of grasses dominated by Redleg grass (*Bothriochloa macra*), spear grasses (*Austrostipa spp.*), weeping grass (*Microlaena stipoides*) and the introduced Chilean needle grass (*Nassella neesiana*) (OEH 2013b).

Potential habitat for this species is present at the project site and is classified as Box Gum Woodland, Derived Native Grassland, and pasture (supporting native species) in any condition (poor to good). The proposal will affect a combined total of approximately 136.8 ha within these vegetation types. Records indicate that not all areas of potential habitat are used by the moth.

The Golden Sun Moth was recorded at 34 separate locations within the Marilba precinct site. All observations correlated with grassland that was either dominated or comprised a high proportion of Wallaby Grass. It was observed at 10 proposed turbine sites with the remaining observations recorded between turbine site areas and in surrounding lowland areas where there is potential to microsite road and transmission line infrastructure and minimise direct impacts. Moths were observed in a variety of topographic situations including broad grassy valleys, low rolling grassy hills, mid slopes and rock hill top areas.

Within the Marilba precinct, at least 12 other sites contain suitable grassland habitat, however no Golden Sun Moths were observed in these areas.

Within the Coppabella precinct, at least 8 sites contain suitable grassland habitat, however no Golden Sun Moths were observed in these areas or within other areas of the Coppabella precinct.

The proposal will affect a combined total of approximately 167 ha within these vegetation types. The pattern of clearing is considered discrete; linear tracks and relatively small footings for power lines, larger footings for turbines, spaced at around 200 – 300m apart. The development of the project has refined the infrastructure layout in response to constraints including biodiversity constraints; hence the majority of the impact avoids areas of better quality vegetation.

Given the species was recorded at a range of sites; a broad area of potential habitat has been delineated for this species within the site. The highest densities were recorded near the existing 132kV transmission line at waypoint 652498E, 6155096N on the 26 November at 11.40am with over 100 individual males observed within a 7-8ha paddock. Densities across the site ranged from low (1-9 individuals) near clusters M2, M3, M4a, M4b and M5 , moderate (10-49 individuals) near clusters M4a and M4b and high (above 50 individuals) near the transmission line. Most individuals were recorded in one location north of proposed transmission line infrastructure in an area that is being considered as an offset site.

Alternative method to estimate habitat usage:

Given the broad habitat preference of this species, potential habitat was estimated as all Box Gum Woodland Derived Grasslands in any condition (poor to good). This estimate of potential habitat was based on vegetation type rather than surveys, given that not all of the infrastructure sites were able to be surveyed (100 out of 144 turbine sites and existing tracks enroute to these areas were surveyed). To provide an alternative means to consider the potential impact on this species, we have mapped habitat potential for those areas that were surveyed based on the location of each GSM search point and the assessment of habitat provided in the survey data (Appendix H). We have extrapolated

100m radius from each search point, this seeming a reasonable distance given the variation in understorey condition, as follows:

- Low potential habitat: no records, very poor to poor potential habitat (94.2 ha)
- Moderate habitat: no records, poor – moderate potential habitat (131.9 ha, 16.2 ha of which would be impacted)
- High potential habitat: confirmed habitat (91.1 ha, 4.98 ha of which would be impacted)

This alternative method is mapped in Appendix H.

It is considered that the Golden Sun Moth has potential to be impacted from the proposed action from habitat loss or direct mortality to individuals during the construction phase, in areas where it occurs within the development footprint.

Movement and collision risk

Only the male moth regularly flies, but is thought not to travel beyond 100 m from suitable habitat (Clarke & O'Dwyer 2000). Male moths fly only in bright sunshine during the warmest part of the day (10:00 – 14:00; 24 hr. time), although moths have been recorded flying as late as 16:00 under favourable conditions. The local regional flying season is relatively short, being about six to eight weeks between November and December, depending on seasonal conditions (OEH 2013b).

Given the limited movement of the Golden Sun Moth there are no collision risks for this species.

Indirect operational impacts: shading

Additionally, shading from infrastructure can affect the microclimate of habitat and may reduce the suitability of habitat, through lower temperatures. The relevant infrastructure consists of turbines, power poles and substations. In all cases, the shading that would fall on areas of adjacent pasture would be considered minor (most shading would be contained with hard stand areas and fenced yards or would be negligible, in the case of the power poles). Operational risks are therefore considered low.

Impact summary

Targeted surveys for the Golden Sun Moth have revealed the species is present within the Marilba precinct. The species was recorded in a range of topographic areas and habitat types, mostly dominated by Wallaby Grass. The impact assessment has identified the presence of populations at the site, utilising a range of habitats. As multiple site visits were not undertaken a precautionary approach has been applied and it is assumed the proposal has the potential to result in impact.

It was found that 10 of the proposed turbine sites surveyed comprised of a number of Golden Sun Moths utilising these areas with densities relatively low (1-9 individuals). Refer to Appendix H for a map of survey results.

It is considered that the Golden Sun Moth has potential to be impacted from the proposed action from habitat loss or direct mortality to individuals during the construction phase, in areas where it occurs within the development footprint. Operational risks from collisions or shading would be low. A management plan based on further preconstruction surveys would be developed to minimise impacts where possible and offset the residual impacts in areas where this species is known to occur.

4.1.4 Superb Parrot – loss of foraging and breeding habitat, collision risk

Known records and population

The Superb Parrot was recorded at the subject site (on a midslope west of Marilba cluster 4b and flying in a flock of 10 over the woodland patch to the north of Coppabella cluster 10) and observed on numerous occasions within mature woodland beside Illalong Road 3 km west of the project site; however, the species was not recorded within the vicinity of proposed turbine sites.

The project area intersects the South-west Slopes of NSW Important Bird Area (IBA), which includes the localities of Bowning, Boorowa, Rugby and the town of Yass (refer Figure 2-1). The IBA supports a regional population of the Superb Parrot and several records exist nearby the project site (Appendix D). The project site is located south of the IBA, but borders its eastern arm nearby Yass.

Records of flocks of between 20 and 50 birds were made in the Yass region only three times during spring and early summer of 1998; most records were of single birds or pairs (ACT Government 1999). The total population has been estimated at 5,000–8,000 birds (DECCW in prep.) and 6,500 adult birds (Garnett & Crowley 2000). Regional estimates include 'several 'several thousand' in the South-west Slopes (NSW) including 50–100 birds in the ACT (DECCW in prep.) (Baker-Gabb 2011).

In a survey of road verges on the NSW south-western slopes, there were 2.5 possible nesting trees per kilometre whilst just prior to the start of the breeding season there were 0.62 birds per kilometre (Davey, & Purchase 2004). While Manning et al. (2004) cites 106 nest trees for the South-west Slopes.

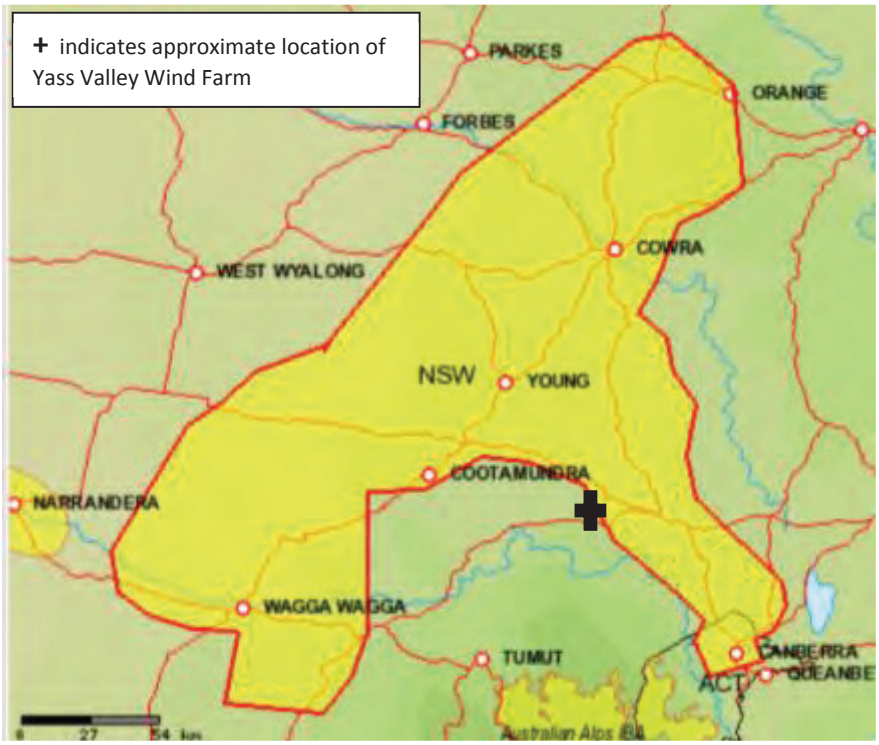


Figure 4-2 Location of South-west Slopes Important Bird Area (source BirdLife Australia 2007)

