

**FLORA AND FAUNA ASSESSMENT  
CAPITAL WIND FARM  
SOUTHERN TABLELANDS, NSW**

a report prepared by

**KEVIN MILLS & ASSOCIATES**  
ECOLOGICAL AND ENVIRONMENTAL CONSULTANTS

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March 2005  
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# 1 INTRODUCTION

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## 1.1 BACKGROUND

Renewable Power Ventures is proposing to construct a wind farm to the east of Lake George on the Southern Tablelands of New South Wales, to be known as Capital Wind Farm. Figure 1 shows the general location of the wind farm project area, the turbines and the properties on which the turbines are to be located.

Kevin Mills & Associates was engaged by Connell Wagner PPI – Energy Section to prepare the Flora and Fauna Assessment for the Environmental Impact Statement (EIS), which they are preparing to accompany the Development Application (DA).

This Flora and Fauna Assessment was prepared in accordance with the requirements of the Department of Environment and Conservation and the Director-General of the Department of Infrastructure, Planning and Natural Resources and the study brief prepared by the project manager. The report assesses the potential impact of the wind farm project on flora and fauna, except for bats; this group is being assessed separately, by another consultant.

## 1.2 DESCRIPTION OF THE PROJECT

The Capital Wind Farm project area is located east of Lake George and South of Tarago, in the local government areas of Palerang Council and Goulburn Mulwaree Council. The turbine sites, which are on several properties, are shown on Figure 1.

The wind farm will have a capacity of approximately 140 MW and will consist of up to 70 large turbines, each with a capacity of about 2 MW. The turbines will have a hub height of about 80 metres and a blade length of up to 45 metres. Figure 2 shows the design of a typical wind turbine. The turbines will be clustered in groups spread across seven farming properties, as shown on Figure 1. Table 1 provides a summary of the turbine groups referred to in this report and the location of access to each Group. Each Group has been identified by a geographical feature..

**Table 1**  
**Summary of Turbine Groups**

Group	General Access
Kalbilli	Off Tarago to Braidwood Road.
Hammonds Hill	Off Tarago to Bungendore Road.
Ellenden	Currandooley Road, off Tarago to Bungendore Road
Groses Hill	Off Taylors Creek Road

Access tracks will be constructed to the turbine sites, and 33 kV underground cables will link the turbines to the substation operated at a voltage of 330 kV. The substation will be located within a valley to the south of the Hammonds Hill Group of turbines, within about 100 metres of the existing 330 kV transmission line; see Figure 1. The turbines located on the Kalbilli site will be linked by underground cable or an overhead line located mainly along Mount Fairy Road as shown on Figure 1.

In summary, the main components of the construction work for the wind farm are:

- the installation of up 70 wind turbines in four groups;
- the construction of a 33kV/330kV substation;
- access tracks to the groups of turbines, and from one turbine to the next; and
- buried cabling between individual turbines and connecting to the substation including from the eastern group , along Mt Fairy Road, to the substation.

For a more detailed description of the Capital Wind Farm and construction activities, refer to the Environmental Impact Statement (EIS).

### 1.3 REPORTING REQUIREMENTS

#### 1.3.1 REQUIREMENTS OF DEC

This report addresses the following directives of the Department of Environment and Conservation (DEC); Attachment "A" to the letter dated 7 September 2004.

"The flora and fauna survey is to consider vegetation communities, protected and threatened flora and fauna species. In particular, for this location the vegetation communities may include Natural Temperate Grasslands in the drainage lines and exposed slopes, this community is listed on the Commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC Act). The Snow Gum *Eucalyptus pauciflora*, Peppermint *Eucalyptus dives* and Ribbon Gum *Eucalyptus viminalis* woodland vegetation community may also be present. This community is a regionally declining vegetation community, which is being considered for inclusion in the *Threatened Species Conservation Act 1995*. Note these trees are all feed trees for koalas, therefore SEPP 44 must be considered."

"Protected flora likely to be found on the site include orchid species and grass trees; a threatened flora species known from the site is Buttercup Double-tail *Diurus aequalis* and species potentially occurring include Silky Swainson-pea *Swainsona sericea* and Creeping Hop Bush *Dodonaea procumbens*."

"Protected fauna species that may be impacted by the proposal are bats, waterbirds, owls that fly at night, raptors, Yellow-tailed Black Cockatoo, aerial bird species (that feed in the air) such as White-throated Needletail (these are migratory and may come under the EPBC Act); and Dusky Woodswallow (which are [sic] a declining woodland bird). Known records of threatened fauna in the area can be obtained from the NPWS Wildlife Atlas. In addition to these the site may provide potential habitat for Striped Legless Lizard *Delmar impar*, Hooded Robin *Melanodryas cucullata cucullata*, Grassland Earless Dragon *Tympanocryptus lineata pinguicollis*, Little Whip Snake *Suta flagellum*, Pink-tailed Worm-lizard *Aprasia parapuchella* and Golden Sun Moth *Synemon plana*."

"In regards to potential impacts, a monitoring plan and mitigation strategy to deter impacts on avifauna (birds and bats) should be considered, consistent with current AusWea protocols."

"As threatened species and their habitat are found and/or are likely to occur in the area, an assessment of significance under Part 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) is required."

"The site appears to overlap with a Wildlife Refuge, proclaimed under the *National Parks and Wildlife Act 1974*. Wildlife Refuges are dedicated for the purposes of: preserving, conserving, propagating and studying wildlife; conserving and studying natural environments, and creating simulated natural environments. The EIS must consider the potential impact of the proposal on these objectives."

"Any planned removal of extant forest/woodland or natural temperate grassland in a largely cleared landscape to provide "green" power should specifically be addressed in the EIS."

"A Planning Framework for natural ecosystems of the ACT and NSW Southern Tablelands (Fallding 2002), is a good literary source for modelled vegetation types and habitats for this area."

### 1.3.2 THE STUDY BRIEF

This report also addresses the following study brief prepared by the project manager, Connell Wagner PPI – Energy Section.

"The flora and fauna assessment of the wind farm will be required to be undertaken, for the potential wind turbine sites, substation site, cable easements and access tracks at a level to satisfy legislative requirements, requirements of the Department of Environment and Conservation and Director-General's Requirements for the EIS. The following services components should be included:

- Desktop studies including a review of relevant NPWS and National databases for species potentially present in the area and published and unpublished documents on threatened flora and fauna species, communities and populations, and their habitats, within the project areas.
- Undertake a site survey to identify species present within the vicinity of the project areas and significant vegetation community and habitat aspects. Specific issues to be addressed by the survey will include the locations of native grasses and any She-oak stands. The locations of any vegetation species or plant communities that could represent a constraint to the project should be shown on a map within the report.
- Undertake an assessment of the potential impact of the project on flora and fauna, including threatened species, communities and populations and their habitats. Particular attention should be given to:
  - aerial fauna and any potential impacts on them. Note that the site is located between Lake George and Lake Bathurst and may have waterbirds passing through the site between the two lakes. A spring survey for birds is required.
  - native grasses and any constraints that should be applied to the project.
- Carry out investigations to address the requirements of Section 5A of the *Environmental Planning and Assessment Act 1979* (EP&A); i.e. the "eight-part test", as applicable.
- Identify flora and fauna species and communities listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC), and the likely impact on these species and communities.

