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TABLES

FIGURES

ACRONYMS

AoS	Assessment of Significance
CMA	Catchment Management Authority
CRA	Comprehensive Regional Assessment
C'wth	Commonwealth Government of Australia
DE	Development envelope (all areas in which infrastructure is currently proposed).
EEC	Endangered Ecological Community – as defined by either the NSW *Threatened Species Conservation Act 1995* or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (C'wth)
ha	hectares
km	kilometres
m	metres
NES	Matters of National environmental significance under the EPBC Act
NPW Act	*National Parks And Wildlife Act 1974* (NSW)
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
POM	Plan of Management
SEWPAC	The Commonwealth Department of Sustainability, Environment, Water, Population and Communities
SIS	Species Impact Statement
sp/spp	Species/multiple species
TSC Act	*Threatened Species Conservation Act 1995* (NSW)
WoNS	Weeds of National Significance

EXECUTIVE SUMMARY

The Rye Park wind farm proposal consists of up to 126 wind turbines and associated infrastructure to be developed over an approximately 14,000 hectare project area. The proposed number of turbines may be reduced in the future, however the calculations for magnitude of impact remain based on the 'worst-case scenario' (126 turbines) at the time of this assessment. The wind farm is proposed for the locality of Rye Park, north of the town of Yass in south-western NSW. The region is dominated by agricultural activities (sheep and cattle production), and large areas are extensively cleared. There are also extensive areas of remnant and regrowth native vegetation in the Rye Park area.

Several field survey programs were undertaken at different times between November 2011 and December 2013 to document vegetation and fauna habitat types and condition, to identify potential habitat for threatened species and, where this occurred, to undertake targeted surveys. In particular, several targeted surveys were undertaken within July 2013 and November 2013. The results of these surveys have informed detailed constraints mapping within the development envelopes and the proposed infrastructure layout has been developed iteratively in response to ecological and other constraints.

The project area includes areas of endangered ecological communities (EECs). Several species of threatened birds and bats were detected during field surveys. To assess impacts, three main types of wind farm impacts were analysed: vegetation clearing for construction and ongoing operational impacts through collision (blade-strike) and habitat alienation for birds and bats. In design planning to avoid impacts, key issues considered for flora were avoidance of high conservation values areas, while key issues considered for fauna were maintenance of connectivity across the landscape and the avoidance of known 'high risk' turbine locations for blade-strike (e.g. near nest sites). The magnitude of impact has been quantified and a worst-case vegetation clearing estimate provided for each affected vegetation community.

In developing measures to minimise impacts, consideration has been given to quantifying the loss of critical habitat such as loss of EEC habitat, threatened species foraging or breeding habitat, or hollow-bearing trees so that a 'maintain or improve' biodiversity outcome can be achieved through offsets. The risk of significant impact was classed as low, moderate or high for ecological communities and species listed under the *Threatened Species Conservation Act 1995* and the *Environmental Protection and Biodiversity Conservation Act 1999* known or likely to occur in the project area. Low and moderate risks were considered manageable, and the following higher risk species were subject to detailed impact assessment, including assessments of significance:

- Yass Daisy (vulnerable TSC Act, vulnerable EPBC Act).
- Box Gum Woodland (endangered TSC Act, critically endangered EPBC Act).
- Superb Parrot (vulnerable TSC Act, vulnerable EPBC Act).
- Regent Honeyeater (endangered TSC Act, endangered EPBC Act).
- Little Eagle (vulnerable TSC Act).
- Eastern Bentwing Bat (vulnerable TSC Act).
- Yellow-bellied Sheathtail-bat (vulnerable TSC Act)
- Golden Sun Moth (endangered TSC Act, critically endangered EPBC Act).
- Striped Legless Lizard (vulnerable TSC Act, vulnerable EPBC Act).
- White-throated Needletail (migratory EPBC Act).

With the implementation of recommendations, which include micro-siting infrastructure to avoid impact on known threatened species habitat and implementation of an offset plan to address impacts that cannot be avoided or sufficiently minimised, a significant impact to the listed communities and species is

considered unlikely. Focus species and communities will be further managed in relevant plans or monitored through an adaptive monitoring program, for example, a Flora and Fauna Management Plan and Bird and Bat Management Program.

1 INTRODUCTION

The Rye Park wind farm proposal consists of up to 126 wind turbines and associated infrastructure over an approximately 14, 000 hectare project area. The wind farm is proposed for the locality of Rye Park, north of the town of Yass in south-western NSW. The project area is located on the edge of the Southern Tablelands and South West Slopes of NSW, across three local government areas (LGAs): Boorowa; Yass Valley; and Upper Lachlan. The region is dominated by agricultural activities (sheep and cattle production), and large areas are extensively cleared. There are also extensive patches of remnant and regrowth native vegetation in the Rye Park area.

This assessment concentrates on the impacts of the following five primary infrastructure components of the proposal:

- Wind turbine footings and placement.
- Creation of new tracks and widening of existing tracks.
- Installation of low voltage powerlines (33kV).
- Installation and clearing corridor for high voltage (132kV) electricity transmission line.
- Construction of substations.

The indicative infrastructure layout and development envelope is mapped in Appendix E.1.

1.1 OBJECTIVE OF THIS ASSESSMENT

This Biodiversity Assessment aims to provide an ecological impact assessment in accordance with the Director-General's Requirements (DGRs) for the Rye Park wind farm, NSW and Commonwealth legislation relating to threatened and protected species. Specifically, this assessment:

- Identifies threatened species, populations and communities listed under NSW and Commonwealth legislation that have the potential to occur on site.
- Maps existing vegetation type and condition and fauna habitat type and condition.
- Documents survey methods and effort with reference to species and communities identified in the DGRs.
- Demonstrates an avoidance, particularly regarding ecological values of high significance.
- Provides a worst case estimate of vegetation to be cleared, with a break down by vegetation and habitat type.
- Assesses the significance of proposed impacts to native vegetation, listed threatened species, populations and communities and their habitats, including consideration of habitat connectivity and wind-farm specific impacts such as blade-strike.
- Where required, includes details of how flora and fauna impacts would be managed during construction and operation phases of the project.
- Demonstrates how the project achieves a biodiversity outcome consistent with "maintain or improve" principles.
- Addresses the risk of weed spread and identifies suitable mitigation measures to address the risk.
- Considers the offsetting requirements and identifies suitable offset areas.

This report documents the findings of onsite ecological studies undertaken for the purposes of impact assessment. The report incorporates relevant information from the *Rye Park Wind Farm Biodiversity Constraints Analysis* (**ngh**environmental 2012) as well as providing a comprehensive impact assessment on

threatened entities for the final infrastructure layout, pursuant to NSW and Commonwealth guidelines. A summary of relevant guidelines and legislative considerations are given in Section 2.

1.2 BACKGROUND

This section describes the project area in the context of the Interim Biogeographic Regionalisation for Australia (IBRA), Mitchell Landscapes, Catchment Management Authority (CMA) Area and local government area. This section also provides a site description and an overview of previous assessments undertaken for the project.

1.2.1 IBRA subregion

The IBRA provides an Australia-wide regionalisation for patterns of biodiversity based on climate, geomorphology, landform, lithology and other characteristics (Environment Australia 2000). Each of the 89 IBRA regions is divided into subregions, which group biogeographic patterns at a higher resolution.

The project area lies across the boundary of two IBRA regions: NSW South Western Slopes and South Eastern Highlands. The South Western Slopes region comprises the western foothills and isolated ranges of the Great Dividing Range dominated by eucalypt forests and woodlands. The South Eastern Highlands region comprises the steep ranges of the Great Dividing Range with a variety of rainforest, sclerophyll forest, woodland and grassland communities (ACT Commissioner for the Environment 2000). Both regions have extensive areas of clearing for agriculture including grazing and cropping with significant loss of biodiversity (SEWPAC 2009; ACT Commissioner for the Environment 2000).

The project area lies within the Murrumbateman subregion of the South Eastern Highlands IBRA region. This subregion is characterised by undulating topography with rounded hills and plateaus, dark loams on valley floors with woodlands, grasslands and swamp vegetation types (Morgan 2001). Threatening processes to biological diversity in the Murrumbateman subregion include clearing of native vegetation, grazing pressure and exotic weeds. Ecosystems are particularly at risk from increasing fragmentation. Key actions have been identified to halt the decline in biodiversity, including protecting and linking woodland fragments. There are few recovery actions in place for threatened species recovery in the Murrumbateman subregion, although it is noted that off-park conservation (e.g. voluntary conservation agreements on private land) makes a significant contribution to ecological recovery within the greater South Eastern Highlands bioregion (SEWPAC 2009).

The project area also lies within the Northern Inland Slopes (formerly the Upper Slopes) subregion of the South Western Slopes IBRA region. This subregion is characterised by steep granite hills with small basalt outcroppings, shallow soils and dry forest types (Morgan 2001). The Northern Inland Slopes has been subject to clearing for agriculture and forestry and remnant vegetation largely occurs as isolated blocks on steep rocky hills. There are major river floodplains in the region which, as well as providing fertile land targeted for agricultural clearing, act as a natural barrier to plant and animal dispersal. Grassy woodlands are particularly threatened as they often occur in the fertile valleys of the subregion. Biodiversity is a risk from increasing fragmentation as well as exotic and environmental weed invasion (NRE 1998).

1.2.2 Mitchell landscapes

Mitchell Landscapes are areas of broadly homogeneous landscapes in terms of geomorphology, soils and broad vegetation types. The proposal site is mostly located within the Dalton Hills Mitchell Landscape extending slightly into the Boorowa Volcanics Mitchell Landscape to the west. The Dalton Hills landscape

is characterised by linear ranges and undulating hills on steep dipping, folded Ordovician quartzose greywacke, slate, chert and phyllite. Typically vegetation is dominated by Yellow box (*Eucalyptus melliodora*), White Box (*Eucalyptus albens*), Grey Box (*Eucalyptus microcarpa*), Red Stringybark (*Eucalyptus macrorhyncha*) and Inland Scribbly Gum (*Eucalyptus rossii*) and grassy woodlands originally dominated by kangaroo grass (*Themeda australis*) which have been extensively modified by grazing and cultivation. River Oak (*Casuarina cunninghamiana*) occurs along most streams with river red gum (*Eucalyptus camaldulensis*) appearing in the north (DECC 2008).

1.2.3 Catchment areas

The proposal site at the intersection of four sub-regions of two CMA:

- Upper Slopes and Murrumbateman sub-regions of the Lachlan CMA.
- Upper Slopes and Murrumbateman sub-regions of the Murrumbidgee CMA.

Key biodiversity issues in both CMAs include reducing fragmentation, managing weeds and pest vertebrates and providing conservation outcomes for native grasslands and woodlands and associated flora and fauna species on private land (CMA 2012).

1.2.4 Land-use and environment

Sensitive area mapping

Local Councils (Boorowa, Upper Lachlan and Yass) were consulted as to whether 'sensitive area mapping' was available and relevant to the Rye Park locality. No such mapping is held by these Councils. Various 'natural resource sensitivity' maps layers are held which have some relevance to biodiversity. The Upper Lachlan Shire Council Biodiversity Planning Framework details the methodology used for determining the 'natural resources sensitivity-biodiversity map' used in the Upper Lachlan LGA; conservation significance is based on native vegetation, riparian corridors, regional corridors and geological significant areas (Upper Lachlan Shire Council, 2008). Other map layers relate to salinity, riparian areas and water courses.

Areas in the Rye Park locality in close proximity to the site are mapped as medium and high conservation value under this Planning Framework mapping. No regional corridors are identified in proximity to the Rye Park site. While regional biodiversity corridors have been identified in the eastern part of the Upper Lachlan LGA, no study has been undertaken to identify them elsewhere in the LGA.

In general, the mapping is broad and it is considered that the onsite field survey and research specific to the proposed Rye Park wind farm provides more accurate information on the biodiversity attributes of the site, including regional corridors and landscape connectivity. This is discussed further in Section 7.3.

Vegetation communities, plants and animals of the local government areas

Boorowa

Nine vegetation types have been recorded in the Boorowa LGA. Approximately 85% of native vegetation has been cleared (mostly for agricultural activities) and remnants are considered highly fragmented. Remnant vegetation includes Box Gum woodland, Red Stringybark-Red Box forest and Long-leaved Box-Candlebark open forest or woodland. Much remnant vegetation occurs as dry forest on shallow or skeletal soils on rocky ridgelines. Remnant woodland patches generally occur as isolated paddock trees or small patches of less than 2 ha, mostly on private land. Threatened species known to occur in the Boorowa LGA include Tarengo Leek Orchid *(Prasophyllum petilum)* and a number of mammals and birds such as the

Squirrel Glider *(Petaurus norfolcensis)* and Barking Owl *(Ninox connivens connivens)* (ACT Commissioner for the Environment 2009).

Upper Lachlan

Of the 53 vegetation types recorded in the Upper Lachlan LGA, 20 are considered vulnerable (i.e. approaching 70% clearance of pre-1750 extent). Clearing and fire have been major pressures on native vegetation. Remnant vegetation includes Box Gum Woodland, Natural Temperate Grassland and Tableland Dry Grassy Woodland. A number of threatened plant species have been recorded in the Upper Lachlan LGA including the orchid Buttercup Doubletail *(Diuris aequalis)*, which is listed as nationally vulnerable and endangered in NSW. Threatened animal species known to occur in the LGA include birds, amphibians, fish and mammals such as the Squirrel Glider and Eastern Bentwing-bat *(Miniopterus oriane oceansis)*, both listed in NSW (ACT Commissioner for the Environment 2009).

Yass Valley

The Southern CRA (Comprehensive Regional Assessment) identified 36 vegetation communities in the Yass Valley LGA including 14 considered vulnerable in 1999. Clearing for agriculture and wood harvesting appear to have been the main pressures on native vegetation in the Shire over the last decade. Remnant vegetation in Yass Valley LGA includes Box Gum Woodland, Natural Temperate Grassland and Tablelands Dry Shrub/Grass Forest. Forests dominated by Ribbon Gum and River Red Gum also occur; these are important feed trees for Koala (NSW threatened species). Other threatened fauna known to occur in the LGA include microbats, arboreal mammals, reptiles, amphibians, invertebrates and woodland birds such as Superb Parrot *(Polytelis swainsonii)* and Diamond Firetail *(Stagonopleura guttata)*. A number of threatened plant species have been recorded in the Yass Valley including Yass Daisy *(Ammobium craspedioides)*, which is listed under NSW and Commonwealth legislation (ACT Commissioner for the Environment 2009).

Bango Nature Reserve

Bango Nature Reserve (Bango NR) in the Yass Valley LGA, created in 2010, is approximately 440 ha and managed under the *Draft Plan of Management for The Gunning Reserves* (POM) (NPWS 2011). Bango NR is located adjacent to the south-western border of the project area. None of the other reserves covered by the POM are near the proposal site. Vegetation in the reserve includes dry open forest with Apple Box *(Eucalyptus bridgesiana)* or Red Stringybark *(E.macrorrhyncha)* and Scribbly Gum *(E.rossii).* It is considered likely that Box Gum Woodland also occurs on lower slopes and drainage lines in the reserve but this has not been ground-truthed (NPWS 2011).

The threatened Yass Daisy *(Ammobium craspedioides)* has been recorded in the Bango NR. This species is associated with dry forest, Box Gum Woodland and secondary grassland (i.e. grassland derived from clearing these communities). Three threatened fauna are known to occur in Bango NR: the Gang-gang Cockatoo *(Callocephalon fimbriatum)*, Scarlet Robin *(Petroica boodang)* and Varied Sittella *(Daphoenositta chrysoptera).*

Land-use

The land use of the region is dominated by agriculture including sheep and cattle grazing for meat and wool production. Large areas have been cleared for production. Other farming activities include breeding studs for cattle, alpaca, sheep and horses, poultry production and olive farms and wine groves. The demographic has shifted from a primarily farming community to a mix including hobby farmers and rural lifestyle residents (Boorowa Council n.d., Upper Lachlan Shire Council n.d., Yass Valley Council n.d.).

1.2.5 Site description

The site boundary is mapped in Appendix E.1, and is made up of the estate boundaries of involved properties. The whole site is termed the 'project area' and encompasses approximately 14,000 ha. The development envelope has been progressively refined over the course of the assessment phase from broad ridgeline and proposed track and electricity transmission line zones to a 100m buffer around the indicative infrastructure layout. The final impact assessment presented in this report relates to discreet turbine and associated infrastructure locations.

The tenure of land in the project area is private freehold and is currently used for commercial agriculture (predominately sheep grazing) and farm residences. The proposal site is characterised by cleared farmland mostly derived from Box Gum Woodland on the lower slopes and flats with Inland Scribbly Gum Dry Forest vegetation on the steeper sheltered slopes. 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 the ridge tops. The pasture ranges from exotic to native species dominated. This pattern of vegetation and use of the land is common across the locality.

2 LEGISLATIVE AND POLICY CONTEXT

2.1 NSW ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) provides for a co-ordinated approach to development and includes the objective to encourage protection of the environment including threatened species, population and ecological communities listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act). Section 5A of the EP&A Act provides a list of factors that must be considered in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats. These factors are known as the 7-part test, or Assessment of Significance (AoS).

The proponent obtained DGRs to guide the assessment of impacts of the Rye Park wind farm, under Section 75F, Part 3A of the EP&A Act (DGRs are discussed further in Section 2.8). Part 3A has since been repealed with transitional arrangements are in place to deal with such projects. It is understood that the submission will be assessed by the NSW Department of Planning and Infrastructure (DP&I), under the provisions of Part 3A.

The recommendations in this report would form Statements of Commitment (SoCs), formulated to avoid impacts where possible, minimise where avoidance is not possible and offset residual impacts to ensure the 'improve or maintain' environmental outcome for the project is met.

2.2 NSW THREATENED SPECIES CONSERVATION ACT 1995

The TSC Act lists threatened flora and fauna species, populations and ecological communities ('threatened entities') and key threatening processes in Schedules 1 through to 3. The TSC Act gives provisions for recovery plans, threat abatement plans and action statements. The Director-General (D-G) for the Office of Environment and Heritage (OEH) must consider the effect of the proposal based on the factors listed in Section 94, which match those in Section 5A of the EP&A Act (AoS). The D-G may grant a licence to harm threatened entities, which may include conditions. Such a licence would form part of the consent conditions for a proposal.

This report considers threatened entities and critical habitat that may occur in the project area and the affect that the proposal may have upon them, including key threatening processes. Assessments of significance are undertaken in accordance with the *Threatened Species Assessment Guidelines: the assessment of significance* (DEC 2007).

2.3 NSW NATIONAL PARKS AND WILDLIFE ACT 1974

The D-G for the OEH is the authority for the protection and care of protected fauna (Part 7) and native plants (Part 8), including threatened entities (Part 8A). This report considers threatened fauna and flora that may occur in the project area and the affect that the proposal may have upon them.

The *National Parks and Wildlife Act 1974* (NPW Act) also provides a mechanism for conservation on private land under Part 4 Division 69. A Conservation Agreement provides legally binding protection for private land, with conditions attached to the land title.

2.4 NSW FISHERIES MANAGEMENT ACT 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve fish stocks and key fish habitats including threatened species, populations and ecological communities of fish and marine vegetation. The FM Act is administered by the Director-General of the Department of Industry and Investment. There are a range of activities that may come under the jurisdiction of this act.

The FM Act covers freshwater and marine habitats and species. Freshwater includes any body of freshwater that is naturally or artificially stored. Any dredging or reclamations works (which includes removing material from land submerged by water, filling in or depositing any material onto land submerged by water or draining water to reclaim land) requires consideration under the FM Act, unless it is an artificial waterbody not connected to a natural waterbody.

Division 8 provides that the passage of fish must not be blocked by obstructions unless a permit under the Act has been obtained. This affects proposals that include water crossings.

Part 7A provides for the listing of threatened species, populations and ecological communities (threatened entities) and key threatening processes. Any development should consider harm to threatened entities as required by the EP&A Act. If harm is likely to be significant, Section 221K outlines the content of a species impact statement under the FM Act.

2.5 STATE ENVIRONMENTAL PLANNING POLICY NO. 44 – KOALA HABITAT PROTECTION (SEPP 44)

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) encourages the conservation and management of natural vegetation that provides habitat for Koalas. Koalas are listed under the TSC Act as a vulnerable species. Yass Valley Council is subject to this SEPP and cannot approve development in an area affected by the policy without an investigation of core koala habitat. SEPP 44 aims to identify areas of potential and core Koala Habitat. These are described as follows:

- Potential Koala Habitat: areas of native vegetation where the trees listed in Schedule 2 of SEPP 44 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component; and
- Core Koala Habitat: an area of land with a resident population of Koalas, evidenced by attributes such as breeding females, and recent and historical records of a population.

This report considers whether any part of the project area could be described as potential or core koala habitat under SEPP 44.

2.6 ENVIRONMENTAL PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (CWTH)

The *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) lists for protection native flora and fauna species of national conservation significance including threatened and migratory species, communities and populations, termed 'Matters of National Environmental Significance' (MNES). If there is potential for a MNES to be impacted because of a proposed development, the nature and potential magnitude of impact must be characterised according to the *Significant Impact Guidelines* (2006). This will determine whether an action is likely to have a significant impact on MNES, in which case the proposal must be referred to the Federal Minister for the Environment for assessment and approval.

This report considers MNES that may occur in the project area and the affect that the proposal may have upon them.

2.7 GUIDELINES

The guidelines used in the preparation of this report include:

- *Draft Guidelines for Threatened Species Assessment* (DEC, 2005).
- *Biodiversity Offset Principles* (OEH).
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*, Working Draft (Department of Environment and Conservation NSW, November 2004).
- *National Wind Farm Development Guidelines – public consultation* draft (EPHC 2009).
- *Australian Wind Energy Association Best Practice Guidelines* (AusWind 2006).
- *Cumulative Risk for Threatened and Migratory Species* (Department of Environment and Heritage, C'th 2006)

In particular, the assessment considered the five main steps listed in the *Draft Guidelines for Threatened Species Assessment 2005* in the following way:

- **Step 1 - Preliminary assessment** – Desktop and database searches were undertaken to assess the conservation value of the area to threatened species / communities.
- **Step 2 - Field survey and assessment** – Surveys were completed within April and November (autumn and spring) to sample the broad development envelope and were designed according to desktop assessment results. The guidelines suggest that where development occurs over a large area the sampling regime must encompass the geographic extent of the development and sample the full range of environments that occur. This approach was applied and is detailed further below (Section 3.1 Strategic Assessment Approach).
- **Step 3 – Evaluation of impacts**: This is presented in Section 7, Appendix B and Appendix C of this report.
- **Step 4 – Avoid, mitigate and then offset:** Constraint mapping was undertaken to highlight areas of high conservation value so these could be avoided where possible. Where infrastructure falls within areas supporting some conservation value, specific mitigation measures have been developed to manage or offset the impact (Section 8).
- **Step 5 – Key thresholds:** To determine the extent of impacts and key thresholds of conservation significant entities the AoS (Appendix C) was applied to species considered high risk as it covers the main points identified in *Appendix 3 of the Guidelines: Identifying potential effects of the proposal on threatened species, populations or ecological communities or their habitats* as well as additional points that are useful in characterising impacts and developing mitigation strategies, where possible.

2.8 DIRECTOR GENERAL REQUIREMENTS

DGRs were issued by the NSW DP&I on 14 February 2011 to guide the format of this assessment (Appendix H). They have been addressed by the objectives of this assessment and by using the guidelines identified (discussed above). Recommended survey requirements were further issued by Department for Environment, Climate Change and Water, now OEH (addressed in Section 3.3.4), and received by **ngh**environmental on 11 June 2013.

3 APPROACH AND SURVEY METHODS

The potential impacts of the proposal have been identified based on desktop assessment and field surveys, including aerial photo interpretation and GIS mapping.

3.1 STRATEGIC ASSESSMENT APPROACH

Wind farm development has several characteristics that have bearing on the survey and impact assessment approach:

- The infrastructure layout is refined several times from the commencement of the project, to reflect constraints (such as biodiversity), maximise wind yield and incorporate changes in involved land owners and increasing site knowledge that may influence civil infrastructure placement. Survey coverage cannot be restricted to a specific infrastructure layout.
- The infrastructure footprint is small in comparison to the spread of infrastructure. That is, over a series of ridgelines spanning 40 km, the infrastructure will represent a small and disparate proportion of the area within the site boundaries, comprised of narrow access tracks, electricity easements and discrete turbine footings and hardstand areas. This provides an opportunity to avoid and minimise impacts on higher conservation value areas, by micro-siting infrastructure around such areas. However, it also presents issues related to survey coverage. Biodiversity survey effort per area of impact is high but survey effort in comparison to the development envelope can appear low.
- The impacts occur both on a very local scale (habitat clearance for a footing) as well as a landscape scale (influence on bird/bat movements or migration). The different types and scale of impact are required to be assessed which results in a very large number of species with potential to occur and be impacted.
- A large number of assumptions are required to be made throughout the assessment because, while a lot of information on the biodiversity impacts of wind farms is available, limitations in the data include:
    - Wind farm biodiversity monitoring data is not collected in a standard manner and is not generally available to the public, making comparisons difficult.
    - No other site can be expected to contain the site specific features of our site, which will influence the resultant impacts.

The approach adopted in this assessment reflects these characteristics as well as addressing the relevant assessment guidelines (DEC 2005).

The Rye Park survey and assessment approach incorporates the following specific elements:

- Constraints mapping – to avoid, minimise and only as a last result offset impacts, constraints mapping is carried out early in the process to ensure key biodiversity constraints are avoided where possible and to guide specific follow up surveys. Refined layout development further minimises impact on constraint areas.
- Development envelope – a broad envelope within which infrastructure could potentially be located is assessed. The survey effort is a sampling within this area. Vegetation and habitat types are identified and surveys are stratified to sample the envelope. This provides flexibility for small changes in layout. It also provides a precautionary bias in that, survey locations are not randomised

within habitat or vegetation types but rather are targeted to better areas of habitat, to maximise the potential to detect rare and cryptic species. Following this broad assessment the infrastructure layout was refined and targeted follow up surveys were then focused within a more discrete area; this area was defined as the infrastructure footprint plus an additional 100 m- 200 m buffer.

- Broad vegetation type mapping – this provides a context for the impact assessment and demonstrates the type and extent of vegetation available within the site boundary for use in an offset package.
- Risk assessment – species with potential to occur are filtered in Appendix B, to ensure that the assessment is focused on those species with more than a low risk of impact. Although not a standard component of a Major Project assessment, the AoS test has been applied to species where a high impact is anticipated. This systematic and transparent test characterises the anticipated impact in a way that provides the best opportunity to develop specific mitigation measures to manage impacts – be they avoidance of habitat or the implementation of specific protocols, as appropriate.

3.2 DESKTOP ASSESSMENT

3.2.1 Database searches

A desktop assessment was undertaken involving database searches of NSW and Commonwealth listed entities. The desktop assessment included searches of the following databases:

1) Atlas *of NSW Wildlife database*, searched by the Upper Slopes sub- region of the Lachlan CMA (searched 14 October 2011). For flora species additional searches were also undertaken for the Murrumbateman sub-region of the Lachlan CMA and the Upper Slopes and Murrumbateman sub regions of the Murrumbidgee CMA (16 August 2012) to account for the lesser dispersal capabilities of plants as the proposal site occurs close to the boundary of these sub-regions.
2) EPBC Act *Protected Matters Search Tool,* using the project area boundary as the search area with a 10 km buffer (searched 14 October 2011).

Topographic maps, air photographs, previous surveys and records contained in national and state databases were also consulted to identify known and potential values. Key web-based databases including the Atlas of Australian Wildlife, NSW Threatened Species database and the Commonwealth Species Profile and Threats (SPRAT) were consulted in the preparation of this report.

Threatened species, populations, and vegetation communities evaluations

A threatened species evaluation has been undertaken to evaluate the presence of habitat in the project area and the likelihood of occurrence and impact from the proposal development for each species and community returned from database searches (NSW Wildlife Atlas and EPBC Protected Matters Search). The potential for these entities to occur in the project area was evaluated post field work based on specific habitat preferences and project area characteristics.

In the evaluation, the presence of habitat rated as either:

Present: Potential or known habitat is present within the project area.

Marginal: Habitat present is not typical but may be suitable, or habitat is typical but condition is poor or microhabitat requirements are not present.

Absent: No potential or known habitat is present within the project area.

There are four categories for likelihood of occurrence:

None: Species known or predicted to occur within the locality but no suitable habitat present within the project area.

Unlikely: Species known or predicted within the locality. Suitable habitat may be present in the project area but the proximity of nearest records suggests it is unlikely to occur.

Possible: Suitable habitat present and the species could occur in the project area based on the proximity of nearest records.

Present: Species was recorded during the field investigations.

Based on the habitat present and the likelihood of occurrence categories above, a threatened species will be placed into one of the four categories for potential for impact:

No: The proposal would not result in an impact to this species.

Low: The proposal is unlikely to result in an impact to this species. No AoS is considered necessary for this species.

Moderate: The proposal could impact this species or its habitats but risks are considered highly manageable. No AoS is considered necessary for this species. Management measures have been developed to address the risks.

High: The proposal is likely to impact this species or its habitats. An AoS has been applied to these entities to properly characterise the impact and provide information then used to either develop management measures to protect the entity or justify avoidance of the entity.

In the evaluation, one of four categories was assigned to each of the listed threatened or migratory species in terms of risk of impact. The risk level was based on evaluating the type and extent of habitat available and likelihood of the species occurring based on its known habitat requirements and ecology. Therefore evaluation of threatened entities has been undertaken at two points: evaluation of likelihood of occurrence and then evaluation of risk of impact.

Based on the categories described above, species that were considered to have a moderate or high risk of impact are considered for further assessment. Impacts to moderate risk species are considered manageable without the need for an Assessment of Significance, but which may require further mitigation measures, as suggested in Section 8 Recommendations. An AoS is applied to high risk species of which mitigation measures are also given for managing risk, which may be included as statements of commitment to be undertaken pending project approval.

3.3 FIELD SURVEY METHODS

A series of field surveys have been undertaken between 2011 and 2013 to assess the biodiversity value of the project area and include:

- A broad two-day reconnaissance was undertaken by two ecologists over 26-27 October 2011, prior to field surveys, to understand the variability of the site and general habitat

types and condition. Establishment of access points during this visit enhanced the efficiency of the field survey program to follow.

- A suite of field surveys were undertaken over five days within the development envelope and project area between 31 October and 4 November 2011.
- Further flora and fauna surveys, including assessments of new areas and targeted surveys of higher constraint areas, were undertaken over five days between 10 and 14 April 2012.
- Additional surveys were also undertaken on 27 May 2013 to investigate alternate substation sites and overhead power line options.
- Follow-up targeted surveys for the threatened Swift Parrot and mapping of habitat features (i.e. hollow-bearing trees) were undertaken between 8 and 12 July 2013 to determine potential presence of the species within the project area during its winter migration to the mainland from Tasmania.
- Follow-up targeted surveys for the Superb Parrot was undertaken between 4 and 9 November 2013 to assess flight paths and local use of the site during the breeding season.
- Additional general bird surveys, Anabat surveys and nocturnal surveys were undertaken in specific higher risk locations between 4 and 9 November 2013 to increase survey effort.
- Follow-up targeted surveys for the Koala between 4 and 9 November 2013 and 18 and 22 November 2013. RapSAT searches were conducted to determine the potential presence of the species within the project area.
- Artificial tile surveys were installed in July 2013 for the Striped Legless Lizard, with tiles checked weekly or fortnightly between November and December 2013 to determine presence of the species within the project area.
- Targeted Golden Sun Moth surveys during November and December 2013 during the known flying time of the species to determine the presence of the species within the project area.
- Targeted surveys for the threatened Yass Daisy and Hoary Sunray within a proposed transmission line in the southern section of the project area between 4 and 6 November 2013.

The field survey methods employed in the above surveys are detailed below. The methods utilised were selected with regard to: 1) their suitability to the assessment required, the project area and access limitations; 2) current NSW and EPBC Act survey assessment guidelines; and 3) specific survey approaches requested by OEH.

3.3.1 Flora survey methods

Survey personnel

The flora surveys were conducted by four botanists. Refer to Appendix G for personnel qualifications and experience:

- Dave Maynard (site reconnaissance, November 2011 and 2013 surveys).
- Paul McPherson (November 2011 surveys).
- Jackie Miles (November 2011 surveys, April 2012 surveys).
- Chris Weston (November 2011 surveys).

The maps 'Flora survey effort' in Appendix E.2 show the flora survey locations across the development envelope. Survey methods included inspection points, quadrat surveys, random meanders and targeted searches.

Detailed survey methods

Quadrats

In each vegetation type and condition class, a 0.04 ha standard quadrat (20 m x 20 m) was used to survey vegetation structure and floristics. Geological and topographical features were also noted. All species that occurred within the quadrat were recorded and cover abundance scores allocated according to a modified Braun Blanquet cover abundance scale[1].

Random meanders

Formal random meanders (after Cropper 1993) within relatively homogeneous vegetation of up to 30 minutes duration and covering up to 1 hectare were undertaken at a number of the quadrat and inspection sites in each vegetation type, recording floristics, with structural and physical data. This method complements the quadrat data by improving comprehensiveness in terms of the number of species and variation within types, and improves opportunities for detecting significant or sparsely distributed plant species.

Inspections

In addition to the traverse and plot-based survey sites, the majority of the subject site was inspected on foot or by vehicle to confirm vegetation types, map the distribution of EECs and search for threatened species. EECs and areas of natural vegetation in better condition were given particular attention. Dominant species occurring at the sites were recorded to adequately confirm the vegetation type and condition where necessary.

Highly disturbed habitats including areas of improved pasture and cultivated paddocks, were surveyed to record general species composition. Because of their low likely conservation significance, these highly modified areas were not inspected in detail.

Targeted searches

Dedicated searches in specific habitat areas were undertaken during quadrats and random meanders for threatened species which were assessed as having at least a moderate potential to be present at the site.

Specific targeted searches for threatened flora were conducted in higher quality areas of Box Gum Woodland and derived grassland near RYP_120 (refer Appendix E.2) and within the originally proposed eastern substation site (removed during layout modifications to avoid sensitive areas). These surveys failed to locate any threatened flora. In addition, five flora quadrat surveys were conducted in moderate or good condition Box Gum Woodland. The timing of all targeted surveys was considered appropriate for the detection of targeted threatened species in particular, the Yass Daisy and Hoary Sunray.