Habitat loss impacts

Across its range, the Superb Parrot uses two distinct habitat types for breeding: riverine forests in the Riverina, and Box Gum woodlands in the tablelands and slopes (Baker-Gabb 2011; Webster 1988).The Superb Parrot forages in Box Eucalypt Woodland, particularly that dominated by Yellow Box or Grey Box. Large flocks of adult and immature birds roam widely in search of food, and may be observed in various habitats at this time (Webster 1988).

Suitable foraging, nesting and breeding habitat for this species are present within the project site, primarily within moderate-good or good condition Box Gum Woodland (CEEC habitat). The species feeds in trees and understorey shrubs and on the ground. Understorey food species include the Common Wallaby-grass (*Austrodanthonia caespitosa*), and numerous Acacia species. The proposal would result in removal of 2.03 ha of this habitat.

Superb Parrots use woodland remnants to forage and move across the landscape and are less likely to cross extensive open areas. In the locality, woodland remnants largely coincide with roadside vegetation; feeding areas and flying routes are more likely to correspond with valleys and low hills supporting tree cover and remnant woodland along

roadsides, rather than with the open and fragmented vegetation on ridge top turbine sites. During the field surveys, the Superb Parrot was observed more commonly along roadsides confirming that the species uses these lower lying landscapes as corridors to travel through their home ranges. More detailed Superb Parrot surveys for a project nearby (Rye Park) that simultaneously surveyed ridges and lower landscape locations support this preference for lower landscape movements.

During surveys, Superb Parrots were observed mostly within the lowland areas where tree connectivity and tree hollows were more abundant, in particular, road side vegetation such as Ilalong Road (refer to Appendix J, showing records in relation to the 550m contour). While the species could be expected to occur in any location onsite, given its local distribution and movements between connected patches of woodland, general foraging habitat on this site has been calculated by mapping treed areas of Box Gum Woodland (Appendix J). 1,497 ha occurs within the project boundaries and 38.5 ha occurs within the proposal footprint (impact area).

This figure doesn't take into account that the species is known to prefer low lying habitat as opposed to ridge tops onsite. This is based on observations during Yass Valley surveys and it agrees well with more detailed surveys recently undertaken at Rye Park. Targeted flight path mapping of Superb Parrots was undertaken at Rye Park Wind Farm in November 2013 during their known breeding season. Results from this survey conclusively indicate the parrots made localised movements confined to Box Gum Woodland habitat and did not undertake long range and large-scale movements across ridge lines, but rather stayed at lower altitudes. Their foraging movements comprised of tree hopping and rest-stops and approximately 95% of flights recorded were at heights within the tree canopy or below 20m. Furthermore, most records of Superb Parrots were recorded within roadside vegetation (i.e. Rye Park Road) outside the project area within better quality Box Gum Woodland habitat as opposed to the more degraded woodland of the project area, indicating the species is likely to prefer better quality habitat if available (Refer to Rye Park map and survey effort details, now provided as Appendix I).

Despite results from Rye Park Wind Farm suggesting that Superb Parrots are likely to utilise woodland at lower altitudes over heavily fragmented and degraded woodland on ridge tops, as a precautionary measure, this assessment assumes that the areas of connected Box Gum Woodland on upper slopes at Yass Valley also constitute habitat and they have been included in the impact area estimates.

Prime breeding habitat for the Yass Valley site equates to Box Gum Woodland with hollow bearing trees, although the species can also utilise isolated trees with hollows, primarily mature trees. It is noted that these trees must be quite old before they develop hollows and while large trees (i.e. tree with large trunk diameter) of White Box or Yellow Box can be observed within the project area they often do not support medium or large hollows of suitable size for this species. As well as ecological literature and observations on site, confinement to Box Gum Woodland for breeding also agrees well with observations at Rye Park. During 1km transects across the entire project area, Superb Parrots were never observed in any other veg types (Rye Park Biodiversity Assessment 2014, nghenvironmental). Habitat removal, particularly the removal of hollow-bearing trees in mature woodland remnants, may be a potential risk for this species. Blakely's Red Gum is the main source of nesting hollows (Davey 1997) and nest trees tend to be close to watercourses (Webster 1988), with the species being faithful to traditional nest sites (Webster 1988). Nest trees tend to be older, often affected by dieback with little regeneration (Manning 2004). Mature trees are generally rare across the project site and tend to occur only in disturbed lowland woodland remnants or as isolated paddock trees in lowland areas. Trees in larger remnant woodland and forest patches on slopes and ridge crests at the project site are generally mature regrowth yet to reach hollow-forming age. Mature woodland and areas where dense numbers of hollows have been recorded have been designated as high constraints and the proposal commits to avoiding them in all but a select number of cases (such as the micrositing of power pole footings and access tracks). Furthermore, a commitment of the project is to avoid hollows, where possible, and offset any hollow removed with a nest box or re-mounted hollow (Refer to Offset Strategy, included in the project's SER and included with this submission as Appendix G).

While hollows have not been mapped extensively for the site, commitments of the proposal include minimisation of tree hollow removal and offsetting of all hollows removed so minimal impact on breeding habitat is anticipated. Again, the preference of this species for the low lying areas suggests that infrastructure development, which will be concentrated on ridges, will not have a high impact on breeding habitat. Breeding habitat has been considered equivalent to the preferred foraging habitat (Appendix J) that being in Box Gum Woodland below 550m. 831.3 ha occurs within the project boundaries and 29.3 ha occurs within the proposal footprint (impact area).

Movement and collision risk impacts

Superb Parrots fly in large flocks and have low fecundity and are at risk of population-scale impacts as a result of blade-strike. Little is known about seasonal migration routes for the Superb Parrot; it is assumed that they move west and then north after the breeding season (A. Manning, CRES ANU, pers. comm.). Webster (1997; 1998) states Superb Parrots generally move away from their breeding habitat in mid-January and the Parrot is rarely observed on the inland slopes of NSW during winter, with the few birds seen usually being breeding pairs (Webster 1988). Most of the breeding population from the inland slopes appears to move to the eucalypt-pine woodlands on the plains of west-central and north-central New South Wales (Webster 1988; DECCW in prep.).

Regional records of the Superb Parrot are concentrated to the west and north of the project site, but are less frequent nearby the project site. The records suggest the parrot relies on movement to the west of the project site confirming the assumption of Webster 1988 that the breeding population move west from the inland slopes (Figure 2-2).