- Assess the relevance of SEPP 44 for the project, in particular, its applicability to the local shires, the likelihood of the presence of Koalas in the project area and the presence of feed trees for koalas in any areas that could be affected by construction works.
- Assess the current status of species, populations and communities identified on the schedules to the:
  - NSW *Threatened Species Conservation Act 1995*;
  - NSW *Fisheries Act 1994*; and
  - Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
- Advise whether a Species Impact Statement (SIS), as set out in the NSW *Threatened Species Conservation Act 1995* is required for the construction of the wind farm and the associated works.
- Provide advice on measures that could be incorporated into the project to mitigate any potential impacts.
- Preparation of draft and final reports on findings, including discussion of: methodology, data obtained and species lists, evaluation of findings, options for mitigation and any recommendations."

Accordingly, this report provides:

- a description of the vegetation communities and fauna habitats in the project area;
- lists of the flora and fauna species observed;
- a discussion of the threatened species and ecological communities known to occur in the local area;
- an assessment of the ecological impact of the project, including an assessment of the potential impact on species, populations and communities listed under the New South Wales *Threatened Species Conservation Act 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*;
- an assessment of the impact on Koala habitat, as required under *State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44)*; and
- a discussion of ecological constraints; and
- a discussion of what environmental protection measures could be taken to reduce the impact.

The NSW National Parks and Wildlife Service (Directorate Office, Queanbeyan) was contacted for comments on the project and, where relevant, their comments have been incorporated into this report.

## 2 THE PROJECT AREA

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The Capital Wind Farm project area is located between Tarago village and Bungendore, in the local government areas of Palerang Council and Goulburn Mulwaree Council. Tarago village is to the north, the Tarago to Braidwood Road is to the east, Bungendore is to the



south and the eastern foreshore of Lake George is to the west. The project area is shown on Figure 1.

Within the project area, there are four primary study areas; see Table 1. These are located around the groups of wind turbines on the seven farming properties, and include the access routes to the turbines, the proposed substation site, and the cable route along Mount Fairy Road.

The project area is covered by the Lake George, Sutton, Boro and Lake Bathurst 1:25,000 topographic maps. The topography is highly variable, with large areas of flat land, undulating land with gentle to moderately steep slopes, and sometimes rugged ridges.

Nearly all of the turbine sites are on high ridges, well above the surrounding area. Some of these ridges are narrow and rocky while others have cleared crests supporting grazing land; some have steep sides covered by woodland.

Most of the project area, however, is flat to gently sloping cleared land used for sheep grazing. The sheep country has mostly been pasture improved, and remnant woodland is virtually non-existent.

There are two main geological units in the project area. Ordovician sediments underlie the eastern and northern parts of the project area, while the central and western sections are on Devonian granites. The altitude of the project area ranges from 680m to 902m (Governors Hill).

The area is within the headwaters of three catchments with drainage as follows:

- to the west into Lake George;
- to the north east to the Mulwaree River and Wollondilly Catchment; and,
- to the south-east of the Kalbilli site into Reedy Creek that flows into the Shoalhaven River.

Most creeks were not flowing at the time of the survey and Lake George and Lake Bathurst were mostly free of standing water. Historical records show significant variations over time for water levels for these lakes.

The Southern Tablelands have been affected by extended drought conditions, but those conditions have eased during mid to late 2004 and extensive pasture growth was evident. Following the survey, in December 2004, small areas of standing water were evident in Lake George and Lake Bathurst. Weather during the survey was generally fine, although periods of rain were experienced.

## **3 FLORA**

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### **3.1 FLORA SURVEY METHOD**

#### Objectives of the Flora Study

Flora surveys were undertaken in the primary study areas from 25 to 27 October 2004 and from 9 to 11 November 2004.

The objectives of the surveys were:

- i. to classify and describe the vegetation communities in the project area, particularly in the primary study areas, where the various components of the wind farm are to be located;
- ii. to prepare a map showing the distribution of the vegetation communities in the primary study areas, particularly any vegetation communities of high conservation value;
- iii. to record as many as possible of the plant species occurring in the primary study areas; and
- iv. to search for threatened plant species and endangered ecological communities in the primary study areas, especially where they may be affected by the wind farm.

### Techniques

The vegetation communities in the primary study areas were classified on the basis of their structure and the name(s) of the dominant plant species in the tallest stratum. The approximate boundaries of the various communities were marked onto a copy of the site map in the field and/or an aerial photograph, and a vegetation map was prepared later.

The characteristic species in each community were recorded, and notes were made on the structure and condition of the vegetation. A general description of each community was then prepared. Information on the vegetation was collected elsewhere in the project area, as well, mainly to ascertain the general distributional patterns of the vegetation throughout the district.

All plant species observed during the survey were recorded, and a search for threatened plant species was undertaken in the primary study areas. The survey was fairly thorough, so most of the native plant species present would have been detected. However, additional species can always be found during longer surveys and in different seasons, especially on the Southern Tablelands, where many ground cover plants cannot be detected all year round. Furthermore, plant species diversity may have declined temporarily as a result of the recent drought.

### Plant Species Nomenclature

The plant species names in this report are the current names published by the National Herbarium of New South Wales in the *Flora of New South Wales* (Harden 1992-2002), with only occasional exceptions. Most of the common names are from the *Flora of New South Wales* (op. cit.) and *Australian Plant Genera* by Baines (1981).

## **3.2 DEFINITIONS**

The following definitions are in common use, and are generally well accepted by environmental scientists; most are from the report by Rehwinkel (1997).

*Grassland*: Vegetation dominated by grasses and forbs (i.e. a herb other than grasses, sedges and rushes), <10% tree and shrub cover.

*Native Grassland:* Grassland with >50% of vegetation cover composed of indigenous species, >50% of species are native, and minimum vegetation cover, alive or dead is >10%.

*Natural Grassland:* Native grasslands occurring in regions considered to have had <10% tree and shrub cover at the time of European settlement.

*Secondary Grassland:* A native grassland remaining after the removal or dieback of previously occurring trees and shrubs, where these occupy >10% cover.

*Native Pasture:* Grassland containing native and introduced species, where introduced species occupy >50%, but <75% of both cover and species present where pasture species have been mechanically sown.

*Exotic Grassland:* Grassland where >75% of species and cover are introduced.

*Woodland:* A plant community in which widely spaced and usually deep crowned trees dominate; usually a treed community with less than 30% canopy cover.

*Forest:* Usually a treed community with more than 30% canopy cover.

### 3.3 PLANT SPECIES

The plant species recorded during the survey have been listed in Appendix 1; native and exotic (introduced) species are recorded. The right hand column indicates on which property each species was recorded. Throughout this report, an asterisk (\*) indicates an exotic or introduced plant species.

### 3.4 VEGETATION OF THE PROJECT AREA

Large tracts of land throughout the project area were cleared many years ago, particularly on the lowlands of the broad valleys. As a result, most of the woodland remaining in the area is on steep, hilly terrain, and the remnants are separated by vast areas of cleared land grazed by sheep.

Four types of woodland occur in the project area: Yellow Box Woodland, Scribbly Gum - Peppermint Woodland, Manna Gum Forest/Woodland and Snow Gum Woodland; there are variations of these communities, as well. The communities have been summarised below, in Table 2.

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**Table 2**  
**Vegetation Communities of the Project Area**

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Community	Key Species	Distribution
Yellow Box Woodland	<i>Eucalyptus melliodora</i> <i>Eucalyptus bridgesiana</i>	Valley floors and adjoining lower slopes.
Scribbly Gum - Peppermint	<i>Eucalyptus rossii</i>	On ridges and steep slopes.