Targeted searches were conducted on foot within the majority of areas. Within the originally proposed eastern substation site, evenly spaced transects 10 m apart were conducted on foot across the entire development area as the entire area would have needed to be cleared to accommodate the proposed substation. Within the proposed transmission line near RYP_120, foot based random meanders were conducted across the majority of the development area as the impacts in this area are more discrete, being limited to the establishment of footing for transmission towers and an access track. Both the evenly spaced

[1] modified from that described by Mueller-Dombois and Ellenberg (1974).

transect and random meander methods are consistent with the Draft Threatened Species Survey Guidelines (DECC 2004).

A vehicle based random meander was conducted in areas of good condition Box Gum Woodland that showed evidence of being heavily grazed prior to the survey given the high levels of visibility and lower likelihood of the species being present.

Understorey condition assessment

Condition assessment was undertaken at all survey points within the original development envelope of the proposal to adequately quantify impacts by both vegetation type and condition. This included all quadrats and a number of inspection points. Vegetation across the broader site boundary has not been assigned a condition class as surveys of the detail necessary to ascertain condition were not undertaken in these areas. As such, where infrastructure locations have been revised to avoid environmental constraints, and are now outside of the original development envelope, vegetation condition has not been necessarily determined and a precautionary (higher condition value) has been assigned for the purpose of calculating potential impacts.

Vegetation surveyed using quadrat, random meander and inspection techniques in woodland, shrubland and grassland were rated according to a four-point condition class scale, focusing on floristic integrity in the understorey:

Exotic	Groundlayer dominated by exotics, no native overstorey present.
Poor	Groundlayer dominated by one or two native grass species, < 5 native non-grass species OR native overstorey present and groundlayer dominated by exotics.
Moderate	Groundlayer dominated by native grasses, 5-11 native non-grass species present.
Good	Groundlayer dominated by native grasses with a diversity of native non grass (at least 12 native non-grass species).

These classes are most relevant for vegetation types with a grassy groundcover, such as Box Gum Woodland.

The Dry Forest community identified on site however, was distinctly different to grassy woodland vegetation. This vegetation type was observed on many of the ridge tops, is distinctly different in structure to woodland vegetation and is generally characterised by a low diversity within the understorey. For this vegetation type, condition classes were based on the ratio of native species to exotics as per below:

Exotic	Groundlayer dominated by exotics (exotics > natives), no native overstorey present.
Poor	Groundlayer dominated by exotics, native overstorey present.
Moderate	Some exotics present in the groundlayer but mostly native dominated.
Good	Groundlayer dominated by native species, few exotics present.

With the exception of the 'exotic', the remaining classes would all fall within the 'moderate to good' definition specified within the biometric guidelines[2] due to the dominance of native vegetation in the ground layer or having a native overstorey with a percent foliage cover greater than 25% of the lower value of the over-storey percent foliage cover benchmark of that vegetation type. The exotic class would equate to 'low' condition vegetation under these guidelines.

Vegetation typing and nomenclature

The identification of specific vegetation types is based on the NSW Vegetation Classification and Assessment developed for the South Western Slopes (Upper Slopes) Bioregion by Benson (2008) and Benson *et al.* (2010), which provides the most recent classification for the project area. Botanical nomenclature follows Harden (1990-2002), except where recent taxonomic changes have occurred. Noxious weeds identified are those declared for the Boorowa Shire Council control area under the *Noxious Weeds Act 1993*.

3.3.2 Fauna survey methods

Survey personnel

The majority of fauna surveys were conducted by the below personnel. Refer to Appendix G for personnel qualifications and experience.

- Bianca Heinze (lead ecologist November 2011, April 2012, November to December 2013 surveys).
- Freya Gordon (lead ecologist November 2011 and November 2013 surveys).
- Deb Frazer (lead ecologist July 2013 and November 2013 surveys).
- Nathaniel O'Rourke (ecologist November to December 2013 surveys).
- Amy Evans (ecologist November 2013 surveys).
- Alana Gordijn (assistant November 2013 surveys).
- Vanessa Place (assistant November 2013 surveys).
- Andrew Morrison (ecologist April 2012 surveys).
- Bryson Lashbrook (ecologist November 2011 surveys).
- Kate Carroll (ecologist November 2011 surveys).
- Brooke Marshall (site reconnaissance, technical officer November 2011 surveys).

A large number of personnel were required for Koala surveys and Superb Parrot flight path mapping during the November 2013 surveys. Experienced sub-contractors were utilised for this survey and included:

- George Madani (bird and reptile expert, November 2013 surveys).
- Rena Goborov of Wildlife Unlimited (bird and reptile expertise, November 2013 surveys).
- Rohan Bilney of Wildlife Unlimited (bird and reptile expertise, particularly owls, November 2013 surveys).

[2] The biometric assessment methodology was developed by OEH and classes vegetation condition more broadly in only two categories: low and moderate – good.

An expert in Golden Sun Moth survey was employed to undertake targeted surveys for this species and included:

- Kris Nash (Nov – Dec 2013 surveys).

General fauna survey methods

Habitat assessment (November 2011, April 2012)

Standard forms were used to record information about the vegetation structure and habitat components of a site, including leaf litter, fallen timber, hollow-bearing trees, rock features, presence of water and canopy connectivity. During the field survey, habitat quality was classified into three categories of either high, moderate or low. Fauna habitat quality[3] is rated on the presence of the following components:

- Diverse structure, that is, structural components at a range of stratum levels (understorey, midstorey, canopy) and age or size classes (trees of different ages, fallen timber of different sizes).
- Shelter and refuge, that is, low shrub or tussock, rocky outcrops, hollow logs (ground dwelling fauna).
- Mature trees, which are more likely to bear hollows and mature hollow-bearing trees, which are more likely to bear multiple hollows of a range of sizes, including those with large internal dimensions. Mature trees also produce more foraging resources for nectar and seed eating fauna.
- Habitat complexity, including ecotones[4] between vegetation types, or areas with different management regimes, which produce a habitat mosaic. Within a habitat patch, there may be a recently disturbed area, as well as a mature area with little recent disturbance. This increases the range of foraging and shelter opportunities within a habitat.
- Key habitat components such as hollow-bearing trees.

Hollow-bearing tree survey (November 2011, July 2013)

Hollow-bearing tree surveys were undertaken as a sub-set of habitat assessments in November 2011, and fed into habitat quality results. Three quadrat sizes were used to survey for hollow-bearing trees in different habitat types:

- Scattered trees in paddocks were surveyed in 100x100 m quadrats.
- Trees in woodland were surveyed in 25x25 m quadrats.
- Trees in forest were surveyed in 10x10 m quadrats.

[3] Habitat 'quality' and vegetation 'condition' classes are not interchangeable, as different criteria are used to distinguish fauna and flora values.

[4] Ecotones are transition zones, where one environments grades into another.

These methods were designed to enable an estimation of hollow density across the different habitat types within the project area, therefore providing an understanding of habitat value for hollow-dependent species.

Hollow bearing trees supporting medium or large hollows were further mapped in July 2013 where they occurred within 100 m of indicative turbine locations or transmission line easements in good-moderate condition forest habitat. This survey was undertaken to determine 1) the quality of habitat for breeding or roosting for threatened hollow-dependent fauna (i.e. owls, Squirrel Glider, Parrots) in potential habitat of these species; and 2) the proximity of hollows to proposed infrastructure.

Bird utilisation survey (November 2011, April 2012, July 2013, November 2013)

- The area search method was used for bird surveys with 30 minutes duration.
- Birds were recorded by sight and vocalisations. Field guides were used for visual identification including Pizzey & Knight (2003) and Simpson and Day (1999). Song-based identification was based on Bird Observers Club of Australia recordings (1998).
- Species present within the search area, flying overhead and outside the search area were recorded.
- As well as species observed, the following variables were recorded: number of individuals; distance from observer; flight height; and bird behaviour. Flight height was broken into four classes: 0-20 m above the ground, 21-40 m, 41-140 m and greater than 140 m above the ground. The third class (40-140 m) represents the potential turbine blade-sweep area.
- The timing of surveys was from early morning to mid-afternoon.

Reptile active searching surveys (November 2011)

- Depending on habitat extent and quality, searches varied between 15 and 45 minutes.
- Two species were targeted: Pink-tailed Worm-lizard *(Aprasia parapulchella)* and Striped Legless Lizard *(Delma impar)*.
- Active searching was undertaking in suitable habitat including rolling rocks, logs, and other debris. Rocks and logs were scanned for basking individuals prior to active searching. The species was targeted in rocky outcrops particularly those on slopes within grassland and woodland. Striped Legless Lizard was targeted by rolling debris (rocks, logs, bark, etc.) in areas of potential habitat.
- The temperature recorded during the November 2011 reptile searches ranged between 19 to 24 degrees and was therefore adequate to detect threatened reptile species.

Microbat Anabat surveys (November 2011, April 2012, November 2013)

Microbats were surveyed using an Anabat detector (passive survey). The detector was left in place overnight in locations chosen to maximise the potential for detecting multiple species of bats, such as in likely flyways through vegetation, along drainage lines and near dams. Recording was typically from approximately 30 minutes before sunset to daybreak the following morning.

Nocturnal surveys (November 2011, April 2012)

<u>Evening listening / stagwatching</u>

Evening listening involved watching potential hollow-bearing trees and listening for fauna activity, particularly owls, for approximately 30 minutes before and after sunset.

Call playback

Call playback was undertaken following the methods of NPWS (2004) targeting Powerful Owl, Barking Owl, and Squirrel Glider. Most surveys were in the early evening. This included an initial listening period of 10 minutes, then playing calls for 5 minutes, followed by an equal listening period. Additionally, one call playback of 10 minutes duration was undertaken for Booroolong Frog.

Spotlighting

Foot-based and vehicle-based spotlighting was undertaken using an area search method searching for nocturnal, arboreal and scansorial vertebrate fauna along the edge and through the middle of patches of vegetation. Spotlighting was conducted using hand-held 12v 50w spotlights. Surveys were of variable duration from 15 minutes to two hours. The length of vehicle-based transects was determined by length of track suitable for spotlighting. Spotlight surveys were undertaken by two to four people.

Targeted fauna survey methods

Squirrel Glider cage-trapping and targeted nocturnal surveys (April 2012, November 2013)

Cage-trapping surveys were undertaken in April 2012. Two sites were installed; one near RYP_92 (8 traps x 4 nights) and the other near RYP_105 (8 traps x 3 nights). Traps were set in good quality woodland and forest areas to target the most appropriate potential habitat available for this species. A total of 56 trap nights were completed. Traps were mounted between two and five metres above the ground and set using standard bait mix (peanut butter, oats and honey).

General nocturnal surveys were undertaken during November 2011 and April 2012 which included surveying for the Squirrel Glider. A total of 9.5 hours of evening listening / call playback, and 17.25 hours of spotlighting (foot and vehicle) were completed.

Further targeted nocturnal surveys were undertaken for the Squirrel Glider in areas of potential habitat (i.e. in areas supporting higher densities of hollows within forest) during 4 to 9 November 2013 to supplement existing survey results. Spotlighting and call playback were undertaken in Inland Scribbly Gum Forest predominantly within ridge top habitat using the methods described above under *General survey fauna methods* for call playback and spotlighting. These targeted surveys were undertaken near the vicinity of turbine sites RYP_66, RYP_84, RYP_90, and RYP_104 and totalled 5.5 hours of survey.

Swift Parrot surveys (July 2013)

Swift Parrot surveys were undertaken during winter between 9 and 12 July 2013. The primary objective of the winter bird survey was to capture the seasonal migration of the Swift Parrot to the mainland from Tasmania. While woodland bird surveys are not optimal during winter, surveys were also undertaken at this time to supplement existing results by increasing the dataset, but to also gain knowledge on bird species for the wind farm within different seasons. However, more focus was placed on surveying for the Swift Parrot. The following method was implemented:

- Ten surveys were undertaken in potential habitat (moderate to good condition Box Gum Woodland or Inland Scribbly Gum – Red Stringybark Open Forest) within or nearby the proposed impact areas (Appendix E.3).
- The areas targeted for survey included larger remnant vegetation with good connectivity in proposed impact areas.

- The potential habitat was searched for 45 to 60 minutes duration using the most appropriate search method for the shape of the available habitat (area search or linear transect).
- Surveys were undertaken by two surveyors at opposite ends of the search area. This was to increase the chance of detecting parrots in the event a parrot rapidly flew through the search area at one end and could not be identified, therefore allowing another chance of identification at the opposite end.
- Surveys were undertaken early morning and late afternoon until dusk.
- All birds were recorded by sight and vocalisations; however, particular attention was made to be watchful for the Superb Parrot as well as the Swift Parrot.
- Species present within the search area, flying overhead and outside the search area were recorded.
- As well as species observed, the following variables were recorded: number of individuals; distance from observer; flight height; and bird behaviour. Flight height was broken into four classes: 0-20 m above the ground, 21-40 m, 41-140 m and greater than 140 m above the ground.
- Notes on the availability of hollow-bearing trees suitable to parrot species were recorded within the habitat searched.

Temperatures during the field week were relatively mild for a winter survey within a cold climate region. Temperatures were cool early morning and late afternoon; however, days were generally sunny with warm temperatures recorded during the day with little wind. Mist was experienced on two days and was often thick within the valleys, but clear on ridge-tops and would dissipate around 10-11 am (Table 3-1).

Table 3-1 Weather details during Swift Parrot field surveys

Date	Temperature during surveys	Cloud	Wind	Rain	Comments
9 July 2013	3-6 degrees in morning.	30 % cloud cover	Gentle breeze	Nil	Slightly overcast – reasonably clear
10 July 2013	11-15 degrees in afternoon.	80 % cloud cover	Gentle breeze	Nil	Overcast – misty
11 July 2013		100 % cloud cover	Mild breeze	Nil	Overcast – misty
12 July 2013		20 % cloud cover	Calm	Nil	Slightly overcast – reasonably clear

Superb Parrot surveys (November 2013)

Superb Parrot surveys were undertaken between 4 and 9 November 2013. The primary objective of the survey was to capture the breeding season of the Superb Parrot to determine if the species was utilising hollows within or nearby proposed infrastructure for breeding, and to determine local movements and potential flight paths of the species. Damon Oliver of OEH (Senior Team Leader, Ecosystems and Threatened Species) was consulted during September 2013 to discuss survey effort and design of the Superb Parrot survey. Transect survey locations were proposed and reviewed by Damon Oliver before surveys were undertaken.

The following method was implemented:

Transect surveys

- Twenty-five transect surveys were conducted across the project area either within or nearby impact infrastructure (Appendix E.3). Two transects could not be surveyed due to access limitations (SP13 and SP16).
- The areas targeted for survey include both low and higher quality habitat. Site selection was prioritised to capture the following:
    - Prioritise typical Superb Parrot habitat (i.e. Box Gum Woodland, Derived Grassland and pasture with scattered tree habitat), while also surveying some 'atypical habitat' (i.e. dry grass forest);
    - Larger remnant habitat with good connectivity in proposed impact areas;
    - Areas where Superb Parrots have previously been recorded;
    - To stratify sites along the length of the wind farm, but also near turbines;
    - To select sites to the west of the wind farm near known records and in closer proximity to potential foraging grounds (cropping paddocks)
    - To allow some sites to be surveyed to the west and east of a turbine simultaneously.
- A 1 km transect line was walked in 1 hour, counting any Superb Parrots within 250m in front and perpendicular to the transect line as per the method requested by OEH (pers. comm. Damon Oliver, September 2013).
- All transect surveys were conducted from sunrise until no later than 10 am, except for two transects which were undertaken between 10 and 11am. Access limitations prevented these sites from being surveyed before 10am; however, weather was still considered suitable (not too hot) when these surveys were conducted and Superb Parrots were still observed flying and foraging throughout the day during the survey week. Due to cooler temperatures experienced at higher elevations such as Rye Park, bird activity on the wind farm site appears more prevalent when temperatures warm later in the morning (i.e. 8am to 11am).
- All other birds were also recorded by sight and vocalisations during the 1 km transect which increased bird survey effort substantially across the entire project area (i.e. 25 hours total transect time).

Mapping nest trees

- During transect surveys the areas parrots were identified were further investigated for evidence of breeding and presence of nest trees.
- Trees regularly used by the parrot were watched at dusk and dawn between 8 and 9 November 2013, and again on 21 and 22 November 2013.
- Nest trees were mapped and recorded by GPS. Trees that were unconfirmed as nest sites but appeared regularly visited by the parrot were mapped as potential nest trees.

Flight path mapping

- Flight path mapping was completed between 7 to 9 November 2013.
- Areas where Superb Parrots were regularly observed within the project area were targeted for flight path mapping. These areas were defined by reviewing all known records of the species, as well as locations the parrot was observed during transect surveys.
    - It became apparent during transect surveys that areas to the west of the project area, particularly along Rye Park Road, Frogmore Road, and Flakney Creek Road were regularly used by the parrot, as well as an area in the south of the project area.
- A team of eight to ten observers were stationed at independent locations in these higher activity areas at the same time to record movement and direction of flight of the parrot (Appendix E.3).
    - Some observers were stationed to the west of the proposed infrastructure, while other observers were stationed further east within the project area to determine if birds moved west to east over the higher ridge tops (i.e. across the location of proposed turbines). In particular, two observers were stationed at vantage points for viewing areas of 'highest activity' with a spotting telescope (i.e. on a proposed turbine location) to determine if parrots were moving across the ridgeline.
- Flight path mapping surveys were undertaken from sunrise until 10 am on three consecutive days, except for sites 1, 2, 9 and 10 which were surveyed for two consecutive days (these sites were considered lower activity areas or lower constraint areas).
- For each observation (i.e. individual bird or flock of birds) the time birds were observed, direction of movement, distance moved (if possible), flight height, habitat and general behaviour of observed parrots were recorded. Each flight path was plotted on aerial imagery in the field.
- Additionally, observations were made of birds throughout the survey week while driving to and from the site, driving between sites within the project area, and during other survey work. Particular attention was given to identify any observed parrot throughout the duration of the field week and note its flight path direction. These general observations provided a clear understanding of the locations Superb Parrots were utilising the most across the project area.

Table 3-2 Weather details during Superb Parrot field surveys.

Date	Temperature (min)	Temperature (max)	Cloud	Wind	Rain (mm)
4/11/2013	-0.5 degrees	21 degrees	30% cloud cover	Light wind	0
5/11/2013	1.0 degrees	23.5 degrees	20% cloud cover	Light wind	0
6/11/2013	1.0 degrees	28 degrees	10% cloud cover	Light wind	0
7/11/2013	5.0 degrees	31.5 degrees	30% cloud cover	Moderate wind	0
8/11/2013	10 degrees	25 degrees	80% cloud cover	Moderate wind	0
9/11/2013	6 degrees	24 degrees	100% cloud cover	Strong wind	0

Koala RapSAT surveys (November 2013)

Discussions on the extent of potential impact to the Koala and level of survey effort required were undertaken with Mike Saxon (OEH) on 10 September 2013. During these discussions it was noted that:

- The extent of clearance is primarily limited to discrete areas, primarily for transmission line corridors. Clearance for wind turbines will be nil to minor as main access tracks and turbine sites are located in cleared or non-forested areas; however, there will be some clearing required for installation of the more minor turbine access tracks that will connect to the main access network;

- The nature of the clearing will not affect fragmentation in the landscape; and
- A substantial amount of similar habitat will remain in the project boundary and will not be affected by the proposal.

For example, the main access tracks to potential turbine sites are already cleared, with many tracks already 20 m wide due to existing agricultural land practices; hence clearing is minimal in these areas and the project will not increase fragmentation. Of the habitat available, Inland Scribbly Gum habitat of all condition classes (i.e. poor-good) is considered most appropriate for this species of which up to 55 ha may be cleared by the proposal; however at least 4350 ha of the same vegetation type will remain within the project boundary which also connects to larger areas of the similar habitat within the surrounding landscape.

Given the severity of impacts is not considered to be adverse on the Koala and the potential area to survey for the Koala is extremely large it was discussed that representative areas of better habitat be sampled (Mike Saxon pers. comm. 10 September 2013) given that if the Koala was in the project boundary it is most likely to inhabit the better quality areas.

The following survey method is based on these prior discussions:

- Koala scat surveys were undertaken using the field aspects of Rapid Spot Assessment Technique (RapSAT) as described by Phillips and Callaghan (2011).
- RapSAT searches were completed between 9 to 12 July 2013, 4 to 9 November 2013 and 18 to 22 November 2013.
- Each survey grid was primarily located in areas of potential habitat (i.e. where remnant patch size is relatively large and contiguous) where these will be impacted (i.e. areas proposed for vegetation clearance); this method enabled a representative sample of the habitat to be surveyed across the entire project area.
- Each individual grid location consisted of a group of individual sites which ranged from three to five sites. Within each grid sites were located at approximately 500 m intervals up to a maximum of a 1 km x 1 km grid, or within a linear alignment where the layout of infrastructure within the Rye Park wind farm landscape did not support this grid formation. In total, 33 RapSAT searches were completed.
- The RapSAT method involves searching for scats or evidence of Koalas at the base of 30 trees per site.

Striped Legless Lizard artificial tile surveys (November to December 2013)

An artificial shelter survey using concrete tiles was undertaken for targeted reptile surveys. Five tile sites were installed on 11 July 2013 during winter and another five sites were installed on 10-11 October 2013. Tiles were checked for presence of reptiles during spring-summer 2013. The primary objective of the reptile survey was to determine the presence or absence of the Striped Legless Lizard.

Rod Pietsch of OEH (Senior Threatened Species Officer) was consulted during October 2013 to discuss survey effort and design of the tile survey. It was concluded an additional five tile sites as well as another two funnel trap sites (methodology discussed below) would be installed to supplement the existing tile sites set up in July 2013. The protocol for checking sites was developed in consultation with Rod Pietsch.

Additionally, the survey effort was also based on EPBC survey guidelines for the Striped Legless (SEWPaC 2011). In particular, site selection was based on these guidelines which state “surveys should be conducted in areas that appear to be the most suitable habitat for the species at a site. Surveys are best done in vegetated areas not areas of open bare ground” (?). The artificial shelter methodology was also selected

as detection rates using artificial shelter sites are nearly double that of pit-falling when undertaken during spring (SEWPaC 2011).

EPBC Act survey guidelines suggest rock-rolling primarily during peak activity (late spring and early summer under warm, but not overly dry, conditions) for the Pink-tailed Worm-lizard. This method was undertaken for the species during the initial BA, however, the artificial tile survey is believed to mimic rock structure and was therefore used to supplement survey effort for this species also.

The following methodology was implemented:

- Artificial tile grids were installed in ten locations. Each site consisted of 50 terracotta concrete tiles in a grid of 10 x 5, with tiles spaced every 10 m. A total of 500 tiles were installed across the project area.
- As per the EPBC Act survey guidelines, sites were spaced across the project area in the most suitable habitat for the species; these areas were nearby Box Gum Woodland, within derived grassland and native pasture. Grassland areas that were considered inappropriate habitat were either dominated by exotic species only, were heavily grazed at the time of survey, were dominated by bare ground and/or supported no tussock forming grass species.
- Sites were checked once or twice per week between the period of 1 November to 20 December 2013, totalling 10 checks per site. Checks were delayed when high rainfall was forecast. The number of checks per week was specifically discussed and developed in consultation with Rod Piestch of OEH as this checking protocol deviated from that specified in the EPBC survey guidelines for this species.
- Sites were checked as early in the morning as possible before species were active. Due to time constraints some checks extended into the afternoon, however all checks were completed when ambient temperatures did not exceed 28^{o}C as per the EPBC Act guidelines (Table 3-3).
- A 30-minute active hand search was also undertaken in tussocks within the location of the tile survey during checks.
- All reptile species and number of individuals observed were identified and recorded.

Table 3-3 Weather details for each Striped Legless Lizard tile check.

Date	Temperature range at the time tiles were checked	Cloud	Wind	Rain
5/11/2011	18 – 26 degrees	Nil	Nil	Nil
15/11/2013	18 – 25 degrees	30% cloud cover	Nil	Nil
19/11/2013	12 – 24 degrees	30% cloud cover	Slight breeze	Nil
22/11/2013	14 – 24 degrees	80% cloud cover	Moderate wind	Nil
27/11/2013	12 – 22 degrees	10% cloud cover	Slight breeze	Nil
3/12/2013	20 – 27 degrees	10% cloud cover	Moderate wind	Nil
6/12/2013	7.5 – 15 degrees	50% cloud cover	Moderate to strong wind	Nil
10/12/2013	13 – 20 degrees	40% cloud cover	Moderate wind	Nil
13/12/2013	18 – 26 degrees	10% cloud cover	Moderate wind	Nil
17/12/2013	18 – 22 degrees	Nil	Slight breeze	Nil

Striped Legless Lizard funnel trap surveys (November 2013)

- Funnel trap surveys were undertaken between 4 and 8 November 2013.
- Twelve funnel traps were installed at two sites (Appendix E.3); these sites were chosen to supplement tile surveys but were placed in accessible locations so they could be checked daily.
- Funnel traps were connected by drift-net fencing, with six rows of two funnel traps; each row was approximately 7 m long.
- Funnel traps were installed for a total duration of four nights and five days.
- Traps were checked during the morning and afternoon daily.
- All reptile species and number of individuals observed were identified and recorded.

Golden Sun Moth surveys (November 2013)

The current survey was undertaken with consideration of the guidelines outlined in EPBC Act policy statement 3.12. Significant impact guidelines for the critically endangered Golden Sun Moth (*Synemon plana*) (DEHWA 2009a) and with reference to NSW Guidelines for Threatened Species (DEC 2004). Commonwealth guidelines for Golden Sun Moth recommend each site be visited up to four times under suitable conditions at approximately weekly intervals to determine presence or absence and relative distribution. NSW guidelines recommend that sites should be surveyed a minimum of three times when detection probability for a threatened species is high, but that for rare species it is more efficient to survey more sites less intensively.

As a consequence of limitations posed by the relatively short survey period, the large area covered by the proposed wind farm site and the travel time required between sites, the survey was confined to areas where potential Golden Sun Moth habitat was most likely to coincide with areas with potential to be impacted by the proposed development. Areas where vegetation mapping indicated that Box Gum woodland and/or Box Gum derived grasslands coincided with proposed development were therefore the focal point of the surveys. Surveys were extended where possible to include native pasture (not derived from Box Gum woodland) where it adjoined Box Gum woodland or adjoined sites where moths were observed.

The following methodology was implemented:

- As a consequence of the limitations described, survey effort was targeted at detecting the presence or absence of the moth in potential habitat of Box Gum woodland, Box Gum derived grasslands and to a lesser extent within native pasture.
- A total of 10 search areas were surveyed across the project area between 18 and 27 November 2013 (Appendix E.3).
- Meandering traverse surveys were completed within the search areas by one person. This approach was adopted because of the patchy nature of the habitat and to ensure thorough coverage of areas containing potential habitat.
    - The most likely habitat within each subject site, i.e. patches dominated by wallaby grasses, grassland with an open structure, less disturbed areas along fences and creek edges, moist sites along gully banks, ridge tops and sheltered areas on the sides of ridges, were a particular focus of the survey.
    - The observer kept a steady pace across each search area, stopping and turning at suitable locations for several minutes to check for flying golden sun moths. A GPS watch (Garmin NX310) was used to record the location of the traverses. Golden sun moths flying up to a linear distance of 25 m were visible at most locations, i.e. a total distance of 50 m width in a corridor. The approximate locations of individual moths or small clusters were recorded on aerial imagery in the field.
- Where the moth was found to occur, an assessment was undertaken to determine the extent of potential habitat within the search area. Where the moth was not observed, an assessment of the potential for occupation based on an assessment of habitat quality is provided.
- Survey constraints reduced survey effort to between one and four visits per site. To increase efficiency, as much of each site was thoroughly surveyed as was feasible, although with less intensity (less repetition) than recommended by Commonwealth guidelines. The adequacy of the survey effort in relation to the conclusions is considered further in the discussion of the results.
- Surveys relating to access track sites were generally confined to a linear corridor approximately 30 m in width while those relating to transmission line corridors were approximately 200 m in width. Site compounds and substation sites were surveyed according to the area covered by the installation.
- Five reference sites or sites where moths were observed early during the current survey were examined prior to the first survey and after the last survey on each day where feasible, to confirm that moths were flying in the vicinity of each search area (Appendix E.3).
- General weather conditions on each of the survey days were suitable for the detection of flying Golden Sun Moth (Table 3-4).

Table 3-4 Weather details for each Golden Sun Moth survey

Survey Date	Time	Rain (mm)*[1]	Temperature (ºC)	Wind (km/h)*	Cloud 8th*	Weather Conditions#
18 November	10:15 – 15:30	0	15 – 22* 18 – 22#	11 – 19	1 – 4	Sunny but cloud increasing during the day, warm, slight breeze at times with moderate gusts in the afternoon
19 November	10:20 – 15:30	0	16 – 28* 22 – 27#	Calm	0	Sunny, warm to hot, calm conditions, occasional light breeze. Temperature rose quickly after 10:00

Survey Date	Time	Rain (mm)*[1]	Temperature (ºC)	Wind (km/h)*	Cloud 8th*	Weather Conditions#
20 November	10:15 – 15:00	0	20 – 29.5* 26 – 32#	Calm - 6	1 – 2	Hot, mostly sunny, generally calm but with increasing wind and cloud
23 November	10:30 – 15:20	2mm 22 Nov	No record* 21 – 24#	No record	No record	Warm, mostly sunny, calm with occasional light breeze, cloud increasing
27 November	10:40 – 15:15	4mm 26 Nov	17.5 – 27.5* 18 – 27#	Calm - 6	0	Warm to hot, slight breeze at times, sunny. Temperature rose quickly after 11:00
3 December	09:50 – 15:15	0	21 – 32* 25 – 32#	Calm	0	Hot, mostly calm with occasional wind gusts later, sunny with some high cloud at times
8 December	10:30 – 14:00	2.2mm 6 Dec	Max 30.5* 21 – 25#	No record	No record	Some high cloud early, warm, generally calm with occasional wind gusts

***** As recorded by the Bureau of Meteorology at YASS (station 070358) generally or at 09:00 and at 15:00. Some records not available.

As recorded in the field during survey period. Temperature records from a hand held thermometer or by the electronic thermometer located in the car used to access each site.

[1] In previous 48 hours

Threatened Large Forest Owls call playback survey and spotlighting (November 2013)

General nocturnal surveys were undertaken during November 2011 and April 2012 which included surveying for large forest owls. A total of 9.5 hours of evening listening / call playback, and 17.25 hours of spotlighting (foot and vehicle) were completed.

Further targeted nocturnal surveys were undertaken for the Powerful Owl and Barking Owl in areas of potential habitat (i.e. in areas supporting higher densities of hollows within forest) during 4 to 9 November 2013 to supplement existing survey results. Spotlighting and call playback were undertaken within forest habitat that was considered to support a greater abundance of prey species or roosting sites for these species. Nocturnal surveys were completed using the methods described above under *General survey fauna methods* for call playback and spotlighting. These targeted surveys were undertaken near the vicinity of turbine sites RYP_66, RYP_84, RYP_90, and RYP_104 and totalled 5.5 hours of survey.

3.3.3 Survey effort

Flora survey effort

Approximately 180 person hours was spent in total on the general flora survey incorporating 59 quadrat/random meander sites and 128 inspection points. The location of the survey sites are shown on the maps in Appendix E.2. Approximately 7 and 5.5 person hours was spent on specific targeted searches within the originally proposed substation site and higher quality areas in the vicinity of RYP_120 during the November 2011 and November 2013 surveys respectively.

Fauna survey effort

Table 3-5 documents the fauna survey effort employed for both general surveys as well as targeted species-specific surveys for the project area.

Table 3-5 Fauna effort summary

Turbine number references (i.e. RYP_92) relate to map sets provided in Appendix E.3.