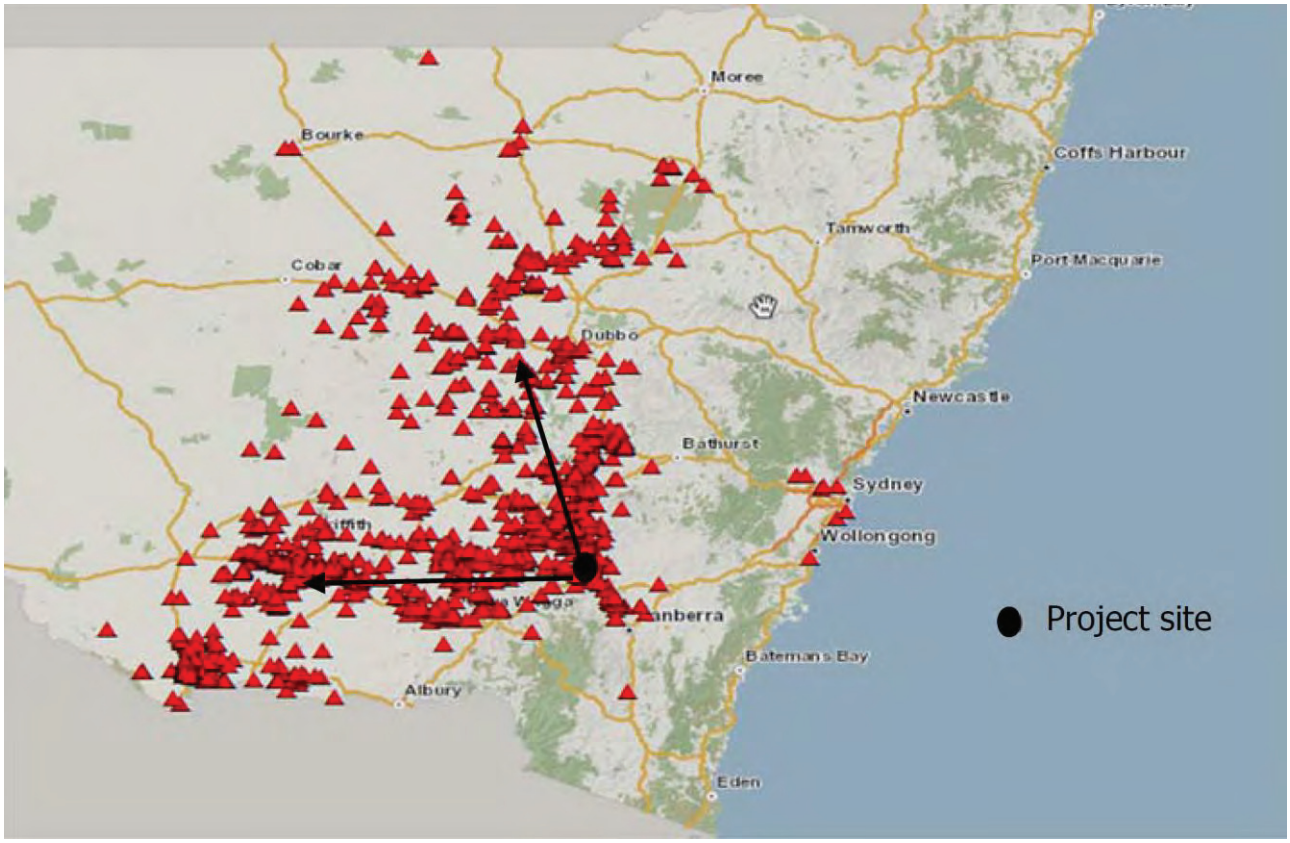
Local migration routes are not known nearby the project site. The species may forage up to 10 km from nesting sites and at the micro scale, distribution and abundance is thought to be influenced by tree cover and species composition (Webster 1988; Garnett1992a). When making local foraging movements, the Superb Parrot avoids open areas on foraging flights and while the species uses woodland remnants as corridors, they rarely cross extensive open ground (Webster 1988, Davidson and Chamber 1992, Webster and Ahern 1992, Higgins 1999).

Because of the extent of clearing and fragmentation, the majority of the turbine sites are unlikely to provide quality foraging habitat for the Superb Parrot. There is not enough flight height data relating to the Superb Parrot to determine if this species is known to fly at turbine height. However, a variety of other parrot species are known to fly at turbine blade height at times, although the great majority of recorded flights are from below that zone (Biosis Research 2006). Flights between roost/nest and foraging areas are likely to be at tree canopy level. Superb Parrots have been observed flying high over open areas in the South-West Slopes. However, they do tend to occur more in the lower elevation/relief parts of the landscape where the Box Gum Woodlands, including scattered paddock trees, are located; this environment is where nest trees and food is likely to occur (A. Manning, CRES ANU, pers. comm.). As a result, the frequency of parrots flying high over the turbine ridge tops is likely to be low reducing risk of collision.

Due to the movements and ecology of the Superb Parrot, it is considered a low-moderate turbine collision risk (for both individuals and at a population level, see summary page 91 and detail in Appendix D, Marilba BA). It has a similar characteristics to the Swift Parrot, modelled to have an actual avoidance rate of around 99% (Biosis Research 2006; cited in Marilba BA p.93). A higher risk is present along roadsides due to vehicle collisions (discussed p85 Marilba BA). Other indirect impacts such as noise and dust during construction would be temporary.

In terms of the operational impacts of wind farms on adjacent habitat, no conclusive buffer can be applied to all species to account for a 'sterilisation' of habitat that may occur as individuals avoid foraging or nesting near turbines. A review of bat deaths at wind farms in Germany revealed turbine placement as a key factor in the mortality of bats. A total of 89 % of all bat fatalities were found to be near turbines that were within 100 m of a wooded area (Durr and Bach 2004). Bird and bat activity levels are generally concentrated around areas of vegetation. The activity levels are likely to be highest in better quality wooded areas (more mature woodland that provides hollows).

A 60m buffer would result from applying the formula provided in Natural England (2012), developed based on bat impacts. The ecology of the Superb Parrot does not suggest that a greater amount should be considered. A 60m buffer from turbines has been mapped and equates to 14.4 ha of potential foraging and 4 ha of potential breeding habitat. Considering the tree hoping movements of this species, 60m is considered to be conservative.



Regional NSW records for the Superb Parrot

Figure 4-3 Regional NSW records for the Superb Parrot

Impact summary

An EPBC assessment of significant impact was undertaken for this species, with results indicating that:

- The construction of the wind farm would result in the loss of 2.032 ha of Box Gum Woodland foraging habitat, that being the diverse CEEC that may provide quality foraging resources.
- Considering movements across the site, potential and preferred habitat could also be considered to extend into all areas of treed Box Gum Woodland onsite. This would equate to the removal of 38.5 ha of potential habitat and 29.3 ha of preferred habitat, based on the mapping in Appendix J.
- Limited breeding habitat is available in the form of hollow-bearing trees; however the proposal has largely avoided intact woodland vegetation with hollow-bearing trees and removal of any hollows will be offset.
- The habitat that would be affected is generally degraded and woodland habitat in similar condition is relatively abundant in the surrounding area.
- Collision risks from migration events or local movements are low given, a) the species migration route appears to primarily be west of the project site (as shown by regional records), and b) the species is unlikely to move across degraded ridge-tops and would use remnant patches along roadsides as 'stepping stones' during migratory or foraging movements.

It is considered that with the implementation of specific measures, particularly those related to hollow-bearing tree protection, the proposed action is unlikely to have a significant impact on the Superb Parrot (refer Section 5 for management measures). A commitment to an operational bird and bat management plan will address the uncertainty and provide a mechanism for operational management, if required.

4.1.5 Swift Parrot – loss of foraging habitat, collision risk

Known records and population

The Swift Parrot was not identified at the project site during surveys. The species has been recorded in Booroowa Shire to the north of the site. The closest record is approximately 8 km north-west of the project site (near McMahons Reef). Potential foraging habitat for this species is present at the proposed site and it is possible that this species occurs there during its winter migration.

As for the Superb Parrot, the project area intersects the South-west Slopes of NSW IBA. The IBA supports a significant wintering population of the endangered Swift Parrot. However, records within 10 km of the project site are few (Appendix D). The location of the mapped IBA boundaries (Figure 4-4) and the regional records (Figure 2-3) indicate the project site is located nearby and adjacent to known populations, but does not support a core population of this species.

Habitat loss impacts

No Swift Parrots were observed at the Yass Valley site during several seasons of surveys since 2008. On the mainland, this species predominantly inhabits dry sclerophyll eucalypt forests and woodlands, in particular, temperate box ironbark woodlands.

The Swift Parrot has potential to be impacted from loss of foraging habitat. Moderate-good or good condition Box Gum Woodland (CEEC habitat) or Long-leaved Box Dry Grass Forest is the most likely vegetation types this species is expected to inhabit if it were to occur within the project site. These vegetation types provide potential foraging habitat including feed trees of the White Box, or Yellow Box and the winter-flowering Long-leaved Box.