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Woodland	<i>Eucalyptus dives</i> <i>Eucalyptus mannifera</i>	
Manna Gum Forest/ Woodland	<i>Eucalyptus viminalis</i> <i>Eucalyptus pauciflora</i>	On deep sand, on the floor of the valleys.
Snow Gum Woodland	<i>Eucalyptus pauciflora</i>	Exposed ridges and slopes, and in some places on the valley floors.
Secondary Grassland	<i>Chrysocephalum apiculatum</i> <i>Themeda australis</i> <i>Leptorhynchos squamatus</i>	Small patches here and there, mainly where the paddocks have not been intensively grazed.
Native Pasture	<i>Stipa scabra</i> <i>Danthonia carphoides</i>	On gentle topography; i.e. on the sides of the valleys and on some ridges.
Exotic Grassland	<i>Hordeum*</i> spp. <i>Phalaris aquatica*</i> <i>Trifolium subterraneum*</i>	In most of the valleys, where pasture improved and fertilised.

The remnant native vegetation in the project area suggests that, prior to large scale clearing, Yellow Box *Eucalyptus melliodora* Woodland covered the floor of the valleys and the adjoining lower slopes, with Scribbly Gum *Eucalyptus rossii* - Peppermint *Eucalyptus dives* Woodland on the steep slopes and ridges. These are still the main communities in the project area.

Other communities are present, but have always had a more restricted distribution, with Snow Gum *Eucalyptus pauciflora* Woodland on exposed slopes and here and there on the valley floors, and Manna Gum *Eucalyptus viminalis* Woodland/Forest on deep sand in the valleys and in sheltered gullies on higher ground. Apple Box *Eucalyptus bridgesiana* occurs in the woodlands along creeks, drainage lines and the gullies. Patches of treeless temperate grassland may have occurred in some of the broad valleys, especially near Bungendore.

Now, however, exotic grassland covers most of the valley floors. Large areas have been pasture improved, i.e. sown with introduced grasses and other herbaceous plants, and/or ploughed and fertilised. Most of the cleared ridge crests support exotic grassland and native pasture. Secondary grassland occurs in a few places in the valleys; this was originally the understorey to Yellow Box Woodland. Good quality native grassland is rare in this district.

### 3.5 VEGETATION FOR THE TURBINE GROUPS

#### 3.5.1 KALBILLI GROUP

Most of the turbines in the Kalbilli Group are on a broad ridge that has been cleared. The ridge is covered by closely grazed grassland that is a mixture of exotic grassland and native pasture. Small patches are dominated by natives such as Speargrass *Stipa scabra*, but these are uncommon.

The proposed turbine sites in the far north of the Group and in the far south are close to or within woodland; see Figure 2. Access to the sites would be across cleared grazing land.

The woodland at the southern end of the Kalbilli Group is good quality; it has a natural structure and floristic composition, and has probably never been cleared. Some of the woodland is particularly impressive, containing a pure stand of large, old Scribbly Gum *Eucalyptus rossii* trees with many hollows. The other trees in this general area are Broad-leaved Peppermint *Eucalyptus dives* and Broad-leaved Hickory *Acacia falciformis*. Narrow-leaved Peppermint *Eucalyptus radiata*, which tends to be a larger tree, occurs in sheltered locations with deeper soils. The slope immediately to the south of the Group supports a stand of Black She-oak *Allocasuarina littoralis*; see Figure 8. The understorey of the woodland is quite bare and open in most places, which is typical of the woodland on the ridges in the project area.

The woodland in the vicinity of the turbine sites at the northern end of the property is composed of Broad-leaved Peppermint *Eucalyptus dives*, Brittle Gum *Eucalyptus mannifera*, Broad-leaved Hickory *Acacia falciformis* and Black She-oak *Allocasuarina littoralis*. In some places, there are dense stands of Black She-oak *Allocasuarina littoralis*; see Figure 8.

### **Ecological Constraints**

- The northern turbines and the most southerly turbine are near stands of Black She-oak, food trees for the threatened Glossy Black-Cockatoo. Evidence of the presence of this bird species was found in several locations, in the form of chewed cones discarded below the trees.
- A turbine is currently shown within a clearing on the edge of the stand of Scribbly Gum woodland in the south of the Group. This woodland is original and contains large old trees and has a high conservation value. Clearing this woodlands should be avoided.

### **3.5.2 HAMMONDS HILL AND ELLENDEN GROUPS**

The Hammonds Hill and Ellenden Groups are adjacent each other and extend from near the Tarago to Bungendore Road in the east all the way to Lake George in the west. Turbines are to be constructed in three locations: the Governors Hill - Red Hill area, the Hammonds Hill - Big Hill area, and on the north-eastern part of the property, between Hammonds Hill and the Tarago to Bungendore Road.

The sites contains several stands of woodland of moderate to high conservation value, including Yellow Box Woodland, which is an endangered ecological community. Figure 4 and Figure 5 shows the location of the woodland for the Hammonds Hill and Ellenden Groups, respectively.

#### Governors Hill - Red Hill

This area is virtually treeless, although there are stands of woodland on the slopes of Governors Hill ridge; see Figure 5. This woodland is dominated by Scribbly Gum *Eucalyptus rossii* and Broad-leaved Peppermint *Eucalyptus dives*, and contains occasional Hickory *Acacia implexa*. Patches of native plants grow among the rocks in the understorey and on the treeless ridge crest, species such as Silvertop Wallaby Grass *Chionochloa pallida*, Spiny-headed Mat-rush *Lomandra longifolia*, Mulga Fern *Cheilanthes sieberi*, Stinking Pennywort *Hydrocotyle laxiflora*, Poverty Raspwort *Gonocarpus tetragynus* and Prickly Starwort *Stellaria pungens*. The Red Hill area is dominated by exotic pasture species.

#### Hammonds Hill – Big Hill

Most of the vegetation on the ridge is native pasture or secondary grassland, a relict of the woodland that once occurred on the ridge. The ground is strewn with small granite boulders and outcrops. Short Wallaby Grass *Danthonia carphoides*, Hairy Panic *Panicum effusum*, Wattle Mat-rush *Lomandra filiformis*, Fuzzy New Holland Daisy *Vittadinia cuneata*, Stinking Pennywort *Hydrocotyle laxiflora*, Flatweed *Hypochaeris radiata*\*, Subterranean Clover *Trifolium subterranean*\* and Capeweed *Arctotheca calendula*\* are common here.

The woodland on the upper slopes of the ridge, especially on the western fall of the main ridge, is dominated by Scribbly Gum *Eucalyptus rossii* and Broad-leaved Peppermint *Eucalyptus dives*, with occasional Hickory Wattle *Acacia implexa*, Broad-leaved Hickory *Acacia falciformis*, Black Wattle *Acacia mearnsii* and Snow Gum *Eucalyptus pauciflora*. Black She-oak *Allocasuarina littoralis* is occasional.

Woodland occurs on the ridge south east of Currandooley Homestead, mostly Scribbly Gum *Eucalyptus rossii* Woodland containing scattered Black She-oak *Allocasuarina littoralis* and Drooping She-oak *Allocasuarina verticillata*; see Figure 4. Native grassland occurs as an understorey to the woodland, and on the indicative turbine sites. About one kilometre south of Currandooley the deep sandy soil of the valley supports a tall forest/woodland of Manna Gum *Eucalyptus viminalis*. It is understood that final siting of turbines will avoid clearing woodland vegetation in this area.