Survey Type	Target Species	Date	Sampling Method	Survey Effort	Comment
Habitat Assessment	All species, predominantly threatened	November 2011	100 x 100 quadrat	• 54 quadrats	
		April 2012	100 x 100 quadrat	• 20 quadrats	
Hollow-bearing Trees	All hollow-dependent fauna	November 2011	100 x 100 quadrat	• 35 quadrats	
		April 2012	100 x 100 quadrat	• 2 quadrats	
		November 2013	HBTs mapped within 100m of infrastructure in mod-good condition vegetation	• 7 search areas	
Birds	All birds	November 2011	Utilisation Surveys	• 18 surveys of 30 minutes duration **Total effort = 9 person hrs**	
		April 2012	Utilisation Surveys	• 6 surveys of 20 minutes duration **Total effort = 2 person hrs**	
		November 2013	Utilisation Surveys	• 8 surveys of 20 minutes duration **Total effort = 2.7 person hrs**	All birds observed during Superb Parrot transects were also recorded substantially increasing survey effort for birds in general (25 hrs).
	Swift Parrot / All birds	July 2013	Point-count method	• 10 search areas • 6 surveys at 60 mins each (2 people) (1 site visited twice) • 5 surveys at 45mins each (1 person) (3.75 person hrs) **Total effort = 15.75 person hrs**	Surveys undertaken to coincide with the winter migration of the Swift Parrot to mainland from Tasmania.
	Superb Parrot	November 2013	1km transects Flight path mapping	• 25 transects of 1 hr duration **Total effort = 25 person hrs** • 3 days x 8 people of flight path mapping **Total effort = 72 person hrs**	Method and survey effort developed in consultation with Damon Oliver (OEH Threatened Species Team Leader)

Survey Type	Target Species	Date	Sampling Method	Survey Effort	Comment
Reptiles and Amphibians	All species, primarily Pink-tailed Worm-lizard	November 2011	Active searching (rock, log, branch rolling)	• 11 surveys of 20 – 60 minutes duration **Total effort = 4 person hrs**	
	All species, primarily Striped Legless Lizard	November 2012	Funnel Traps	• 2 sites off Flakney Ck Rd along proposed TL **Total effort = 24 traps x 4 nights (96 traps nights)**	Method and survey effort developed in consultation with Rod Piestch (OEH Senior Threatened Species Officer)
	Striped Legless Lizard	November to December 2012	Artificial Tiles	• 10 sites of 50 tiles each • 10 independent checks **Total effort = 50 tiles x 10 sites (500 tiles) checked 10 times each**	
	All Frogs	November 2011	Frog vocalisation survey	• 10 minutes duration	
Microbats	All microbats	November 2011	Anabat surveys	• 9 overnight surveys	
		April 2012	Anabat surveys	• 6 overnight surveys	
		November 2013	Anabat surveys	• 7 overnight surveys	Additional survey effort developed in consultation with Martin Henery (OEH Conservation Planner)
Squirrel Glider	Squirrel Glider	April 2012	Cage trapping	• 2 trap sites near RYP_92 and RYP_105 **Note: RYP_105 is now removed from layout* **Total effort = 8 traps x 4 nights, 8 traps x 3 nights (56 trap nights)**	
Golden Sun Moth	Golden Sun Moth	November 2012		**Total effort = 10 sites visited between 1 and 4 times each.**	
Koala	Koala	July 2013, November 2013	Spot Assessment Technique (RapSAT)	**Total effort =** 7 grids (33 plots)	Method and survey effort developed in consultation with Rod Piestch (OEH Senior Threatened Species Officer)
Nocturnal Survey					

Survey Type	Target Species	Date	Sampling Method	Survey Effort	Comment
Evening listening / stagwatch	Forest Owls Squirrel Glider	November 2011	N/A	• 3 surveys each by 2-3 people for 30 minutes **Total effort = 3.5 person hrs**	
		April 2012		• 6 surveys by 60 minutes **Total effort = 6 person hrs**	
Call Playback (including listening period)	Forest Owls Squirrel Glider	November 2011		• 5 surveys of 20 minutes duration **Total effort 1.6 person hrs**	
		April 2012		• 3 surveys of 30 minutes duration **Total effort = 1.5 person hrs**	
		November 2013		• 4 surveys of 30 minutes duration **Total effort = 2 person hrs**	Additional survey effort developed in consultation with Martin Henery (OEH Conservation Planner)
Spotlighting	Squirrel Glider Arboreal mammals	November 2011	Vehicle and foot surveys	• 3 vehicle-based surveys • 5 foot-based surveys between 15 minutes and 2 hours **Total effort = 11.75 person hrs**	
		April 2012	Foot surveys	9 foot-based surveys between 30 and 50 minutes **Total effort = 5.5 person hrs**	
		November 2013	Foot surveys	4 foot-based surveys between 30 and 60 minutes **Total effort = 3.5 person hrs**	Additional survey effort developed in consultation with Martin Henery (OEH Conservation Planner)

3.3.4 OEH recommended survey requirements

Table 3-6 addresses each species-specific survey requirement recommended by OEH (received by **ngh**environmental 11 June 2013). The table considers the survey effort implemented for this assessment and provides a justification for any deviation from the OEH requirements (for, example, where no suitable habitat for the species occurs or where the level of impact that would be imposed by the wind farm is manageable with regard to the species).

After the initial November 2011 survey was undertaken, further targeted surveys were undertaken to fill survey effort gaps and to determine the presence / absence of a species. OEH requested specific survey requirements for the Superb Parrot, Koala, Striped Legless Lizard, Squirrel Glider, threatened forest owls, threatened microbats, woodland birds, and Golden Sun Moth. Substantial targeted surveys were therefore undertaken in November to December 2013 for the above species; the survey effort and survey locations for these species-specific surveys were developed in consultation with OEH and documented in *Rye Park Biodiversity Assessment - targeted fauna survey V2 2013)*.

Additional to the surveys already undertaken, additional survey work is planned both prior to approval and prior to construction (pending project approval) to address remaining uncertainty or inform management of impacts (particularly during construction). These additional surveys are specified in the recommendations of this Biodiversity Assessment, in Section 8.

Table 3-6. Species specific survey requirements issued by OEH

Species	OEH recommended survey requirements (paraphrased)	Surveys in accordance with OEH	Justification for any deviation from OEH requirements
Flora			
Box Gum Woodland	Identify the extent and condition of this community in the study area and locality.	Yes.	59 quadrat/random meander sites and 128 inspection points (approximately 180 person hours). Vegetation type mapped to the site boundaries. Condition mapped for the development envelope. Infrastructure was designed to avoid good condition areas for Box Gum Woodland (Section 8) (i.e. turbines moved out of Box Gum Woodland remnants or removed from layout altogether). The community has a long history of grazing, with much of the development located within low condition areas. The survey effort employed is considered adequate to the nature and quality of habitat found within the project area.
Silky Swainson Pea, Mountain Swainson Pea, Tarengo Leek Orchid, Crimson Spider Orchid, Yass Daisy.	Systematic surveys using 10m transects through woodland and grassland areas. Surveys should be undertaken during the flowering periods.	Yes, within the originally proposed substation site. Random meanders substituted for transects within proposed transmission line routes	59 quadrat/random meander sites and 128 inspection points (approximately 180 person hours) Box Gum Woodland and derived grassland in moderate or good condition is considered to be the most likely habitat these species would be found. Targeted transects for threatened flora were conducted in higher quality areas of Box Gum Woodland and derived grassland within the originally proposed eastern substation site (removed during layout modifications to avoid sensitive areas). Random meanders were substituted for transects within the high quality habitat in between RYP_109 and RYP_120 given the large area to be covered and the nature of the impacts in this area (limited to the establishment of transmission pole footings and an access track). Both methods are considered acceptable under the Draft Threatened Species Survey Guidelines (DECC 2004). These surveys failed to locate any threatened flora. In addition, five flora quadrat surveys were conducted in moderate or good condition Box Gum Woodland and failed to detect any threatened flora. No threatened flora were detected during the other 54 quadrat/random meander sites and 128 inspection points (approximately 180 person hours) conducted across the broader site or while travelling between these sites.
Fauna			
Regent Honeyeater	Diurnal fixed-width transects or point counts surveys and call playback during breeding season. Surveys can be conducted at any time of year, but optimal conditions during spring and summer.	No. But the species was indirectly surveyed through utilisation bird surveys.	26 bird surveys (11.5 person hours) were conducted across the project area during November 2011 and November 2012. Primary breeding and foraging habitat is not widely available within the project area (i.e. riparian areas of Red Ironbark, Red Gum and Casuarinas, or wetter areas supporting Box-ironbark Eucalypt associations). Two species of mistletoe were recorded on site, but are not widely distributed and occur in low densities. Casuarina and Red Gum are not recorded on site. Potential foraging habitat is primarily present within the Box Gum Woodland within the project area. The Guidelines suggest bird searches of woodland patches with heavily flowering trees, especially around waterpoints, such as creeklines. Woodland patches within the impact area were surveyed during bird

Species	OEH recommended survey requirements (paraphrased)	Surveys in accordance with OEH	Justification for any deviation from OEH requirements
			surveys. The method employed such as listening for calls during the known breeding season (November) within the most appropriate habitat type available within the impact area is considered adequate to detect this species. Given that core breeding habitat is not available on site, foraging resources are generally limited (i.e. not wetter more fertile areas), and known records indicate movement of the species east of the project area, the proposal is not considered to adversely affect the existence of this species
Swift Parrot	Diurnal fixed-width transects and/or point-count surveys during Autumn-Winter.	Yes.	10 point-count surveys undertaken during July 2013 during the species winter migration to the mainland from Tasmania.
Brown Treecreeper, Diamond Firetail, Hooded Robin, Speckled Warbler, Grey-crowned Babbler, Little Lorikeet, Black-chinned Honeyeater, Turquoise Parrot, Varied Sittella.	Diurnal bird census in the early morning or late afternoon at a minimum of three locations within the subject site. Surveys should be 45 minutes duration and separated by a period of one week. Can be undertaken at any time of the year, but not in high-wind and/or rainy days.	Yes.	42 bird surveys (29.45 person hours) were conducted across the project area during November 2011, April 2012, July 2013, and November 2013, with emphasis on wooded areas. The survey effort undertaken is above that recommended by OEH. Additionally, infrastructure has been designed to avoid high habitat value areas for woodland birds (Section 8) and to maintain habitat connectivity (i.e. turbines moved out of Box Gum Woodland remnants or removed from layout altogether).
Scarlet Robin, Flame Robin	As above, but surveys are optimal between July-January, but can be undertaken at any time of the year.	Yes.	As above.
Gang-gang Cockatoo, Glossy Black-cockatoo	Diurnal bird surveys, using a combination of stag-watching and listening for calls of the birds returning to nests in the late afternoon during the known breeding season. Surveys should target hollow-	No. But both species were not observed during bird surveys	Both species were not observed during bird surveys despite a total of 42 bird surveys undertaken, indicating they are unlikely to be a permanent resident of the project area. Both foraging (Casuarina) and nesting resources for the Glossy Black-cockatoo are absent from the project area and the species is not expected to occur there. The gang-gang was not observed during bird surveys and therefore stag watch surveys were not considered necessary for this species. The survey effort employed is considered adequate for the extent and quality of habitat found within the project area.

Species	OEH recommended survey requirements (paraphrased)	Surveys in accordance with OEH	Justification for any deviation from OEH requirements
	bearing trees (hollows > 10 cm).		
Superb Parrot.	Undertake surveys during breeding season using 1 km transects within the project area to determine local flight paths and usage of the project area. Undertake flight path mapping at advantage points across the project area.	Yes.	Surveys deviated from initial OEH requirements but subsequent transect and flight path mapping methodology was developed in consultation with OEH specific to this species.
Barking Owl, Powerful Owl	Nocturnal call playback (1 site per 100 ha). Identify and map all hollow-bearing trees and estimate the availability within the locality.	Slight deviation	10 nocturnal surveys conducted (spotlighting, evening listening, and call playback). Nocturnal call playback was undertaken in suitable potential habitat for these species in accordance with the draft guidelines for threatened species assessment (DEC 2005); however, call playback targeted potential habitat of this species and was not undertaken every 100 ha across the project area given much of the habitat in other unsurveyed areas was unsuitable or marginal. These species are considered further in the impact assessment.
Squirrel Glider	Live-trapping in trees, with traps spaced 50-100m apart, for minimum of 4 nights. Infra-red cameras are supported as a trade-off survey intensity.	Yes.	Cage trapping (56 trap nights) was conducted at two locations of suitable habitat in April 2012, with 9.5 hrs of evening listening, and 20.75 hrs of spotlighting (foot and vehicle) also completed in total. Additional survey effort completed in November 2013 was developed in consultation with OEH and constituted targeted spotlighting in areas of potential habitat that were considered the most appropriate habitat for this species. This species is considered further in the impact assessment.
Koala	Undertake regularised Grid Based Spot Assessment Technique (RapSAT). Map potential Koala habitat in the study area.	Yes.	Survey effort and location of RapSAT grids were developed in consultation with OEH prior to field surveys.
Spotted-tailed Quoll	Use digital infrared cameras in suitable habitats, such as	No.	The project area does not support habitat for this species. The spotted-tailed Quoll was given a low potential impact rating as rocky habitats (i.e. boulders and cliff faces) required for breeding by quolls are not present within

Species	OEH recommended survey requirements (paraphrased)	Surveys in accordance with OEH	Justification for any deviation from OEH requirements
	drainage lines. Install cameras for a minimum of four weeks.		the project area. While this species can also den in large logs and hollows these habitat features are absent from the impact area. Therefore impact of the proposal is negligible and intense survey effort was not warranted.
Eastern False Pipistrelle, Eastern Bentwing-bat, Greater Broad-nosed bat, Yellow-bellied Sheathtail-bat, Greater Long-eared Bat.	Conduct surveys using Anabat recorders and stag-watching. Identify important foraging habitat in the study area and locality. Hollow-bearing tree surveys of the subject site, study area, and locality.	Yes.	23 Anabat surveys were undertaken in 22 different locations. Hollow-bearing trees were mapped in areas of mod-good condition habitat considered potential habitat for these species. As it is difficult to determine abundance or flight paths from Anabat survey there are limitations to determining important foraging habitat given the mobility of microbat species. It is therefore considered that forest and woodland areas in general represent a constraint for these species, as do hollow-bearing trees. However, infrastructure has been designed to avoid high habitat value areas (woodland habitat) to mitigate impact to microbats. Microbats were considered further in the impact assessment and were noted as focus species for a bird and bat monitoring program.
Grassland Earless Dragon	Spider tubes should be used to survey areas of suitable habitat (natural temperate grassland or nearby secondary grassland dominated by Wallaby Grass). 10-wk survey season from February to April with tubes checked twice a week.	No.	11 herpetofauna searches in suitable habitat including active searching and rolling of rocks, logs and other debris. In the project area, rocky outcrops generally occur on hill crests in cleared and forested areas and are sparsely distributed, occurring mostly in the northern portion of the site. Primary habitat for these species does not occur within the project area. The survey effort is considered adequate for the extent and quality of habitat available within the project area.
Pink-tailed Worm-lizard, Little Whip Snake	Rock rolling and active searching under logs and debris. Undertake surveys between mid-August and end of October. Daily temperatures to not exceed 25 degrees. Surveys in the locality for habitat of the species.	Yes, for the Pink-tailed Worm-lizard.	
Striped Legless Lizard	Pitfall trapping in suitable habitat (natural temperate grassland or nearby secondary grassland dominated by Kangaroo Grass). Trapping	Yes.	Survey effort and location of artificial tiles sites were developed in consultation with OEH prior to field surveys.

Species	OEH recommended survey requirements (paraphrased)	Surveys in accordance with OEH	Justification for any deviation from OEH requirements
	should last for 6 weeks (mid-November to mid-late December). Roof tiles should also be used 4 months prior to checking.		
Golden Sun Moth	Surveys should target areas with greater than 40% *Austrodanthonia* (Wallaby Grass) in ground cover. Conduct surveys when known populations in the local area are in flight.	Yes.	Surveys undertaken by Kris Nash, an expert in Golden Sun Moth survey especially within the ACT region.

3.4 SURVEY LIMITATIONS

Assumptions	Where required, we have assumed a precautionary approach, assuming a species is present unless good reasons preclude its use of the site. We have stated explicitly the assumptions, where made, and the limitations of our approach or survey. Where required, we have developed measures to address uncertainty; chiefly these include a monitoring program to respond to unforseen operational impacts to birds and bats. Information on the ecology and flight paths, as well as movement patterns are not available for some species and in this instance specific impacts cannot be quantified and such species need further consideration within a monitoring program. Additionally, several specific surveys are proposed, to confirm the assumptions of this assessment and make any necessary changes, if required, to ensure that impacts are kept below key thresholds.
Competency	Suitably qualified and licensed individuals carried out the survey work; refer to Appendix G for staff qualifications and experience.
Accessibility	Night work was targeted toward forest and woodland safely accessible at night. Some forested areas in the northern part of the proposal area were not surveyed at night due to unsafe access in the dark. Detailed habitat assessments were undertaken in these areas during the day. Not all areas within the development envelope were able to be accessed efficiently for vegetation survey, due mostly to the presence of a very dense shrub layer or steepness of the terrain. In these areas, inspection from nearby inspection points[5] utilising high powered binoculars was used to confirm vegetation types. Condition for these areas was extrapolated from other known areas of similar vegetation that had been surveyed in detail. The survey effort maps clearing illustrate the location of all survey and inspection points.
Timing	The field surveys were undertaken in mid spring and autumn, and considered suitable for detecting the majority of target species. Some summer flowering flora species may have gone undetected however, the precautionary approach outlined below has been utilised in these instances.
Scope	The fauna survey focussed on habitat assessment to identify areas that may harbour threatened species, rather than undertaking a comprehensive trapping program. Targeted follow-up surveys in April then focussed on better quality habitat.
Hollow-bearing trees	Data was obtained from hollow-bearing tree quadrats and targeted search area surveys and has been averaged and extrapolated for the remainder of the site.

[5] The flora survey effort map shows all flora inspection points.

	This is likely to lead to either over-estimates or under-estimates in some areas with different disturbance or land management regimes.
Precautionary approach	As it is difficult to rule out the presence of any particular species without extensive surveys, a precautionary approach has been adopted. That is, if suitable habitat is present and desktop assessment has determined the species could occur in the area, the species has been assumed to have potential to utilise habitat within the proposed alignment.
GIS	A common issue when displaying survey effort and results point data is that some points obscure other points which are located in the same or similar locations. An innovative GIS approach has been applied to randomly disperse such points which are co-located. The effect of this is to move co-located points up to around 200m from their original location. This assists the reader to distinguish co-located points. However, it should be noted that the location of survey effort and results point data is approximate only, and that in some cases, the moved points may therefore overlay onto adjacent vegetation type or habitat conservation value.

3.5 GIS MAPPING

Figures have been produced by **ngh**environmental using ArcView 10. Geo-referenced aerial imagery and development envelopes were provided by Epuron.

No existing vegetation mapping (including any sensitive area mapping) exists for the proposal site. Vegetation and habitat mapping have been hand-digitised by **ngh**environmental based on aerial imagery and field records. Vegetation type and condition has been mapped for the development envelope that was current at the time of the field survey. Vegetation types (excluding condition) have also been mapped within the broader site boundary, based on the inspection data recorded in the field and extrapolation from known vegetation types and their topographic context within the landscape.

3.6 LANDSCAPE CONNECTIVITY ANALYSIS

As impacts on habitat connectivity can fragment populations, affecting their ability to access important resources and undertake genetic exchange, a landscape connectivity analysis was undertaken. This was done with reference to aerial imagery, considering the spatial configuration of vegetation including percentage vegetation cover and connectivity across the landscape. The field surveys also provided an opportunity to ground truth assumptions about local connectivity.

3.7 CONSTRAINTS ANALYSIS

A Biodiversity Constraints Analysis was prepared by **ngh**environmental (2012) to spatially identify key ecological values that represent a constraint to the proposal. A constraint, for the purposes of this assessment, is an environmental condition that reduces the suitability of a site to accommodate the proposed development. Constraints mapping was undertaken as a means to guide the development of the infrastructure layout to minimise biodiversity impacts. It also provides a means to group management strategies. For example; areas within which infrastructure should be avoided, areas requiring further

survey, areas requiring specific management measures, and areas requiring standard management measures.

The biodiversity constraints in the project area have been identified and assessed based on desktop assessment and field surveys, including aerial photo interpretation and GIS mapping. Aerial photo interpretation was used to extrapolate data in areas that were not directly assessed within the field. In this instance knowledge of the surrounding areas was considered adequate to make a judgement call on the constraint level applied. The result of the constraints analysis is provided in Section 6.

The biodiversity constraints within the development envelopes at Rye Park wind farm have been classified and mapped according to three constraint classes (Table 3-7). Constraints maps are intended to inform more detailed project development to avoid and minimise impacts, where possible and are provided in Appendix E.4. The layout was iteratively refined by the Proponent in response to the identified constraints throughout the assessment phase of the project. Constraint maps have been adjusted several times throughout the project to include new information from field surveys as they are completed.

Table 3-7 Constraint classes

Level of Constraint	Description	Management Options
High	• Impacts in these areas are significant. • Impacts would be difficult, costly, or require large offset areas, and should be avoided as a preference. • Further survey and targeted assessment required in these areas to determine extent of impact.	• Preference is to avoid direct or indirect impacts in these areas. • Undertake detailed follow up surveys and assessment to determine the significance of likely impacts and resultant management option, if impact is proposed for these areas.
Moderate	• Impacts have potential to be significant if not managed carefully. • Further survey work to guide mitigation and management strategies.	• Mitigate through specific management actions (i.e. micrositing, pre-clearance surveys for HBTs). • Offsetting may require a larger offset ratio. • Undertake detailed follow up surveys and assessment to determine the significance of likely impacts and resultant management option.
Low	• Impacts highly unlikely to be significant in these areas. Infrastructure is most appropriately located in these areas.	• Standard mitigation actions required. • Offset residual impacts (a lower offset ratio will apply).

4 RESULTS: FLORA

4.1 EXISTING ENVIRONMENT

4.1.1 Site conditions: disturbance and weeds

Many areas of the site have been grazed and show evidence of this in the areas extensively cleared of overstorey vegetation often with a low diversity of native pasture species and forbs. Common weeds associated with grazing are widespread and have invaded areas of more intact woodland and forest vegetation.

Large areas of the site that have been subject to previous clearing are now dominated by the colonising species Sifton Bush (*Cassinia arcuata*), which often forms an almost impenetrable shrub layer. This species is a declared noxious weed in many shires within NSW however, it is not declared within the Boorowa Local Control Area (LCA) within which the site occurs. Two noxious weeds declared for the Boorowa LCA were detected during the surveys:

- Scotch Thistle (*Opopordum acanthium*) was detected within the development envelope in the vicinity of RYP_1, slightly west of RYP_34 to 44 and in the far north-east of the site to the east of RYP_23 south to RYP_33.
- Blackberry (*Rubus fruticosus* aggregate) was detected west of the proposed 132kV transmission line along Colondal Lane.

Most areas of forest have a low diversity of tree age groups, being mostly dense young regrowth as a result of previous clearing.

4.2 VEGETATION COMMUNITIES

Eleven vegetation types occur within the development envelope:

- Inland Scribbly Gum – Red Stringybark open forest.
- Blakely's Red Gum - Yellow Box grassy tall woodland.
- Blakely's Red Gum - Yellow Box grassy tall woodland derived grassland.
- Argyle Apple – Acacia mearnsii valley open forest.
- Brittle Gum - peppermint open forest.
- Red Box Woodland.
- Phragmites Swamp.
- Sifton Bush Shrubland.
- Native Pasture.
- Exotic Pasture.
- Planted vegetation.

These vegetation types are described below. The natural vegetation types are classified according to the communities described for the South Western Slopes Bioregion (Upper Slopes) in Benson (2008) and Benson *et al.* (2010). Vegetation types that do not represent a natural vegetation type (e.g. highly modified) have been given a generic name. The distribution of these communities is displayed on the flora result maps in Appendix E.2. A species list for the site is provided as Appendix A.

Inland Scribbly Gum – Red Stringybark open forest (ID349)

Figure 4-1 Inland Scribbly Gum – Red Stringybark open forest at the site

This community is the most common and widespread wooded community across the site. It occurs primarily on ridge tops and upper slopes and is characterised by the dominance or presence of Inland Scribbly Gum (*Eucalyptus rossii*) with other common tree species including Red Stringybark and Long-leaved Box (*E. goniocalyx*) with occasional Broad-leaved Peppermint (*E. dives*) (Figure 4-1). The understorey is typically sparse with a low diversity of native shrubs commonly including, Daphne Heath (*Brachyloma daphnoides*), Urn Heath, Grey Guinea Flower, *Daviesia leptophylla,* Prickly Broom-heath (*Monotoca scoparia*), *Hovea heterophylla* and Sifton Bush (*Cassinia arcuata*). The ground cover is generally dry and sparse and is dominated by tussock grasses such as Robust Wallaby Grass (*Joycea palida*), Spear Grass (*Austrostipa scabra* subsp. *falcata*) and Wallaby Grasses (*Austrodanthonia* spp.). The sedges *Lomandra filiformis* subsp. *filiformis*, *Lomandra filiformis* subsp. *coriacea* and *Lomandra multiflora* subsp. *multiflora* can be common. Forbs are generally sparse.

This community is considered to be common and widespread in the region. Across the site this community is generally intact and in good condition. Areas in poor condition occur where the community has been previously impacted by clearing and grazing pressure such as in the vicinity of RYP_83 and the transmission line north-west of RYP_102.

A similar community containing Mugga Ironbark (*E. sideroxylon*) occurs at the site and is likely equivalent to Mugga Ironbark – Inland Scribbly Gum – Red Box shrub/grass open forest (ID 289). There are limited occurrences of tFigurehis community within the development envelope where it forms an intergrade with Inland Scribbly – Red Stringybark open forest and for the purposes of this assessment it has been included within this vegetation type.

Blakely's Red Gum - Yellow Box grassy tall woodland (ID277)

Figure 4-2 Blakely's Red Gum – Yellow Box grassy tall woodland at the site

This community typically occurs on the lower slopes and valleys and is dominated by Yellow-Box (*Eucalyptus melliodora*) and Blakely's Red Gum (*Eucalyptus blakelyi*) (Figure 4-2). A shrub layer may be present or more often absent with common species including Silver Wattle (*Acacia dealbata*), Grey Guinea Flower (*Hibbertia obtusifolia*), Urn Heath (*Melichrus urceolatus*) and Silver Tea-tree (*Leptospermum multicaule*). More intact remnants of this community in good condition occur along established roadsides and at a few locations within the development envelope (refer to Section 4.3, below). In these situations a diverse groundlayer may be present such as north of RYP_120 where grazing sensitive forbs such as Scaly Buttons (*Leptorhynchos squamatus*), Tiger Orchid (*Diuris sulphurea*), Native St John's Wort (*Hypericum gramineum*) and Common Sunray (*Triptilodiscus pygmaeus*) persist. Kangaroo Grass (*Themeda australis*) also forms a common component of the ground cover.

Most of the remnants within the development envelope and across the broader site boundary occur in highly modified native or exotic pasture and are in poor condition. This includes the transmission line north of RYP_73 and south of RYP_144. In these instances the groundcover is often dominated by Spear Grass or Wallaby Grass with a low diversity of native forbs.

This community is listed as an EEC under the TSC Act with better quality remnants also qualifying for the national listing under the EPBC Act. Areas of this community in good condition can also provide habitat for threatened flora.

Blakely's Red Gum - Yellow Box grassy tall woodland (ID277) derived grassland

Figure 4-3 Blakely's Red Gum - Yellow Box grassy tall woodland derived grassland at the site

This community is effectively native pasture but occurs in situations where it is likely to have been derived from Blakely's Red Gum - Yellow Box grassy tall woodland that has been cleared of overstorey vegetation (Figure 4-3). Similarly to the woodland community that it is derived from, the majority of the community within the development envelope and across the broader site is in poor condition as a result of past land management practices. Dominant grasses include Speargrass, Wallaby Grass, Wheat Grass (*Elymus scaber*) and Weeping Grass (*Microlaena stipoides*). Native forb diversity is generally low and restricted to grazing tolerant species such as Native Geranium (*Geranium solanderi*), Bluebells (*Wahlenbergia* spp.) and Small-leaved Poranthera (*Poranthera microphylla*).

No occurrences of this community in good condition occur within the area to be impacted however, a small area in the far south-east of the broader site boundary (east of RYP_124) exhibits relatively high species diversity.

This community is also considered to comprise the EEC under both state and federal legislation and similarly areas of this community in good condition can provide habitat for threatened flora.

Argyle Apple – Acacia mearnsii valley open forest (ID344)

Figure 4-4 Argyle Apple – Acacia mearnsii valley open forest at the site

This community is distinguished by the dominance of Argyle Apple (*Eucalyptus cinerea*). It often forms pure stands and occurs naturally in a patchy distribution across lower lying areas of the landscape, as it does at the proposal site (Figure 4-4). Parramatta Wattle (*Acacia parramattensis*) is a common small tree. Within the site boundary this community is characterised by a native grassy understorey with species including Wallaby Grasses, Speargrass, Purple Wiregrass (*Aristida ramosa*) and Robust Wallaby Grass. A moderate diversity of forbs is also generally present with common species including Bluebells, Native St John's Wort, Ivy Goodenia (*Goodenia hederacea* subsp. *hederacea*), *Solenogyne dominii* and Raspwort (*Gonocarpus tetragynus*).

This community occurs within the development envelope around RYP_66 and the access track to the north and is in moderate and good condition. It is mostly restricted to this area and does not occur widely across the broader site.

This community is common and widespread within the region and is not listed as threatened. It can however, provide important habitat values for a range of fauna species.

Brittle Gum - peppermint open forest (ID296)

Figure 4-5 Brittle Gum - peppermint open forest at the site

Highly modified examples of this community occur in the vicinity of RYP_71 and RYP_72 and within the proposed transmission line in this area and also around RYP_2 and RYP_4 in the far north of the site. It is characterised by the dominance of Brittle Gum (*Eucalyptus mannifera*) with occasional Red Stringybark (*Eucalyptus macrorhyncha*) and within the development envelope exhibits a frequently grazed understorey of mostly low diversity native grasses and forbs (Figure 4-5). Dominant grasses include Weeping Grass and *Austrodanthonia racemosa*. Forb species are almost entirely exotic.

All occurrences of this community within the development envelope and broader site boundary are in low condition.

This community is considered to be common and widespread in the region.

Red Box Woodland

Figure 4-6 Red Box Woodland at the site

This community was identified along the eastern section of an access route to RYP_51. This access route is no longer part of the proposal and this community does not occur within the development envelope. It is characterised by the dominance of Red Box (*Eucalyptus polyanthemos*) and exhibited a reasonable diversity of native shrubs, grasses and forbs in the ground cover and was considered to be in good condition (Figure

4-6). Red Box can form a component of a number of vegetation types including Box Gum Woodland however, due to the absence of Yellow Box or Blakely's Red-Gum, it was not considered to comprise the EEC and is considered a variant of one of the more common vegetation types at the site.

Phragmites Swamp

Figure 4-7 Exotic infested swamp vegetation at the site

A swampy area dominated by Phragmites (*Phragmites australis*) was identified to the east of the proposed transmission line in the south of the site. This area was highly localised and it had a high proportion of exotic species including Willows (*Salix* spp.) (Figure 4-7).

This vegetation could be considered to form a component of the Tussock grass- sedgeland fen – rushland – reedland wetland community (ID335) described by Benson *et al.* (2010). It is common in wet situations on valley floors and often has a high component of exotic species due to disturbance and surrounding land uses. Very few sites are in near-natural condition and the extant protected is unknown (Benson *et al.* 2010). For these reasons it is considered to have conservation significance. This community is not located within the development envelope and would not be impacted by the proposal.

Sifton Bush Shrubland

Figure 4-8 Sifton Bush dominated vegetation at the site

This community occupies previously cleared and disturbed areas where Sifton Bush (*Cassinia arcuata*) has vigorously colonised and is now the dominant species (Figure 4-8). Other shrubs are commonly scattered throughout the Sifton Bush including Silver Wattle, Early Wattle (*Acacia genistifolia*), Grey Guinea Flower, Silver Tea-tree and Nodding Blue Lily (*Stypandra glauca*). It often occurs on rocky ridge tops and upper slopes and can have a good diversity of native grasses, sedges and forbs in the understorey, as livestock appear to avoid it in most cases, keeping grazing pressure low. As such, the majority of this vegetation type within the development envelope is considered to be in good condition with some more disturbed areas in moderate condition. Dominant forbs include those that are common to the other vegetation types that this community would be derived from including Common Sunray, Bluebells, Ivy Goodenia, Native St John's Wort, Stinking Pennywort and Raspwort. Rock Ferns (*Cheilanthes sieberi*) and sedges such as Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and *Juncus filicaulis* are also common and widespread. Native grasses are mostly comprised of Wallaby Grasses, Speargrass, Purple Wiregrass and Robust Wallaby Grass. Less commonly species such as *Poa sieberiana* var. *cyanophylla* and *Austrostipa densiflora* also occur.

This community has no conservation significance as Sifton Bush is considered to be a highly invasive plant and tends to occupy areas where threatened flora habitat potential is low.

Native Pasture – Exotic Pasture – Planted Vegetation

Figure 4-9 Native pasture at the site

Native Pasture was the term applied to all areas of native dominated grasslands derived from common vegetation types that were not considered to be part of an EEC (Figure 4-9). The majority of areas within the development envelope were in poor – moderate condition with a reasonably low diversity of native grasses and forbs although some areas (particularly rocky outcrops) exhibited a higher diversity. Areas with scattered paddock trees were also included in this community when not derived from an EEC. These areas were typically dominated by Speargrass and Wallaby Grasses with other native grasses commonly found in the other vegetation types forming a sub component. Native forb diversity is generally low and restricted to grazing tolerant species such as Native Geranium, Bluebells and *Cymbonotus* sp. similarly found in the Blakely's Red Gum - Yellow Box grassy tall woodland derived grassland at the site.

Exotic pastures and planted vegetation consisted of mostly non-native pasture grasses and trees such as Pines (*Pinus* sp.) planted as wind breaks. These communities were common and widespread across the site.

4.3 CONSERVATION STATUS OF COMMUNITIES THAT OCCUR

The conservation status of each of the natural vegetation types present as remnants in the development envelope is summarised in Table 4-1, based on data presented in Benson *et al.* (2010).

Table 4-1 Conservation status of natural vegetation types in the development envelope

Vegetation type	Pre-1750 Extant (ha)	Extant area (ha)	Total area reserved or protected (ha)	Conservation status
Inland Scribbly – Red Stringybark open forest (ID349)	80,000	40,000 (50% of 1750 extent)	3,089 (3.9% of 1750 extent)	Not listed as threatened
Mugga Ironbark – Inland Scribbly Gum – Red Box shrub/grass open forest (ID 289)	20,000	8,000 (40% of 1750 extent)	1,130 (5.65% of 1750 extent)	Not listed as threatened
Blakely's Red Gum - Yellow Box grassy tall woodland (ID277)	500,000	30,000 (6% of 1750 extent)	1,101 (0.3% of 1750 extent)	TSC Act – endangered EPBC Act – critically endangered
Argyle Apple – Acacia mearnsii valley open forest (ID344)	4,500	1,300 (29% of 1750 extent)	176 (3.9% of 1750 extent)	Not listed as threatened
Brittle Gum - peppermint open forest (ID296)	30,000	18,000 (60% of 1750 extent)	7,212 (24% of 1750 extent)	Not listed as threatened
Tussock grass- sedgeland fern – rushland – reedland wetland community (ID335)	6,000	1,000 (17% of 1750 extent)	Not known to be protected	Not listed as threatened

Table 4-1 shows the high level of depletion and poor protection status of the majority of the natural vegetation types which would have originally occupied much of the development envelope. Applying the general JANIS reservation target of 15% of the original extent for each forest type (JANIS 1997), almost all of the vegetation types within the proposal area are under-represented in the conservation reserve system. Under JANIS criteria, 60% of the remaining stands of vulnerable types and 100% of endangered types should be reserved or otherwise protected.

The impact of this depletion is compounded by the severe fragmentation and continuing degradation of remaining stands. Blakely's Red Gum - Yellow Box grassy tall woodland is a listed EEC and remnants are threatened by a range of processes including further clearing, firewood cutting, livestock grazing, weed invasion, inappropriate fire regimes, soil disturbance, increased nutrient loads, soil acidification and salinisation and loss of connectivity (NSW SC 2002).

4.4 DATABASE SEARCHES

Threatened species database searches returned one tree, eight shrubs, one fern, 15 forbs (including four orchids), one sedge and one grass listed as threatened and Five EECs that occur or have the potential to occur in the Upper Slopes and Murrumbateman sub-regions of the Lachlan CMA and the Upper Slopes and Murrumbateman sub-regions of the Murrumbidgee CMA. The 10 km EPBC Act search identified an

additional forb listed as nationally threatened. A threatened species evaluation has been undertaken to evaluate the presence of habitat in the project area and the likelihood of occurrence and impact from the proposal for each species and community returned from database searches. This evaluation is presented in Appendix B.1.