The proposal would result in removal of 2.032 ha of Box Gum Woodland and 1.060 ha of Long-leaved Box Dry Grass Forest, therefore a total of 3.092 ha. However, habitat is marginal over most of the site due to clearing associated with long-term grazing. Long-leaved Box stands were generally uncommon and scattered on side slopes and consisted of regrowth; better habitat is likely to be present in timbered lowland areas.

Considering movements of this species across the landscape, in regard to potential foraging habitat, there is greatest potential for the species to forage in areas identified for the Superb Parrot; within the lowland areas with tree connectivity, in particular, road side vegetation such as Ilalong Road. However, for the reasons stated for the Superb Parrot, the species could be expected to use better vegetation on upper slopes. Using the same method as for the Superb Parrot - 1,497 ha occurs within the project boundaries and 38.5 ha occurs within the proposal footprint (impact area). Considering preferred foraging habitat, 831.3 ha occurs within the project boundaries and 29.3 ha occurs within the proposal footprint (impact area).

No breeding habitat is present on mainland Australia.

Movement and collision risk

The Swift Parrot breeds in Tasmania and Furneaux Group islands, migrating to the mainland between autumn and winter, where it becomes nomadic in response to the availability of blossoms and other food (Pizzey et al 2006). Wintering flocks may remain in a district for weeks, returning as a flock to the same tree each night for roosting.

Movement pathways used by Swift Parrots throughout their range are not well understood. Although large scale movement trends have been demonstrated from Tasmania to mainland Australia, it is not known if long distance movements are predominantly undertaken in groups, nocturnally or diurnally, at specific heights or what triggers such movements (Saunders et al 2011).

The closest regional records are concentrated to the west and south-west of the project site within the Upper Slopes sub-region of Murrumbidgee CMA, although records are not known directly east of the project site, but are abundant on the coast (Figure 2-3). The records suggest the parrot relies on movement west and east of the project site, but is not heavily reliant on movement directly within the project site which is most likely attributed to the lack of adequate foraging habitat in these more heavily grazed areas.

As the Swift Parrot is a migratory species that travels in large flocks, there is potential for collision with turbines. However, the project site does not appear to be directly located within the migration pathway of the species, as

depicted from known regional records of the species in NSW and the lack of records nearby the project site. It is therefore expected that if the parrot were to occur within the project site it would move lower through the landscape during foraging movements.

The movement and collision risk is expected to be the same as detailed for the Superb Parrot. That is, flights between roost and foraging areas are likely to be at tree canopy level and the species may fly at turbine blade height as they migrate to other woodland and forest sites. However, the Swift Parrot is noted as a manoeuvrable flier and frequency of flights over the turbine ridges is likely to be low given the lack of mature woodland habitats within these predominantly cleared and degraded areas; hence collision with turbines is expected to be low.

Known deaths of Swift Parrots have been related to window strike, fence strike or vehicle impact and are associated with situations where such structures are in close proximity to sites of concentrated foraging by the species; the project site is not known to be located within a primary foraging site. While more recent data is lacking for collision impacts from wind farms, no Swift Parrot deaths have been attributed to collisions with turbines within initial studies (Smales, 2005). An assessment that modelled the potential collision rate of 39 wind farms located in the distribution range of the Swift Parrot concluded that the potential combined blade-strike impact of all of these wind farms would not be significant; the modelled results equated to slightly more or less than one parrot killed due to wind turbine collision every ten years (Smales, 2005).

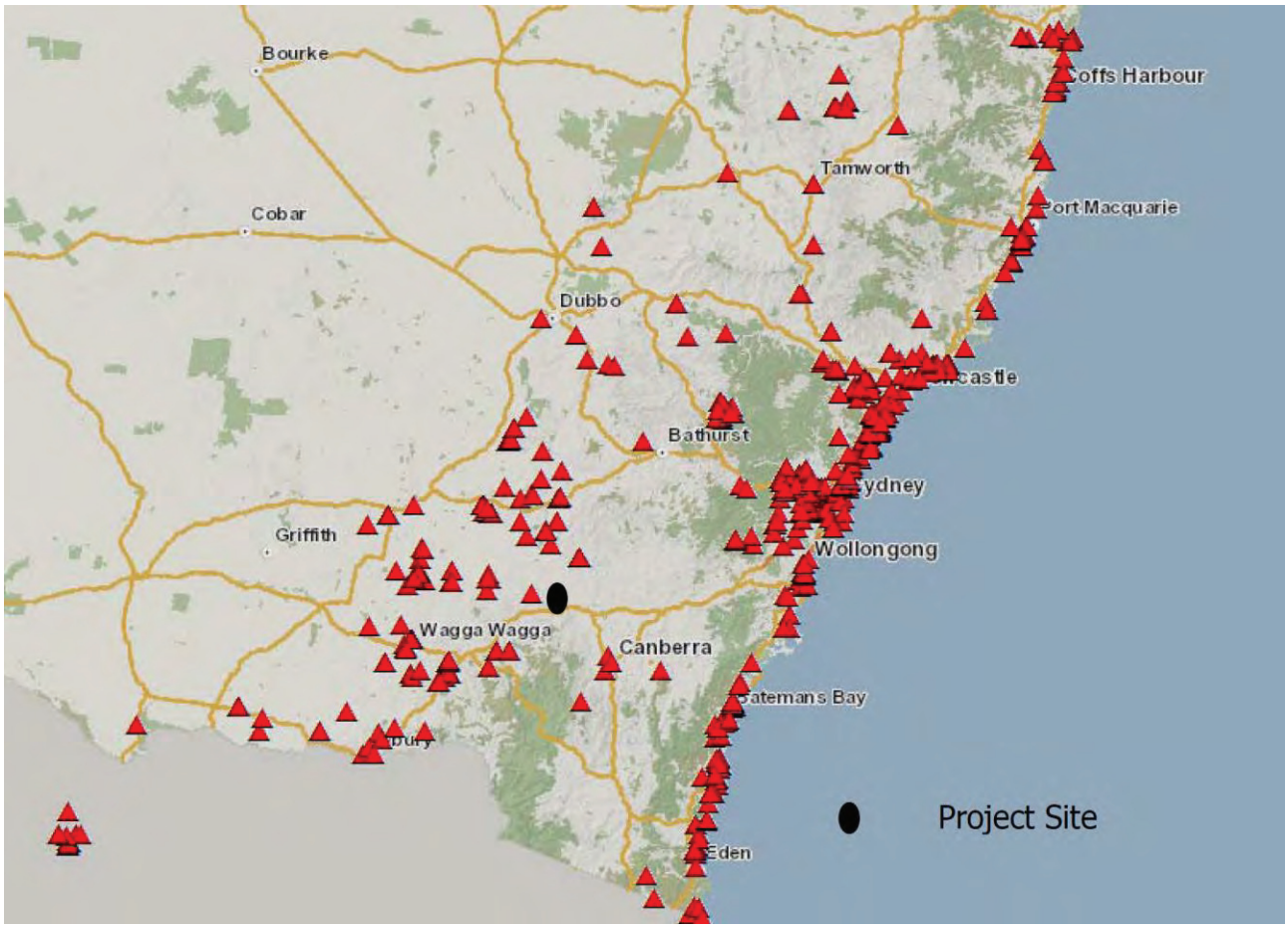


Figure 4-4 Regional NSW records for the Swift Parrot

It is considered that a bird species with the flight characteristics of the Swift Parrot would be likely to have an actual avoidance rate of around 99% (Biosis Research 2006; cited in Marilba BA p.93). It is considered a low-moderate turbine collision risk (for both individuals and at a population level, see summary page 91 and detail in Appendix D, Marilba BA). Other indirect impacts such as noise and dust during construction would be temporary. In terms of operational impacts on habitat, no conclusive buffer can be applied to all species to account for a 'sterilisation' of habitat that may occur as individuals avoid foraging or nesting near turbines.