#### West of Tarago to Bungendore Road, North-eastern Corner of Hammonds Hill Group

There is a stand of modified Yellow Box Woodland and a patch of secondary grassland adjacent to Tarago to Bungendore Road, and a stand of Scribbly Gum - Peppermint Woodland to the north, in the north-eastern corner of the site; see Figure 4. Around the woodland, there are stands of Black Wattle *Acacia mearnsii*. The Yellow Box Woodland contains several large old Yellow Box *Eucalyptus melliodora* trees and secondary grassland with fairly high native species diversity; see survey sheets TO01 and TO02 in Appendix 2.

The turbine sites are covered by exotic grassland, with patches of native pasture. There are stands of Snow Gum *Eucalyptus pauciflora* Woodland to the west, but these are well away from the turbine sites.

### **Ecological Constraints**

#### Governors Hill – Red Hill

- The large granite outcrops in this area have a very high habitat value for reptiles. This is the main area of fauna habitat on this part of the site; in the surrounding area, there is little to attract native fauna.

### Hammonds Hill – Big Hill

- The presence of good quality woodland is an ecological constraint. Some of the turbine sites are within woodland, others are near woodland.

### Tarago to Bungendore Road, North-eastern Corner of Hammonds Hill Group

- Access off Tarago to Bungendore Road to the to the Hammonds Hill Group would involve passing through Yellow Box Woodland (mainly secondary grassland), an endangered ecological community.

### **3.5.3 GROSES HILL GROUP**

The turbine sites for the Groses Hill Group are on exposed ridges used for grazing; see Figure 6. Most of the paddocks have been pasture improved. There are no stands of native trees, other than a few Snow Gums *Eucalyptus pauciflora* and a Broad-leaved Peppermint *Eucalyptus dives* growing on the low knoll at the eastern end of the Limon property. Rows of pines and some native trees have been planted in a few places.

Patches of native pasture occur here and there, but native plants are generally scarce or altogether absent. The species observed in the paddocks include Barley Grass *Hordeum*\* sp., Subterranean Clover *Trifolium subterranean*\*, Capeweed *Arctotheca calendula*\*, Sheep Sorell *Acetosella vulgaris*\* and Scotch Thistle *Onopordum acanthium*\*. The native grassland species in some places on the western parts of the properties include Common Everlasting *Chryscephalum apiculaum*, Short Wallaby Grass *Danthonia carphoides*, Tall Speargrass *Stipa bigeniculata* and Swamp Dock *Rumex brownii*.

#### **Ecological Constraints**

- No ecological constraints were identified. There is no vegetation or habitat of particular conservation value on or near the turbine sites.

### **3.6 VEGETATION OF THE SUBSTATION SITE**

The proposed substation site is located near the high voltage transmission line, in a valley about 1.3 km south-east of Big Hill (Osborne Trig Station). The site supports treeless grassland, a mixture of exotic grassland and native pasture grazed low to the ground. Most of the natives in the grassland are species that commonly occur in grazing pastures; see survey sheets TO04 and TO05 in Appendix 2. The site was probably originally covered by woodland.

#### **Ecological Constraints**

- No ecological constraints were identified; the conservation value of the grassland is low.

### **3.7 VEGETATION OF THE OTHER CABLE ROUTES**

#### Internal Cable Routes

There are numerous cable connections within the wind farm sites to connect the turbines to the local cable system and then to the central cable. In most cases, these routes are across

grazing paddocks and mostly would logically be located along the access roads to the turbines. These routes were not finalised or pegged at the time of our surveys. To ensure that no inadvertent environmental impact occurs, an ecologist should be involved during the route selection process.

#### Kalbilli along Mount Fairy Road to Substation Site

Most of this route is along Mount Fairy Road, from the northern edge of the Kalbilli Group in the east to the junction with the Tarago to Bungendore Road in the west. Most of the vegetation along the road is exotic grassland, with areas of native pasture and occasional patches of native grassland dominated by Kangaroo Grass *Themeda australis*. No areas of good quality grassland were found. Kangaroo Grass often invades disturbed sites and is not necessarily indicative of good quality native grassland. The patches of native grassland along the road have fairly low species diversity.

The route within Kalbilli property has not been inspected in detail as it was not known at the time of the field studies. There is woodland in the Kalbilli property that contains Black-She-oak trees. Once the route is finalised, a botanist should inspect this route.

#### **Ecological Constraints**

- No significant vegetation or habitat was found. Appropriate measures should be implemented at watercourse crossings and on steep slopes to minimise the impact on these areas.

## **4 FAUNA**

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### **4.1 FAUNA SURVEY METHOD**

#### Objectives of the Fauna Study

Fauna surveys were undertaken on 25 to 27 October 2004 and 9 to 11 November 2004. The weather during the surveys was generally fine, although periods of rain were experienced.

The surveys concentrated on the vertebrate fauna; i.e. mammals, birds, frogs and reptiles. Spring is the ideal season for fauna surveys on the Southern Tablelands, because animals are active and most of the migratory species have arrived.

The objectives of the surveys were:

- to detect and record as many as possible of the vertebrate fauna species present;
- to carry out appropriate targeted surveys to assess the potential impact of the wind farm on particular fauna groups, namely woodland birds, birds of prey, waterfowl and other birds that flock, and threatened species;
- to describe the fauna habitats in the project area, particularly in the primary study areas; and
- to assess the potential for the area to support threatened fauna.

Mammals were identified by sight, as well as by interpreting any distinctive calls and other conclusive evidence of their presence. The survey techniques included incidental



sightings and a ground search for scats, tracks, diggings and other signs of mammal presence (Triggs 1996). A spotlight was used to detect nocturnal fauna, particularly arboreal mammals.

Birds were identified by sight and by interpreting calls. Observations were made throughout the whole study period, and all habitat types were investigated.

Reptile searches were conducted at the turbine sites, particularly in rocky locations. Rocks, logs and debris were moved in the search for fauna, and then replaced. The number of items moved was recorded. Potential basking sites were investigated, especially near water and on bare surfaces.

Amphibians were usually identified by interpreting their characteristic calls. Moist areas and habitat niches were also searched, especially under rocks, wood and debris.

A literature review was also undertaken, in an attempt to locate all relevant information on the fauna of the area. This included published environmental studies and the NSW Wildlife Atlas maintained by the Department of Environment and Conservation (DEC).

### Targeted Surveys

Targeted surveys and investigations were undertaken for the groups of animals listed above; the following methods were used.

### Woodland Birds

Two types of surveys were conducted for woodland birds. In lowland woodlands, one hour searches were made at the appropriate time of day; i.e. early to mid-morning and late afternoon. All species were recorded on a survey sheet, along with details of the locality and environs. The aim of these surveys was to obtain information on the species in the lowland woodlands.

Surveys were also conducted near the turbine sites on the ridges. All birds seen or heard within about 100 metres of the ridges were recorded, with an estimate of the height at which the birds were flying. The aim of these surveys was to obtain information on the species present in the woodlands on the ridges, and the height at which the birds are active. This data could then be related to the height of the wind turbine blades.

### Birds of Prey

All sightings of birds of prey were recorded on a map of the project area. Searches were conducted in the vicinity of the turbine sites for large stick nests likely to be used by birds of prey. This information was collected because the impact of wind turbines on birds of prey has been an important issue for some wind farms overseas.

### Waterfowl

Records were kept on the waterfowl observed in the project area, particularly large flocks of waterfowl. The potential impact of wind farms on waterfowl has received considerable attention, particularly overseas. A previous study by URS (2004) indicated supposed flight paths for water birds between Lake George and Lake Bathurst through the shallow valleys to the north of the project area.

### Other Flock Birds

Records were kept of flocking birds observed in the project area, particularly birds flying high above the ground.