Threatened species or EECs that are considered possible to occur and have at least marginal or (potential or known) habitat present in the project area are given in Table 4-2 below.

Table 4-2 Threatened flora species or Endangered Ecological Communities that could possibly occur in the project area

Species	Status	Habitat	Further Assessment of Significance (Y / N)
Threatened flora			
Hoary Sunray *Leucochrysum albicans var. tricolor*	E EPBC	Grasslands and grassy woodlands, often colonising disturbed sites such as road verges.	No
Yass Daisy *Ammobium craspedioides*	V TSC V EPBC	Moist or dry forest communities, Box Gum Woodland and secondary grassland derived from clearing of these communities. Can persist in lightly grazed situations.	Yes
Tarengo Leek Orchid *Prasophyllum petilum*	E TSC E EPBC	Box Gum Woodland and Natural Temperate Grassland.	No
Endangered Ecological Communities			
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and derived native grasslands	EEC TSC CEEC EPBC	Open woodland community occurring on the slopes and in valleys at the proposal site	Yes

4.5 THREATENED FLORA

No threatened flora species were detected during the surveys.

Targeted searches for the three species identified in Table 4-2 were conducted in higher quality areas of Box Gum Woodland and derived grassland within the proposed transmission corridors between RYP_109 and RYP_120 and within the originally proposed eastern substation site (removed during layout modifications to avoid sensitive areas). The targeted surveys failed to locate any threatened flora despite the suitable timing of the surveys.

4.6 ENDANGERED ECOLOGICAL COMMUNITIES

Of the vegetation that occurs in the development envelope, one community that would meet the definition of a listed EEC occurs:

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box Gum Woodland; EPBC and TSC).

Since Box Gum Woodland habitat coincides with prime farmland, this community has been heavily impacted by clearing, grazing, cultivation and the introduction of weed and pasture species. The impact of this depletion is compounded by the severe fragmentation and continuing degradation of remaining stands. Areas of the EEC and where they occur within the development envelope, are outlined in Table 4-3 below and correspond with the vegetation mapping in flora results in Appendix E.2.

NSW Endangered Ecological Community (EEC)

The White Box, Yellow Box, Blakely's Red Gum Woodland EEC listed under the TSC Act includes:

- Woodland areas which include Yellow Box or Blakely's Red Gum (with or without native understorey); and
- Grasslands and pastures dominated by native grasses that are derived from this community.

All areas mapped as either Box Gum Woodland or Box-Gum Derived Grassland would be considered part of this community.

Commonwealth Critically Endangered Ecological Community

The Commonwealth EPBC Act sets more stringent criteria for the recognition of the Box Gum Woodland Critically Endangered Ecological Community (CEEC) listed under that Act.

Under the EPBC Act, Box Gum Woodland remnants belong to the CEEC if:

- One of the most common overstorey species is/was Yellow Box, Blakely's Red Gum or White Box.
- The understorey is predominantly native.
- The patch is greater than 0.1 ha.

OR EITHER*:*

- There are 12 or more non-grass species in the understorey including at least one important species (based on a list issued by the Commonwealth Government).

OR:

- The patch is greater than 2 ha with an average of 20 or more mature trees per hectare, or natural regeneration of the dominant overstorey eucalypts is present.

Areas that are mapped as being Box Gum Woodland or Box-Gum Derived Grassland in 'good' condition would correspond to this community.

Table 4-3 Box Gum Woodland EEC in the development envelope, and location (where known)

EEC	Average condition	Location	Status
Box Gum Woodland	Moderate	Access to RYP_12	EEC – TSC Act
Box Gum Woodland and derived grassland	Poor	Within the construction compound east of RYP_132. Patches within the transmission easements south of RYP_144.	EEC – TSC Act
Box Gum Woodland	Good: (along Blakney Creek Road) Poor: (from Blakney Creek Rd across pasture)	Turbines are no longer proposed in this area	CEEC - EPBC Act EEC - TSC
Derived Grassland	Moderate	Access track from the Rye Park Dalton Road west of RYP_89	EEC - TSC Act

EEC	Average condition	Location	Status
Derived Grassland	Poor	Access track and underground power south-east of RYP_101	EEC - TSC Act
Box Gum Woodland	Good	North of RYP_120 and along overhead transmission line routes to the north-west towards RYP_109.	CEEC - EPBC Act
Box Gum Woodland and derived grassland	Good	Originally proposed eastern substation site (removed during layout modifications to avoid sensitive areas).	CEEC - EPBC Act
Box Gum Woodland and derived grassland	Poor	Access to and within southern substation and construction compound site.	EEC - TSC Act

4.7 BIOMETRIC STATUS

The Biobanking assessment pathway was not used for this assessment. However, the following text relates the vegetation condition classes used in this assessment to those defined under the NSW OEH Biometric guidelines (DECC 2008a).

Under the Biometric guidelines, native woody vegetation is in low condition if:

- The over-storey per cent foliage is <25% of the lower value of the over-storey per cent foliage cover benchmark for that vegetation type.

AND

- < 50% of vegetation in the ground layer is indigenous species or > 90% ploughed or fallow.

Native grassland or herbfield is in low condition if:

- < 50% of vegetation in the ground layer is indigenous species or > 90% ploughed or fallow.

If native vegetation is not in low condition then it is considered to be in moderate to good condition. Hence, treeless native pasture derived from woodland and dominated by native grasses is also considered 'moderate to good' condition under this system. All areas of EEC identified within the development envelope would be considered moderate to good condition under this system.

5 RESULTS: FAUNA

5.1 HABITAT TYPES AND CONDITION

Habitat in the project area can be broken into four main types (excluding exotic pasture). The four habitat types are:

- Woodland.
- Forest.
- Mixed native/exotic pasture with scattered trees.
- Native pasture.

The distribution of these habitat types in the development envelope is shown on the map in fauna results in Appendix E.3, and described below.

Habitat condition within the project area was variable due to different soil types, disturbance histories and land management. Habitat condition depends on the availability of micro-habitat resources, such as hollow-bearing trees, and habitat extent and connectivity to other areas. Generally the habitat quality was higher in the southern portion of the proposal area, and more degraded in the northern portion. Areas where habitat types intersect, providing ecotones, tended to provide the highest habitat quality.

5.1.1 Pasture with scattered trees

This takes the form of cleared land with remnant trees scattered throughout paddocks. The trees are distributed fairly uniformly or in small clumps. This habitat type has been found to be important for a range of fauna as both habitat and for connectivity within a wider habitat matrix. Remnant paddock trees are often older than surrounding regenerated woodland and forest and thus provide an important source of hollow-bearing trees, on which many of Australia's fauna are dependent. Amongst the fauna to utilise this habitat type onsite are threatened birds (such as Superb Parrot) and disturbance-tolerant common farmland bird species such as common parrots, Australian Magpie, and Australian Raven.

5.1.2 Woodland

Areas of woodland tended to be grazed regrowth, and thus habitat condition was negatively affected by lack of mature trees, loss of fallen timber and litter and simplification of the understorey. Good quality woodland remnants mostly occur along drainage lines and roadsides. The site contains dry sclerophyll woodland with a mixture of rough and smooth barked trees, some hollow-bearing trees and mistletoe. Mistletoes are parasitic plants that grow on other trees and provide important resources for a range of birds including nomadic honeyeaters (e.g. Painted Honeyeater, Regent Honeyeater) (Cooper and McAllen 1999). The structure of woodland is generally simple with the open canopy dominated by eucalypts, a grassy groundcover with fallen timber and litter. While a relatively high diversity of bird life was observed in some woodland areas, a high level of clearing or fragmentation and a general lack of large hollows suggests that habitat quality for conservation significant mammals, such as Squirrel Gliders, was low.

5.1.3 Forest

The majority of forest in the project area is dense regrowth forest with young trees and a simple habitat structure with few micro-habitat resources. Deeper gullies and slopes tended to have more mature forest

and therefore provided higher quality habitat, however these areas are mostly outside of the development envelope. Areas of dry forest have similar habitat features to those present in the woodland (such as fallen timber), as well as additional understorey strata, such as a small tree layer and shrubby mid storey. Dry forest usually forms a more closed canopy than woodland and features a more developed understorey, which provides refuge. The line between pasture with scattered trees and woodland, and woodland and forest, is based on qualitative assessment of the degree of canopy cover and understorey structure. In many cases, the habitat in the project area intergrades between habitat types without clear distinction. Depending on hollow availability and connectivity/size of patch, woodland and forest patches provide habitat for a range of fauna including possums, microbats and birds (such as Brown Treecreeper, Southern Boobook and White-throated Gerygone).

5.1.4 Native pasture

Native Pasture habitat varies in quality across the project area from areas more dense with native species, to areas highly degraded with invasive exotic species in which some native grass persist. Ground structure also varies considerably due to grazing pressure and different land management practices between landholders. The structure increases in quality in areas where grazing pressure is low and tussock forming grass species are larger and patches of clumping grasses is more evident. Better quality Native Pasture is evident in the southern section of the project area. Areas of native pasture have potential to provide habitat for a range of reptiles (such as Striped Legless Lizards) and resources for many birds (such as Diamond Firetails).

5.1.5 Habitat features

Additional habitat units occur within some of the above units:

- Hollow-bearing trees.
- Rocky outcrops.
- Aquatic areas.

Hollow-bearing trees

Quadrat plot results

Hollow-bearing trees occur as scattered mature trees over pasture and through woodland and forest. Raw survey data for hollow-bearing tree plots is provided in Appendix A.3. In 35 plots, 114 hollow-bearing trees were recorded; most with a diameter at breast height at or greater than 60 cm. The majority of hollows were of small to medium hollow entrance size, most likely to be utilised by small to medium birds and microbats, rather than owls and gliders. The density of hollow-bearing trees within wooded areas is shown in Table 5-1.

Search area results (i.e. searches within 100 m of infrastructure within good condition woodland / forest)

Within the hollow-bearing tree survey undertaken in good condition woodland / forest areas in July and November 2103, a total of 121 hollows were recorded. Appendix A.3 details the raw data for all trees recorded. Both Box Gum Woodland and Inland Scribbly Gum Forest was surveyed in this assessment and hollow density between vegetation types is substantially different. The results of hollow-bearing tree surveys are further discussed in the impact assessment chapter (refer Section 7.4).

Rocky outcrops

Rocky outcrops are particularly important for reptiles as they provide shelter and cover, as well as a habitat for insects, a food source for many species. In the project area, rocky outcrops generally occur on hill crests in cleared and forested areas. These are sparsely distributed and occur mostly in the northern portion of the project area between turbines RYP_97 - 101, RYP_81 - 83, RYP_31, RYP_33, RYP_36 RYP_12 and RYP_3. Rocky outcrops in the project area tend to be mostly large embedded rocks that were unable to be turned for survey. Some rocky outcrops also featured small (10-15 cm), flattish, loose rocks such as slate. Several rocky outcrops were in mostly open areas on hill crests or well-drained upper slopes featuring partially embedded and loose small to medium rocks; such rocky outcrops have potential to provide habitat for the Pink-tailed Worm-lizard.

Aquatic areas (dams, watercourses)

Aquatic areas are habitat for fish, frogs and waterbirds. Any water source is generally an important habitat component for all fauna, including microbats. Dams provide habitat for species with capacity to disperse between the water bodies. Dams and watercourses generally occur outside of the turbine development envelope at lower elevations. Dams in the project area vary in condition from poor to moderate in habitat quality for amphibians and water birds. Dams in poor condition are in areas currently being grazed, where sheep and cattle accessing the dam trample vegetative growth and stir up sediments. Dams that offer better quality habitat have grass and trees along the edges and may also feature aquatic vegetation such as sedges or bulrush; such dams were observed to be used by species such as Australasian Grebe *Tachybaptus novaehollandiae* and Common Froglet *Crinia signifera*. However, being a small water body the quality of habitat offered by a farm dam is transient, changing with the grazing regime and seasonal rainfall. The transmission lines and tracks would cross numerous small ephemeral drainage lines which provide transient habitat for aquatic species. Permanent streams suitable for fish were not observed within the development envelope.

Threatened fish listed under the FM Act are not anticipated in the minor creeklines of the project area. The development is not expected to have an adverse impact on riparian habitats; however recommendations to design creek crossings in accordance with NSW Fisheries Policy and Guidelines for Fish Friendly Waterway Crossings (2003) are provided in Section 8.

Table 5-1 Results of hollow-bearing tree (HBT) plots in the development envelope, stratified by forest, woodland and paddock

	No. of hollows	Plot size_1	No. plots_1	No. hollows_1	Plot size_2	No.plots_2	No. hollows_2	Av. No. HBT per plot	Av. HBT per hectare
Forest	54	25x25	16	(54)	n/a	n/a	n/a	3.4	13.5
Woodland	53	25x25	16	(53)	n/a	n/a	n/a	3.3	13.3
Paddock	7	100x100	4	(7)	25x25	3	0	1	1

5.1.6 Landscape connectivity

The term 'landscape connectivity' describes the broad spatial configuration of areas of vegetated lands and includes a consideration of barriers to connectivity such as roads, clearing and rows of turbines (Lindenmayer & Fischer 2006; Brett Lane & Associates 2005). Connectivity is maintained through intact forest and woodland, 'corridors' of vegetation and 'stepping stones' (i.e. scattered trees; or patches of shrubs or trees that act as stepping stones across an otherwise cleared landscape). For example, Superb Parrot was seen along roadsides and riparians areas in the project area, using these areas as corridors to travel through their home ranges.

A desktop landscape connectivity analysis indicates the proposal area may be very important for north-south connectivity toward Brindabella and Namadgi National Parks. Vegetation in the project area also facilitates an east-west linkage toward extensive areas of forest approximately 100 km to the east (Abercrombie River and Tarlo River National Parks). Between the project area and the additional forested areas to the east, vegetation is patchy and scattered. There are extensive areas of clearing immediately west of the project area. A specific assessment of landscape connectivity and barrier effects of wind farms is given in Section 7).

5.2 FAUNA SPECIES RECORDED DURING FIELD SURVEYS

A total of 143 fauna species were recorded during the field surveys and these are listed in Appendix A.2. In summary the total numbers for each fauna group included:

- Ninety-nine bird species.
- Fifteen mammal species (excluding microbats) of which five are introduced species.
- Twelve microbat species.
- Fifteen reptile species.
- Two amphibian species.

5.2.1 Birds

Ninety-nine bird species were recorded within the project area all during surveys, including utilisation surveys, Superb Parrot transect surveys, Swift Parrot surveys and general opportunistic observations. Species recorded are listed in Appendix A.2. The project area supports foraging, nesting and roosting habitat for a variety of bird species. Nesting for hollow-dependent species is most abundant in areas of Inland Scribbly Gum Forest and to a lesser degree in scattered paddock trees in remnant Box Gum Woodland habitat. Theses habitat types as well as grassland areas provide foraging habitat for some bird species. Aquatic areas for birds are limited across the project area and restricted to farm dams and some minor creeks and drainage lines. Wetland bird species were not commonly observed as the habitat value of farm dams is limited for these species.

Species common to the site included farmland species of Australian Magpie (*Gymnorhina tibicen*), Australian Raven (*Corvus coronoides*), Crimson Rosella (*Platycercus elegans*), Eastern Rosella (*Platycercus eximius*), Laughing Kookaburra (*Dacelo novaeguineae*), Red Wattlebird (*Anthochaera carunculata*), Sulphur-crested Cockatoo (*Cacatua galerita*), Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*), and Grey Fantail (*Rhipidura fuliginosa*). One nocturnal species, the Southern Boobook (*Ninox novaeseelandiae*), was recorded during the field surveys.

Five species of raptors were seen in the project area, all considered common in the region:

- Brown Falcon (*Falco berigora*).
- Nankeen Kestrel (*Falco cenchroides*).
- Black-shouldered Kite (*Elanus axillaris).*
- Brown Goshawk (*Accipiter fasciatus*).
- Wedge-tailed Eagle (*Aquila audax*).

Raptors were seen in a variety of landscape positions, mostly in pasture with scattered trees or along the edges of forest or woodland. An inactive Wedge-tailed Eagle nest was found along the upperslope of between RYP_90 and RYP_92 (Appendix E.3). A pair of Wedge-tailed Eagles would usually have two or more nests in their breeding territory, and they may alternate their use of nests (pers. comm. Jerry Olsen to Bianca Heinze 20 April 2010). Thus, it is likely another nest occurs within a few kilometres of this one. A Nankeen Kestrel nest was observed along Flakney Creek Road in November 2013 near a proposed transmission line and access tracks.

Nine threatened bird species were recorded within the project area. These species are listed below and further discussed in Section 7. The locations of each threatened species is shown in Appendix E.3 and documented in Table 5-4.

- Diamond Firetail (*Stagonopleura guttata*).
- Speckled Warbler (*Pyrrholaemus sagittatus*).
- Flame Robin (*Petroica phoenicea*).
- Scarlet Robin (*Petroica multicolour*).
- Hooded Robin (*Melanodryas cucullata cucullata*).
- Painted Honeyeater (*Grantiella picta*).
- Varied Sittella (*Daphoenositta chrysoptera*).
- White-fronted Chat (*Epthianura albifrons*).
- Superb Parrot (*Polytelis swainsonii*).

Bird utilisation results

A total of 36 utilisation surveys were undertaken within the project area. A total of 70 species of birds were observed utilising the proposed wind farm site during the surveys. Table 5-2 represents the number of species observed at each site and in which height zone they were observed during the utilisation surveys across the three years they were undertaken. Approximately 90% of the flight height of all birds observed is predominantly below 10 m or within 0-20 m. Less than 10% of flights were within 41-140 m zone or above, indicating that most flights were below the rotor-swept-area and therefore below the area of potential impact.

Table 5-3 shows the numbers of individual birds of each species observed flying at rotor-swept-area. A total of five species were observed across all sites flying within the rotor-swept-area, or about 2% of the total number of birds observed during all surveys. These species included the: Nankeen Kestrel, Sulphur-crested Cockatoo, Wedge-tailed Eagle, Welcome Swallow and White-browed Woodswallow. The Sulphur-crested Cockatoo and the White-browed Woodswallow where the most abundant species flying within the rotor-swept-area during the surveys. These species accounted for almost 70% of observations for all the five birds flying within the rotor-swept-area (42% for Sulphur-crested Cockatoo and 25% for White-browed Woodswallow).

Of these species, the Wedge-tailed Eagle and Nankeen Kestrel were observed above or within the rotor-swept-area every time they were recorded (i.e. 100% of the time).

The raw height data for each species observed within each utilisation survey site is presented in Appendix A.4.

Table 5-2 Bird utilisation survey results and the number of species recorded in each height category. 41-140m and > 140m represent the rotor-swept-area (i.e. area of potential collision)

Site	Easting	Northing	No. Species	<10m	0-20m	21-40m	41-140m	>140m
Nov-11								
1	686029	6156391	6	0	6	0	0	0
2	686319	6155682	9	0	8	1	0	0
3	687129	6152576	18	0	17	0	1	0
4	686435	6154142	5	0	3	2	0	0
5	684432	6151587	8	0	6	2	0	0
6	681598	6163997	12	0	12	0	0	0
7	685052	6154832	10	0	9	1	0	0
8	686400	6158045	19	0	18	1	0	0
9	686538	6157244	7	0	7	0	0	0
10	686341	6159223	12	0	12	0	0	0
11	681975	6170733	6	0	5	1	0	0
12	682094	6170102	9	0	9	0	0	0
13	682113	6171579	9	0	9	0	0	0
14	680599	6181026	4	0	4	0	0	0
15	677245	6184125	4	0	3	1	0	0
16	678102	6182954	8	0	6	1	0	1
17	677294	6183731	10	0	10	0	0	0
18	677245	6184125	5	0	5	0	0	0
Total			161	0	149	10	1	1
Percentage				**0.00**	**92.55**	**6.21**	**0.62**	**0.62**
Jul-13								
19	685100	6156806	24	10	12	2	0	0
20	684337	6155325	8	3	4	0	1	0
21	684507	6154254	7	1	3	3	0	0
22	685085	6153044	14	7	5	1	1	0
23	684290	6154206	10	8	2	0	0	0
24	686102	6156162	5	3	2	0	0	0
25	682064	6170388	9	3	5	1	0	0
26	681390	6167591	8	1	6	1	0	0
27	681314	6165295	6	0	6	0	0	0
28	681305	6182534	11	5	6	0	0	0
Total			102	41	51	8	2	0
Percentage				**40.20**	**50.00**	**7.84**	**1.96**	**0.00**
Nov-13								
29	684527	6154269	19	17	2	0	0	0
30	682782	6151506	7	5	1	0	1	0
31	686076	6156231	2	2	0	0	0	0
32	679390	6182800	10	4	6	0	0	0
33	686342	6155645	4	0	4	0	0	0
34	679041	6182828	5	3	2	0	0	0
35	681234	6182433	12	6	6	0	0	0
36	622693	6151902	9	3	5	1	0	0
Total			68	40	26	1	1	0
Percentage				**58.82**	**38.24**	**1.47**	**1.47**	**0.00**

Table 5-3 Bird species recorded in rotor-swept-area (41-140m and > 140m) during bird utilisation surveys

Species	% of all observations within RSA from all surveys	Abundance (%) of each individual species at RSA height	% observations of birds at RSA of all bird observations in all height categories
Nankeen Kestrel	100	8	0.13
Sulphur-crested Cockatoo	10	42	0.66
Wedge-tailed Eagle	100	8	0.13
Welcome Swallow	40	17	0.26
White-browed Woodswallow	10	25	0.40
	2%	**100%**	**2 %**

5.2.2 Mammals

Fifteen mammal species were recorded within the project area during surveys, including five introduced species). Species recorded are listed in Appendix A.2. The species recorded are common to the area and included five native ground-dwelling species of Black Wallaby (*Wallabia bicolor*), Common Wombat (*Vombatus ursinus*), Eastern Grey Kangaroo (*Macropus giganteus*), Eastern Wallaroo (*Macropus robustus robustus*), Red-necked Wallaby (*Macropus rufogriseus*), and Short-beaked Echidna (*Tachyglossus aculeatus*).

Arboreal mammals recorded included Sugar Glider (*Petaurus breviceps*), Common Ringtail possum (*Pseudocheirus peregrines*), and Common Brushtail Possum (*Trichosur vulpecular*). Of these three arboreal species, the Brushtail Possum was the most common species observed but appeared to be present in particular patches of forest and woodland, rather than being common throughout this habitat. Abundance of the Brushtail Possum increased in forest areas of greater structural diversity (i.e. more hollows and understorey species). The Sugar Glider and Common Ringtail Possum were either observed in very low numbers or not at all in some forest areas during spotlighting surveys.

One Water Rat (*Hydromys chrysogaster*) was observed during funnel trap surveys within a nearby drainage area supporting dense sedges.

5.2.3 Microbats

Eleven microbat species confirmed to be present and one unconfirmed species identified to genus level were recorded within the project area (Appendix A.2).

The most common species recorded by Anabats were attributed to the Large Forest Bat (*Vespadelus darlingtoni*), the Southern Freetail Bat (*Mormopterus sp.4)* and Eastern Freetail Bat (*Mormopterus ridei*), with a total of 2734 calls, 751 call, and 86 calls respectively.

The most records were recorded from areas nearby Inland Scribbly Gum Forest; however habitat for microbats is present across the entire project area and given the mobility of these species it is possible they could occur within all habitat types; however, no caves were recorded within the study area which are required by the Eastern Bentwing bat for roosting or breeding.

Three threatened microbat species were recorded within the project area. These species are listed below and further discussed in Section 7.

- Eastern Bentwing Bat (*Miniopterus oriane (schreibersii) oceansis*).
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*).
- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*).

5.2.4 Reptiles

Fifteen reptile species were recorded within the project area during surveys (including one unidentified gecko species). Species recorded are listed in Appendix A.2. The most common species recorded by observation were the Eastern Beared Dragon (*Pogona barbata*) and Shingleback (*Tiliqua rugosa*). Species commonly detected during funnel traps surveys and tile searches included: Delicate Skink (*Lampropholis delicata*), Southern Rainbow Skink (*Carlia tetradactyla*), and Common Delma (*Delma inornata*), with a total of 354, 277 and 261 observations respectively. Abundance of reptile species across the tile sites were generally similar, with tile plot 2 and 9 recording the most captures at 51 and 55 records respectively.

One threatened reptile species was recorded within the project area at tile plot 10 (near RYP_27), the Striped Legless Lizard (*Delma impar*). This species is further discussed in Section 7. The location of the Striped Legless Lizard is shown in Appendix E.3 and documented in Table 5-4.

Habitat for reptiles includes woodland and grassland areas supporting scattered rocky outcrops; however, rocky outcrops are minimal across the project area or are rocks are small and loosely scattered. Woody debris is common to the inland Scribbly Gum Forest, however very low reptile diversity was observed in this habitat type when searching through dense leaf litter during the 33 Koala scat searches.

5.2.5 Amphibians

Two amphibian species were recorded within the project area during surveys and included the Common Froglet (*Crinia signifera*) and Peron's Tree Frog (*Litoria peronii*). No threatened amphibians were recorded within the project area. Habitat for amphibians is limited across the project area and restricted to farm dams and some minor creeks and drainage lines.

5.3 CONSERVATION SIGNIFICANT FAUNA SPECIES

5.3.1 Database search results

The Commonwealth and State online database searches and NSW Wildlife Atlas threatened species records returned two amphibian, five microbat, 33 bird, one invertebrate, five marsupial and three reptile species listed as threatened in the Upper Slopes sub-region of the Lachlan CMA.

A threatened species evaluation has been undertaken to evaluate the presence of habitat in the project area and the likelihood of occurrence for each species returned from database searches. This species evaluation was used to determine which species could be impacted by the proposed wind farm development and for which further impact assessment was required. The species evaluation is presented in Appendix B.2 and those species requiring further assessment is provided in Section 7.

The evaluation concluded that 17 threatened species have potential to be present on parts of the project area, based on habitat and site quality and known distribution. Sixteen threatened species were recorded during the field surveys including: one invertebrate species, one reptile species, nine birds, and three microbats (Table 5-4). Locations of observations are shown in Appendix E.3.

Table 5-4 Threatened or migratory listed species that are known or could occur in the project area

Species	Status	Habitat	Likelihood of occurrence	Location in project area	Further Assessment of Significance (Y / N)
Invertebrates					
Golden Sun Moth *Synemon plana*	E TSC CE EPBC	Grassy Box Gum Woodlands and natural temperate grasslands.	Present	South of RYP_144 near proposed transmission line; north of RYP_73; west of RYP_99; south of RYP_101 near proposed transmission line; west of RYP_120 and RYP_127; and east of RYP_131.	Yes
Amphibians					
Sloane's Froglet *Crinia sloanei*	V TSC	Periodically inundated areas in grassland, woodland and disturbed habitats.	Possible	N/A	No
Reptiles					
Pink-tailed Legless or Worm Lizard *Aprasia parapulchella*	V TSC V EPBC	Open woodland with predominantly native grasses and natural temperate grasslands on well-drained slopes with scattered, partially-buried rocks.	Possible	N/A	No
Rosenberg's Goanna *Varanus rosenbergi*	V TSC	Heath, open forest and woodland.	Possible	N/A	No
Striped Legless Lizard *Delma impar*	V TSC V EPBC	Temperate lowland grasslands, secondary grasslands and occasionally open Box Gum Woodland.	Present	RYP_27	Yes
Birds					
Barking Owl *Ninox connivens*	V TSC	Dry box-dominated forest and woodlands and roosts in dense foliage of *Acacia, Casuarina* or *Eucalyptus* species.	Possible	N/A	No

Species	Status	Habitat	Likelihood of occurrence	Location in project area	Further Assessment of Significance (Y / N)
Black-chinned Honeyeater *Melithreptus gularis gularis*	V TSC	Drier open forests or woodlands most often dominated by box and ironbark eucalypts.	Possible	N/A	No
Brown Treecreeper (eastern subspecies) *Climacteris picumnus victoria*	V TSC	Occurs in eucalypt woodlands, mallee and drier open forest, preferring woodlands lacking dense understorey	Present	RYP_102-104 in November 2011, April 2012, and November 2013.	No
Diamond Firetail *Stagonopleura guttata*	V TSC	Woodland remnants of grassy eucalypt woodlands, including Box-Gum, grassland and riparian areas, and sometimes lightly wooded farmland.	Present	In paddock tree east of the transmission line between RYP_101 and RYP_102 in November 2011 (outside project area); north of RYP_102 in November 2013 (outside project area).	No
Flame Robin *Petroica phoenicea*	V TSC	Native vegetation with an open understory. It breeds in upland forests and woodlands and migrates to more open lowland habitats in winter.	Present	Near RYP_95 in November 2011 and April 2012; near RYP_103 during November 2013; near Flakney Ck Rd in November 2013.	No
Gang-gang Cockatoo *Callocephalon fimbriatum*	V TSC	Varies from open forests and woodlands to heavily timbered and mature wet forest.	Possible	N/A	No
Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis*	V TSC	Box Gum Woodlands, open forests, scrub lands, even farmlands and suburbs.	Possible	N/A	No
Hooded Robin (South eastern form) *Melanodryas cucullata cucullata*	V TSC	Woodland remnants with high habitat complexity and uses stumps, posts or fallen timber.	Present	RYP_103 and around RYP_106 and RYP_107 in April 2012; near RYP_120 in November 2013; east of RYP_53 in November 2013.	No
Little Eagle *Hieraaetus morphnoides*	V TSC	Open eucalypt forest, woodland or open woodland.	Possible	N/A	No

Species	Status	Habitat	Likelihood of occurrence	Location in project area	Further Assessment of Significance (Y / N)
Little Lorikeet *Glossopsitta pusilla*	V TSC	Open eucalypt forest and woodland.	Possible	N/A	No
Painted Honeyeater *Grantiella picta*	V TSC	Dry open forests and woodland with mistletoe.	Present	All records in November 2013: west of RYP_4; Flakney Ck Rd; and west of RYP_106 to RYP_120.	Yes
Powerful Owl *Ninox strenua*	V TSC	Dry sclerophyll forest including Argyle Apple and roosts in dense mid-canopy trees or tall shrubs, often associated with drainage lines.	Possible	N/A	No
Regent Honeyeater *Xanthomyza phrygia*	V TSC	Box-ironbark eucalypt associations including Yellow Box and Blakely's Red Gum.	Possible	N/A	Yes
Scarlet Robin *Petroica boodang*	V TSC	Dry eucalypt forests and temperate woodland. Fallen timber is an important habitat feature	Present	In forest south of RYP_105 (now removed from layout) in November 2011; south of RYP_56 in April 2012; and near Flakney Ck Rd in November 2013.	No
Speckled Warbler *Pyrrholaemus saggitatus*	V TSC	Eucalypt woodland with a grassy understorey.	Present	Near RYP_106 and RYP_107 in April 2012 and November 2013; east of RYP_42 in November 2013.	No
Spotted Harrier *Circus assimilis*	V TSC	Grassy open woodland and riparian woodland.	Possible	N/A	No
Square-tailed Kite *Lophoictinia isura*	V TSC	Open forest, woodlands and mallee.	Possible	N/A	No
Superb Parrot *Polytelis swainsonii*	V TSC V EPBC	Box Gum Woodland and can nest in isolated paddock trees.	Present	On transmission line between RYP_101 and RYP_102 in November 2011; Flakney Ck Rd in November 2013, and south of project area between RYP_110 and RYP_120 in November 2013; several records along access roads outside of project area and to west of project area in November 2011 and November 2013. Nests near RYP_120 and east of RYP_143.	Yes

Species	Status	Habitat	Likelihood of occurrence	Location in project area	Further Assessment of Significance (Y / N)
Swift Parrot *Lathamus discolour*	E TSC E EPBC	Eucalypt forests and woodlands.	Possible	N/A	No
Turquoise Parrot *Neophema pulchella*	V TSC	Grassy woodland and open forest including Box Gum Woodland.	Possible	N/A	No
Varied Sittella *Daphoenositta chrysoptera*	V TSC	Eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches.	Present	RYP_106 and RYP_107 in April 2012 and November 2013.	No
White-fronted Chat *Epthianura albifrons*	V TSC	Open grassland habitats inland form the coast or damp open habitats.	Present	Outside of impact area in April 201; north of RYP_27 and west of RYP_120 in November 2013.	No
Mammals (excluding microbats)					
Koala *Phascolarctos cinereus*	V TSC	Eucalypt woodland and forest communities.	Possible	N/A	No
Squirrel Glider *Petaurus norfolcensis*	V TSC	Mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest.	Possible	N/A	No
Microbats					
Eastern Bent-wing Bat *Miniopterus orianae oceanensis*	V TSC	Forage over canopy in range of forest types. Breeds in caves and mine tunnels.	Present	RYP_104 and in the forest south of this site, near RYP_143, RYP_82, RYP_80, RYP_25 and RYP_9 in November 2011. One location in April 2012 (RYP_105 – now removed from layout). At RYP_84 and RYP_90 during November 2012.	Yes
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V TSC	Forages below or near the canopy and along tracks, uncommon on ridge tops where soil fertility is low. Roosts in tree hollows and buildings.	Present	RYP_80 in November 2011	No
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	V TSC	Wide-ranging species across northern and eastern Australia. It roosts in tree hollows.	Present	Near RYP_7 in November 2011	Yes

5.3.2 Invertebrates

Golden Sun Moth

The Golden Sun Moth was observed at seven of the ten sites surveyed, with approximately 200 moths observed in total. The habitat targeted for survey included Box Gum Woodland, Derived Grassland and areas of Native Pasture. Moths were found in a variety of habitats, but all sites where they were recorded supported Wallaby Grass. Table 5-5 details the number of moths observed at each location, their general abundance and the extent of surrounding habitat near the locations they were found.

This species is further discussed within the impact assessment chapter of this report, refer Section 7.

Table 5-5 Results of Golden Sun Moth survey for each search area.