A 60m buffer would result from applying the formula provided in Natural England (2012), developed based on bat impacts. The ecology of this species does not suggest that a greater amount should be considered. A 60m buffer from turbines has been mapped and equates to 14.4 ha of potential foraging and 4 ha of potential breeding habitat. Considering the tree hoping movements of this species, 60m is considered to be conservative.

Impact summary

An EPBC assessment of significant impact was undertaken for this species, with results indicating that:

- The Swift Parrot is a migratory species that can travel in large flocks, however, they are manoeuvrable fliers and do not breed locally, therefore the construction of the wind farm would result in the loss of foraging habitat only (3.092 ha of Box Gum Woodland and Long-leaved Box Dry Grass Forest)
- The foraging habitat that would be affected is marginal and wintering feed resources (Long-leaved Box) are not readily available.
- Considering movements across the site, potential and preferred habitat could also be considered to extend into all areas of treed Box Gum Woodland onsite. This would equate to the removal of 38.5 ha of potential habitat and 29.3 ha of preferred habitat, based on the mapping in Appendix J.
- Collision risks from migration events or local movements are low given the project site does not appear to be directly located within the migration pathway of the species due to lack of records in the locality.
- The species is unlikely to move across degraded ridge-tops and would use remnant patches along roadsides as 'stepping stones' during migratory or foraging movements.

It is considered that the proposed action is unlikely to have a significant impact on the Swift Parrot. A commitment to an operational bird and bat management plan will address the uncertainty and provide a mechanism for operational management, if required.

4.1.6 Regent Honeyeater – loss of foraging habitat, collision risk

Known records and population

The Regent Honeyeater was not identified at the site during surveys. Closest records of this species are approximately 9 km east / north-west of the site nearby Binalong (Appendix D).

There are only three known key breeding regions for the Regent Honeyeater and include: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. The NSW breeding populations are located significantly north of the project site, with the Capertee Valley population being the closest (approximately 230 km north) (OEH 2013b). Generally, in NSW the distribution of the Regent Honeyeater is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. Known records indicate the project site does not support a core population of this species. No breeding habitat would be affected.

Habitat loss impacts

No Regent Honeyeaters were observed during surveys. Potential foraging habitat is present within the project site and it is considered possible that this species could occur there. Potential foraging eucalypt species that occur within the project site include Yellow Box, Blakely's Red Gum, Red Box and Red Stringybark within Box Gum Woodland. However, the habitat supporting these eucalypt species is generally degraded and trees are largely scattered within their distribution within the project site. The proposal would impact woodland habitat primarily along the edges of larger patches of woodland and in isolated stands on slopes, but the works would not impact habitat connectivity.

Regent Honeyeaters are generalist foragers, which feed mainly on nectar from a wide range of eucalypts and mistletoes (Blakers et al 1984) and the project site does not support a variety or large number of different flowering feed trees. Therefore, the Regent Honeyeater is expected to forage in moderate-good or good condition Box Gum Woodland where feed trees are higher in abundance and therefore more accessible. The proposal would result in the removal of 2.032 ha of this habitat.

Considering movements of this species across the site, there is greatest potential for the species to forage in areas identified for the Superb Parrot; within the lowland areas with tree connectivity, in particular, road side vegetation

such as Ilalong Road. However, for the reasons stated for the Superb Parrot, the species could be expected to use better vegetation on upper slopes. Using the same method as for the Superb Parrot - Using the same method as for the Superb Parrot - 1,497 ha occurs within the project boundaries and 38.5 ha occurs within the proposal footprint (impact area). Considering preferred foraging habitat, 831.3 ha occurs within the project boundaries and 29.3 ha occurs within the proposal footprint (impact area).

Despite the species mobility, local populations appear not to persist in small remnants (less than 200 ha) (Garnett & Crowley 2000). The largest remnant within the project area is approximately 140 ha suggesting that while some habitat maybe available on site, habitat quality is marginal and the species is therefore unlikely to be a permanent resident of the project site.

This species breeds in specific locations. No breeding habitat is known from the site or immediate surrounds.

Movement and collision risk

The Regent Honeyeater can undertake large-scale nomadic movements across the landscape, also moving in flocks and movement patterns are often linked to availability of resources (Pizzey et al 2006). It can be assumed that the species may travel through the project site to other foraging grounds and there may be a risk of blade-strike to this species during the operation of the wind farm.

Little information is available on the migration patterns of this highly mobile species; however regional records across NSW indicate a strong presence of this species to the south, east and north-east of the project site in better quality habitat (i.e. National Parks) (Figure 2-4). This better quality habitat includes Namadgi NP, Morton NP, Nattai NP and Blue Mountains NP. It is expected the movement of this species would commonly occur through this connection where better quality foraging resources exist. Research in grazing landscapes in southern NSW showed a pronounced trend for nectarivores to move along densely vegetated areas, and use the same route for return journeys (Fischer and Lindenmayer 2002a).

Additionally, the species prefers the wettest, most fertile sites for foraging such as along creek flats, broad river valleys and foothills (Pizzey 2006). This suggests that if present, Regent Honeyeaters are more likely to use valleys, roadside remnant corridors and low hills than the disturbed high ridges of the proposed turbine sites to reach foraging habitat.

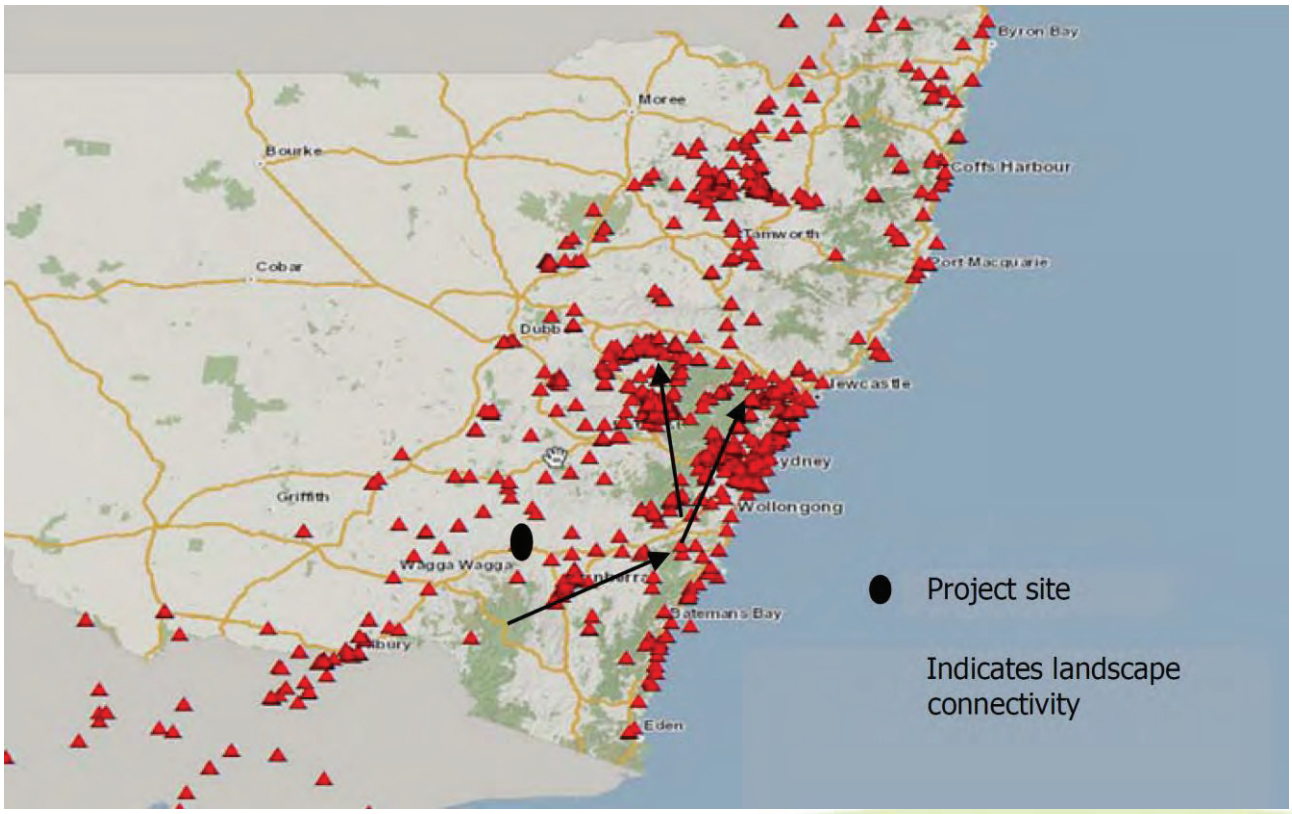


Figure 4-5 Regional NSW records for the Regent Honeyeater

Research in grazing landscapes in southern NSW showed a pronounced trend for nectarivores such as the Regent Honeyeater to move along densely vegetated areas, and using the same route for return journeys (Fischer and Lindenmayer 2002a; cited in Appendix F, Marilba BA). On current knowledge, the Regent Honeyeater is considered unlikely to fly high above the turbine ridges, and therefore the risk of bladestrike would be low.