### Threatened Species

Threatened woodland birds have been recorded in the surrounding areas on previous occasions, and are expected to occur in some parts of the project area. Searches were undertaken for these species using the above methods, and the habitat was assessed for its potential to support these species.

### Fauna Species Nomenclature

The fauna species nomenclature in this report is based on the Australian Museum's *The Mammals of Australia* (Strahan 1995), *The Taxonomy and Species of Birds of Australia and its Territories* (Christidis & Boles 1994) and *Reptiles and Amphibians of Australia* (Cogger 1992).

## **4.2 FAUNA SPECIES**

The vertebrate fauna species recorded during the surveys have been listed in Appendix 3, together with species listed in other relevant studies and in the NSW Wildlife Atlas. The list differentiates between the various properties in the project area, and between the results of this study and studies by others.

## **4.3 FAUNA HABITAT**

The habitats within the project area are typical of the grazing country on the Southern Tablelands of New South Wales. Most of the woodland that once occurred on the lowlands has been cleared, so the lowlands now support grasslands; these range from exotic grassland to native pasture and, in some places, secondary grassland. There are remnant stands of trees and isolated old trees, but few large stands of lowland woodland.

Most of the woodland in the project area is on the steep, hilly land in the east, and on the western slopes of the Hammonds Hill/Bill Hill ridge line. The woodland on the ridges is quite different from the woodland of the lowlands. The woodland on the ridges contains species such as Scribbly Gum *Eucalyptus rossii*, Silvertop Ash *Eucalyptus sieberi*, Broad-leaved Peppermint *Eucalyptus dives* and Brittle Gum *Eucalyptus mannifera*, with Narrow-leaved Peppermint *Eucalyptus radiata* and Manna Gum *Eucalyptus viminalis* in some sheltered locations, while the lowland woodland contains trees such as Yellow Box *Eucalyptus melliodora*, Apple Box *Eucalyptus bridgesiana*, Snow Gum *Eucalyptus pauciflora* and Manna Gum *Eucalyptus viminalis*. Large trees mainly occur in the Yellow Box country

on the floor and fringes of large valleys. The woodland on the exposed ridges is often quite short, some only about four metres tall, and is composed of small trees heavily damaged by strong winds.

The riparian habitats and farm dams in the project area, which are mostly on the valley floors, provide small areas of wetland habitat. Wetlands are not a major habitat type in the project area, although Lake George, when full of water, is a major regional wetland. Lake George is also a wetland of national significance.

Most of the wind farm sites contain rock outcrops; the larger rocky areas provide good quality habitat for reptiles.

#### 4.4 SURVEY RESULTS; TARGETED SURVEYS

The fauna survey program included targeted surveys of several sites and fauna groups (see Section 4.1), mainly birds that may be particularly prone to turbine blade-strike. The results of these surveys have been provided below.

##### Woodland Bird Surveys at Selected Turbine Sites

Table 3 summarises the results of the bird surveys in the vicinity of the turbine sites; the raw data sheets have been presented in Appendix 4. Seventy-nine (79%) percent of the birds observed were active less than 10 metres from ground level and 90% were seen below 20 metres. Only 10 percent were above 20 metres and few were observed over 50 metres above the ground. This suggests that about 10% of birds use the air space around the turbine blades; at their lowest point, the blades are 35 metres above the ground. The tallest trees in the vicinity of the turbines are seldom more than 10 metres tall, so it is not surprising that most birds are found below this canopy height.

**Table 3**  
**Summary of Bird Surveys near the Turbine Groups**

Locality Survey No.	No. of Birds Observed					
	<5m	5-10m	10-20m	20-50m	>50m	
<b>Kalbilli Group</b>						
1	6	7	3	1	0	
2	11	5	2	1	0	
3	11	19	3	6	0	
<b>Hammonds Hill &amp; Ellenden Groups</b>						
1	4	13	5	1	3	
2	9	12	4	2	0	
3	12	4	2	0	3	
<b>Ridges to the northeast of the Capital Wind Farm</b>						
1	14	4	2	2	0	
2	5	10	4	2	0	
3	18	6	0	0	0	
<b>All Sites</b>	<b>90 (42%)</b>	<b>80 (37%)</b>	<b>25 (11%)</b>	<b>15 (7%)</b>	<b>6 (3%)</b>	<b>216 100%</b>

Most of the birds recorded above 20 metres were Australian Raven, Sulphur-crested Cockatoo, Australian Magpie and birds of prey.

#### Woodland Bird Surveys in Good Quality Yellow Box Woodland

Two sites on the eastern edge of the Hammonds Hill Group near the Tarago to Bungendore Road were surveyed to identify the bird species occurring in what is probably the best quality woodland in the project area. Five surveys were undertaken in two locations; see survey sheets in Appendix 4.

The survey results suggest that intact lowland woodland, i.e. the habitat to the southeast of the Hammonds Hill East Group of turbines, supports a diverse range of birds and is of high conservation value.

#### Broad Scale Surveys of Birds of Prey

During the survey, five species of diurnal birds of prey were observed in the project area. Another three species have previously been recorded in the project area. The species recorded have been listed below:

Brown Falcon	<i>Falco berigora</i>
Brown Goshawk	<i>Accipiter fasciatus</i>
Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>
Little Eagle	<i>Hieraaetus morphnoides</i>
Nankeen Kestrel	<i>Falco cenchroides</i>
Peregrine Falcon	<i>Falco peregrinus</i>
Wedge-tailed Eagle	<i>Aquila audax</i>
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i> .

Our sightings have been marked on Figure 7. No real patterns of occurrence can be identified, although the Wedge-tailed Eagle was observed only around the high ridges. Large stick nests were found in several locations, in woodland and in pine trees. Breeding by the above species was not confirmed, although it no doubt occurs in the project area.

#### Surveys of Local Wetlands for Waterfowl

Except for the large dam on the Woodlawn Mine site, the wetlands in the project area are small. Lake George is nearby, to the west, but is seldom filled with water. Observations of waterfowl in the project area were largely restricted to small numbers of common and widespread ducks on farm dams, such as the Pacific Black Duck, Grey Teal and Australian Wood Duck. The largest number of waterfowl observed was a flock of 24 Australian Shelducks on a medium sized farm dam on the Osborne property, to the west of Governors Hill.

It has been suggested that there are waterfowl flight paths between Lake George and Lake Bathurst. This would be the case only when both lakes hold water, which is a rare event. The EIS for the Woodlawn Mine (URS 2004) contained a map showing supposed waterfowl flight paths between the above lakes. The maps suggest that the waterfowl would move along the valleys to the north of the project area, which is a reasonable assumption.

### Other Birds that Flock

Yellow-tailed Black-Cockatoos, Sulphur-crested Cockatoos, Australian Ravens and Little Ravens were also seen in flocks. The occurrence of the flocks was random, except that the Yellow-tailed Black-Cockatoos were mainly seen in and around pine plantations.

At certain times of year, large flocks of migrating honeyeaters move northwards (autumn) and southwards (spring), and White-throated Needle-tails visit the region in summer. Honeyeater move through the tree canopy or just above the trees, although night-time movements are little known. Needle-tails fly above the tree canopy, often well above the canopy.

### Reptile Searches

Searches for reptiles were undertaken mainly in rocky terrain on the turbine sites. Roadkills were also inspected, to identify species that otherwise may not have been found. The results of the reptile surveys have been presented below, in Table 4. Species previously recorded in the project area have been included in the list in Appendix 3.