Search area ID	Impact Type	Number moths observed	Abundance	Number surveys undertaken in search area	Habitat Quality	Conclusion
GSM 1	Upgrades to existing sealed & unsealed road	Nil	None	2	Unsuitable	Unlikely to support moths. Potential habitat limited.
GSM 2	Site Compound	Nil	None	1	Unsuitable	Not suitable habitat. Repeat surveys not required.
GSM 3	Underground cabling / OH TL / access route	~ 25	Moderate	3	Variable - Moderate	Moth's presence corresponds with tops of rises and areas where wallaby grass is dominant. Similar habitat in surrounding areas.
GSM 4	Access track	~ 9	Low	2	Moderate	Localised population. Landowner sprays superphosphate aerially, but does not plough. Suitable habitat in search area. Adjoining suitable habitat to east of search area.
GSM 5	Access track	Nil	None	1	Unsuitable	Not suitable. Repeat surveys not required.
GSM 6	Underground cabling / OH TL / access route	~ 89	Widespread	2	Suitable	Habitat best on western route than eastern route of transmission line. Habitat extends to south.
GSM 7	Access track	~ 9	Low	3	Suitable - limited	Moths probably more widespread in area. However, direct area of survey shows habitat within a band across centre part of the slope, extending beyond the boundary of the proposed disturbance to the north.
GSM 8	Underground cabling / OH TL / access route	~ 8	Low	3	Variable - Moderate	Suitable habitat south of Rye Pk - Dalton Rd, unsuitable habitat to the north of this road. Small localised population occurs in the sheltered area at the southern eastern end of the search area. Heavily grazed property. With management habitat could extend further.
GSM 9	Underground cabling / OH TL / access route	~ 19	Moderate	4	Suitable	Habitat is widespread throughout the southern part of this site beyond the disturbance area. It is probable the area supports a widespread population. Moths observed near mast and in southern end of site.

Search area ID	Impact Type	Number moths observed	Abundance	Number surveys undertaken in search area	Habitat Quality	Conclusion
GSM 10	Underground cabling / OH TL / access route. Substation to the west of railway line.	~ 42	Widespread	3	Suitable	Habitat widespread. Wallaby grass better in this area. Most moths observed along access tracks between the railway and Reference site 3.

5.3.3 Reptiles

Threatened reptile species detected within project area

Striped Legless Lizard

One individual of the Striped Legless Lizard was recorded at one tile site at RYP_27 in the northern section of the project area. The species was located on a grazed ridge top supporting a predominantly exotic grassland, with some native species.

This species is discussed within the impact assessment chapter of this report, refer Section 7.

Other threatened reptile species with potential to occur

Two other species were listed on the database searches as having the potential to occur within the project area, including the Pink-tailed Worm-lizard (*Aprasia parapulchella*) and Rosenberg's Goanna (*Varanus rosenbergi*).

Potential habitat for the Pink-tailed Worm-lizard was targeted during reptile searches in which active searching within grasslands and rock-rolling was undertaken. In particular, areas supporting rockier habitats (loose scattered or embedded rocks of loose to medium size) were targeted by rock-rolling. Temperature recorded during the November 2011 reptile searches ranged between 19 to 24 degrees. This temperature range is adequate for detecting reptile activity of this species.

In the project area, rocky outcrops are sparsely distributed occurring mostly in the northern portion of the site. Based on the limited distribution of rocky outcrops and the non-detection of the species during targeted rock-rolling the species is considered unlikely to inhabit the site.

While potential habitat is present for the Roesenberg's Goanna in forest and woodland habitat it is considered unlikely this species would be significantly impacted given the species is large home range. Termite mounds are in low abundance across the site and no records are known for this species within the locality.

5.3.4 Birds

Threatened bird species detected within project area

Brown Treecreeper

The Brown Treecreeper was detected between RYP_102 and RYP_104 using an ecotonal area between forest and cleared land. The cleared land on the most northern peak (RYP_102) consists of a ring-barked

forest, with dead standing and fallen trees. The Inland Scribbly Gum Forest provides habitat for this species. The Brown Treecreeper is dependent on hollows for breeding and dead timber for foraging (provides habitat for invertebrate prey) (Noske 1991).

Diamond Firetail

Two pairs (four individuals) of Diamond Firetail were observed preparing nests in a communal nest tree on the lower slope east of the transmission line between RYP_101 and RYP_102 in open grassy habitat. The species forages for seeds and insects on the ground in open grassy Eucalyptus dominated communities (Garnett & Crowley 2000). The habitat components considered important to this species are water and shelter near feeding areas during the day and dense shrubbery for roosting by night (Schodde and Tidemann 2007).

Speckled Warbler

Three Speckled Warblers were seen around RYP_106 and RYP_107 and east of RYP_42 within Inland Scribbly Gum Forest and on the edge of disturbed woodland that lies adjacent good condition Scribbly Gum Forest. Speckled Warblers are a sedentary species that inhabit grassy eucalypt forests and woodlands, utilising a home range of around 10 ha (OEH 2012). They are thought to require large relatively undisturbed remnants to persist; here the species was seen in an area that appears to be highly fragmented habitat. However, the shrubs and small patches of vegetation are in close proximity and well connected to a large forest/ woodland remnant.

Flame and Scarlet Robins

The Flame Robin was observed foraging in Inland Scribbly Gum Forest near RYP_95 and near RYP_103. Flame Robins occur in small to large groups and migrate seasonally between dry and wet forests in the highlands and lowlands. The Flame Robin was also observed outside the project area (to the west) on Flakney Creek Road.

One pair of Scarlet Robins was recorded within Inland Scribbly Gum Forest south of RYP_105 (now removed from layout) in November 2011 and several observations (<5) were made of the species in an area south of RYP_56 in April 2012 and November 2013. The species was also recorded along Flakney Creek Road outside the project area. Scarlet Robins are sedentary and occur either singly or in pairs in permanent territories. They breed in scrubby eucalypt forests but may forage in more open habitat (Schodde & Tidemann 2007). The Scarlet Robin utilises open areas in their habitat and some studies have found higher abundance of Scarlet Robins along forest edges than the interior (Berry 2001).

Hooded Robin

A pair of Hooded Robins were seen near RYP_103, around RYP_106 and RYP_107, near RYP_120 and east of RYP_53 in open grassy habitat adjoining other forest areas. The Hooded Robin requires structurally diverse microhabitat within woodland habitats, utilising fallen timber and stumps for foraging invertebrates. The species is sedentary and occupies territories between 10 ha (during breeding season from July to November) and 30 ha at other times (OEH 2012).

Painted Honeyeater

Painted Honeyeaters were predominantly observed west of RYP_106 to RYP_120 in the southern section of the project area within Box Gum Woodland in trees supporting flowering mistletoe in November 2013. Approximately 10-12 individuals were observed foraging in this area. A transmission line was proposed for this area but has been removed from the layout. Individuals of this species were also observed west of RYP_4 and along Flakney Creek Road. The species was not recorded within the project area during previous surveys and is not common to the area. No records for this species are known for the locality.

Varied Sittella

A group of eight Varied Sittellas were observed foraging through shrubby vegetation around RYP_106 and RYP_107 and on the edge of Inland Scribbly Gum Forest. The Varied Sittella forages under bark and in crevices along trees branches, preferring rough-bark species (OEH 2012). The species is sedentary and moves about a relatively large home range in small family groups. Despite this apparent mobility, Varied Sittella appears to be highly sensitive to habitat fragmentation (OEH 2012).

White-fronted Chat

A pair of White-fronted Chats were observed in a low lying paddock outside of the development area alongside an existing track that would provide access to RYP_83 and RYP_143. An individual was observed near RYP_27 and another west of RYP_120 in native pasture habitat. White-fronted Chats are sedentary and are usually found in small groups foraging along the ground for invertebrates in their grassland habitat. They nest in low shrubs, included isolated patches of exotic shrubs.

Superb Parrot

The Superb Parrot was regularly observed during November 2011 and November 2013 surveys, but primarily outside of the project area to the west of the site along Rye Park road, Flakney Creek Road, or other roads west of the project area. The area the species was commonly observed within the project area is located to the south between RYP_110 and RYP_120 within Box Gum Woodland or native pasture habitat.

Three nest trees were identified for this species: two north of RYP_120 within the same area birds were regularly recorded and the other nearby Flakney Creek Road along a proposed transmission line. Two potential nest trees were also identified north of RYP_120 in which individual birds were observed to be interested in a hollow, but did not appear to be nesting at the time.

The Superb Parrot was not observed during April 2012 or July 2013 indicating the parrot moves away from the inland slopes during winter.

Superb Parrot Transects

Superb Parrots were detected at five of the 25 transect surveys completed in November 2013. The areas the parrots were detected correspond with the areas birds were also observed during prior surveys in November 2011 (Table 5-6). Three of these transects in which parrots were observed lie outside the project area to the west (SP3, SP17, SP18). The other two sites (SP25 and SP26) are located within the project area at the southern end. All transects parrots were observed within support Box Gum Woodland or open grassy habitat supporting scattered trees. No parrots were observed within transects that were nearby or traversed Inland Scribbly Gum Forest.

Table 5-6 Transects Superb Parrots were observed during November 2013.

Transect ID	Date	Number and sex recorded m = male; f = female; j = juvenile	Habitat	Behaviour and flight height
SP3 (outside project area near Frogmore Rd)	4/11/2013	2 (m), 2 (f), 3 (juv)	Road reserve and paddock with scattered trees. Grass in groundlayer. Box Gum Woodland.	Stayed in general area, local movements below canopy (< 10m). Significant activity at HBT. Flying within canopy, perching, calling.

Transect ID	Date	Number and sex recorded m = male; f = female; j = juvenile	Habitat	Behaviour and flight height
SP17 (outside project area near Flakney Ck Rd)	5/11/2013	1 (f)	Paddock with scattered trees. Grass in groundlayer.	Flew overhead landed in Yellow Box. Flying south toward Rye Park rd (<15m).
SP18 (outside project area near Flakney Ck Rd)	5/11/2013	3 (m), 2 (f)	Paddock with scattered trees. Grass in groundlayer.	3 in tree, 2 flying south toward Rye Park rd (< 10m)
SP25 (south of project area near RYP_120)	6/11/2013	2 (m), 1 (f), 4 (?)	Predominantly scattered trees in paddock with grass, no shrubs.	5 foraging in tree; 1 flying north (~ 15m), 1 flying south ~ 20 m)
SP26 (south of project area near RYP_120)	22/11/2013	5 (f), 3 (m), 4 (?)	Gully with Box Gum Woodland and scattered trees. Grassland. Dense Shrubs. Nest tree.	Flying locally (i.e. within 100m). Flying < 15m.

Flight Path Mapping

Superb Parrots were detected at six of the ten flight path mapping stations in which individual observers were stationed in November 2013. A total of 48 flight observations were recorded; one flight observation could consist of an individual bird, or group of birds moving in the same direction. Most observations of Superb Parrots were recorded within the vicinity of Site 1, 4 and 8 with 10, 24 and 18 flight observations recorded respectively (Table 5-7, Appendix E.3).

The majority of flights were localised to discrete patches where foraging habitat was available. The average flight height of the Superb Parrot was 20m and most observations were of the parrot making short movements within the tree canopy or flying low over paddocks hopping between scattered trees. The Superb Parrots flight height was below 30m at all sites, except for Site 8 where flight heights of 40 m and 50 m were recorded.

Appendix E.3 defines the primary flight path corridors were parrots were observed to regularly fly and is based on all the raw data from each individual flight path recorded. Appendix A.4 details the raw data for each individual flight observation.

The results of transect and flight path mapping for this species is discussed further within the impact assessment chapter of this report, refer Section 7.

Table 5-7 Flight path mapping viewing stations Superb Parrots were observed during November 2013

Viewing station ID	Date	Number of observations	Average and maximum flight height (m)	Habitat at site
Site 1	7-8 Nov 2013	10	20 average 30 maximum	Frogmore Road. Scattered trees in paddock.
Site 3	7-9 Nov 2013	1	20 maximum	Top of low ridge west of High Rock Rd. Within paddock with scattered trees.
Site 4	7-9 Nov 2013	24	11 average 20 maximum	Flakney Creek Road. Scattered trees in open paddock.
Site 6	7-9 Nov 2013	1	20 maximum	High Rock Road. Scattered trees in paddock. Adjacent treed road reserve.
Site 8	7-9 Nov 2013	17	30 average 50 maximum	Box Gum Woodland and scattered trees over pasture.

Viewing station ID	Date	Number of observations	Average and maximum flight height (m)	Habitat at site
Site 10	9 Nov 2013	1	30 maximum	Rye Pk - Dalton Rd. Box Gum Woodland along road reserve with paddocks adjoining road.

Other threatened bird species with potential to occur

Swift Parrot

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. The Swift Parrot is known to occur within this IBA. The far north and far southern portions of the project area would be within the IBA.

Targeted surveys were undertaken in July 2013 to capture the species known winter migration period from Tasmania to the mainland. Ten surveys were undertaken within Box Gum Woodland and Inland Scribbly Gum Woodland at this time. The extent and location of survey sites were limited by the amount of available habitat within or nearby impact areas. The species was not detected during targeted surveys and the foraging resources are considered marginal as preferred feed trees of this species are few or scattered within the project area.

This species and the available habitat is discussed further within the impact assessment chapter of this report, refer Section 7.

Glossy Black Cockatoo and Gang-gang Cockatoo

Habitat for the Glossy Black Cockatoo is not available within the wind farm site and habitat for the Gang-gang Cockatoo is marginal as mature forest supporting larger hollow-bearing trees is not widely available within the project area. It is considered these species are unlikely to occur within the project area on a regular basis.

Database records show the Gang-gang Cockatoo has been recorded within Bango Nature Reserve but no-where else within the locality and the Glossy Black Cockatoo is not known for the locality.

For the Glossy Black Cockatoo, both foraging (Casuarina) and nesting resources are absent from the project area. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, *Allocasuaraina diminuta* and *A. gymnanthera*; these species are unavailable in the project area. Large hollow-bearing eucalypts suitable for this species to nest are also absent. It is highly unlikely this species would occur within the project area.

The Gang-gang is reported to occur in in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests in summer (this habitat type is not present onsite), whereas in winter it can move to lower altitudes, preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages of the inland slopes. Regarding the latter habitat type, while Box Gum woodland may support some habitat for this species, this habitat is considered very marginal and extensive bird surveys have been undertaken in these areas. No Gang-gang Cockatoos were recorded during all bird surveys, despite the species being known to occur within Bango Nature Reserve.

Impact to these species from the proposal are therefore not expected and they are not discussed further in this report.

Powerful Owl and Barking Owl

A record is known for the Powerful Owl south of the project area within the locality and the closest Barking Owl records is 40 km of the site. However, given the mobility and large home ranges of these owls they were considered to have potential to occur within the project area. Ten nocturnal surveys were undertaken for these species consisting of targeted call playback and spotlighting in potential habitat across the project area. In particular, an area of Inland Scribbly Gum Forest near RYP_104 was considered to provide the best quality habitat for this species within the project area as it supported several hollow bearing trees. This area was specifically targeted for call playback and spotlighting along with other areas of potential habitat.

Hollow-bearing trees were mapped within areas of better quality vegetation considered the most appropriate nesting locations within the project area for these owls (i.e. within moderate and good condition vegetation). There is a general lack of large hollows across the project area and it is considered there is no suitable breeding habitat. The majority of hollows are of small to medium hollow entrance size, most likely to be utilised by small to medium birds and microbats, rather than owls.

The Powerful Owl and Barking Owl were not detected by call or direct observation during the field surveys and are not considered to regularly utilise the project area, however these species are discussed in more detail with regard to impact in Section 7.

Regent Honeyeater

Records of the Regent Honeyeater are present within the locality and the species is known to utilise box-ironbark eucalypt associations. 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. As the species can undertake large-scale nomadic movements in the order of hundreds of kilometres the species has the potential to occur within the project area. The species was not detected during bird surveys of the project area, but has potential to be impacted from the proposal from collision when it migrates.

This species is discussed further within the impact assessment chapter of this report, refer Section 7.

Black-chinned Honeyeater

The Black-chinned Honeyeater occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). The Black-chinned Honeyeater has not been recorded within the locality and records of this species are primarily located to the west of the project area north of Boorowa. The species was not detected during surveys of the site. Substantial survey was undertaken for other species (Superb Parrot and Swift Parrot) in the potential habitat (Box Gum Woodland) this species would occur within if present on site. The Black-chinned Honeyeater was not detected during bird surveys and as it is a gregarious species usually seen in pairs and small groups of up to 12 birds, it is unlikely this species inhabits the project area on a permanent basis.

Little Lorikeet and Turquoise Parrot

The Little Lorikeet forages primarily in the canopy of open Eucalypt forest and woodland, yet also finds food in *Angophora, Melaleuca* and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, such as paddocks, roadside remnants and urban trees are also reported to be used by the species.

The Turquoise Parrot is typically recorded west of the escarpment in the tablelands and on the western slopes, extending to the coastal districts. It occurs in grassy woodland and open forest carrying a mixed

assemblage of White Box, Yellow Box, Blakely's Red Gum, Red Box and Red Stringybark. The species will also utilise the edges of woodland, timbered ridges and creeks in farmland.

Both these species were not observed during bird surveys and are not expected to utilise habitat within the project area. Both species are gregarious, travelling and feeding in small flocks and it is considered they would've been readily observed if they occurred within the project area. Records indicate these species are more prevalent at least 200km west of the project area.

Little Eagle

The Little Eagle is found throughout the Australian mainland except the most densely forested parts of the Dividing Range escarpment. The species occupies open eucalypt forest, woodland or open woodland. The distribution of the species is known to include the project area. While the species was not detected during surveys of the project area, the species is a medium sized raptor that exhibits soaring and prospecting foraging behaviour at higher elevation and may therefore be at risk from collision with turbines.

This species is discussed further within the impact assessment chapter of this report in regard to collision risk, refer Section 7.

Square-tailed Kite and Spotted Harrier

The Square-tailed Kite is found in a variety of timbered habitats including dry woodlands and open forests and shows a particular preference for timbered watercourses. The Spotted Harrier occurs in grassy open woodland including *Acacia* and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Given the species have large home ranges and are known to forage in open woodland habitats it is possible they could occur within the project area.

However, both species were not observed during bird surveys of the project area and are not known to occur within the immediate project area.

Grey-crowned Babbler

The Grey-crowned Babbler is known to occur on the western slopes of the Great Dividing Range. Records in NSW show this species west of the project area near Boorowa. No records are known for the locality however the species is known to forage in Box Gum Woodland in the areas it is located and was therefore considered a 'potential' species that could occur within the project area. The species is gregarious and forages on the ground on invertebrates on tree trunks and branches and by foraging amongst litter and tussocks. The species was not observed during bird surveys and is not expected to utilise habitat within the project area.

Migratory species

One migratory species listed under the EPBC Act was recorded onsite, the Satin Flycatcher (*Myiagra cyanoleuca*), foraging in forest along the ridge near RYP_95. One migratory species, the Rainbow Bee-eater (*Merops ornatus*) was recorded west of the project area on Flakney Creek Road.

Several other bird species which migrate seasonally but are not listed under the EPBC Act were also recorded, including:

- Noisy Friarbird (*Philemon corniculatus*) (common in the project area).
- Silvereye (*Zosterops lateralis*) (recorded once along the slope in woodland).
- Fan-tailed Cuckoo (*Cacomantis flabelliformis*) (recorded on three occasions in woodland, forest and along the edge of woodland utilising both ridges and slopes).

One other migratory EPBC species was not recorded within the project area but was considered to have the potential to occur and included the:

- White-throated Needletail (*Hirundapus caudacutus*).

5.3.5 Mammals

Other threatened species with potential to occur

Koala

There are a number of local records for Koala, but most are located outside of the project area. However, given the cryptic nature of the species and the presence of one primary feed tree (*Eucalyptus viminalis*) and six secondary feed trees (*E. rubida, E. albens, E. melliodora, E. Blakelyi, E. bridgesiana, E. mannifera)* listed under the Central and Southern Tablelands management areas within the Recovery Plan for the Koala (2008), it was considered there is potential for this species to occur. These feed tree species would primarily occur within Box Gum Woodland. However, the Koala has also been recorded in other areas of forest and could inhabit Inland Scribbly Gum Forest, although this vegetation type does not typically support feed trees for this species.

Thirty-three RapSAT scat searches were undertaken across the project area for the Koala within woodland habitat and no evidence of the Koala was detected during these searches.

Schedule 2 of SEPP 44 lists Koala feed tree species to be considered under the SEPP. No Feed tree species listed under SEPP 44 were recorded in the project area and the area is not considered core Koala habitat under this SEPP.

Squirrel Glider

There are a number of local records for the Squirrel Glider to the south and east of the project area and the species was therefore considered to have potential to occur. Cage trapping, targeted call playback and spotlighting were undertaken for the Squirrel Glider in potential habitat across the project area. In particular, an area of Inland Scribbly Gum Forest near RYP_104 was considered to provide the best quality habitat for this species within the project area as it supported several hollow bearing trees. Cage traps and spotlighting specifically targeted this area along with other areas of potential habitat.

The Squirrel Glider was not detected by call or direct observation during the field surveys.

5.3.6 Microbats

Microbats – Eastern Bentwing, Eastern False Pipistrelle and Yellow-bellied Sheathtail Bat

Five calls of the Eastern False Pipistrelle and four calls of the Yellow-bellied Sheathtail-bat were recorded at RYP_80 in an area comprising Inland Scribbly Gum Forest, but nowhere else where Anabat surveys were undertaken.

Thirty-six calls of the Eastern Bentwing Bat were recorded near RYP_104 and in the forest south of this site, near RYP_143, RYP_82, RYP_80, RYP_25 and RYP_9 in November 2011, and five calls were recorded at one location in April 2012 (RYP_105 – now removed from layout). Less than 10 calls were recorded at each site the Eastern Bentwing Bat was noted. Sites the Eastern Bentwing Bat was recorded primarily correspond with Inland Scribbly Gum Forest, however the location near RYP_9 supports more open habitat of native pasture.

The Eastern False Pipistrelle forages below or near the canopy and along tracks and is reported to be uncommon within ridgetop forests where soil fertility is low. The species is highly mobile, with a large foraging range. Both the Yellow-bellied Sheathtail Bat and the Eastern Bentwing Bat forage above the canopy and open areas, in particular the Eastern Bentwing bat can travel up to several hundred kilometres to over-wintering roosts. Both of these species are fast fliers when foraging over the forest canopy.

The Eastern False Pipistrelle and Yellow-bellied Sheathtail-bat both utilise hollow-bearing trees for roosting, whereas the Eastern Bentwing Bat roosts in caves. The Eastern Bentwing Bat maternity cave at Wee Jasper is approximately 40 km south of the site.

A risk assessment was conducted for both common and threatened microbats recorded within the project area (Appendix A.6). As both the Eastern Bentwing Bat and Yellow-bellied Sheathtail bat forage above the canopy and are fast fliers they are considered to be at higher risk of collision from the proposed wind farm These species are discussed further within the impact assessment chapter of this report, refer Section 7.

6 CONSTRAINTS ANALYSIS

A constraints analysis was applied to the project area and was based on three constraint classes; high, moderate or low. Key ecological issues identified from several rounds of field survey and assessment within the project area were used to inform the constraints analysis and the impact assessment. The key ecological issues relate to the presence of an EEC, threatened flora and fauna habitat, landscape connectivity, as well as threatened and 'high risk' fauna species (with regard to potential wind farm impacts).

Table 6-1 details the application of identified ecological issues into a constraint class. The implications of the development on these ecological issues are further investigated in the impact assessment section of this report (Section 7), with recommendations provided in Section 8. Further survey work has been recommended in areas identified as Golden Sun Moth and Striped Legless Lizard habitat; after which these areas may be elevated or downgraded into another constraint class pending survey results.

Low constraint areas have not been listed within Table 6-1 as these are considered to be of low conservation value and include all other areas not marked as high or moderate constraint. Low constraint areas include:

- Disturbed and / or common vegetation communities, including:
  - Exotic-dominated pasture.
  - Native vegetation in poor condition, including degraded areas of forest and woodland.
  - Habitat in poor, poor-moderate and moderate condition classes.
- Disturbed or developed areas such as existing track and disturbance footprints, including where these occur within higher conservation value areas.

Appendix E.4 shows the locations of each constraint class for flora and fauna. Please note, that several constraints may occur within the same area and the highest constraint level takes precedent in this instance.

Table 6-1 Identified ecological issues for the project area and their constraint class

Constraining Value	Constraint	Description / Location
EEC : Box Gum Woodland		
• Moderate-good condition EEC / CEEC	**High**	• Access to RYP_12; Access track from the Rye Park Dalton Road west of RYP_89; North of RYP_120 and along overhead transmission line routes to the north-west towards RYP_109.
• Poor condition EEC	**Moderate**	• Within the construction compound east of RYP_132. Patches within the transmission easements south of RYP_144; Access track and underground power south-east of RYP_101; Access to and within southern substation and construction compound site.
Hollow-bearing trees		
• Mature habitat supporting larger patches of hollow-bearing trees in moderate-good or good condition vegetation	**High**	• Near RYP_104, near vicinity of RYP_84. These areas supported a higher density of hollow-bearing trees and are not directly impacted by the proposed infrastructure. However, these areas have been highlighted to prevent micro-siting of the turbine within this area at a later stage.

Constraining Value	Constraint	Description / Location
Turbines sited near edge of continuous good condition forest		
• Turbines sited on the edge of good condition forest habitat.	**High**	• Where good condition habitat is present in the vicinity of proposed turbines, this has been marked as a high constraint. This includes areas of: RYP 143 through to RYP_101 (central section of project area) and an area between RYP_104 and RYP_145. • The turbine itself is not considered to be sited within a high constraint area as during the design phase the turbines were sited within the most disturbed area, however the adjacent habitat has been highlighted to prevent micro-siting of the turbine within the nearby good condition habitat at a later stage.
Turbines surrounded by patchy (partially disturbed) good condition woodland / forest		
• Turbines surrounded by woodland habitat, presenting potential fauna avoidance impact in this area.	**Moderate**	• RYP_17. This turbine is surrounded by woodland habitat, however this area was surveyed in detail and no unique or important habitat was observed in this area. Hollow-bearing trees were not noted within 100 m of this turbine and the area generally consists of regrowth vegetation. However there may be potential impact to woodland birds if they avoid the turbine during the operational phase of the project.
Breeding habitat for Superb Parrot		
• Identified known and potential nest trees for the Superb Parrot	**High**	• A 100 m buffer has been applied to all known (three trees) and potential nest trees (two trees) where they occur in the project area. These are recorded in the southern section of the project area in the general vicinity north of RYP_120.
Striped Legless Lizard habitat		
• Known Striped Legless Lizard habitat where individual species was observed	**High**	• The Striped Legless Individual was recorded at RYP_27. A 500 m buffer has been applied to the location the species was recorded.
• Potential Striped Legless Lizard habitat	**Moderate**	• All other grassland areas of the project area the species was not recorded is designated as potential habitat, including Box Gum Woodland, Derived Grassland and Native Pasture.
Golden Sun Moth habitat		
• Known Golden Sun Moth habitat where individual species were observed	**High**	• RYP_27: a 200 m buffer has been applied to the location the species was recorded.
• Potential Golden Sun Moth habitat	**Moderate**	• All other grassland areas of the project area the species was not recorded is designated as potential habitat, including Box Gum Woodland, Derived Grassland and Native Pasture.

Constraining Value	Constraint	Description / Location
Important habitat and movement corridor for Superb Parrot and Painted Honeyeater		
• Known Superb Parrot and Painted Honeyeater foraging habitat and potential movement corridor *Note: Golden Sun Moth also recorded in this area.*	**High**	• This area is located in the southern section of the project area generally south of RYP_106 and north of RYP_120. • This area supports the best quality Box Gum Woodland located in the project area and was the primary location the Superb Parrot and Painted Honeyeater were located within the project area. This area supports foraging habitat and is a potential local movement corridor for both species. The Superb Parrot nests trees are also in this area.
Important threatened species habitat (woodland bird records in this area)		
• Known habitat of several threatened woodland birds	**Moderate**	• An area north of RYP_104 is known habitat for several threatened woodland birds and these birds appeared to be in higher abundance in this area. While habitat for these species is abundant in the project area and impact to these species is not considered significant, the siting of infrastructure should be minimised as much as possible in this area.

7 IMPACT ASSESSMENT

7.1 APPROACH TO IMPACT ASSESSMENT

The following impact assessment section has been divided into:

1) General information relating to the types of impacts associated with wind farms with reference to available research and its application to the Rye Park wind farm site, where relevant (Section 7.2); and
2) Detailed information on the specific impacts to flora and fauna from the proposed Rye Park wind farm including impacts from vegetation clearing, fauna habitat loss and collision or barrier effects (Section 7.3 and 7.4).

7.2 TYPES OF IMPACTS – CURRENT RESEARCH

There are three primary adverse effects of wind farms upon biodiversity (Macintosh and Downie 2006):

1. Vegetation clearance (habitat loss);
2. Blade-strike (bird and bat collision with turbines and barotrauma); and
3. Alienation or barrier effects (behaviour change in fauna).

7.2.1 Vegetation clearance (habitat loss)

Impact to vegetation relates primarily to clearing associated with construction. Operation of the wind farm has little impact on vegetation as the supporting infrastructure is in place, with operational turbines occupying a vertical plane. During construction, the majority of clearing occurs through supporting infrastructure such as tracks, cable trenches, overhead transmission lines, turbine footings, crane hard stands and crane operational areas. This supporting infrastructure may require substantial clearing of vegetation.

Across a broad area, key issues are effects upon landscape connectivity for fauna and impact upon over-cleared vegetation communities, such as EECs. Furthermore, with clearing come impacts including vegetation and soil compaction, erosion and sedimentation risks, weed spread and others.

7.2.2 Blade-strike

A range of direct and indirect impacts of wind farms on birds and bats have been recognised in recent years, with mortality via direct collision with moving turbine rotors being an obvious impact (Madders and Whitfield 2006; Smales 2006).

Collision risk can be defined as the likelihood of individual species migrating, feeding or roosting in the proximity of a wind farm which may lead to collisions with wind turbines and other infrastructure (Drewitt and Langston 2006). The number and behaviour of birds, topography and the specifications and layout of the wind farm are all factors influencing collision risk (Smales 2006). Collision with rotor blades generally occurs when birds are approaching the rotor with a tail-wind, which reduces their ability to take evasive action. Mortality or injury can also result from birds being driven down to the ground by the force of the wake behind the rotor (Sharp 2010).

Industry research reveals that the species that appear to be most susceptible to population scale impacts due to blade-strike are common species (i.e. not listed as threatened in state or Commonwealth

legislation). However, evidence shows that operational impacts affect particular species disproportionately, compared to habitat loss or stationary elevated structures (Willis *et al.* 2010). While research on Australian wind farms is lacking, evidence to date suggests the species most affected by collision mortality fall into the following groups (MacMahon 2010, Roaring 40s Renewable Energy 2010, Smales 2006):

- Large sedentary raptors.
- Fast high flying microchiropteran bats.
- Fast high flying non-passerines.

Available data from operational wind farm monitoring (i.e. carcass searches) at Australian wind farms is presented in Table 7-1. Based on the data in this table below, carcass searches at operational wind farms have found an average mortality of 0.71 birds and 0.55 bats per turbine per year, although these rates are imperfect given the limited datasets.

Table 7-1Table 7-1 also shows that although a range of species have been recorded from carcasses searches, four species are disproportionately represented (shaded grey in Table 7-1): White-throated Needletail, Wedge-tailed Eagle, White-striped Freetail Bat and Gould's Wattled Bat.

Collision risk modelling has been developed for birds and involves the use of avoidance rates for each species modelled based on observed flights around turbines, with most species assumed to have an avoidance rate of 98-99%. This means that out of 100 flights near a turbine, an individual of a species of bird would take avoidance action to avoid the turbine and rotors 98 or 99 times (i.e. 1 in 100 likelihood of collision with turbine rotors). These avoidance rates are generally considered to be accurate for the majority of bird species (Biosis Research 2009), but Wedge-tailed Eagles have a considerably lower avoidance rate at between 90% and 95% (Smales 2009, MacMahon 2010). This is supported by carcass search data presented in Table 7-1. If Elmoby Ecology (2012) data is excluded for species analysis (as small sample size skews fine analysis), the figures in the table provide an average of 0.05 Wedge-tailed Eagle, 0.03 White-throated Needletail and 0.09 Gould's Wattled Bat deaths per turbine per year.

Table 7-1 Collisions per turbine per year from five Australian wind farms

Species	Elmoby Ecology 2012 (2 turbines, 6 mths)	Hydro Tasmania 2012 (62 turbines, 1 yr)	Roaring 40s 2011 (62 turbines, 1 yr)	Roaring 40s 2012 (62 turbines, 1 yr)	nghenvironmental (unpubl.) (15 turbines, 2 yrs)	Av.
Brown Falcon	1	0	0	0.03	0	
Silvereye	0	0.02	0	0	0	
Australian Pelican	0	0.02	0	0	0	
White-throated Needletail	0	0.02	0.02	0.08	0	
Wedge-tailed Eagle	0	0	0.02	0.05	0.13	
Swamp Harrier	0	0	0	0.011	0	
Pied Currawong	0	0	0	0	0.03	
Australian Magpie	0	0	0.35	0	0.003	
Other bird species	0		0.4	0.35		
ALL BIRDS	2	0.05	0.79	0.52	0.2	0.71
White-striped Freetail Bat	1	0	0	0	0.27	
Gould's Wattled Bat	0	0.05	0.15	0.11	0.07	
Large Forest Bat		0	0	0	0.03	
Other bat species				0.02	0.03	
ALL BATS	2	0.05	0.15	0.13	0.4	0.55

Raptors

Raptors are generally considered the most vulnerable group of birds in Australia (Roaring 40s Renewable Energy 2010), particularly the Wedge-tailed Eagle (as well as the White-bellied Sea-eagle, however this species is uncommon or rare in the project area). Particular bird groups, such as raptors and waterbirds are considered at greater risk of collision because of their flight heights, size and behaviour. A review of avian collision mortality in the United States by Erickson et al. (2001) found that most avian fatalities were nocturnal migrant passerines.

The flying heights of bird species varies considerably; many birds rarely, if ever, reach rotor-swept height, while others do so routinely and some frequently fly above that height (Sharp 2010). In relation to the Rye Park wind farm proposal, the highest tip of the blade is at 157 m and the lowest point of the blade to the ground will be 40 m. At risk flight heights (i.e. within the rotor-swept area) are therefore between 40 m and 157 m. The tips of turbine rotors generally travel at speeds of between 200 and 300 km/h (Smales 2006).