Other indirect impacts such as noise and dust during construction would be temporary. In terms of operational impacts on habitat, no conclusive buffer can be applied to all species to account for a 'sterilisation' of habitat that may occur as individuals avoid foraging or nesting near turbines. A 60m buffer from turbines has been mapped and equates to 14.4 ha of potential foraging and 4 ha of potential breeding habitat. Considering the tree hoping movements of this species, 60m is considered to be conservative.

Impact summary

An EPBC assessment of significant impact was undertaken for this species, with results indicating that:

- The construction of the wind farm would result in the loss of potential foraging habitat only (2.03 ha of Box Gum Woodland).
- The lack of records in the locality suggests the potential foraging habitat that would be affected is marginal and the abundance of feed trees is low in the affected habitat.
- Considering movements across the site, potential and preferred habitat could also be considered to extend into all areas of treed Box Gum Woodland onsite. This would equate to the removal of 38.5 ha of potential habitat and 29.3 ha of preferred habitat, based on the mapping in Appendix J.
- The proposal would impact woodland habitat primarily along the edges of larger patches of woodland and in isolated stands on slopes, but would not impact habitat connectivity.
- The Regent Honeyeater can undertake large scale nomadic movements and travel in large flocks, however, collision risks from migration events or local movements are low given the project site does not appear to be directly located within the migration pathway of the species due to lack of records in the locality.
- Regent Honeyeaters are more likely to use valleys, roadside remnant corridors and low hills than the disturbed high ridges of the proposed turbine sites to reach foraging habitat.

It is considered that the proposed action is unlikely to have a significant impact on the Regent Honeyeater. A commitment to an operational bird and bat management plan will address the uncertainty and provide a mechanism for operational management, if required.

4.1.7 Clarification regarding potential foraging habitat for Superb and Swift Parrot and Regent Honeyeater

In the EPBC referral, areas of impact for these species were calculated to be:

- 2.03 ha of Superb Parrot foraging / breeding habitat ('moderate to good' and 'good' condition Box Gum Woodland)
- 3.092 ha of Swift Parrot foraging habitat ('moderate to good' and 'good' condition Box Gum Woodland and treed Long-leafed Box Woodland)
- 2.03 ha of Regent Honeyeater habitat (treed Box Gum Woodland, not pasture derived from this vegetation unless in moderate to good condition)

This restriction based on vegetation condition reflects that the poor condition vegetation is considered more marginal habitat for these species. Whether or not the vegetation meets NSW or C'wealth EEC criteria has not been used to define the habitat potential to host these species. The use of the categories 'moderate to good' and 'good' conditions is appropriate to quantifying the Superb Parrot and Regent Honeyeater habitat as it includes all areas of connected canopy, but it is noted that it also includes better condition area of derived grassland. It excludes degraded pasture without tree cover.

However, for these wide ranging species, it is accepted that even lower condition vegetation can provide habitat as individuals make use of remnant woodland patches separated by areas of pasture. The site contains large areas of very poor pasture habitat that would not be considered important habitat for these species.

To map and calculate how much habitat occurs within the project boundaries, the condition restriction has been relaxed but the vegetation type confined to Box Gum Woodland. This agrees with the literature for these species:

> Superb Parrot: It inhabits Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. The species nests in the hollows of large trees (dead or alive) in open Box-Gum Woodland or isolated paddock trees. Species known to be for used for nesting are Blakely's Red Gum, Yellow Box, Apple Box and Red Box (DECC 2008a). It forages on the ground in grassy woodland, also on fruit, seeds and blossoms of acacias, eucalypts and mistletoes (Pizzey et al 2006). (Cited in Appendix C-15, Marilba BA).
>
> Swift Parrot: During the non-breeding season the Swift Parrot feeds extensively on nectar and lerp and other items from eucalypt foliage. Mugga Ironbark (E. sideroxylon), Red Ironbark (E. tricarpa), Yellow Box (E. melliodora), White Box (E. albens), Grey Box (E. macrocarpa) and Yellow Gum (E. leucoxylon) are important sources of nectar in the box-ironbark forests and woodlands of NSW (Kennedy & Tzaros, 2005).
>
> Regent Honeyeater: Most records are from box-ironbark eucalypt associations and it appears to prefer wetter fertile sites within these associations (Menkhorst et al. 1999). It is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Yellow Gum, Blakely's Red Gum and White Box (Menkhorst et al. 1999). It also occurs in riparian forests of River She-oak and wet lowland coastal forests dominated by Swamp Mahogany and Spotted Gum and (DECC 2008a; NPWS 1999d). The species can undertake large-scale nomadic movements in the order of hundreds of kilometres. (Cited in Appendix C-13, Marilba BA).

The following method has been used to differentiate areas able to be used (potential) from areas more likely to be used (preferred):

> Superb Parrot, Swift Parrot, Regent Honeyeater *potential* foraging habitat (Box Gum Woodland – excluding derived pastures)
>
> a. Area within the project boundaries = 1497 ha
>
> b. Area within the development footprint (impact area) = 38.5 ha
>
> Superb Parrot, Swift Parrot, Regent Honeyeater *preferred* foraging and Superb Parrot *preferred* breeding habitat (Box Gum Woodland below 550m contour – excludes derived pastures)
>
> a. Area within the project boundaries = 831.3 ha
>
> b. Area within the development footprint (impact area) = 29.3 ha

4.1.8 Clarification risk assessment process: MNES

Risk matrix assessments are provided within the BAs (Marilba Appendix D). This risk assessment incorporates all bird and bat species listed as threatened or migratory under the Commonwealth Environmental Protection Biodiversity Conservation Act 1999 which are included on the EPBC Act Matters of National Environmental Significance search report. The impact risk rating is derived from the cumulative scores of eight risk factors: 1) Local occurrence, 2) breeding habitat present, 3) breeding habitat potentially impacted, 4) foraging habitat present, 5) foraging habitat potentially impacted, 6) use of turbine ridge airspace, 7) flocking or gregarious, 8) migratory or nomadic. Factors were weighted equally, except for presence of local records as this was considered to be important to filter out species with known distribution ranges outside the study area. The Marilba risk assessment of relevant MNES is summarised below:

Species	Risk factors								Cumulative risk score
	Occurs locally (2 points)	Breeding habitat present	Breeding habitat potentially impacted	Foraging habitat present	Foraging habitat potentially impacted	Use of turbine ridge airspace	Flocking or gregarious	Migratory or nomadic	
Regent Honeyeater	2	1	1	1	1	1	1	1	**9**
Superb Parrot	2	1	1	1	1	1	1	0	**8**
Swift Parrot	2	0	0	1	1	1	1	1	**7**
Rainbow Bee-eater	2	1	0	1	0	1	1	1	**7**
Cattle Egret	2	0	0	1	1	1	1	1	**7**
White-throated Needletail	2	0	0	1	0	1	1	1	**6**
White-bellied Sea-Eagle	2	0	0	0	0	1	0	1	**4**
Fork-tailed Swift	0	0	0	1	0	1	1	1	**4**
Satin Flycatcher	2	0	0	1	0	1	0	1	**5**
Great Egret	0	0	0	0	0	1	1	1	**3**
Australian Painted Snipe	0	0	0	0	0	1	0	1	**2**
Eastern Long-eared Bat	0	1	1	1	1	1	0	0	**5**