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**Table 4**  
**Results of Reptile Surveys**

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Species		Method of recording
Blotched Blue-tongued Lizard	<i>Tiliqua nigrolutea</i>	Observed; roadkill.
Copper-tailed Skink	<i>Ctenotus taeniolatus</i>	Observed.
Eastern Blue-tongued Lizard	<i>Tiliqua scincoides</i>	Observed.
Eastern Brown Snake	<i>Pseudonaja textilis</i>	Observed; roadkill.
Jacky Lizard	<i>Amphibolurus muricatus</i>	Observed.
Long-necked Tortoise	<i>Chelodina longicollis</i>	Observed; roadkill.
Three-toed Skink	<i>Hemiergis decresiensis</i>	Observed.

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## **5 CONSERVATION VALUES**

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### **5.1 THREATENED FLORA**

Threatened plant species are listed on schedules under the New South Wales *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Under the TSC Act, they are classified either as “endangered” (Schedule 1, Part 1), “vulnerable” (Schedule 2) or “presumed extinct” (Schedule 1, Part 4). Under the EPBC Act, they are classified as “extinct”, “critically endangered”, “endangered” or “vulnerable”.

Information on the occurrence of threatened plant species in New South Wales can be obtained from the NSW Wildlife Atlas, which is maintained by the Department of Environment and Conservation (DEC). Correspondence from the DEC (see Section 1.3) listed several threatened flora species thought to occur in the project area. The report by the National Parks and Wildlife Service entitled *A Planning Framework for Natural Ecosystems of the Act and NSW Southern Tablelands* (Fallding 2002) is also a useful reference.

Based on these sources of information, a list of threatened plant species with potential to occur in the project area was prepared, see Table 5.

Species	Growth Habit	Habitat	TSC Act <sup>+</sup>	EPBC Act <sup>+</sup>
<i>Diurus aequalis</i> Buttercup Double-tail	Ground orchid	Woodland/ forest, grassy understorey	E	V
<i>Dodonaea procumbens</i> Creeping Hop Bush	Prostrate shrub	Woodland, sandy soils	V	V
<i>Swainsona sericea</i> Silky Swainson-pea	Small herb	Native grassland	V	-

<sup>+</sup> V = vulnerable, E = endangered, - = not listed.

No threatened plant species were found on any of the site in the project area. None are likely to occur on cleared sites and in areas that have been heavily grazed and/or pasture improved, but the occurrence of threatened species in stands of good quality woodland or native grassland cannot be ruled out on the basis of a single survey.

## 5.2 THREATENED FAUNA

Threatened fauna species are listed under the TSC Act and EPBC Act in a similar way to flora species; see Section 5.1. Information on the occurrence of threatened fauna species in the local area can be ascertained from the NSW Wildlife Atlas and previous environmental studies in the area. The DEC's correspondence (Section 1.3), lists several threatened fauna species thought to occur in the project area. *A Planning Framework for Natural Ecosystems of the Act and NSW Southern Tablelands* (Fallding 2002) was also a useful reference.

Based on these sources of information, a list of the threatened fauna species was prepared for the project area; see Table 6. The potential for these species to occur in the project area has been assessed below, in Table 6. Species recorded in the project area or likely to occur there have been discussed below the table. The list does not include the threatened wetland species that occasionally occur on Lake George and Lake Bathurst when they are holding water.

Species	TSC Act <sup>+</sup>	EPBC Act <sup>+</sup>	Potential to Occur in the Project Area (Low, Medium, High, Recorded)
<b>Mammals</b>			
Koala <i>Phascolarctos cinereus</i>	V	-	Recorded. The Wildlife Atlas contains records from near the project area.

## Birds

Brown Treecreeper <i>Climacteris picumnus</i>	V	-	Medium. The woodlands in the project area provide potential habitat, although there are no local records; the species has become very rare in this region.
Diamond Firetail <i>Stagonopleura guttata</i>	V	-	High. Diamond Firetails probably occur in the area; there are records from Bungendore.
Freckled Duck <i>Stictonetta naevosa</i>	V	-	Recorded. Occasionally recorded on Lake George and Lake Bathurst.
Glossy Black-Cockatoo <i>Calyptrorhynchus lathami</i>	V	-	Recorded. Evidence of the species was found on the Kalbilli site, and the species was recently recorded on the Woodlawn Mine land.
Hooded Robin <i>Melanodryas cucullate</i>	V	-	High. Hooded Robins probably occur in the woodlands of the project area, although there have been no local sightings.
Magpie Goose <i>Anseranas semipalmate</i>	V	-	Low. There is a record from Lake Bathurst, but Magpie Geese are very rare in this area.
Regent Honeyeater <i>Xanthomyza phrygia</i>	E	E	Medium. Regent Honeyeaters could occur in the project area when the eucalypts are flowering, particularly the Yellow Box trees. They are rare in this region.
Speckled Warbler <i>Chthonicola sagittata</i>	V	-	High. Speckled Warblers probably occur in the woodlands of the project area, although there have apparently been no local records.

## Reptiles

Little Whip Snake <i>Suta flagellum</i>	V	-	Recorded. The Wildlife Atlas contains records from the project area and areas nearby.
Striped Legless Lizard <i>Delmar impar</i>	V	V	Low. There is no natural temperate grassland for this species on the development sites.
Pink-tailed Worm-lizard <i>Aprasia parapuchella</i>	V	V	Moderate. Suitable habitat appears to be present, but there are no records from the local area.
Grassland Earless Dragon <i>Tympanocryptus lineata pinguicollis</i>	E	E	Low. There is no natural temperate grassland for this species on the development sites.

## Amphibians

Green and Golden Bell Frog E V Recorded. The Wildlife Atlas contains a record dated 1985. The species has virtually disappeared from this region since the 1980s.  
*Litoria aurea*

### Invertebrates

Golden Sun Moth E CE Low. There is no natural temperate grassland on the development sites.  
*Synemon plana*

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+ V = vulnerable; E = endangered; CE = critically endangered; - = not listed.

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## **Species Recorded in the Project Area**

### Koala

*Phascolarctos cinereus*

Habitat: The Koala inhabits eucalypt forest and woodland, preferring stands occurring on higher nutrient soils that contain preferred food tree species. Koalas now live in marginal habitat because so much prime habitat has been cleared.

Local Records: The Wildlife Atlas contains records from sites between Tarago and Woodlawn Mine. There are other records from the Shoalhaven River Valley towards Braidwood.

Occurrence in the Project Area: The records near Tarago are near the project area. There are numerous stands of Manna Gum *Eucalyptus viminalis* in the project area, as well as other known Koala food trees.

### Glossy Black-Cockatoo

*Calyptorhynchus lathami*

Habitat: Glossy Black-Cockatoos live in mature eucalypt forest and woodland containing stands of mature casuarinas, which are their primary source of food. The species prefers mature forest, because only mature forest contains tall old eucalypts with hollows for nesting and casuarina fruit in sufficient quantities to sustain whole populations of Cockatoos. Glossy Black-Cockatoos feed almost exclusively on the seeds of casuarina trees, but select only particular species; some species appear to be unsuitable. Black She-oak *Allocasuarina littoralis* is the dominant food tree in southern New South Wales.

Local Records: Glossy Black-Cockatoos have been recorded in the Shoalhaven River Valley north of Braidwood; there are apparently no other records.

Occurrence in the Project Area: The species has been recorded on the Woodlawn Mine site (URS 2004) and evidence in the form of chewed cones was found on the Kalbilli site, where there are large stands of Black She-oak; see Figure 8. Glossy Black-Cockatoo would be unlikely to fly far above the tree canopy.