Different types of flight, such as hovering, circling, vertical and horizontal flights made by different species of birds, and by birds engaged in different activities, may pose quite different risks of collision (Smales 2006). Collision risk may vary within the same bird species; depending on the bird's age, behaviour and stage of annual cycle, e.g. a Wedge-tailed Eagle when searching for food to support its young. Weather conditions (e.g. fog, rain and wind) and the time of day or night also have an influence on collision risk (Drewitt and Langston 2006; Smales 2006).

Microchiropteran Bats

Bat-strike interactions are likely during the operation of proposed wind turbines in the project area. Although it is not exactly known which species may fly within the rotor-swept area, it is expected that several species may have interactions with turbines. Little is known about the effect of operating turbines on bat behaviour, whether bats avoid turbines or not, and the actual number of bat-strikes that have been caused by operational wind farms in Australia. Some recent wind farm studies overseas have suggested that bats may be impacted by a sudden change in localised air pressure created by turbines, after bats had been found with fatal injuries consistent with Barotrauma (Baerwald et al. 2008). Barotrauma is likely to be caused by the sudden air pressure change at turbine blades to which microchiropteran bats are more susceptible than birds (Baerwald *et al.* 2008).

In Europe and North America, migrating bats are most susceptible to collision with high numbers of fatalities during migration periods (Cryan and Barclay 2009). Horn *et al* (2008) studied bat activity around wind turbines at a facility in Virginia USA, where hundreds of migrating bats had collided with turbines. The turbines were located along a heavily forested ridge, and activity was monitored with thermal imaging cameras. Out of 998 bat observations of bats interacting with turbines, 41 avoidances (4.108%) were observed and five collisions (0.501%) were recorded. In the remaining 952 observations, bats flew around the blades or investigated them. Whether or not these figures would apply to an Australian situation is unknown, an extrapolation of the US activity may give the only possible indication of the potential for fatalities at the proposed Rye Park wind farm proposal.

In Australia, there are relatively few migrating bats. However, evidence from carcass searches suggests that even when microchiropteran bats are using echolocation for moving through their environment certain species are still at risk of collision with turbine rotors. In terms of blade-strike, Australian species that appear to be most at risk are those that forage above canopy (i.e. in open areas) and move through their environment at high speeds, such as the White-striped Freetail Bat. These species are more likely to travel at blade-sweep height and either fail to detect the moving blades, or are less able to quickly manoeuvre around them (this is discussed in more detail in Section 7.5.3).

7.2.3 Alienation / barrier effect

Alienation involves changes in behaviour (such as avoiding nesting or foraging resources) and habitat utilisation (such as diverging around the broad area where turbines are located). A barrier effect may cause birds and microchiropteran bats to alter their flight pathways to avoid the wind farm area, i.e. the ridgelines and hilltops where the turbines are located. Barrier effects may affect local sedentary birds in their daily traverses for foraging, roosting and breeding sites or may cause migratory birds to shift migratory flyways. Alienation of hunting habitat for raptors such as Wedge-tailed Eagle may be of particular concern (Smales 2006). Siting and configuration of turbines is the primary issue; inappropriate layout (such as lines of turbines between important habitat features) can create a 'barrier effect', resulting in habitat loss or fragmentation (Brett Lane & Associates 2009).

Although the zone of disturbance around individual turbines can be relatively small, the cumulative area of this zone around large wind farms such as that proposed has the potential to be substantial (Sharp 2010). Turbines are generally placed to maximise wind values and to minimise turbulence from topographic features and other turbines. In practice, this means there are usually large and variable spaces between turbines (Smales 2006). Rows of turbines throughout the project area could in effect act as multiple barriers to the movement of birds and bats. Birds and bats may be forced to change their flight behaviour to avoid collisions with turbines, subsequently impacting on their breeding and foraging success (Drewitt and Langston 2006).

7.3 FLORA IMPACTS SPECIFIC TO RYE PARK WIND FARM

7.3.1 Vegetation clearance

At the time of this assessment, the proposal included scope for the development of 126 turbines. This may be reduced, however the calculations for magnitude of impact remain based on the worst-case scenario (126 turbines). The proposal would result in the removal of vegetation under the development footprint, including the turbine towers and surrounding hardstand and crane operation areas, substation and control building and access tracks. Electrical cabling (33kV) would be installed within areas disturbed for the access tracks.

Estimates of permanent habitat loss for each of the affected vegetation types are presented in the tables below (Table 7-2 through Table 7-4), based on the final indicative infrastructure layout provided by the proponent (several layout revisions have taken place to reduce impacts since the beginning of site investigations – refer Section 8).

Overall impact areas have been determined based on worse case infrastructure footprints provided by the proponent. Impact areas by vegetation type were calculated using GIS mapping software, however it should be noted that some total habitat loss figures are likely to be *overestimated* due to overlaps of infrastructure, for example tracks crossing hardstand areas and tracks within overhead transmission easements. It should be noted that for the purposes of these calculations, exotic dominated pasture is not considered to constitute habitat.

Endangered Ecological Community (Box Gum Woodland EEC/CEEC)

Moderate and good condition EEC areas

Within the project area few areas were defined as moderate or good condition EEC areas. Good condition areas estimated to be cleared account for approximately 10 ha of the 3,068 ha Box Gum Woodland area assessed. One area in the south of the project area (in the vicinity of RYP_110 and RYP_120 and to the west of these) consists of higher diversity Box Gum woodland and would be directly impacted by the proposal due to the establishment of a 45m wide easement for the 132kV overhead transmission line and some smaller areas for access tracks. Of all the Box Gum Woodland mapped, this area supported the largest patches of this community within the project area and the highest abundance of mature box trees. This area was also identified as important habitat for the Superb Parrot and Painted Honeyeater. These areas have high conservation value and also qualify as the Commonwealth Box Gum Woodland CEEC and have been mapped as a high constraint. Approximately 2 ha of moderate condition Box Gum Woodland would also be permanently cleared by the proposal. Although modified, areas in moderate condition are considered to have potential for recovery and have also been mapped as a high constraint.

The infrastructure layout has been refined to avoid, where possible, Box Gum Woodland habitat, especially moderate to good condition areas. As a result the turbines RYP_14, RYP_108, RYP_111, and RYP_116, were moved out of Box Gum Woodland remnants. In particular, at least 4 km of proposed transmission line has been removed to avoid good condition EEC in the southern section of the project area.

The EEC over the vast majority of the project area is characterised by low diversity native pasture in poor condition. Of the EEC within the project area (3,068 ha), the estimated amount of poor condition EEC to be cleared accounts for 28 ha. Predominately, the areas to be impacted contain a moderate to low tree density with an understorey of native grass dominated pasture with a relatively low native forb and shrub diversity (0 – 11 non-grass species in poor and moderate condition). This structural and understorey configuration is common and widespread in farmland throughout the region, and particularly within high elevation areas on the ridgetops of the project area. The areas of habitat within the site are already fragmented due to previous clearing, grazing pressure, the planting of exotic pastures, the ingress of weeds and the occurrence of other vegetation communities in habitats not suitable for Box Gum Woodland. The long history of grazing, fertiliser use and weed invasion means that the potential for natural regeneration is likely to be very low. Given the low conservation value of this vegetation and the highly localised and limited impacts associated with the proposal, impacts to poor condition Box Gum Woodland are not expected to be significant.

As a precautionary approach, this assessment has considered that the worst case scenario would be the total loss of this vegetation type within the 132 kV transmission line easement; however in reality the vegetation is open woodland meaning that only scattered trees would need to be cleared. The understorey would also be mostly retained excluding small areas required for footings and tracks. It is considered likely that the community would maintain its existing functionality following construction.

Where occurrences of EEC are along established roads or tracks it may be possible to further avoid or minimise impacts in these areas. Impacts to areas in transmission line clearing corridors of the study areas may also have the potential to be avoided or minimised by micrositing infrastructure with input from an ecologist. Where new tracks, turbines or other infrastructure are placed within identified areas of EEC impacts are unavoidable and offsetting these impacts would be required. Higher offset ratios apply to higher value habitat, providing an incentive throughout the construction process to minimise impacts in high value areas.

Offsetting is recommended by this report to maintain or improve the biodiversity values associated with the EEC/CEEC within the proposal site. Large areas potentially exist within the site boundary that if properly managed can assist with the recovery of this community, arresting existing threats and managing the land for biodiversity outcomes in perpetuity. With the implementation of the controls and recommendations of this report the proposal is considered unlikely to have a significant impact on the Box Gum Woodland EEC/CEEC.

Box Gum Woodland provides habitat for several threatened fauna species, particularly the Superb Parrot, Painted Honeyeater, Golden Sun Moth, and Striped Legless Lizard. These species were detected in this habitat type within the project area. The value of Box Gum Woodland habitat specific to these species is considered in more detail below (Section 7.4).

Non-threatened Vegetation Types

The total vegetation clearance (impact footprint) for the project area is approximately 236 ha, with approximately 14,000 ha of vegetation within the entire project area. Native Pasture is the most common vegetation type within the project area totalling 4,374 ha, of which a total of 60 ha will require clearance for the proposal. Of this 60 ha, only 2 ha is categorised as good condition, 22 ha as moderate condition and 36 as poor condition. Much of the Native Pasture vegetation across the project area has, and continues to be heavily grazed resulting in the presence of many exotic grasses. Native forb diversity is generally low and restricted to grazing tolerant species. Clearing and grazing practices over the long-term have reduced the condition of this vegetation type and condition will remain the same until grazing is reduced or removed from the landscape. While the Native Pasture habitat is generally degraded and supports lower biodiversity value for fauna in general, there are several threatened species that are reliant on a particular habitat attribute or suite of native grasses and can occur within degraded habitats, such as the Striped Legless Lizard and Golden Sun Moth which were both detected within the project area. In particular, these species are found in areas supporting Speargrass and Wallaby Grasses which were recorded within this vegetation type at Rye Park wind farm. The value of Native Pasture habitat to specific fauna species is considered in more detail below (Section 7.4).

The second most common vegetation association is Inland Scribbly Gum totalling 3,753 ha within the project area of which a total of 91 ha will require clearance for the proposal. Of this 91 ha, 41 ha is categorised as good condition, 30 ha as moderate condition, and 19 ha as poor condition. The typical location of good quality vegetation of this community was on ridge tops or steep slopes. While turbines are proposed for areas supporting Inland Scribbly Gum Forest, these areas will primarily be affected by clearing associated with access tracks and transmission lines rather than clearing for turbines. In particular, wide access tracks of up to 20 m (including existing clearance on each side of the road) on the top of ridge in this vegetation type are already present in most parts of the development footprint as a result of existing farming practices and while they will require upgrading, they will not require additional clearance for the proposal. The majority of the turbines are sited within already cleared areas on ridge tops and dense forest has been avoided during the design phase of the project. This vegetation type is common to the project area and similar condition vegetation is also known to extend east of the project area.

Inland Scribbly Gum provides habitat for woodland birds and arboreal mammals. While an open grassy understorey lacking shrub or mid-canopy stratums is typical to this vegetation type, much of this vegetation community showed evidence of grazing and regeneration of grasses and forbs was low at the time of the survey resulting in a lack of structure and ground foraging resources for woodland birds. The lack of foraging resources (i.e. native grasses) appears to have affected woodland bird diversity. Woodland bird diversity increased where this vegetation type was near other shrubland vegetation.

Other areas of good condition vegetation were found in Sifton Bush Shrubland (14 ha), however, this community occupies previously cleared and disturbed areas where Sifton Bush has vigorously colonised and is now the dominant species outcompeting other native species. Sifton Bush is considered to be a highly invasive plant and tends to occupy areas where threatened flora habitat potential is low.

Table 7-2 Estimated impact area of the development by vegetation type

Infrastructure	Quantity	Width (m)	Length (m)	Area (ha)	BGW (ha)	DGL (ha)	ISG (ha)	AA (ha)	BGF (ha)	SB (ha)	NP (ha)	EX (ha)
Turbine footing	126	20	20	5	0	0	1	0	0	1	3	0
Crane hardstand (in woodland and forest)	22	28	45	3	0		3	0	0			
Crane hardstand (in pasture areas)	104	28	45	13		0				4	8	1
New tracks (permanent formed width)	1	8	125,755	101	8	6	20	0	1	11	48	6
Existing tracks (widening)	1	2	40,705	8	0	1	2	0	0	1	4	1
Transmission (33kV)	1	0	125,587	0	0	0	0	0	0	0	0	0
Transmission (132kV) (in woodland and forest)	1	45	18,222	82	16		65	0	1			
Connection substations	1	200	300	6	0	6	0	0	0	0	0	0
Wind farm substations	3	100	100	3	0	1	0	0	0	0	2	0
Construction compound, staging and storage	1	200	250	5	0	2	0	0	0	0	3	0
Vegetation remaining within site boundary				**14,036**	1,555	1,513	3,753	59	175	1,720	4374	887

KEY:

BGW Box Gum Woodland
DGL Box Gum Woodland Derived Grassland
BGF Brittle Gum Forest
AA Argyle Apple Forest
ISG Inland Scribbly Gum Forest
SB Sifton Bush Shrubland
NP Native pasture
EX Exotic

Table 7-3 Estimated permanent impact areas by vegetation condition[6]

Vegetation types	Permanent habitat loss within each condition class (ha)					Total of each vegetation type within the site boundary (ha)
	Good	Moderate	Poor	Unknown	Total	
Box Gum Woodland	10	1	14	0	25	1,555
Box Gum Woodland Derived Grassland	0	1	6	0	6	1,513
Inland Scribbly Gum Forest	41	30	19	0	90	3,753
Argyle Apple Forest	0	0	0	0	0	59
Brittle Gum Forest	0	0	2	0	2	175
Sifton Bush Shrubland	14	15	2	0	30	1,720
Native pasture	2	22	36	0	60	4,374
Exotic/planted	0	0	23	0	23	887
					235.93	**14,035.99**

Table 7-4 Estimated TSC Act EEC permanent impact areas by condition class

EEC	Permanent habitat loss within each condition class (ha)			
	Good	Moderate	Poor	Unknown
Box Gum Woodland and Derived Grassland	10	2	28	0
Total area within the site boundary	**353**	**27**	**357**	**2,331**

7.3.1 Impacts to threatened flora species

Yass Daisy

The Yass Daisy is a rare perennial herb, 30-60 cm high, inhabiting sclerophyll woodland, forest and roadsides (Harden 1992). It appears to be unaffected by light grazing, with some populations persisting in grazed sites (OEH 2011). In surveys conducted in the Boorowa Shire, all of the occurrences of this species were on land characterised by a light grazing regime. The Yass district is the centre of distribution for this species (Fallding 2002). Most populations occur in the Yass District, at Lake Burrinjuck, Bookham, Rye Park and Dalton (DSEWPC 2008). The Yass Daisy has been recorded within 2.5 km west and south-east of the project area. Current threats to the species include agricultural developments, intensification of grazing

[6] All of the condition classes in Table 7-3 and Table 7-4 (good, moderate and poor) excluding the 'exotic' class would equate to the 'moderate to good' definition specified within the Biometric Guidelines due to the dominance of native vegetation in the groundlayer or having a native overstorey with a percent foliage cover greater than 25% of the lower value of the over-storey percent foliage cover benchmark of that vegetation type. Exotic dominated vegetation would equate to 'low' condition

regimes, invasion of weeds, road works (particularly widening or re-routing) and inappropriate mowing or slashing in cemetery sites (OEH 2012).

Targeted searches were undertaken for this species in higher quality areas of Box Gum Woodland and derived grassland immediately north of RYP_120 and within the proposed overhead transmission line routes to the north-west of RYP_120 and south west of RYP_110. These areas have a long and continuing grazing history. Much of the total area of disturbance would involve tree clearing for a 45m wide easement for the 132kV overhead powerlines. The groundlayer habitat under the powerlines would be largely undisturbed, with the exception of small areas required for pole footings and a maintenance track. In view of the limited extent and pattern of clearing and the low impact on groundlayer vegetation within the transmission line, the works are not expected to add to the existing level of fragmentation or isolation of potential Yass Daisy habitat. The proposal would result in the permanent loss of up to 12 ha of moderate and good condition Box Gum Woodland, which provides potential habitat for the threatened Yass Daisy.

The potential habitat at the subject site is considered unlikely to support the species given the species was not detected during targeted searches; these areas considered as potential habitat are now assessed as low importance for the Yass Daisy. The proposal will not result in significant impact to this species.

7.4 FAUNA HABITAT LOSS IMPACTS SPECIFIC TO RYE PARK WIND FARM

As a worst-case scenario, the proposal involves the permanent removal of up to approximately 235.93 ha of potential habitat for a variety of species, including 92 ha of forest, 26 ha of woodland, 30 ha of shrubland, 60 ha of native pasture and 23 ha of exotic vegetation. Given the proposal is linear in structure, involves narrow clearance corridors and as such does not result in large consolidated areas of clearing, the proposed habitat removal is unlikely to be considered large with respect to the remaining areas of potential habitat present throughout the project area.

7.4.1 Habitat Loss (Hollow-bearing trees and landscape connectivity)

Hollow-bearing trees are present across the project area, and may occur in all habitat types and condition classes. Using the estimates above of vegetation community extent and total clearing (Table 7-3), an approximation of the number of hollow-bearing trees that may occur within the project area and the number that may be cleared by the proposal is given in Table 7-5. The average number of hollow-bearing trees per hectare for each vegetation type is derived from Table 5-1 and is based on the hollow-bearing tree data recorded from the 35 plots surveyed.

In general, hollow density within Box Gum Woodland is low given this community is largely fragmented and exists as scattered trees. In particular, large hollows in this vegetation type occur in low abundance. While large mature trees occur across the project area in Box Gum Woodland they often supported no hollows, or small hollows and were often in Yellow Box trees. The results indicate that the trees within Box Gum Woodland take years to develop large hollows compared to other vegetation types and Yellow Box is particularly important in this immediate area of the proposal. It is therefore expected that the larger Yellow Box trees within the project area are selectively used by hollow-dependent species for nest and roost sites.

Much of the Inland Scribbly Gum Forest is regrowth vegetation within the areas to be impacted by the proposal and hollows range from being low in abundance to occurring more densely in patches where the vegetation appears more mature. There are pockets of mature vegetation that support a high abundance of hollows, including several large branch and trunk hollows, however these exists as small pockets between larger areas of regrowth forest supporting either no, or smaller hollows. This patchy distribution

of hollows is likely to be a result of different clearing regimes within the project area. Areas where mature vegetation was recorded and supported a high density of forest occur near RYP_104 and in the vicinity of RYP_84. These areas are not directly impacted by the proposed infrastructure, however they have been highlighted as a high constraint area to prevent micro-siting of the turbine within this area at a later stage.

While it is recognised that hollow-bearing trees within the Inland Scribbly Gum forest could be utilised by some bird species, hollows typically preferred by threatened large forest owls, threatened arboreal mammals, and parrot species such as the Glossy-black Cockatoo need to occur in better quality forest vegetation to be utilised by these species. In general, the majority of hollows were of small to medium hollow entrance size within forest remnants, most likely to be utilised by small to medium birds and microchiropteran bats, rather than owls and gliders.

Recommendations have been made to the proposal in order to avoid impact upon fauna connectivity and habitat patch size and integrity, as well as hollow-bearing trees, where possible. These provisions include pre-clearance surveys and micro-siting of infrastructure. Additionally, recommendations have been made to include 100 m buffers to known Superb Parrot nest sites (including potential nest sites), as well as to micro-site all transmission lines and access tracks near all Yellow Box trees between the area of RYP_110 and RYP_120 even they do not appear to contain a hollow; this area corresponds with good quality Box Gum Woodland. This recommendation will act to preserve Yellow Box trees in the landscape which will develop hollows in the long-term and of which are believed to be an important nesting resource in the project area.

Table 7-5 Estimates of number of hollow-bearing trees (HBT) in project area (HBT extent) and the number and percentage of total that may be cleared by the proposal

Vegetation	Av. HBT per hectare	Veg extent (ha)	HBT extent	Clearing (ha)	No. HBT cleared	Percentage of total
Forest	13.5	4654	62829	53	715.5	1.1%
Woodland	13.5	3048	41148	21	283.5	0.7%
Paddock	1	7307	7307	30	30	0.4%
Total worst-case HBT cleared			111284		1029	0.9%

Note: Forest amalgamates Argyle Apple, Brittle Gum and Scribbly Gum forest types. Woodland is equivalent to Box Gum Woodland and paddock combines Box Gum Woodland derived grassland and native pasture.

7.4.2 Impacts to mammal species (excluding microbats)

Koala

The extent of vegetation clearance for the Koala is primarily limited to discrete areas, primarily for transmission line corridors. Clearance for wind turbines will be nil to minor as main access tracks and turbine sites are located in cleared or non-forested areas; however, there will be some clearing required for installation of the more minor turbine access tracks that will connect to the main access network. However, the nature of the clearing will not affect fragmentation in the landscape and a substantial amount of similar habitat will remain in the project area that will not be affected by the proposal.

For example, the main access tracks to potential turbine sites are already cleared, with many tracks already 20 m wide due to existing agricultural land practices; hence clearing is minimal in these areas and the project will not increase fragmentation. Of the habitat available, Inland Scribbly Gum habitat of all condition classes (i.e. poor-good) is considered most appropriate for this species of which up to 90 ha may

be cleared by the proposal; however at least 3,753 ha of the same vegetation type will remain within the project boundary which also connects to larger areas of the similar habitat within the surrounding landscape.

The main threats to the Koala are the ongoing loss, fragmentation and degradation of habitat, vehicle strike, disease and predation by the domestic dog (SEWPAC 2013). As direct clearance of habitat for the Koala is defined to limited areas the proposal will not increase the main threats of loss of habitat and fragmentation. Furthermore, vehicle strike is not anticipated as the movement of trucks transporting turbines will be temporary and confined to the construction stage; due to steep terrain and land access trucks will be moving at slow speeds within the project area at this time. Vehicle movement will be limited during the operational phase of the project to a single 4WD vehicle for routine maintenance checks. Therefore, the proposal will also not enhance other key threats from indirect impacts of vehicle strike.

Given evidence of the Koala was not detected during the 33 RapSAT surveys, the Koala is not expected to occupy the habitat in high numbers and severity of impact is not considered to be adverse on the Koala (if it were to occur). Additionally, a substantial amount of available habitat will remain within the project area and locality and the proposal will not fragment habitat for this species. Therefore, the proposal is not considered to significantly impact on this species.

Squirrel Glider

Habitat assessment undertaken by **ngh**environmental ecologists has identified that habitat available to the Squirrel Glider is of marginal quality within the proposed wind farm's project boundaries. Mature growth open forest and woodland supporting structural diversity is not widely available. The proposal will affect a minor amount of potential closed forest habitat (Inland Scribbly Gum Forest) that is considered to be of low quality with regard to habitat for arboreal mammals. The species prefers mixed species stands with a shrub or *Acacia* mid-storey and requires structural integrity to satisfy dietary requirements; their diet varies seasonally and consists of *Acacia* gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein (NSW Scientific Committee 2008). Patches of mature forest are present, but scarce. The available habitat is predominantly young regrowth in many locations, lacks structural integrity and foraging feed resources, apart from canopy eucalypt species. The canopy is characterised by the dominance of Inland Scribbly Gum (*Eucalyptus rossii*) with Red Stringybark (*E. macrorhyncha*) as the second dominant. The winter flowering Long-leaved Box (*E. goniocalyx*) occurs within the canopy in patches, but is less common and accounts for approximately 10% of the overstorey. Consequently, the availability of feeding sap and nectar resources is low and a good winter supply of nectar is unavailable. Squirrel Gliders often move through the landscape according to foraging resource availability, however the potential habitat (Inland Scribbly Gum Forest) for this species is consistent in diversity and structure across the project boundary. Such uniformity of potential habitat would suggest foraging resources remain consistent across the project boundary and are generally in low abundance for the reasons stated above; hence if the Squirrel Glider is present, densities are expected to be low throughout the year.

Similar to the Koala, construction disturbance and vegetation clearance impacts will occur from the proposal, however these impacts are considered minor due to the nature of clearing and the location of clearing in the context of the available habitat remaining within the landscape. Potential habitat for the Squirrel Glider is limited to a number of proposed turbine sites and the access tracks that will connect these to the main access network (none is present in transmission line easements, the main access track network or proposed substation locations). Within the area of available habitat for this species, clearance for wind turbines will be nil in many locations and minor in other areas, as the main access tracks and turbine sites are predominantly located in cleared or non-forested areas with many tracks already 20m wide due to existing agricultural land practices. The species typically requires sufficient connectivity of tree cover within

their maximum gliding distance (70m) (Van der Ree *et al.* 2003) to move through the landscape. The proposal will not fragment existing habitat given the minor amount of clearance and access tracks will be no larger than 70m wide.

In total 90 ha (41 ha of good condition) of Inland Scribbly Gum will be removed for the proposal, with 3,753 ha remaining within the project area. Given the Squirrel Glider was not detected during targeted field survey, clearance impacts are not considered to be adverse on this species, and a substantial amount of available habitat will remain within the project area and locality, the proposal is not considered to significantly impact on this species.

7.4.3 Impacts to reptile species

Striped Legless Lizard

This species is typically said to inhabit temperate lowland grasslands, secondary grasslands and occasionally in open Box Gum Woodland. However, the species has also been recorded in degraded habitats such as 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). This species is mostly associated with grasslands supporting a dense cover of perennial tussock grasses, particularly spear grass (*Stipa bigeniculata*) and Kangaroo Grass (*Themeda triandra*) (Osborne et al. 1993, O'Shea 2005). The highest densities of the species have been reported from sites with a *Themeda* ground cover of more than 70 % (Osborne et al. 1993).

One individual of the Striped Legless Lizard was recorded at tile plot 10 (RYP_27) in the northern section of the project area. The species was located on a grazed ridge top supporting a predominantly exotic grassland, with some native species. Common species included: Spear grasses (*Austrostipa* sp.), Thistles (*Sonchus* sp.), Cat's Ear (*Hypochaeris radicata*), and Rye Grass (*Lolium perenne*), with some embedded rock consisting of approximately 10-15% cover. No Kangaroo Grass (*Themeda australis*) was observed in the area at the time the tiles were laid. The observation of the Striped Legless Lizard was made on the ninth tile check of the ten tile checks completed.

The Striped Legless Lizard tile surveys sampled areas of potential habitat across the project area to determine presence or absence of the species. The survey was confined to areas where potential habitat was most likely to coincide with areas to be impacted by the proposed development. As the species was detected the habitat in which it was located and all contiguous habitat of similar structure and condition has been assessed as potential habitat for this species.

Given the species was detected once, it could occur in other areas of grassland habitat of the project area and impact to known habitat of this species could result from the proposal. To determine the extent of impact, management measures have been developed and are prescribed and include undertaking more detailed microhabitat survey of the site (referencing habitat attributes where the species was located) prior to the end of February 2014 to determine the extent of similar habitat within the project area and quantify the extent of clearance impact. These survey results would be used to minimise impacts and ensure offsetting requirements, where avoidance is not possible.

Assuming the Striped Legless Lizard could occur in all grassland habitats of the project area, the total impact to potential habitat of this species is 66 ha (including Box Gum Woodland Derived grassland and native pasture habitat). Of these habitat types, 5,887 ha is available within the project area and therefore the ability to offset impact to this species within the immediate project area is achievable.

7.4.4 Impacts to invertebrate species

Golden Sun Moth

The Golden Sun Moth shows a preference for natural temperate grasslands or derived grasslands (derived from Box Gum Woodland) that are dominated by a low and open cover of native wallaby grasses (*Rytidosperma* spp., formerly *Austrodanthonia* spp.), spear grasses (*Austrostipa* spp.), and the introduced Chilean needle grass (*Nassella neesiana*) (Richter *et al.* 2013; DEWHA 2009b). Golden Sun Moths appear to favour slightly sloping, north facing sites with minimal shading. Areas of bare or sparsely covered ground between grass tussocks (inter-tussock space) are thought to be important in helping males locate females and therefore high biomass renders habitat less suitable. Sites that have been pasture improved, fertilised or ploughed are unlikely to provide habitat for Golden Sun Moth.

The Golden Sun Moth was observed at seven of the ten sites surveyed and approximately 200 moths were observed in total. In particular, the southern section of the site appears to support larger numbers of Golden Sun Moth, as well as the area surveyed east of RYP_72. The habitat within these sites was variable and supported a mixture of native grasses and exotic grasses including Weeping Grass, Brush-tail Spear Grass, Wattle Matrush, Wallaby Grasses and localised patches of bracken. Large areas could also be dominated by the annual *Vulpia* spp. These grasses occur in different assemblages across the areas surveyed and abundance of native versus exotic grass cover is related to grazing pressure. The abundance of Wallaby Grasses also varied, from a low abundance and patchy distribution to being more dominant with a tussocky structure (especially in the south of the project area). Condition of habitat therefore varied in the sites surveyed.

The survey results identify that the project area supports small populations of Golden Sun Moth in localised areas that are generally widespread throughout the area in the typical habitat described above. However, within the site Golden Sun Moths were also observed to occupy areas not typical for the species in that they were observed on rocky hillsides, elevated sites, areas where superphosphate has been regularly applied and in grassland areas derived from ecological communities other than Box Gum Woodland. Habitat quality was variable across the areas surveyed, but all sites where moths were observed supported Wallaby Grasses (even if in low abundance).

The Golden Sun Moth survey was confined to areas where potential habitat was most likely to coincide with areas to be impacted by the proposed development. As a consequence of limitations posed by the relatively short survey period for Golden Sun Moth, the large area covered by the proposed wind farm site, and the travel time required between sites, the surveys were targeted at detecting the presence or absence of the moth in higher potential and more typical habitat of Box Gum woodland, Box Gum derived grasslands and to a lesser extent within native pasture. However, based on the above, it is assumed that the area occupied by the species is more extensive than that observed in the current survey as not all areas dominated by native pasture were examined. Potential habitat was recorded to extend beyond the areas likely to be disturbed at most sites where Golden Sun Moths were observed.

The locations moths were observed are currently impacted by transmission lines, access tracks and substation infrastructure, but no turbines. For the transmission line, several concrete poles would need to be erected, requiring vegetation clearing and excavation within small discrete footprints. Spoil would be temporarily stockpiled next to each pole during excavation. Poles and transmission lines would be laid along the ground prior to being raised. During construction and operation, vehicles would travel underneath the lines. For these infrastructure types, the proposal has potential to primarily directly impact the emerged phase of the Golden Sun Moth during habitat clearance (i.e. not below ground other than for

pole excavation). However, as the species was detected on site in variable quality habitats it is likely it could occur elsewhere not assessed during the November 2013 survey.

Therefore, as a precautionary measure, the habitat in which the species was located and all contiguous habitat of similar structure and condition has been delineated as potential habitat. This includes all Box Gum Woodland, derived grassland and native pasture habitats across the project area. To determine the extent of impact in this habitat type and specifically quantify habitat for this species within the project area, management measures have been prescribed to undertake further preconstruction surveys of the final infrastructure layout in accordance with the relevant survey guidelines (Significant Impact Guidelines for the critically endangered Golden Sun Moth *Synemon plana;* DEWHA 2009a) for this species. The results of these surveys would be used to minimise impacts and ensure offsetting requirements, where avoidance is not possible. The management protocols for this species would be documented within a management plan, to be implemented as part of the construction process.

However, assuming the Golden Sun Moth occurs in all grassland habitats of the project area, the current total impact for this species is 66 ha. Of these habitat types, 5,887 ha is available within the project area and therefore the ability to offset impact to this species within the immediate area of proposed infrastructure is achievable. Offset sites would target better quality areas of Wallaby Grasses.

Furthermore, there are 15 known populations of the Golden Sun Moth in the general area between Yass and Boorowa, including at Rye Park (DEWHA 2009b) and this species has recently been shown to be more widespread than currently thought, particularly within the Yass Valley region. Recent survey results at another wind farm in the region (Yass Valley Wind Farm) have also shown the species to occur in high numbers (i.e. > 200 individuals). In light of the above, a significant impact to this species is not expected and impacts are considered manageable.

7.4.5 Impacts to woodland bird species

Eight threatened woodland bird species were recorded within the project area during the surveys and include:

- Brown Treecreeper.
- Diamond Firetail.
- Flame Robin.
- Hooded Robin.
- Scarlet Robin.
- Speckled Warbler.
- Varied Sittella.
- White-fronted Chat.

Table 7-6 details the amount of habitat present within the project area for these bird species and the amount likely to be impacted by the proposal. Given the habitat present for these species within the project area in comparison to that to be cleared, it is unlikely that the proposal would result in a significant reduction in habitat for these species. In addition, areas of good quality woodland or forest, including patches comprising movement corridors, have been avoided in the majority of instances. As a result woodland and forest patches would not become fragmented as a result of the proposal.

In particular, the area of mosaic habitat around the transmission line and turbines near RYP_102-110, where a number of threatened woodland birds were observed, was considered in detail. Constraint mapping was expanded outside of the proposed development envelope in order to allow for design

changes to avoid and minimise clearing of vegetation in this area. When mapping the habitat value / constraint in this area, the following was taken into account:

- The ecology of the NSW threatened species (six woodland birds) identified in the area.
- The type and extend of suitable habitat.
- Connectivity between habitat patches provided by shrubland, areas of bracken regrowth, paddock trees, woodland and forest.
- The patterns of movement through the landscape that were observed during surveys.

Recommendations have been made including micro-siting all infrastructure in this location with the aid of an ecologist.

Collision with turbines is not considered a risk for these species as these species were not recorded within the rotor-swept-area during utilisation data or during general observations. These species were observed to stay below 15 m the majority of the time, with many records observed of these species on, or near the ground.

Table 7-6 Likely habitat loss impacts to threatened birds recorded within the project area.