Species with cumulative risk scores of 5 and above are included in the relevant Assessments of Significance / Principle Significance Assessment in Appendices E and F of the BAs, in order that they be assessed in more detail. The following text is extracted from those assessments:

Foraging and migration behaviour

Superb Parrot

> *The Superb Parrot avoids open areas on foraging flights (DNRE 1992). While Superb Parrots use woodland remnants as corridors, they rarely cross extensive open ground (Webster 1988, Davidson and Chamber 1992, Webster and Ahern 1992, Higgins 1999). A variety of other parrot species are known to fly at turbine blade height at times, although the great majority of recorded flights are from below that zone (Biosis Research 2006). Superb Parrots have been observed flying high over open areas in the South-West Slopes. However, they do tend to occur more in the lower elevation/relief parts of the landscape where the Box-Gum Woodlands, including scattered paddock trees, are located - this is where nest trees and food are likely to occur (A. Manning, CRES ANU, pers. comm.). Because of the extent of clearing, the ridgetop turbine sites are unlikely to provide quality foraging or migration habitat for the Superb Parrot. The frequency of parrots flying high over the turbine ridgetops, and the risk of bladestrike, are likely to be low.*
>
> [These assumptions are consistent with recent surveys at Rye Park, which found that local movements are largely confined to the lower landscape position, away from ridges – additional information has been supplied, Attachment I.]

Swift Parrot

> *No flight height data is available for this species; a variety of other parrot species are known to fly at turbine blade height at times, although the great majority of recorded flights are from below that zone (Biosis Research 2006). Migratory routes and durations of residency are likely to be variable depending on food supplies. Flights between roost and foraging areas are likely to be at tree canopy level. The frequency of flights over the turbine ridges is likely to be low.*
>
> *A recent cumulative assessment of 39 wind farms located in the distribution range of the Swift Parrot concluded that the combined bladestrike impact of all of these wind farms would not be significant (Biosis Research 2006).*

Regent Honeyeater

> *Research in grazing landscapes in southern NSW showed a pronounced trend for nectarivores to move along densely vegetated areas, and using the same route for return journeys (Fischer and Lindenmayer 2002a). On*

current knowledge, the Regent Honeyeater is considered unlikely to fly high above the turbine ridges, and therefore the risk of bladestrike would be low.

General

The Regent Honeyeater, Superb Parrot and Swift Parrot are highly mobile, but dependent on remnant forest and woodland habitat. Precise migration routes at the site are not known, but woodland species dependent on tree cover (such as the Regent Honeyeater and Superb Parrot) could be expected to use scattered trees and remnant patches as 'stepping stones' during migratory or foraging movements.

There are valley areas with scattered trees providing east-west and north-south connectivity within 5 kilometres of the site. Black Range Road to the south and Illalong Road/Illalong Creek to the west provide linear remnants with tree cover that may be used for woodland bird foraging and dispersal. The heavily cleared nature of the involved properties, and the turbine ridges in particular, would appear to make their frequent use for bird migration unlikely.

Migratory species: White-throated Needle tail, Satin Flycatcher etc.

There is potential for the wind turbine collisions to affect local populations of the White-throated Needle-tail and Satin Flycatcher. The risk of population level impact is heightened by the flocking behaviour in migrating birds. The White-throated Needle-tail appears readily capable of habituating to artificial structures and humanised landscapes. The Satin Flycatcher favours heavily vegetated gullies and taller woodlands during breeding, and uses woodlands, scrubs, trees in open country during migration (Pizzey et al 2006). The single bird sighted at Marilba may have been foraging or migrating south from Papua New Guinea. The site does not provide optimal habitat for this species and habitat use is expected to be infrequent. Mortality rates affecting the lifecycle of a significant proportion of the populations of these species are not anticipated. The risk assessment in Appendix D for these species indicates a low-moderate risk at the individual level and low risk at the population level. A monitoring and adaptive management program would be developed and implemented to respond to any unforeseen impacts on this species, and other significant fauna (refer section 5.3).

4.2 Cumulative impacts

There are three operating wind farms within approximately 65 km of the project area. These comprise a total of 54 wind turbines (Cullerin Range Wind Farm: 15, Gunning Wind Farm: 31, Crookwell Wind Farm: 8). Gullen Range Wind Farm is currently under construction: 80 turbines approximately 55km from the project area. Several other wind farms are proposed within a maximum distance of 60 km from the project area including Rugby Wind Farm, Bango Wind Farm, Conroys Gap Wind Farm, and Rye Park Wind Farm).

The cumulative impacts of all operating wind farms within the region may have adverse impacts on threatened or migratory species through loss of habitat, collision risks resulting in mortality, creating barriers to movement, therefore limiting foraging or breeding movements on a regional scale, and/or affecting large-scale migrations. However, the biggest concern appears to stem from potential ongoing bird and bat collision with operating turbines (Parsons & Battley 2013).

The cumulative operational impacts of wind farms for this specific area are largely unknown. The difficultly in drawing conclusions about cumulative operational risk is highlighted in a report commissioned by the Commonwealth Department of Environment and Heritage (Biosis 2006), Wind Farm Collision Risk for Birds: Cumulative Risks for Threatened and Migratory Species (species considered included Swift Parrot and Tasmanian Wedge-tailed Eagle). Based on collision risk modelling and population viability analysis, the assessment of significance of cumulative risk from all wind farms operational in Australia at that time (wind farms operational in 2005) was inconclusive due to variation in site specific factors and poor scientific knowledge of bird populations. With this background of uncertainty, precautionary management measures implemented as part of this proposal become more important. A commitment to an operational bird and bat management plan will address the uncertainty and provide a mechanism

for operational management, if required. It will also provide more locally relevant data upon which to base future management actions.

4.2.1 General cumulative habitat loss impacts

The wind farm infrastructure is located primarily within degraded and already fragmented landscapes. The location of the Yass Valley Wind Farm is such that it has been sited, through several iterations of the design process, to avoid high value biodiversity areas supporting good condition woodland or threatened species habitat resulting in approximately 131 ha of the total 146.5 ha footprint area being located within grassland habitat (exotic and native). On this basis, the proposal is not considered to significantly contribute to cumulative habitat loss impacts, especially considering vegetation loss will be offset and long-term management of the offset areas within an already degraded landscaped will maintain or improve biodiversity within the area.

4.2.2 General cumulative collision risk impacts

The operational and proposed wind farm localities in the district may involve overlapping bird territories and bird migration routes. For this reason, wind farm biodiversity impact assessment considers at length the differing risks of species with potential to occur at the height of operational wind turbines, as well as the habitat features that may contribute to collision risks (collision risks for affected species have been discussed in Section 4.1 above and summarised below).

Within the locality of the project site, intermittent woodland occurs along Jugiong Creek and its smaller tributaries which create a linear corridor to the Murrumbidgee River, and eventually to Lake Burrinjuck (approximately 25km from the site) and forest woodland reserves to the south. The principal flight paths for woodland bird species are likely to follow slopes and lowland areas carrying remnant woodland and water sources. The project site features four large woodland remnants which occur outside the development envelope:

- The long south west facing slope below cluster 7 (Coppabella precinct)
- The flat north of cluster 10 (Coppabella precinct)
- The larger north-south remnant west of cluster 4 (Marilba precinct)
- The north-south remnant west of cluster 7 (Marilba precinct)

These woodland patches are likely to contribute to local bird movement across the district. However, only sparse, disturbed woodland remnants occur on the ridges where turbines have been proposed. The heavily cleared nature of the involved properties, and the turbine ridges in particular, would appear to make their frequent use for bird migration unlikely. Many woodland birds that occur in the region are unlikely to venture far from large remnants and many more species, such as the Superb Parrot and Regent Honeyeater, rarely cross extensive open areas (Garnett and Crowley, 2000; Fischer and Lindenmayer, 2002). Birds moving at tree canopy height through these corridors are unlikely to be affected by the wind turbines located on adjacent ridges.