### Little Whip Snake

*Suta flagellum*

Habitat: The Little Whip Snake inhabits "grassland and woodland on well drained hillsides" (NPWS 1999) where they are usually found under rocks and logs.

Local Records: The Wildlife Atlas contains records from sites to the east of Bungendore.

Occurrence in the Project Area: The Wildlife Atlas contains records from near Mount Fairy.

## **Species expected to occur in the Project Area**

### Brown Treecreeper

*Climacteris picumnus*



Habitat: This species occurs in woodland and forest, particularly where there is abundant dead timber on the ground. The species is mainly a ground dweller.

Local Records: There are apparently no local records; it has become very rare in this area.

Occurrence in the Project Area: The woodlands in the project area provide potential habitat for the species. This species is a ground bird and would not be likely to be active above the tree canopy.

#### Diamond Firetail

*Stagonopleura guttata*

Habitat: The Diamond Firetail inhabits "eucalypt woodland, forest and mallee where there is a grassy understorey" (NSW Scientific Committee 2001).

Local Records: There are records from Bungendore and other sites in the region; in some places, it is relatively common.

Occurrence in the Project Area: Although the species has not been recorded, the Diamond Firetails probably occur in the project area. This species is a ground bird and would not be likely to be active above the tree canopy.

#### Hooded Robin

*Melanodryas cucullate*

Habitat: The NSW Scientific Committee (2001) noted that the species occupies "a wide range of Eucalypt woodlands, *Acacia* shrublands and open forests. In temperate woodlands, the species favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover".

Local Records: There are apparently no local records from the local area, although the species has been recorded in the broader region, e.g. in the Coogong area, south of Queanbeyan.

Occurrence in the Project Area: There have been no sightings in the project area, but the species is expected to occur in lowland woodlands. This species is a ground bird and would not be likely to be active above the tree canopy.

#### Regent Honeyeater

*Xanthomyza phrygia*

Habitat: The Regent Honeyeater is highly nomadic. It mainly occurs in "temperate eucalypt woodland and open forest, including forest edges, wooded farmland and urban areas with mature trees" (Garnett 1992). According to Webster and Menkhorst (1992), its favoured trees are Red Ironbark *Eucalyptus sideroxylon*, White Box *Eucalyptus albens* and Yellow Box *Eucalyptus melliodora*, and the birds prefer areas with large trees, many flowering trees and a tall shrub layer.

Local Records: There are records of the Regent Honeyeater from the region although there are apparently no local records.

Occurrence in the Project Area: This honeyeater could turn up in any patch of trees in the project area. The stands of Yellow Box *Eucalyptus melliodora* when they are flowering are the most likely location. This species forages in the tree canopy; it would not be likely to be active well above the tree canopy.

#### Speckled Warbler

*Chthonicola sagittata*

Habitat: "Speckled Warblers inhabit woodlands with a grassy understorey, often on ridges or gullies. The species is sedentary, living in pairs or trios and nests on the ground in grass tussocks, dense litter and fallen branches" (NSW Scientific Committee 2001).

Local Records: This species is relatively common in the region although there are apparently no local records.

Occurrence in the Project Area: Speckled Warblers probably occur in woodlands in the project area, even though there have apparently been no local records. This species is a ground bird and would not be likely to be active above the tree canopy.

### **5.3 MIGRATORY SPECIES**

In addition to threatened species, the EPBC Act allows for the listing of internationally protected migratory species, i.e. species listed under the Japan - Australia Migratory Bird Agreement (JAMBA), the China - Australia Migratory Bird Agreement (CAMBA) and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Many common Australian bird species have been listed as internationally protected migratory species under the EPBC Act, including all waders, ducks and diurnal birds of prey. Many bird species recorded in and/or adjacent to the project area are internationally protected migratory species, including the Australian Wood Duck, Pacific Black Duck, Australian Shelduck, Nankeen Kestrel, Brown Falcon and Wedge-tailed Eagle.

### **5.4 ENDANGERED POPULATIONS**

Endangered populations are listed under the TSC Act (Schedule 1, Part 2). No endangered populations have been declared in or near the project area.

### **5.5 ENDANGERED ECOLOGICAL COMMUNITIES**

Endangered ecological communities are listed under the TSC Act (Schedule 1, Part 3) and the EPBC Act. Yellow Box Woodland is the only such community in the project area (see Section 3.3 and below).

Natural Temperate Grassland, the nationally threatened community, was not found in any of the proposed development areas.

#### Yellow Box Woodland

This woodland is a part of the White Box - Yellow Box - Blakely's Red Gum Woodland complex that has been listed as an endangered ecological community under the TSC Act. This community has also been listed under the EPBC Act, as part of the Grassy White Box Woodlands complex.

Appendix 5 provides a copy of the NSW Scientific Committee's Final Determination to list White Box - Yellow Box - Blakely's Red Gum Woodland as an endangered ecological community; the Final Determination defines the community under the Act. Some sites that are treeless or almost treeless still form part of this endangered community, a point made clear in Clause 4 of the Final Determination. Where trees are absent and only the understorey remains, the community is called "secondary grassland"; see Section 3.2.

Clearing, grazing and pasture improvement have led to the demise of Yellow Box Woodland which once occurred extensively on the valley floors and lower slopes in this district. Most of it has disappeared from the project area, but there are some good examples of the woodland in some places and many areas of secondary grassland.

The primary study areas were investigated for examples of the Yellow Box Woodland community, and an assessment was made of the condition of the remnants; these have been briefly discussed below.

#### Yellow Box Woodland near Tarago to Bungendore Road

This woodland near the Tarago to Bungendore Road is in very good condition; it contains many old trees, sapling growth, a good native grassland understorey and few weeds. Figure 4 shows the location of this woodland. Most of the stand is dominated by Yellow Box *Eucalyptus melliodora* and Snow Gum *Eucalyptus pauciflora* and Manna Gum *Eucalyptus viminalis* are common in some places. Apple Box *Eucalyptus bridgesiana* occurs here and there, usually near drainage lines. See survey sheets TO03 and TO06 in Appendix 2.

#### Secondary Grassland, North-eastern corner of the Osborne Property

This area supports secondary grassland and scattered Yellow Box and other native trees. The grassland is quite rich in native species, as the vegetation survey sheets show. This is a reasonably good example of secondary grassland which is part of the endangered ecological community. The location of this area is shown on Figure 4. See survey sheets TO01 and TO02 in Appendix 2.

#### Natural Temperate Grassland

Natural Temperate Grassland on the Southern Tablelands of NSW and the Australian Capital Territory is listed as an endangered ecological community under the EPBC Act, but not the TSC Act. The community is dominated by moderately tall (25-50 cm) to tall (50 cm-1 m), dense to open tussock grasses with up to 70% of species being forbs (i.e. a herb other than grasses, sedges and rushes). The community may be treeless or contain up to 10% cover of trees, shrubs or sedges. On the Southern Tablelands, natural temperate grasslands are at altitudes of 560-1200 metres in valleys influenced by cold air drainage, and on broad plains. These grasslands occur southwards from the Abercrombie River to the Victorian Border, from Boorowa and Jindabyne to the west and Goulburn to Braidwood and Bombala to the east.

No Natural Temperate Grassland was found in the project area; although the community may have once occurred on the lower valley floors, mainly in the southern part of the project area towards Bungendore and Lake George. The grassland in these areas today does not satisfy the definition of native grassland, at least not on the proposed development sites surveyed.