Species	Habitat within project area	Total habitat (ha) within project area	Total habitat to be impacted within project area	% of total habitat to be impacted
Brown Treecreeper	Predominantly Inland Scribbly Gum Forest	3,753	90	2.4%
Diamond Firetail	Box Gum Woodland Native Pasture	7,442	91	1.2 %
Flame Robin	Inland Scribbly Gum Forest Native Pasture	8,127	150	1.8 %
Hooded Robin	Inland Scribbly Gum Forest Native Pasture	8,127	150	1.8 %
Scarlet Robin	Inland Scribbly Gum Forest Native Pasture	8,127	150	1.8 %
Speckled Warbler	Inland Scribbly Gum Forest	3,753	90	2.4 %
Varied Sittella	Inland Scribbly Gum Forest	3,753	90	2.4 %
White-fronted Chat	Native Pasture	4,374	60	1.3 %

7.5 FAUNA COLLISION RISK SPECIFIC TO RYE PARK WIND FARM

7.5.1 Impacts to bird species

The flying heights of bird species varies considerably; many birds rarely, if ever, reach rotor-swept height, while others do so routinely and some frequently fly above that height (Sharp 2010). In relation to the Rye Park project, the wind turbines under consideration have a typical hub height of 90 m – 101 m and a typical blade length of between 45 to 56 m. The tallest wind turbine tip height combination under consideration is 157 m. At risk flight heights (i.e. within the rotor-swept area) are therefore between 40 m and 157 m. The tips of turbine rotors generally travel at speeds of between 200 and 300 km/h (Smales 2006). The species listed below are considered to be most at risk from collision risk. Where appropriate, the impact of habitat loss for these species is also discussed.

- Superb Parrot.
- Powerful Owl and Barking Owl.
- Painted Honeyeater.
- Swift Parrot (Migratory).
- White-throated Needletail (Migratory).
- Regent Honeyeater (Migratory).
- Rainbow Bee-eater (Migratory).

Superb Parrot

The Superb Parrot forages in Box Eucalypt Woodland, particularly that dominated by Yellow Box (*E. melliodora*) or Grey Box (*E. microcarpa*). After breeding, Superb Parrots generally move away from their breeding habitat in mid-January (Webster 1988, 1997). 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). Superb Parrots were recorded during November 2011 and 2013 surveys at Rye Park; they were not recorded in April 2012 or July 2013. Thus, Superb Parrots were observed to use habitats in the project area and locality during their nesting season (September to January). It can be assumed that they disperse to other foraging grounds outside of nesting season.

General results

The results of Superb Parrot transects and flight path mapping suggest that Superb Parrots are commonly recorded to the west of the project area, especially along Rye Park Road, and are likely to utilise habitat outside or adjacent the western boundary of the project area within open grassland or Box Gum Woodland, except for a discrete area in the southern end of the project area where parrots were commonly recorded This location (near Site 8 viewing station) is the only one within the project area that was primarily used by the Superb Parrot as habitat on a regular basis (discussed in more detail below).

Primary flight paths appear to run in a north-south alignment along the western edge of the project area, or from the western edge of the project area further west towards Boorowa (Appendix E.4). It is expected that Superb Parrots are moving regularly between the western edge of the project area and Boorowa (a known important breeding area for the species), but are not coming from further east of the project area for the following reasons:

- Parrots were regularly observed in higher numbers and larger flocks then at the project area when travelling to Boorowa during the survey week.
    - This habitat west of the project area supports greater expanses of foraging resources including commercial crops and wider open grassland habitat with scattered trees that once constituted Box Gum Woodland. The Inland Scribbly Gum on ridgelines which comprised most of the vegetation type within the project area was not utilised by the parrot.
- Habitat on the eastern side of the project area was not observed to be utilised by the Superb Parrot during transect surveys and parrots were not recorded flying from the west, where they were observed, to the east across ridges.
    - This conclusion has been made as observers stationed to the west of the project area observed birds, whereas observers stationed east of these observers within the project area did not observe birds. Further reasoning for this conclusion is provided in Table 7-7.

It is therefore concluded that Superb Parrots are common to the west of the project area, but are not moving across the ridges proposed for turbines and are not undertaking large-scale movements at higher

elevations (i.e. at rotor-swept-area height) in this direction and risk of collision impact is low overall. Rather, movement nearby the project area consists of local movements within discrete areas where foraging habitat is available. Superb Parrots generally followed corridors of vegetation and flew below canopy height (i.e. less than 20 m). In particular, Rye Park Road is regularly utilised by the parrot and is considered important roadside vegetation for this species in the locality. The species was recorded in higher abundance along this road than anywhere else within the project area.

Known database records of the Superb Parrot in NSW are located to the west of the project area, but are generally absent from the project area. These records suggest the parrot relies on movement to the west and outside of the project area confirming the flight path mapping results from this current survey (Figure 7-1).

Potential impact area – Southern section of project area

The total clearance impact to Box Gum Woodland habitat would be 25 ha, with 1,555 ha remaining within the project area; however, the greatest impact to this species is considered to occur where the Superb Parrot was observed regularly in one area at the southern end of the project area (near viewing station site 8), with 17 flight observations made in this area over the three days of flight path mapping. Most of the movement appeared to be localised to the distribution of Box Gum Woodland habitat and Native Pasture south of RYP_106 and north or RYP_120 within this area. It is possible the parrot is using the Box Gum Woodland that runs in a north to north-east direction as a movement corridor for local movements to forage and breed in this area. This habitat coincides with proposed infrastructure of turbines RYP_106 to RYP_110 and an area proposed for a transmission line. This is also the only location parrots were recorded flying at higher elevations (up to 50m). As a result the turbines RYP_106 to RYP_110 have been highlighted as a high constraint for potential collision risk.

However, as Superb Parrots are making localised movements in this area and staying within Box Gum Woodland habitat they are considered unlikely to collide with turbines as they are not making long range and large-scale movements. Their foraging movements comprise of tree hopping and rest-stops and it is considered the spacing of turbines at a minimum of 300 m would allow safe passage of this species within the area during these types of movement. The potential collision risk to this species overall is therefore not considered to result in a significant impact to this species, especially as the majority of the population within the locality occurs outside the project area and was observed flying within the tree canopy or below 20 m on most occasions.

However in light of the above, recommendations have been made to include the Superb Parrot within an operational Bird and Bat Management Plan. It should also be noted that a proposed transmission line that extended further west of the current transmission line in this area has been removed from the layout to avoid impact, as much as possible, to Box Gum Woodland and threatened species occupying this habitat.

Nest trees

Two of the three identified nest trees also occur within this southern section of the project area, however these nests are buffered by at least 600 m to the nearest turbine. Additionally, two potential nest trees were also mapped in the same vicinity. Transmission lines are proposed in the areas of identified nest trees and recommendations to apply a minimum of 100 m buffer to both known and potential nests trees is prescribed. Tracks and transmission lines will require micro-siting with the aid of an ecologist within these areas. The third nest tree is identified outside the western boundary of the project area along Flakney Creek Road and no impact to this tree will result from the proposal. Impacts to known breeding resources of the Superb Parrot will therefore be avoided.

Clearing has the potential to affect breeding habitat, namely hollow-bearing trees (especially Yellow Box) in Box Gum Woodland. Hollows suitable for breeding by the Superb Parrot within the project area are generally scattered across the landscape as a result of the cleared and fragmented nature of the remnant Box Gum woodland. However, the southern section of the site is the primary area breeding is expected to occur due to the presence of the known nest trees, as described above. Appendix E.4 shows mapped hollow-bearing trees within moderate to good quality vegetation and displays quality of hollows as low to high. Hollows mapped as high quality were considered suitable for the Superb Parrot; these hollows were either trunk or branch hollows that were not exposed (i.e. not jagged at the entrance and open) and of suitable size for this species. As a result of the proposal, three hollows designated as high quality within potential Superb Parrot habitat would be removed by the proposal; however no evidence of parrots utilising these hollows was observed at the time of survey.

In summary, the greatest potential for impact to breeding habitat occurs along the proposed 132kV transmission line within the southern section of the project area; however, the magnitude of impact for habitat loss for Superb Parrot is likely to be low to moderate (around 1% of available hollows to be cleared) and unlikely to lead to a long-term decrease in population size, reduce the area of occupancy or fragment the existing population.

Design measures (Section 8) were undertaken to avoid areas identified as important to the Superb Parrot and to maintain connectivity throughout the project area. Further recommendations have been made for hollow-bearing tree pre-clearance surveys, and micro-siting of infrastructure to avoid hollow-bearing trees, where possible. Recommendations are also given to offset or replace (with artificial hollows) all hollows that are cleared during the construction phase. Thus, it seems unlikely that habitat loss for Superb Parrot at Rye Park would place the local population at risk of extinction.

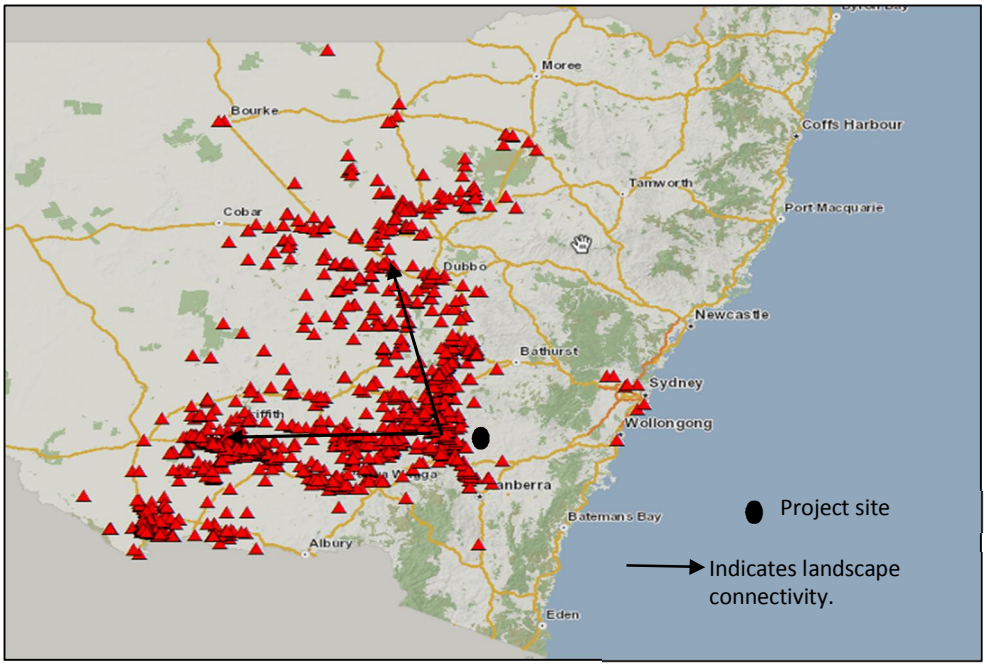

Figure 7-1 Known records for the Superb Parrot in relation to the project area, detailing movement patterns to the west (OEH 2013, Bionet – Atlas of NSW Wildlife)

Table 7-7 Flight path mapping stations Superb Parrots were recorded and the corresponding viewing station used to determine if Superb Parrots were moving from the west (where they were regularly observed) to the east across the project area (refer Appendix E.4 for flight path mapping results and location of viewing stations)

Viewing station Superb Parrots recorded	Corresponding viewing station used to determine if Superb Parrots were moving from the west to east across the project area	Comment on observed flight paths
Site 1	Site 2	Site 2 was located east of site 1 on a ridge in an area of proposed turbines. While several observations were made of Superb Parrots at Site 1, no observations were made at Site 2 indicating the parrots did not move east across the ridgeline during the survey.
Site 3	None	One flight observation was made at Site 3 on one of the three days of survey. One parrot was observed to fly south away from proposed infrastructure to a patch of forest classified as Box Gum Woodland. The lack of observations at this site indicates the area is not regularly used as a flight path and parrots are not moving west to east across the project area. These results are supported by the non-detection of the parrot at SP12 transect which lies just east of this viewing station.
Site 4	Site 5	Site 5 was located on a ridge in the middle of an area of proposed turbines that extend north and south of this viewing station. This viewing station was considered an important vantage point and a spotting telescope was used to improve viewing range. While several observations were made of Superb Parrots at Site 4 outside the project area, no observations were made at Site 5 indicating the parrots did not move east across the ridgeline during the survey.
Site 6	Site 7	One flight observation was made at Site 6 on one of the three days of survey. Two parrots were observed to fly south-west away from proposed infrastructure to an individual tree. Site 7 was considered an important vantage point and a spotting telescope was used to improve viewing range. No observations were made from Site 7 of parrots moving from Site 6 across the project area. The lack of observations at Site 6 and the non-detection of parrots at Site 7 indicates the area is not regularly used as a flight path and parrots are not moving west to east across the project area. These results are supported by the non-detection of the parrot at SP21 transect which lies just east of Site 6.
Site 8	Site 7	Site 7 was considered an important vantage point primarily for Site 8 which recorded the highest activity of parrots in the project area. Several observations were made of Superb Parrots at Site 8, no observations were made at Site 7. Flight observations at Site 8 indicate a probable movement corridor between RYP_106 and RYP_120 which encompasses Box Gum Woodland and native pasture habitat. However birds do not appear to be coming further from the north near RYP_104 (i.e. where Site 7 viewing station was located) as no observations were made at this location.
Site 10	Site 3	One flight observation was made at Site 10 on one of the three days of survey. Three parrots were observed flying along Rye Park – Dalton Road in a north – south direction. Superb Parrots were regularly observed within roadside vegetation along Rye Park Road during surveys. No parrots were observed flying east across the project area from Site 10 or Site 3, but rather birds were observed flying north or south outside the project area. The lack of records at both sites indicates parrots were not regularly moving across the project area in this area.

Powerful Owl and Barking Owl

Habitat for threatened large forest owls is marginal within the wind farm site, especially for the Powerful Owl. Several rounds of design layout changes have been undertaken to remove the majority of turbines away from woodland / forest areas. In recent surveys (July 2013), hollow bearing trees were mapped where they occurred within 100m of indicative turbine locations in high quality forest habitat. This survey confirmed one location only (near RYP_104) supports mature eucalypt species with numerous hollows of varying size near a proposed turbine site. This area will not require clearance for this turbine and has been identified as a high constraint area to avoid. The areas where turbines remain are unlikely habitat for these species given the lack of flora diversity and mature woodland / forest. Large hollow-bearing trees and suitable nesting and roost sites are absent in these areas.

Both the Powerful Owl and Barking Owl roost in dense foliage in large trees or dense mid-canopy trees including rainforest species of streamside gallery forests, casuarina species, Angophora or large *Acacia* species, or for the Powerful Owl the turpentine tree. Roost sites are often in sheltered moist gullies or watercourses. The proposal will not affect habitat of this type nor is it available within the project boundary.

For both species hollows have to be large for nesting surrounded by canopy trees and sub-canopy, or understorey trees or tall shrubs. In particular, the Powerful Owl requires hollows greater than then 45 cm wide and 100 cm deep. Those of a size used by owls for nesting and roosting form in trees greater than 150 cm trunk diameter and probably greater than 200 years old (Lindenmayer et al. 1991, Milledge et al. 1991).

Both species predominantly forage on medium-sized arboreal marsupials such as the Common Ringtail Possum and Sugar Glider. However, the Powerful Owl predominantly forages on the Greater Glider in escarpment and tableland forests which has been reported to comprise 80% of its diet. Tree hollows used by many of the Powerful Owls main prey species is said to form in trees greater than 120 years old (NSW Department of Environment and Conservation 2006) which are not available within the project area.

Depending on forest productivity, several major prey species (the gliders and large possums) are each likely to require at least 1-2 hollow trees per hectare, and up to 10-20+ den trees per hectare in the best habitat (Gibbons & Lindenmayer 1997). Hollows of at least medium size in these densities are not present across the project area. While the Common Brush-tailed Possum occurs within the project area and would be a prey species, results of Koala scat searches suggest the possum does not occur in high densities given scats can be easily identified but were rarely observed within any of the Koala scat search areas. The possum was also not readily detected during 17.25 hrs of spotlighting surveys across forested areas of the site.

Based on these factors (paucity of mature habitat, abundance of prey species), the project area does not support roosting or breeding habitat and is unlikely to provide important foraging habitat, especially for the Powerful Owl. The Barking Owl is more likely to forage through the area than the Powerful Owl but no records are known for this species within at least 40 km of the project area. The proposal is therefore not considered to have a significant impact on these species.

Painted Honeyeater

The Painted Honeyeater is nomadic and occurs at low densities throughout its range. Some north-south migratory movements have been reported for the Painted Honeyeater in which the species moves north to Queensland in winter and is considered a breeding spring to summer visitor in NSW. Within NSW the greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range. The species inhabits Boree, Brigalow and Box Gum Woodlands and Box-Ironbark Forests and is a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias (OEH 2012).

Painted Honeyeaters were predominantly observed west of RYP_106 to RYP_120 in the southern section of the project area within Box Gum Woodland in trees supporting flowering mistletoe in November 2013. The species was not recorded within the project area during previous surveys and is not common to the area. No records for this species are known for the locality and the closest concentrations of records are at Cooatmundra and near Wagga Wagga, indicating the records observed at the project area are outside the known distribution for this species.

Approximately 10-12 individuals were observed foraging in Box Gum Woodland in the south of the site on a regular basis in November 2013. Individuals of this species were also along Flakney Creek Road (outside the project area) and west of RYP_4, however Box Gum Woodland is not widely available in the north of the site and is reduced to scattered trees, therefore the lower numbers observed at RYP_4 are reflective of the amount of available habitat.

The Painted Honeyeater's movements are correlated with the flowering and fruiting of mistletoes at different localities. The detection of the Painted Honeyeater in the project area this year and not the other years may be a result of the species needing to fly further east (i.e. increasing its distribution) in pursuit of foraging resources given that dry weather was experienced further inland in 2013 which may have reduced its flowering resources.

The area used by Painted Honeyeaters in the south of the project area also corresponds to the Box Gum Woodland habitat being used by Superb Parrots. As mentioned for Superb Parrots, a transmission line was proposed for this area but has been removed from the layout to avoid the better quality Box Gum Woodland within the site; most of the records observed for this species were in this area and consequently the majority of habitat utilised by this species has been avoided. The remaining Box Gum Woodland habitat will be affected by the existing transmission lines but this area is highly fragmented and trees supporting mistletoe are in lower abundance (i.e. scattered across paddocks). Recommendations have been made to micro-site the transmission line in areas of Yellow Box trees supporting mistletoe in this area to avoid further impact to potential foraging resources for this species. The impact of the proposal to Box Gum Woodland habitat for this species is therefore considered low.

It is unknown if the species will continue to be a regular inhabitant of the Rye Park wind farm, although it can be assumed that the species can travel between the project area and other foraging grounds given its presence in November 2013. It is unknown what heights the species flies at when making migrating movements, but it is possible the species would fly at blade height as it is capable of migrating long distances. Although, when present within an area for foraging it is expected the species would remain at canopy level where it forages within mistletoe, which was the behaviour observed during this assessment. All observations of this species were made opportunistically in which flight height was recorded; the maximum flight height recorded for this species was 15 m. However in light of the above, recommendations have been made to include the Painted Honeyeater within an operational Bird and Bat Management Plan.

Swift Parrot

The Swift Parrot was not recorded within the project area during targeted surveys for the species. The species migrates to the Australian south-east mainland between March and October to forage. On the mainland this species predominantly inhabits dry sclerophyll eucalypt forests and woodlands, in particular, temperate box ironbark woodlands. The South-west Slopes of NSW IBA supports a significant wintering population of the endangered Swift Parrot. For this species a specific risk window exists during their migration period (winter), in terms of the operational impact of the wind farm.

During the non-breeding season this 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). Grey Box, River Red Gum (*E. camaldulensis*) and White Box are major sources of lerps in these areas at times.

Of these feed trees only two are known for the project area, Yellow Box and Mugga Ironbark. Yellow Box is located within Box Gum Woodland habitat as scattered trees. Mugga Ironbark is rare to the project area and was only identified in one location in the north of the site as scattered individuals; this area will not be impacted by the proposal. In general, the areas surveyed are heavily degraded and exist as either open woodland over grassland (with no mid- or understorey stratums) or as derived grassland with scattered trees. The abundance of flowering feed trees within the project area for the Swift Parrot are therefore low in abundance and the species is more likely to use roadside vegetation or larger remnants where greater diversity of feed trees are present.

As impacts to Box Gum Woodland have been largely avoided in the project design and little habitat is present within the project area for the Swift Parrot, apart from those areas targeted for survey in July 2013 in which the species was not detected, the project area is not considered to support an important foraging area for this species.

Database searches indicate there are no Swift parrot records within Murrumbateman CMA, but records are scattered for the Upper Slopes CMA. Records across NSW indicate a strong presence of this species to west of the project area where more Box Gum Woodland would be located (i.e. towards Boorowa) or along the east coast where more Ironbark species are located (Figure 7-2). It is expected the movement of this species would commonly occur through these connections where better quality foraging resources exist, given the species was not detected within the project area during targeted surveys.

As a result the project area is not considered to support important foraging habitat for these species, especially as the species was not observed during targeted surveys, and impact to this species from the proposal will not be significant.

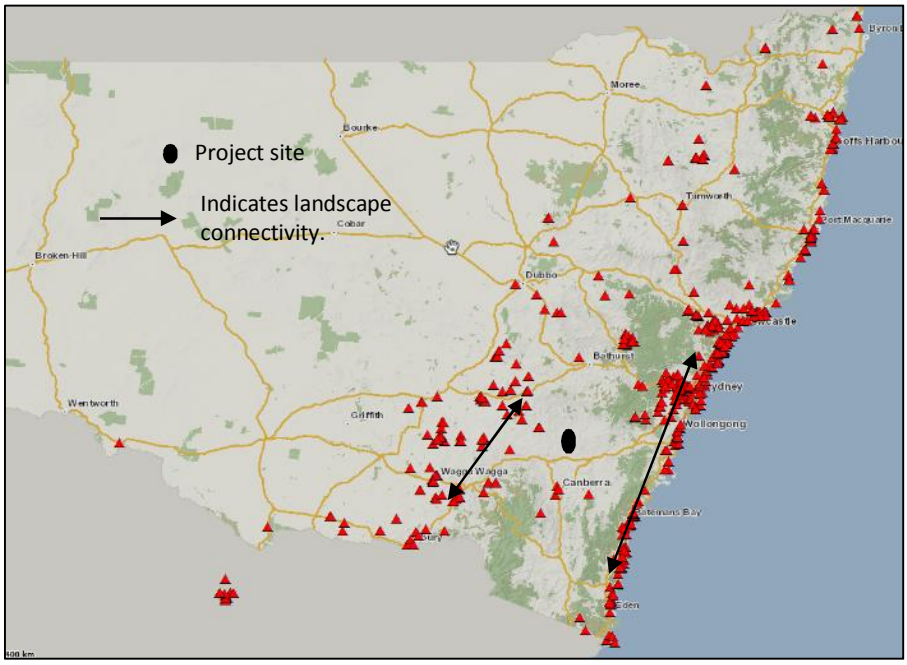

Figure 7-2 Known records for the Swift Parrot in relation to the project area, detailing most records common to the west of the project area or along the east coast (OEH 2013, Bionet – Atlas of NSW Wildlife)

White-throated Needletail

White-throated Needletail was not recorded during surveys, but based on records in the Atlas of Living Australia there is potential for the species to occur. The species is a seasonal migrant present in Australia outside of breeding season, and may occur in large flocks foraging aerially at heights of up to 1,000 m above the ground (SEWPAC 2012). As the species breeds overseas, the potential for impact would be upon migration resulting in potential collision risk during the operational phase of the wind farm. It appears to collide with wind turbines in some areas and the species has been affected at other wind farms around eastern Australia, with one Bird Monitoring Report recording that "no other non-raptor species had more than four mortality events over the 3 year period" (Roaring 40s Renewable Energy 2010).

Based on the collision data presented in Table 7-1, on average there may be around four collisions of White-throated Needletails per year at Rye Park. However, an even temporal distribution of mortality events of this species is unlikely given the natural flux in numbers across season and weather conditions. Although the species' total population is unknown, it is thought to be abundant in areas where it is found (SEWPAC 2012). Given the huge area of occupancy of this species, the Rye Park wind farm is unlikely to affect an ecologically significant proportion of the population.

Regent Honeyeater

The Regent Honeyeater primarily inhabits temperate woodland and open forest of the inland slopes of south-east Australia, particularly Box-Ironbox woodland. The species prefers the wettest, most fertile sites within these associations such as along creek flats, broad river valleys and foothills. The species 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). Potential foraging habitat is primarily present within the Box Gum Woodland within the project area, which includes the feed tree Yellow Box.

There are three known key breeding regions for this species including: Chiltern-Albury in north-east Victoria; Capertee Valley, NSW; and the Bundarra-Barraba region, NSW. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands, although other lesser used breeding sites also occur. The species is known to make large-scale nomadic movements across the landscape, which is thought to coincide with the flowering times of different eucalypt species on which they feed.

The Guidelines suggest bird searches of woodland patches with heavily flowering trees, especially around waterpoints, such as creeklines. Woodland patches within the impact area were surveyed during bird surveys, especially areas supporting the larger Yellow Box trees which were flowering at different times of the survey and supported mistletoe. The method employed such as listening for calls during the known breeding season within the most appropriate habitat type available within the impact area is considered adequate to detect this species.

This species was not detected during bird surveys of the project area and the project area is not considered to support primary breeding and foraging habitat (i.e. wetter areas supporting Box-ironbark Eucalypt associations or feed trees). Two species of mistletoe were recorded on site, but are not widely distributed and occur in low densities. However, as this species is nomadic and movement patterns are often linked to availability of resources, it can be assumed that they may travel through the project area to other foraging grounds. Therefore it is considered there may be a potential operational risk of blade-strike to this species; however, at the time of survey this species was not observed to utilise the project area.

Records across NSW indicate a strong presence of this species to the south, east and north-east of the project area in better quality habitat (i.e. National Parks) and could be considered an important landscape connection. This area traverses Namadgi NP, Morton NP, Nattai NP and Blue Mountains NP (Figure 7-3). It is expected the movement of this species would commonly occur through this connection where better quality foraging resources exist.

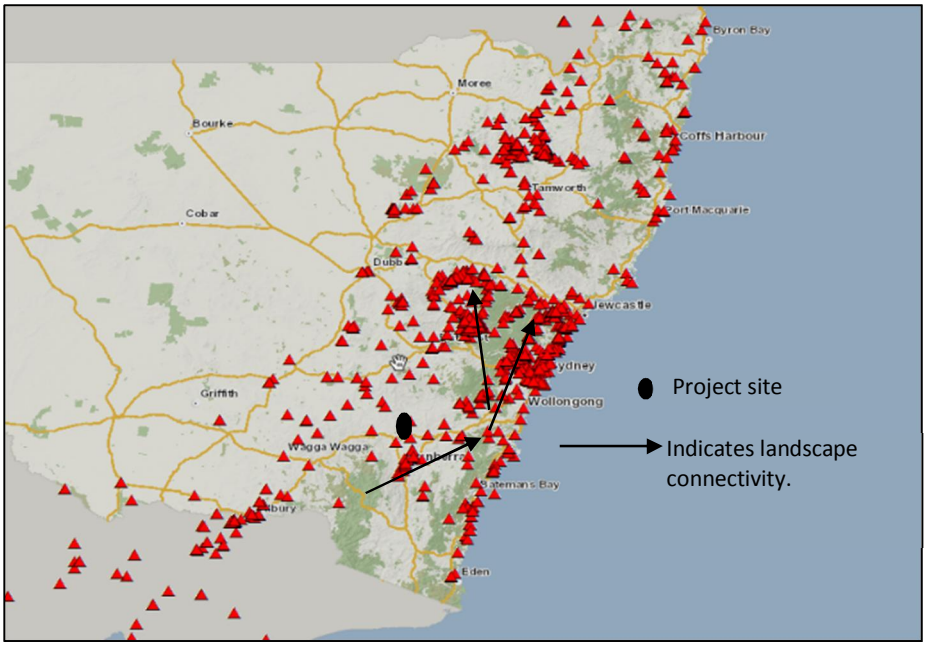

Figure 7-3 Known records for the Regent Honeyeater in relation to the project area, detailing movement patterns to the east (OEH 2013, Bionet – Atlas of NSW Wildlife)

Rainbow Bee-eater

The Rainbow Bee-eater inhabits a variety of habitats including open woodlands, it also occurs in riverbanks, sandspits, road cuttings, beaches and golf courses. The species is a summer breeding migrant (Sept-Apr) to south-eastern Australia, but winters in northern Australia, Solomon Islands, PNG and Indonesia, moving in large flocks (SEWPAC 2012). This species was detected outside the project area to the west on Flakney Creek Road. Potential habitat for this species is present on site and this species is considered most at risk from blade-strike during operation. However, as the Rainbow Bee-eater is a common and secure species and widespread within its Australian and global distribution and given the high manoeuvrability of the species it is considered unlikely that the proposal would result in impact such that there would be a population scale effect on the Rainbow Bee-eater.

7.5.2 Impact to raptor species – collision risk

The flights heights and behaviour of raptor species typically places them at risk of potential collision with turbines. Two species were considered to be at higher risk from collision at the Rye Park wind farm due to their foraging behaviour in which they soar and dive from heights above or within the rotor-swept-area. The wedge-tailed Eagle was recorded within the project area, however the Little Eagle was not recorded but has the potential to occur based on known database records for the locality.

Wedge-tailed Eagle

Although Wedge-tailed Eagle (*Aquila audax*) does not have a rating under legislation, it is recognised as an at risk and flagship raptor species in relation to wind farm developments. As mentioned, Wedge-tailed Eagles exhibit a lower collision avoidance rate than other species of birds. Reasons for this including size, manoeuvrability and hunting style are discussed in the literature. In large part the higher risk seems attributable in part to flight behaviour and the use of territories. If turbines are placed within the core territory of an individual Wedge-tailed Eagle, for example, then the likelihood of a collision is greatly increased for this individual due to the high proportion of flights made within the rotor-swept area by the species and their regular use of updraughts in certain landscape positions (often coinciding with turbine placements). To minimise risk to Wedge-tailed Eagles, proposed turbine locations at Rye Park were classed as high or moderate risk based on landscape position, such as on an escarpment, at the head of a valley or atop an isolated peak away from other turbines. Turbines in high risk locations have been moved (refer to Section 8).

Little Eagle

While Little Eagles have not been recorded in the Australian carcass search literature cited herein, it is a medium sized raptor with similar soaring and prospecting foraging behaviour (Aumann 2001) as the Wedge-tailed Eagle and may be similarly at risk from turbines in certain landscape positions. As for Wedge-tailed Eagles, juvenile Little Eagles with turbines near nests would be most at risk.

Little Eagles were not recorded during surveys at Rye Park but are known to occur in the locality. Should a Little Eagle forage or nest in the project area, the proposal has potential to affect the species during the operational phase. That is, the turbine rotors present a collision risk to the species. As no Little Eagle nests were found within 100 m of surveyed proposed turbine locations, the risk to fledging Little Eagles is considered low. Adult birds, including raptors, have generally shown an ability to habituate to the turbines by taking avoidance action around rotors or by modifying their behaviour (such as approach a root at the head of a gully from below rather than above – EBS Ecology 2012). Further, the carcass monitoring results reviewed (refer Table 7.1) suggest common species are most at risk of colliding with turbines. Thus on the basis of probability it appears unlikely that a viable local population of Little Eagle at Rye Park would be placed at risk of extinction from the wind farm proposal. However, this species should be a focal species of an operational Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

7.5.3 Impact to microbat species – collision risk

Bats forage around woodland vegetation, in open space and over open water, dependent on the species foraging strategies. Many bat species use an 'edge-space' aerial foraging strategy focussed on treed habitat and water bodies, and are expected to stay within close proximity to these features (Churchill 2008). This is generally the case for the bat species recorded during the field survey.

Linear features such as roads, drains and ridges have been recorded to have high bat activity (often associated with vegetation or water) and bats have been observed to navigate and forage along the length of these features (Churchill 2008). Higher bat activity levels were generally observed in wooded areas of the project area, where bat foraging and roosting habitat is higher. Suitable bat roosting habitat is present in the forest vegetation of the project area, specifically the Inland Scribbly Gum Forest which comprises the bulk of the vegetation in the project area.

Bat-strike interactions are likely during the operation of proposed wind turbines in the project area. Although it is not specifically known which species may fly within the rotor-swept area, a risk assessment that considers the flight height of bat species recorded for the project area was completed using flight characteristics currently presented in literature (Appendix A.6). As a result of the risk assessment, four species were considered to be most at risk of collision from the proposal based on their conservation rating, flight height and flight characteristics and included: 1) two threatened bats, the Yellow-bellied Sheathtail Bat and Eastern Bentwing Bat; and 2) two non-threatened bats, the White-striped Freetail Bat and Gould's Wattled Bat. These species are discussed in more detail below.

Without a more detailed knowledge of the bat species present, their distribution and their behaviours in the project area (pre/post construction and during operation) it is difficult to accurately assess the impacts of the proposed wind farm on bats. Therefore, ongoing monitoring of bat populations is recommended to gain a better understanding of their utilisation of the site and confirm the assumptions of this assessment.

Eastern Bentwing Bat

The Eastern Bentwing Bat inhabits a diverse range of forest types and roosts and raises its young in caves and mine tunnels. The species appears to be widely distributed throughout NSW. The Eastern Bentwing Bat is reported to be a fast and direct flier that forages above the canopy and in open areas and will travel up to several hundred kilometres to over-wintering roosts (Churchill 2008, Lloyd *et al.* 2006), which place it at risk of collisions. In overseas studies, the most affected group of microbats are migrating bats (Cryan and Barclay 2009).

Thirty-six calls of the Eastern Benting Bat were recorded within the project area primarily within Inland Scribbly Gum Forest along the ridgeline supporting turbines RYP_80 to RYP_143. This habitat type is considered the most suitable within the project area for temporary roosting sites and a total of 90 ha will be removed, with 3753 ha remaining within the site boundary.

Given the mobility of the species it could forage anywhere within the project area, and the relatively small areas of forest, woodland and grassland habitat to be removed or modified over the project area are not considered to adversely affect the foraging ability of this species. The species is considered more at risk from the proposal from potential collision with operational turbines. The flight height and migratory movements of this species make it potentially vulnerable to blade-strike.

The layout has two distinct areas of turbines with a spacing of approximately 5 km between them. Spacing between turbines in the current layout is generally around 300-500 m. The distance between turbine clusters and also the distance between individual turbines is likely to allow for safe passage between turbines, without creating a barrier effect.

The risk of the proposal impacting on breeding populations (i.e. maternity caves) is low as the nearest maternity cave is 40 km away. There is a staging area and maternity cave in the region (near Bungendore approximately 65 km away and Wee Jasper approximately 40 km away, respectively) for Eastern Bentwing Bat; these are used by a large proportion of the female and juvenile population. It is possible that the local population of Eastern Bentwing Bats may spike slightly when a large proportion of the female and juvenile population migrate to and from the maternity cave (November and February-March); however Anabat results were recorded within November 2011 and 2013 and suggest a relatively low abundance of this species within the project area at this time.