Based on the quality of available habitat (as described above) which has primarily been cleared in the local area and elsewhere in the district (especially to the west), and the absence of major wetlands, with the closest being Lake Burrinjuck, the project site is not likely to be located on a major migratory route for wetland birds or seasonally migrating birds.

4.2.3 Specific cumulative impacts – affected species / communities

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

The infrastructure layout has been designed to primarily avoid impact to good condition CEEC and management measures prescribe that direct removal of CEEC is limited to only one site where discrete power poles will be located.

Residual impacts to the Box Gum Woodland CEEC will be mitigated through an offset package developed specifically to ensure an overall 'improve or maintain' environmental outcome for the project. A strategy to develop this offset is included as Appendix G and includes the following components:

- How will offsets be calculated
- When will the offsets be implemented and delivered
- Where will the offsets be defined
- How will the offsets be managed and secured

Proposed offsets will contribute to the long-term protection and improvement of the Box Gum Woodland CEEC in the locality and, by contributing to landscape connectivity, within the wider region also.

Yass Daisy, Golden Sun Moth

The infrastructure layout (and management prescriptions developed for these species) will ensure all Yass Daisy populations are avoided. Therefore, the proposal will not contribute to a cumulative impact on this species.

Golden Sun Moth has been found in several areas onsite, both within and outside the development footprint. It is also now being recorded at other wind farm sites nearby (Rye Park, Bango) and is therefore more regionally abundant than previously assumed. The pattern of clearing and ability to microsite infrastructure to minimise impacts on habitat for this species as well as the commitment to offset, ensures that cumulative impacts will be managed. In the long term, these regional wind farm projects will provide ongoing biodiversity improvements in the form of managed offset lands. Given the context of land degradation, this is considered a benefit of the project.

Superb Parrot, Swift Parrot, and Regent Honeyeater

The cumulative impact from loss of habitat associated with this proposal is considered negligible for the Swift Parrot and Regent Honeyeater, given that these species do not breed within the project site and they are unlikely to rely on the low quality foraging habitat available, as evidenced by the lack of records in the locality. However, cumulative impacts from loss of habitat within the region for the Superb Parrot are probable.

The location of the proposed wind farm turbines on largely cleared ridge top sites already compromised from long-term grazing, coupled with avoidance of clearing good condition woodland, should restrict the cumulative impacts for the Superb Parrot, which has been noted to utilise habitats in the lower-lying areas and along roadsides. The offsetting of vegetation losses and hollow-bearing tree removal with the long term protection of similar vegetation in the study area will reduce the cumulative effects of the proposal on loss of habitat for this species. Managed offsets that accompany the project, will provide areas protected from degradation and managed for biodiversity improvement, as stated above.

The potential of the operational wind farm to affect movements or increase mortality rates through collision impacts for the Superb Parrot, Swift Parrot and Regent Honeyeater is considered low. Based on the discussion of bird movements for the Superb Parrot, Swift Parrot and Regent Honeyeater, visits from migratory or nomadic species are expected to be either infrequent and sporadic, or not within the area of impact. The wind farm is not expected to significantly affect migratory or nomadic species such that populations would be at risk, and is therefore not considered to add to the cumulative impact of these species for collision risk. This project, like others proposed at this time for the region, includes the commitment to an operational bird and bat management plan will address the uncertainty and provide a mechanism for operational management, if required.

Local weather conditions

Local weather conditions that affect collision impacts could be considered a cumulative effect. Marilba Section 8.2.2:

> *Many studies have shown that poor weather conditions increase the occurrence of turbine collisions (Canada Bird Studies 2001). Weather conditions which reduce the ability of birds to perceive the turbine blades or avoid collisions (such as fog and strong gusty winds) add to risks for susceptible species.*

Although collision risk would be expected to be higher during periods of reduced visibility (such as heavy rain, fog or low cloud), less flights are anticipated during these times, reducing overall collision numbers expected. This can be demonstrated generally by the lower number of birds recorded during bird surveys in sub-optimal weather conditions. Increased risks of reduced visibility are expected to be more relevant to shorter flights associated with breeding and local foraging than with than with flights over larger distances, such as migration. Marilba Section 8.2.2:

> [Regarding weather conditions and collision risks to species…] *The relative location of key habitat areas (such as updraft zones, prey populations, wetlands and nesting sites) and natural diurnal and seasonal migration routes also affects risks to birds.*

The southern tablelands are known for cold winters including periods of fog. The Yass Valley Wind Farm site is known for regular high wind speeds. However, it is considered that, as the site is not likely to be on any important migration routes and as turbines are not proposed within any areas of important habitat for threatened species (high constraint area mapping has informed the infrastructure layout), that collision risks would not be expected to be high or unacceptable. Additionally, prescriptions have been added to minimise impacts to hollows and a monitoring and adaptive management program would be implemented to respond to any unforeseen impacts (detailed in refer Marilba BA section 5.3. Outline provided Attachment N).

Regarding MNES, species with higher risk factors have been identified and subject to more detailed assessment. This included the Regent Honeyeater, Superb Parrot and Swift Parrot, White-throated Needle tail and Satin Flycatcher. The assessment considered onsite resources and movement patterns, local weather conditions as well as literature on species ecology and collision risk modelling, where available. The infrastructure is not considered to be inappropriately sited, such that collision impacts may affect local populations of these species. Significant impact is not anticipated. Mitigation measures including an adaptive management program address remaining uncertainty.

Buffers

In terms of the operational impacts of wind farms on adjacent habitat, as stated above, no conclusive buffer can be applied to all species to account for a 'sterilisation' of habitat that may occur as individuals avoid foraging or nesting near turbines. A 60m buffer would result from applying the formula provided in Natural England (2012), developed based on bat impacts. The ecology of these three bird species does not suggest that a greater amount should be considered. The aerial imagery for the site demonstrates that woodland habitat is fragmented already, particularly on the ridges where turbines would be located. The literature cited above demonstrates that, generally speaking, the ridge locations where turbines would be constructed are not preferred habitat for the Superb, Swift Parrot or Regent Honeyeater at the site. They would be associated with lower elevations and connected tree cover and are therefore lower risk of collision and alienation impacts are anticipated for this site.

Using the broader definitions of potential and preferred habitat, mapped in Appendix J of this document,

- Superb parrot, Swift Parrot, Regent Honeyeater *potential* foraging habitat (Box Gum Woodland – excludes derived pastures), the area within 60m of a turbine = 14.4 ha.
- Superb parrot, Swift Parrot, Regent Honeyeater *preferred* foraging and Superb Parrot *preferred* breeding habitat (Box Gum Woodland below 550m contour – excludes derived pastures), the area within 60m of a turbine = 4.0 ha.

4.2.4 Impacts of other wind farms: movements pathways and collisions

As discussed above, for wide ranging species such as the Superb and Swift Parrot and Regent Honeyeater, even lower condition vegetation can provide habitat as individuals make use of remnant woodland patches (preferred habitat) separated by areas of pasture (non-preferred habitat). For Australian species, defined migration routes that are used regularly each year are not common. Australian species are more likely responding to ephemeral resource availability and utilising changing routes to access these. As such, migration and foraging routes cannot be mapped for the subject site or surrounds. However, regarding the movements of these three species, a preference for the low land areas along roadside vegetation has been demonstrated for the Superb Parrot and assumed for the Swift Parrot and Regent Honeyeater. Based on these factors, a map has been generated to show the Box Gum Woodland tree cover across the site, identifying more low lying areas as those likely to be preferred habitat (Appendix J mapping). Superb Parrot records have also been superimposed.

The proximity of other wind farms, which may generate cumulative effects on the use of movement pathways, is also relevant. As shown below, the location of other wind farm proposed for the area are relatively distant from the Yass Valley site, with the exception of Conroys Gap which is relatively cleared of trees. As turbine placement for all of these proposals requires high ridges, impacts on these species, which prefer the lower landscape positions, seems unlikely.