It appears unlikely that the local population would be placed at risk of extinction from the wind farm proposal given that the proposal is not near Wee Jasper or the Bungendore staging area and a relatively low number of calls of this species were detected. However, this species should be a focal species of an

operational Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

Yellow-bellied Sheathtail-bat

Four calls of the Yellow-bellied Sheathtail-bat were recorded within the project area within one location. Although this species occurs across much of Australia, it is never found in large numbers. The species migrates from northern Australia into south-eastern Australia during the summer months (Churchill 2008), but as it flies predominately above the tree canopy, it is rarely trapped or detected via AnaBat. This species is considered an occasional seasonal visitor that may roost temporarily in tree hollows within the project area. The flight height of this species make it potentially vulnerable to turbine strike, however given it is an infrequent visitor, the overall risk to the species is considered low. However, this species should be a focal species of an operational Bird and Bat Management Plan to confirm the assumptions of this assessment, addressing inherent uncertainty.

White-striped Freetail-bat and Gould's Wattled Bat

Although the White-striped Freetail-bat does not have a rating under legislation, it is recognised as an at risk bat species in relation to wind farm developments due to their foraging and flight behaviour. The White-striped Freetail Bat is a relatively large microbat that pursues prey in open air above canopy height (around 50 m above ground – within RSA) at high speed (up to 60 km per hour). Due to speed and wing structure, they are not a highly manoeuvrable bat (Churchill 2008). Observations show that the species is a relatively straight path flier and appear to have limited ability to turn (McKenzie et al 2002). The echolocation call design of the White-striped Freetail Bat, which provides individuals with information to navigate through their environment, is a slow low frequency pulse which provides a low resolution picture (Herr 1998). Its echolocation call design is used for target detection of prey rather than navigating cluttered environments, hence the species' utilisation of open habitat (Rhodes 2006). The characteristics of its echolocation calls as well as flight and wing design mean White-striped Freetail Bat have a poor ability to detect and avoid obstacles (such as rotors) during pursuit flight. While White-striped Freetail Bats occupy a wide range of habitats including woodland, forest, agricultural land and grasslands (Churchill 2008), habitat preferences are correlated with open areas in canopy gaps and along the edge of vegetation and it is more active on upper slopes (Lloyd *et al.* 2006).

Like the White-striped Freetail Bat, the Gould's Wattled Bat does not have a rating under legislation, but it is a relatively large microbat and a fast, high flier with restricted manoeuvrability (Herr 1998) the may put it at higher collision risk. The Gould's Wattled Bat also have an echolocation call design which provides a low resolution image of its environment ideally suited to fast flying in open areas (Herr 1998) meaning this bat too has a poor ability to detect and avoid obstacles while pursuing prey, particularly mobile ones such as rotors. This species hunts most in the sub-canopy and along flyways, particularly on upper slopes (Lloyd *et al.* 2006), so turbines located between closely linked patches of bush or within patches are likely to present the highest risk to Gould's Wattled Bat.

While these species are not threatened they should also be a focal species of an operational Bird and Bat Management Plan. Management measures to reduce risk to common species will also be considered at the operational stage of the proposal.

7.5.4 Alienation or Barrier effects (susceptible fauna species)

Each bird species and/or individuals response to turbines is likely to differ based on their own sensitivities or tolerances. There have been no published studies of the effects of wind farms on the behaviour of Australian birds, so it is difficult to evaluate the extent to which bird communities will be adversely affected. The distance over which disturbance effects can extend from a wind farm varies considerably. A distance of 600 m is often reported as the zone of disturbance around turbines, however this ranges, e.g. from 80 m (for a grassland songbird), to 800 m (for waterfowl) and 4 km (for seabirds) (Sharp 2010).

The most obvious approach to mitigate the risks posed by a wind farm on bird movements and behaviour would be to space turbines at a distance that allow birds to fly between them. There are no generally accepted minimum separation distances for turbines. The Rye Park layout has two distinct areas of turbines with a spacing of approximately 5 km between them, and in specific areas clusters of turbines are separated by at least 1 km to the next cluster. Spacing between individual turbines within clusters in the current layout is generally around 300 - 500m. There is no evidence to suggest that this spacing is sufficient to manage the risk of potential bird strike, but it is generally considered that the greatest the distance allowed between turbines, the better. For the majority of birds recorded within the project area, such as woodland birds which were not recorded to make large movements above the canopy, the distance between turbine clusters and also the distance between individual turbines is likely to allow for safe bird passage between turbines, without creating a barrier effect. Additionally, the arrangement of turbines into clusters in may better enable birds to use the gaps between turbine clusters when travelling across the landscape.

Landscape connectivity and protected areas

Bango Nature Reserve

Bango NR lies east of RYP_123 and RYP_126. Most of the vegetation recorded in the reserve is common in the region although Box Gum Woodland is considered likely to occur. Several threatened species have been recorded in the reserve: Yass Daisy, Gang-gang Cockatoo, Scarlet Robin and Varied Sittella. As the reserve appears to support forest (and potentially woodland) in moderate and good condition, it is considered to be of moderate conservation significance. It should be noted that no part of the reserve would be directly impacted by the proposal, i.e. no vegetation would be cleared within the reserve therefore no direct impact upon vegetation communities of conservation significance, threatened species habitat or connectivity. Therefore, any impact of the proposal on Bango NR would arise from the operational phase.

Based on the threatened fauna recorded in the reserve, (Gang-gang Cockatoo, Scarlet Robin and Varied Sittella), the siting of turbines close to reserved habitat is not considered a high operational risk (i.e. blade-strike) and collision is considered unlikely for these species.

In terms of objectives in reserve management that have potential to conflict with the siting of wind turbines nearby, the POM states that the "Promotion of visitor understanding and appreciation of the values of the Reserves is important ..." (NPWS 2011 p.25) and pack camping is allowed in Bango NR (although not promoted). However there are no guidance documents in terms of appropriate setbacks for turbines near conservation areas. Given that biodiversity risk appears to be low (in terms of vegetation clearing or operational risk) **ngh**environmental (2012a) recommended turbines be setback between 150-200 m from the reserve boundary in order to minimise conflict with reserve objectives. However the proposal has a setback of around 70 m.

7.5.5 Buffers for birds and bats

Bird and bat activity levels are generally concentrated around areas of vegetation. A minimum buffer of 70 m from the turbine blades is recommended for areas of high habitat value for birds and bats and is now a recent standard recommended by OEH.

The activity of the majority of bat species utilising the project area is likely to be highest in moderate or moderate-good quality wooded areas (i.e. Inland Scribbly Gum Forest). Wooded areas are more likely to be used for foraging and roosting by a greater abundance and diversity of birds then areas supporting degraded woodland over pasture, or those absent of trees. A 70 m buffer around areas of high habitat value will reduce the potential for ongoing risks to birds and bats (e.g. collision, disturbance and barotrauma) during the operational phase of the proposal. Limited open water surfaces were present within the project area; however any present could also be buffered. If turbines are placed within this buffer zone, the risk of bird and bat interactions with turbines increases.

Nest sites are focus areas for bird activity including behaviour which has potential to represent a risk to birds where turbines are located, such as display flight and juvenile birds learning to fly. A standard prescription is to apply a 100 m buffer around nest sites for key birds and to avoid locating turbines in these areas. It is considered that tracks and other infrastructure can be micro-sited to avoid impacting such features.

One Wedge-tailed Eagle nest was identified during the survey, further survey work may reveal other nest sites. Given the activity of Wedge-tailed Eagles during the survey it is expected breeding pairs utilise habitat within the project area, or close to the area. A 100 m buffer has been applied to this Wedge-tailed Eagle nest near RYP_92 and it is recommended that consideration of a buffer greater than 100 m is applied due to larger size and habitat utilisation differences of this bird. Therefore a minimum of 100 metre buffer is recommended, with preference for up to 500 m (if possible). Similarly, one Nankeen Kestrel nest was identified on Flakney Creek Road at the eastern end near a proposed transmission line and a 100 m buffer has also been applied to this nest.

As described above in Section 7.5.1, three Superb Parrot nest trees were identified within the project area during the survey and a 100 m buffer has been applied to these and other potential nest trees for this species.

7.5.6 Key threatening processes under TSC Act

The proposal may increase the impact of the following key threatening processes relevant to the species discussed above:

- Clearing of native vegetation.
- The invasion of native vegetation by exotic perennial grasses.
- Loss of hollow-bearing trees.
- Removal of dead wood and dead trees.

Clearing can lead to direct habitat loss, habitat fragmentation and associated genetic impacts, habitat degradation, loss of the leaf litter layer increased habitat for invasive species and off-site impacts such as downstream sedimentation. The proposal would not contribute significantly to the operation of clearing as a threatening process at the local or regional level, since the majority of the project area is already cleared and highly modified by agricultural practices. The proposal would remove up to 31 ha of

predominately low quality Box Gum Woodland and derived grassland, an endangered ecological community. The significance of this clearing has been discussed above.

The invasion of native vegetation by exotic perennial grass is a further Key Threatening Process relevant to this proposal. The Box Gum Woodland EEC in particular is vulnerable to the introduction and spread of perennial grasses such as African Love Grass, Serrated Tussock, Phalaris, Cocksfoot, Yorkshire Fog, and Paspalum. Unnecessary disturbance of areas containing exotic perennial grasses within and adjacent to the works should be avoided so as not to increase the impact of this Key Threatening Process in the area. Cleaning of vehicles and plant prior to arrival on the site (and departure if working in areas containing these species) would help to ameliorate this impact, by preventing the introduction and spread of additional weeds. Section 8 identifies further safeguards to minimise risks from weeds, and the proposal is not expected to significantly increase the impact of this Key Threatening Process in the study area.

In addition to the design measures already implemented, a number of recommendations are given to minimise and offset the impacts of the proposal upon the individual fauna species assessed. Recommendations have been given to minimise the impact of the proposal to an acceptable level, specifically in relation to hollow bearing trees. With implementation of recommendations, the proposal would not exacerbate existing key threatening processes.

7.5.7 Indirect and peripheral impacts

As well as direct clearing impacts, vegetation surrounding the development footprint would be affected by vehicle access and parking, materials laydown and stockpiles. Peripheral impacts may include smothering of vegetation, soil compaction and erosion. Compaction of soil can impede vegetative growth and the successful re-establishment of groundcover in disturbed areas. The works have the potential to introduce and spread weed species. Common pasture weeds are widespread across the site however, listed noxious weeds and Weeds of National Significance (WoNS) are scarce. With the implementation of specific weed control measures, the risk of spreading and introducing additional weed species is considered to be manageable.

Pollution risks are associated with the use of concrete, fuels and lubricants and construction chemicals. These risks are considered manageable with appropriate safeguards. Dust would be generated from the excavation and building activities at the construction sites, and by traffic using unsealed access routes. Dust deposition is not expected to significantly affect the habitat values of the site. Noise, vibration and activity during construction phase may disturb fauna during nesting, foraging and migration periods. This disturbance is likely to be of low magnitude temporally and spatially, considering the spread out pattern of infrastructure proposed.

Recommendation have been prescribed in Section 8 to manage these indirect impacts.

7.5.8 Cumulative impacts

There are a number of developments including wind farms in the region and the proposal may contribute to cumulative impacts from vegetation clearing and operational or alienation effects. Of particular concern locally is clearing of Box Gum Woodland and clearing of hollow-bearing trees because this adds to the cumulative and ongoing loss of this community and resource. Cumulative clearing is a key threat for the Box Gum Woodland EEC and threatened species that depend on it, such as hollow-dependent species.

In terms of operational impact, there are three operating wind farms within approximately 50 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). Several other wind farms are proposed within approximately 60 km of the project area including Rugby Wind Farm, Bango Wind Farm, Conroys Gap Wind Farm, and Yass Valley Wind Farm). The cumulative operational impact of these wind farms is unknown. The difficultly in drawing conclusions about cumulative operational risk is highlighted in a report commissioned by the then 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.

Biological impacts of wind farms can be far-reaching, because of the mobility of migratory, nomadic and territorial fauna species such as bats and birds, with the biggest concern stemming from potential bird and bat collision with operating turbines (Parsons & Battley 2013). The operational and proposed wind farm localities in the district may involve overlapping raptor territories and bird and bat migration routes. However, based on the available habitat 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 (approximately 47 km to the south-west), the project area is not likely to be located on a major migratory route for wetland birds, seasonally migrating birds or microchiropteran bats. Visits from migratory or nomadic species are expected to be infrequent and sporadic. The wind farm is not expected to significantly affect migratory species such that whole populations would be at risk.

Mortality through collision of some bird species with low reproductive rates, such as raptors, could represent a 'mortality sink'. This could have the potential to affect region-level populations, although the likelihood of this is considered low. Given the low rate of bladestrike recorded at other Australian wind farms, as well as the more recently documented avoidance of turbines by Wedge-tailed Eagles at three wind farm sites in northern Tasmania (Hull & Muir 2013) mortalities are not expected to affect local or regional populations by outstripping the reproductive capacity of any species. For this reason, the proposal is not expected to significantly add to the collective impacts of wind farms in the region. If the ongoing monitoring and assessment of the operational impacts of all wind farms operating in the region becomes available, the data should however be reviewed to ensure cumulative impacts remain within acceptable limits. An adaptive monitoring and management program would be implemented to ensure that any unforeseen impact on bird or bat species are detected and addressed in a timely manner.

The location of the proposed wind farm turbines on largely cleared ridgetop sites already compromised from long-term grazing, coupled with avoidance of clearing good condition woodland, should restrict the potential to affect locally declining woodland or wetland species. The offsetting of vegetation losses with the long term protection of similar vegetation in the study area will reduce the cumulative effects of the proposal.

The impacts of the wind farm on biodiversity values would combine with existing impacts resulting from land clearing, agricultural activities, weeds and hazards. It is important to recognise that the district has experienced extensive losses to ecosystem integrity and stability. Woodland and grassland communities in particular, which coincide with prime agricultural land, and riparian and wetland communities have been heavily simplified and destabilised. It is likely that many woodland flora and fauna species have become locally extinct, and many are in continuing decline prior to wind farm development. In this instance, the development of wind farms can be seen to promote management of biodiversity in what was an already degrading landscape.

7.6 CONCLUSION OF IMPACT ASSESSMENT

Based on the extent of clearance associated with the proposal, impacts arising from the wind farm upon the EEC and species known and likely to occur in the project area are manageable and unlikely to be significant. Further survey is required for the Golden Sun Moth and Striped Legless Lizard to validate this assessment. Further surveys have been prescribed for these species and will ensure that the project is responsive to the results (exclusion zones or management prescriptions, as required). Those species considered to be most affected by the project occur within Box Gum Woodland or grassland habitats. The worst-case scenario for clearing of these habitats is estimated at 66 ha (including poor condition vegetation), with a total of 5,887 ha remaining indicating the ability to offset impact to these species within the immediate project area is achievable. AoS are provided in Appendix C for those species considered most at risk for the proposal to further support the conclusions of the above impact assessment.

Impacts have been avoided where possible through design changes based on information and constraints and recommendations have been given to confirm assumptions made in the assessment and further minimise and manage impacts during the final design, construction and operational phases of the wind farm.

Presently, the land in the project area is agricultural utilised for production which has been subject to prior clearing. The management measures and offsets presented in this report provide an opportunity to arrest existing pressures in the project area such as weeds, and conserve a portion of land for biodiversity outcomes resulting in a positive gain.

8 RECOMMENDATIONS

8.1 DESIGN MEASURES TO AVOID IMPACT

The proponent has undertaken several reviews of layout revisions to avoid impacts in areas identified as a high constraint in **ngh**environmental (2012) and subsequent correspondence. Design measures to avoid impacts associated with vegetation clearing including loss of Box Gum Woodland EEC and connectivity, are given in Table 8-1. Design measures to avoid blade-strike impacts associated with the operational phase of a wind farm including proximity to nest trees, are given in Table 8-2. These design measures are already part of the proposal. Recommendations given in Section 8 are supplementary to the design measures incorporated by the proponent.

Table 8-1 Design measures by the proponent to avoid vegetation clearing in areas identified to have a high risk of impact to threatened ecological communities or species

Constraint type	Design measures to avoid impact
EEC: Box Gum Woodland	The following turbines moved out of Box Gum Woodland remnants: RYP_14, RYP_111, RYP_116 and RYP_108. At least 4 km of transmission line in the southern section of the project area in the vicinity of RYP_120 removed. Proposed substation in the south-east corner of the site moved.
Fauna habitat: Patch size and integrity	RYP_36, RYP_53 moved to a 50 m buffer from high conservation value fauna habitat
Fauna habitat: Connectivity	RYP_59, RYP_55, RYP_54, RYP_60 removed from layout due to high conservation value fauna habitat. RYP_64, RYP_107 moved to a 50 m buffer from high conservation value fauna habitat.
Fauna habitat: Key features	RYP_96 moved slightly but still within high conservation value fauna habitat.

Table 8-2 Design measures by the proponent to avoid high and moderate operational risks to bird and bat species.

Operational constraint types	Risk description	Design measures to avoid impact
High risk locations		
Proximity to nests	Proximity to Wedge-tailed Eagle nest tree: RYP_91, RYP_92. Proximity to Superb Parrot nest tree: RYP_117, RYP_118.	RYP_91 removed from layout. RYP_92 shifted further south.
Proximity to Superb Parrot, Painted Honeyeater habitat. Potential habitat for Golden Sun Moth and Striped Legless Lizard.	Transmission line in the southern section of the project area in the vicinity of RYP_120 traverses good quality Box Gum Woodland habitat used by these species.	132 kV transmission line in part of this area removed from layout.
Landscape position	RYP_10 was a high risk to all birds that may fly in the rotor sweep area because of isolated position on a low hill between two much taller ridges.	RYP_10 has been removed from layout and replaced by RYP_16.
Landscape position	These two turbines were outliers from the rest of the layout and were positioned on peaks in a key movement corridor.	Turbines have been relocated to be within the main layout area.

Operational constraint types	Risk description	Design measures to avoid impact
Moderate risk locations		
Landscape position	Turbines in higher risk locations for blade-strike such as along an escarpment or at the head of a valley	RYP_28-30, RYP_32, RYP_36, RYP_41, RYP_52, RYP_56, RYP_83 have been repositioned in line with the recommendation to move turbines back from heads of valleys or escarpments.
Layout position	Turbines in higher risk locations such as isolated (>800 m) from other turbine clusters.	RYP_113 and RYP_115 removed from layout, repositioned to RYP_124 and RYP_145.
Proximity to Bango Nature Reserve	Proximity to Bango Nature Reserve.	Turbines shifted for a 70 m buffer from reserve.

8.2 IMPACT MITIGATION

Mitigation measures recommended to minimise impacts during the design, construction and operational phase of the wind farm proposal are highlighted in Table 8-3. These measures to minimise impact were developed to ensure potential impacts are minimised at: 1) a broad level in which general management or control measures can be applied to the entire proposal; or 2) at a defined level in which management or control measures can be applied to particular areas, individual species, faunal groups, or a vegetation type.

In particular, a Flora and Fauna Management Plan as well as an adaptive Bird and Bat Management Plan should be prepared prior to construction. These management plans would focus on migratory and at risk bird and bat species, and any threatened species found during further survey work. Particularly, the latter is required to address inherent uncertainty related to bird and bat collision risks at this site. Management strategies for the construction phase of the proposal need to be developed and incorporated into the Flora and Fauna Management Plan. Prescriptions for inclusion in the plan are set out in the tables below. These measures are required to ensure a significant impact is avoided.

The construction footprint should be kept to a minimum for least impact on flora and fauna. The proponent commits to upfront offset ratios before clearing proceeds which is an incentive to achieve 'minimal clearance' during the detailed design and construction phases.

8.3 MEASURES TO OFFSET IMPACTS

Measures to offset impacts are provided within Table 8-4 to ensure that an overall 'maintain or improve' outcome is met for the proposal; where impacts cannot be avoided, or sufficiently minimised, the residual impact will be offset in perpetuity. Appendix F details the biodiversity offset principles developed by the former DECCW (now OEH) and how these guide the identification and management of the offset site. Appendix F also details how offsets are proposed to be identified, managed, and the offset ratios to be applied. An Offset Plan would be developed with input from OEH and the CMA and finalised prior to any construction impacts.

The Offset Plan would achieve:

- For common vegetation types a ratio of approximately 1:2 (cleared: offset) is proposed. Where vegetation is listed as an endangered community, such as the Box Gum Woodland EEC, a ratio of 1:5 to 1:10 (cleared:offset) is proposed, depending on the quality of habitat.

- Hollows removed would be offset at a ratio of 1:1 (offset site vegetation must contain the same number of hollows, artificial hollows may need to be installed to achieve this ratio).
- The offset site would be protected in perpetuity and appropriate management actions attached to the land title. For example, fencing and signage maintained, minimum biomass to be retained (through controlled grazing if appropriate), regular weed control and pest fauna management.

Additional detail on the achievability of this offset is provided in Appendix F.

8.4 DECOMMISSIONING PHASE

A Flora and Fauna Management Plan would be developed prior to decommissioning to manage decommissioning impacts on biodiversity values. Biodiversity investigations would be required prior to decommissioning, to update the knowledge of site attributes and evaluate specific impact types (given the life span of the proposal is in the order of 30 years) and to minimise biodiversity impacts related to the removal of infrastructure. New measures to avoid and mitigate impacts may be required depending on: 1) the results of the investigation; and 2) outcomes of the monitoring programs implemented during the operational phase of the proposal. Any implementation of a rehabilitation plan would consider the implemented plans and the environment at the time of decommissioning.

Table 8-3. Design measures to avoid and minimise impacts for Rye Park wind farm

Item	Area	Target Species	Objective	Timing	Proponent Commitment	Avoid or Minimise Impact
Design Phase						
General measures	Project area	N/A	Ensure all infrastructure will be sited entirely within the areas assessed in the Biodiversity Assessment.	After final alignments / development envelopes confirmed	• If infrastructure is required outside of the areas surveyed in this biodiversity assessment, more survey and assessment will be required.	Avoid
General Measures	Project area	High risk birds and bats	Turbine infrastructure design to minimise operational impacts on birds and bats.	Prior to operation	• If possible, red flashing lights[7] should be fitted to turbine towers to reduce insect attraction and potentially night-flying birds. • No guy lines to be fitted to turbine towers. • Flags and/or marker balls to be fitted to wind monitoring mast guy lines • Turbines (e.g. nacelles) should minimise perching opportunities.	Minimise
Striped Legless Lizard habitat	Identified areas of potential habitat for the Striped Legless Lizard (i.e. all grassland habitats)	Striped Legless Lizard	Further targeted survey in all grassland habitat of the project area to avoid and minimise impacts.	Prior to construction (February 2014)	• Undertake more detailed micro-habitat survey of the site (referencing habitat attributes where the species was located) prior to the end of February 2014. • Use survey results to minimise impacts and ensure offsetting requirements, where avoidance is not possible. • Document management protocols for this species within a management plan, to be implemented as part of the construction process.	Avoid, minimise, offset

[7] Although lighting effects are poorly understood at this time, migrating birds and bats appear to be attracted to steady burning lights and red flashing lights are said to decrease insect activity and reduce bird and bat activity at turbines.

Item	Area	Target Species	Objective	Timing	Proponent Commitment	Avoid or Minimise Impact
Superb Parrot nest trees and impacts to breeding, Painted Honeyeater foraging habitat	Where all nests trees and Painted Honeyeater records identified in Appendix E.4.	Superb Parrot	Avoid impact to known and potential nests trees and construction impacts during breeding period for the Superb Parrot. Avoid impacts to foraging habitat (Yellow Box) for the Pained Honeyeater.	Prior to construction (for avoidance of nests trees); During construction (for no clearance near nests trees during this time)	• Maintain a 100 m buffer around identified and potential Superb Parrot nest trees (refer Appendix E.4) in the southern section of the project area. • Micro-site all transmission lines and access tracks near known nest trees and Yellow Box trees between RYP_110 and RYP_120.	Avoid, minimise
Raptor nest trees	Where all nests trees identified in Appendix E.4.	Wedge-tailed Eagle, Nankeen Kestrel	Avoid impact to known nests trees.	Prior to construction	• Maintain a 100 m buffer around identified nest trees.	Avoid
Good condition fauna habitat	Project area	All species, primarily threatened woodland birds	Avoid impact to woodland and forest habitat.	Prior to construction	• Maintain a 70 m buffer around turbines in good condition fauna habitat, especially turbines RYP_17 in the north of the project and turbines near Bango NR (RYP_123 & RYP_126).	Avoid
Construction Phase						
Golden Sun Moth habitat	Identified areas of potential habitat for the Golden Sun Moth (i.e. all grassland habitats)	Golden Sun Moth	Further targeted survey in all grassland habitat of the project area avoid and minimise impacts.	Prior to construction	• Undertake preconstruction surveys of the final infrastructure layout in accordance with the relevant survey guidelines (Significant Impact Guidelines for the critically endangered Golden Sun Moth *Synemon plana;* DEWHA 2009). • Results of these surveys used to minimise impacts and ensure offsetting requirements, where avoidance is not possible. • Document management protocols for this species within a management plan, to be implemented as part of the construction process.	Avoid, minimise, offset
Box Gum Woodland and Good quality fauna habitat	Project area, particularly good condition EEC/CEEC between RYP_110 and RYP 120 and within transmission	Box Gum Woodland areas and threatened species	Prevent unauthorised clearance. Minimise track and transmission line	During construction	• Clearly define works areas nearby or within Box Gum Woodland areas to strictly defined permitted clearance zone. • Minimise track width, where possible, to the minimum required for safe access and operation.	Minimise

Item	Area	Target Species	Objective	Timing	Proponent Commitment	Avoid or Minimise Impact
	line south of RYP_110		impacts in areas of high conservation value.		• Install the 33kV powerlines (co-aligned with roads) as underground, where possible. • Removal of topsoil and subsoil for trenching to be replaced and revegetate disturbed areas with local native grasses (i.e. Kangaroo Grass, Wallaby Grass or Spear Grass).	
Woodland bird habitat	Around the transmission line and turbines near RYP_102-110	Brown Treecreeper, Diamond Firetail, Flame Robin, Hooded Robin, Scarlet Robin and Speckled Warbler	Minimise track and transmission line impacts in areas of high conservation value for these species.	During construction	• Clearly define works areas nearby this area. • Micro-site all infrastructure in this location with the input from an ecologist.	Minimise
Hollow-bearing Trees	Project area where targeted hollow-bearing tree survey not previously undertaken	Threatened hollow dependent fauna	Targeted hollow-bearing trees survey to accurately record the number of hollows to be cleared to ensure impacts are offset.	After final alignments / development envelopes confirmed	• Pre-clearance survey within final development envelope and alignment for hollow-bearing trees. • Infrastructure micro-sited to avoid hollow-bearing trees, where possible. • For hollow-bearing trees to be cleared a management plan should be prepared by an ecologist detailing: procedures to minimise impacts to, and relocate resident fauna; timing of works to avoid breeding periods, where possible; number and type of hollow-bearing trees to be removed and offset (to be included in Flora & Fauna Management Plan). • Where hollow-bearing trees are to be cleared a standard pre-clearance survey, such as that described in *Biodiversity Guidelines* (**ngh**environmental / RTA 2011), should be undertaken and details of hollow-bearing trees cleared including number and size of hollows and number of hollow-bearing trees recorded.	Minimise
Reptile Species habitat	Project area	All reptiles, primarily Pink-tailed Worm-lizard	Pre-clearance surveys in Box Gum Woodland and native pasture to identify rocky outcrops for avoidance, where possible.	During construction and as required	• Turbines and infrastructure would be micro-sited to avoid rocky outcrops in this habitat, where possible. • Where rocky outcrops cannot be avoided, replace rock in nearby areas in consultation with an ecologist. • Fallen timber > 50cm to be left in place or moved to a nearby area to retain fauna habitat.	Minimise
General Measures	Project area	All species and vegetation communities	Minimise clearance and disturbance.	During construction and as required	• Clearly define works areas and restricting impacts to these. Including vehicle and equipment parking and access routes.	Minimise

Item	Area	Target Species	Objective	Timing	Proponent Commitment	Avoid or Minimise Impact
					• Co-locating underground and overhead 33kV powerlines with the track network to minimise additional impact area, where possible. • Establish construction compound in a disturbed area. • Use disturbed areas for vehicle and machinery access, materials laydown, stockpiling of cleared vegetation and deposition and retrieval of spoil, wherever practicable. • Fill in trenches as soon as possible. Trenches left open overnight to be inspected at first light for trapped fauna. Trapped fauna to be released appropriately in a nearby location. • Hollow-bearing trees and sensitive features to be retained to be communicated to staff via inductions and other methods.	
Riparian Area Management	Project area	All species and vegetation communities	Minimise clearance and disturbance.	During construction	• Creek crossing to be designed in accordance with: NSW Fisheries Policy and Guidelines for Fish Friendly Waterway Crossings (2003). • Creek works not to be undertaken when heavy rain is forecast and should be avoided when there is flow. • Implement sedimentation and erosion controls in accordance with best practice guidelines.	Minimise
Weed Management	Project area	All species and vegetation communities	Pre-construction inspection for noxious weeds within project area. Prevention of spread of weeds and pathogens. Weed monitoring.	Before commencement of works and as required Monitoring – late spring / early summer after construction	• Control noxious weeds in works area according to plans and control measures of the LGAs. • Minimise use and adhere to best practice guidelines for herbicide treatment in environmentally sensitive areas (i.e. Box Gum Woodland). • Establish a machinery hygiene plan to ensure vehicle and machinery is absent of organic matter pre- and post-site access. • Sign environmentally sensitive areas (i.e. CEEC areas) and designate clean-down area for entry / exit points into these areas. • Monitoring and weed control in areas of known noxious or invasive species.	Minimise

Item	Area	Target Species	Objective	Timing	Proponent Commitment	Avoid or Minimise Impact
					• Understorey vegetation in easements should be managed to maintain composition and quality to prevent weed invasion	
Pollution Prevention	Project area	All species and vegetation communities	Prevention of contaminants and erosion outside works zones.	As required	• Establish a spill plan to prevent chemicals or pollutants from having an adverse effect on the environment. • Backfill cable trench where cement is used; at least 20 cm of cement free topsoil to be replaced as the top layer in the back fill. • Establish an erosion and sediment control plan so appropriate controls are in place prior to commencement of works.	Minimise
Site Management	Project area	All species and vegetation communities	Stabilisation of soil, rehabilitation and revegetation to be undertaken progressively to re-establish ground cover.	As required	• Lightly mulch exposed soils with chipped vegetation or sterile hay in areas dominated by exotic groundcover species. Sow with an appropriate cover crop in consultation with land owners. • Lightly mulch exposed soils with chipped vegetation or sterile hay in areas dominated by native grasses using local provenance species. • Fertiliser should not be used to promote revegetation in areas dominated by native grasses.	Minimise
Operational Phase						
Flora & Fauna Management Plan	Project area	All species and vegetation communities	To avoid significant impact to flora and fauna outside of the accepted clearance boundaries and prevent 'unassessed' impacts occurring.	Implement prior to construction	• An ecological professional to develop and implement a Flora and Fauna Management Plan to report on and manage impacts. • The management plan should highlight ecological important areas (vegetation communities and threatened fauna species habitat) and their management. • Specific areas requiring monitoring or management should be highlighted as well as timing for monitoring. • Weed species should be highlighted along with prescriptions for their management.	Minimise
Adaptive Bird & Bat Management Plan	Project area	Superb Parrot, Painted Honeyeater, Regent Honeyeater, Wedge-tailed Eagle,	Development of an 'insurance' monitoring program to address	Implement prior to construction. Survey and monitor during 'high risk' periods,	• An ecological professional to develop and implement a Bird and Bat Monitoring Program to report on, and manage impacts with potential to be significant.	Minimise

Item	Area	Target Species	Objective	Timing	Proponent Commitment	Avoid or Minimise Impact
		Little Eagle, Eastern Bent-wing Bat, Yellow-bellied Sheathtail-bat, Gould's Wattled Bat and White-striped Freetail Bat.	uncertainty inherent in the assessment.	when species may be moving through or foraging in the area	• Monitoring surveys should include an understanding of breeding activity (i.e. nest locations) and foraging movements. • Baseline (pre-construction) and operational collision and abundance data would be collected, focused on higher risk species and higher risk locations in order that actions can be taken to address unforseen impacts, should they occur. • Management Plan methods would utilise AusWEA (2006) best practice guidelines. • Management Plan should include management response options (i.e. restriction of lambing on ridges with high raptor activity to reduce collision risks) to be implemented where significant impacts are anticipated.	
Habitat Connectivity	Transmission Line Easement	All common species, as well as threatened fauna, particularly threatened parrots, gliders and bats	Minimise fragmentation of landscape connectivity.	After construction	• Promote growth of vegetation under the transmission line to the maximum allowable height to maintain fauna habitat connectivity. • Understorey vegetation in easements should be managed to maintain composition and quality to prevent weed invasion. • Near areas of intact woodland or forest a spacing of 600m should be considered for turbines.	Minimise

Table 8-4. Offset measures to maintain or improve biodiversity for Rye Park Wind Farm

Item	Area	Target Species	Objective	Timing	Proponent Commitment
Construction Phase					
Development of offset strategy and offset plan	Project Area	Box Gum Woodland, Hollow-bearing trees, Threatened species habitat	Proponent will develop an offset plan to offset all permanent native vegetation removal to maintain or improve biodiversity in the longer term.	Prior to construction	• Develop an offset strategy and finalise prior to any construction impacts an ecological professional, in accordance with Appendix F • Develop an offset plan prior to operation, demonstrating the suitability of the final offset site and providing detailed management actions specific to the site. • Ensure the offset strategy complies with the *Principles for the use of biodiversity offsets in NSW* guidance document. • The offset ratio will be determined with reference to: the conservation status of the vegetation, the condition of the vegetation, and the actual threatened species habitat value lost (i.e. known threatened species habitat, not potential habitat). • Where vegetation is listed as an EEC, a ratio of 1:5 to 1:10 is proposed, depending on quality of habitat. • Where non-threatened vegetation is cleared an offset ratio to be applied at 1:2. • Where hollow-bearing trees are to be cleared and cannot be avoided an offset ratio to be applied at 1:1 and is supplementary to other areas offset. • Include provisions for offsetting Commonwealth listed EEC to demonstrate compliance with the Commonwealth offset policy.

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