#### Other Plant Communities of Concern

The Department of Environment and Conservation (DEC) (see Section 1.3.1) suggested that Snow Gum *Eucalyptus pauciflora* - Peppermint *Eucalyptus dives* - Ribbon Gum *Eucalyptus viminalis* Woodland may occur in the area. The DEC noted that this is a "regionally declining vegetation community" that is being considered for inclusion in the

*Threatened Species Conservation Act 1995* as an endangered ecological community. As at 10 December 2004, the community had not received a Preliminary Determination from the NSW Scientific Community.

Enquiries at the DEC in Queanbeyan revealed that the community is "a low-lying [lowland] woodland community that is dominated by either *E. pauciflora*, *E. rubida* and sub dominance of *E. viminalis*, with a grassy ground layer which may or may not be forb-rich, or the grassy ground layer as a secondary grass layer derived from the clearing of that woodland". No further information could be obtained from the Department.

Stands of *Eucalyptus pauciflora*, with *Eucalyptus dives* and/or *Eucalyptus viminalis*, occur in the south-eastern part of the Hammonds Hill site, amongst the Yellow Box Woodland mapped on Figure 4.

## 6 IMPACT ASSESSMENT

### 6.1 IMPACT ON NATIVE VEGETATION AND FAUNA HABITAT

Many of the proposed turbine sites, the substation site and the majority of the proposed cable routes are on cleared land with a long history of grazing. However, many of the turbine sites are in or near woodland, and this places constraints on developments in some areas.

Some clearing would be required to install some of the turbines, and to link them together with cables and access roads. This can be largely avoided by selecting slightly different turbine sites at the detailed design stage. The impact on the woodland and rock outcrops in some places would be considerable.

The ecological impact of the wind farm on each turbine site has been summarised below, in Table 7; the impact assessment is based on the assumption that the recommendations of this report will be adopted; see Section 7.

**Table 7**  
**Summary of Impact on Fauna Habitat**

Location	Turbine Groups	Woodland to be Cleared	Disturbance to Major Rock Outcrops	Potential for Significant Impact <sup>3</sup>
Kalbilli	Southern group	Yes <sup>1</sup>	No	Yes
Kalbilli	Northern group	No	No	No
Hammonds Hill	Governors Hill - Red Hill	No	Yes	Yes
Hammonds Hill	Hammonds Hill - Big Hill	Yes	No	Yes <sup>2</sup>
Hammonds Hill	Near Tarago Road	No	No	No
Groses Hill	All sites	No	No	No
Other	Substation Site	No	No	No
	Other Cable Routes	No	No	No

1. May include Black She-oak habitat for threatened Glossy Black-Cockatoos.

2. More information required re possible lopping of woodland near turbines.
  3. Potential for Significant Impact is assessed without consideration of mitigation measures.
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## 6.2 IMPACT OF BLADE-STRIKE ON BIRDS

Investigations of wind farms in Australia and overseas have identified various bird species and groups of birds as potential "at risk" from turbine blade-strike. The birds potentially at most risk from blade-strike are:

- wetland birds that form large flocks;
- birds of prey; and
- species that flock and fly above the tree canopy.

All of these groups are represented in the Tarago Study Area. A brief discussion of these groups was provided in Section 4.4.

The incidence of turbine blade-strike on birds and bats is often cited as a potential impact of wind farms. Although most of the available literature relating to this issue is based on overseas studies, the principles and findings may be applicable to Australian conditions, although the data have not been assembled to validate this. The overseas studies have found that the magnitude of the impact on birds is strongly influenced by the physical characteristics of the site, particularly the type of habitat on the site and in the surrounding area (Jacobs 1994; Curry 1994; Still, Little, Lawrence & Carver 1994; Harrison 1996).

The greatest impact seems to occur near large wetlands and at sites on important migration routes, locations where large flocks of birds are regularly present. One such location was in California, where birds of prey were affected in a mountain pass where they congregated. An early study also found that an impact on birds of prey was at least partly due to the lattice framework construction of the towers, which provided perching sites for the birds. Modern towers, however, are enclosed and have no perching sites. It should also be appreciated that wind farms in America, with up to 5,000 turbines, are much larger than those currently being considered in Australia.

So far, the Australian data suggest that wind farms have little impact on native birds. No dead or injured birds were found during surveys at selected turbine sites at the Crookwell Wind Farm (PPI Environmental Services 1999); nor did bat population studies before and after installation of the wind farm indicate that any bats had been killed by blade-strike (Richards 1999). No carcasses were found below the turbines during a monitoring study between August 1998 and January 1999. A study at the Woolnorth Wind Farm in Tasmania found that 20 birds were killed by collision with turbines during the first 14 months of operation (quoted in URS 2004). The AWEA (2002) cited several studies that found mortality from wind farms in Australia to be very low.

The following points are worth considering:

- i. The location of the wind turbines in relation to key habitat areas for birds in the "at risk" groups.

ii. Wind turbines are likely to have a greater impact on flocking birds if they are near large wetlands or in locations where migrating birds are concentrated, e.g. in gaps through mountain ranges.

iii. Threatened bird species are affected only occasionally, e.g. when the turbines are near wetlands or raptor breeding areas.

iv. Some studies suggest that birds soon adapt to the presence of the wind turbines and actively avoid flying into them.

v. Fewer birds are likely to be killed by blade-strike than by collision with motor vehicles on the roads surrounding the wind farm. Studies overseas have found that power lines are responsible for killing far more birds than wind farms.

In summary, the impact of wind turbines on birds has been found to be low in Australia. However, wind farming has had only a short history in this country and few large wind farms have yet been established, so studies to accurately predict the impact of blade-strike are limited.

### 6.3 THREATENED SPECIES CONSERVATION ACT

The *Threatened Species Conservation Act 1995* requires that the following matters be taken into account when considering whether a proposal is likely to have a significant effect on threatened species, populations or ecological communities, and whether a Species Impact Statement (SIS) is required. This process, commonly referred to as the "eight part test", has been applied below to the proposed wind farm.

*(a) in the case of threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction*

Section 5 of this report documented the threatened species that are known and likely to occur in the project area. It was concluded that there are unlikely to be any threatened plants on the turbine sites or other locations where developments are being placed.

Threatened fauna do occur in the project area, most notably woodland birds, the Koala, Little Whip Snake and Glossy Black-Cockatoo. Assuming the location of the turbines avoids a requirement for significant clearing of woodland and that rocky habitats are avoided or re-created after construction, there is unlikely to be disruption to any of these species such that a local population would be placed at risk of extinction. Recommendations to protect key habitats, such as woodland, Koala food trees and stands of Black She-oak and ensure that the impact on threatened species is negligible are provided later in this report.

*(b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised*

There are no endangered populations in the project area.

*(c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed*

#### Yellow Box Woodland

There are stands of Yellow Box Woodland in the project area, those closest to the developments are shown on the maps accompanying this report; this includes native grassland that was once an understorey to this woodland (i.e. "secondary grassland"). These stands of woodland and grassland can be avoided and the design of the development is such that this is the case. As long as our recommendations are followed, the wind farm will not modify or remove a significant area of habitat for the Yellow Box community.

#### Threatened Plants

There are apparently no threatened plant species in the project area. As noted above, no such species are likely to occur on the development areas; these are almost all cleared sites that have been heavily grazed and/or pasture improved.

#### Threatened Animals

The important habitats for the group of threatened species that are known or most likely to occur in the project area are woodland, native grassland, rocky outcrops and stands of Black She-oak. These habitats can be avoided by the developments associated with the wind farm, through careful siting of facilities and the involvement of an ecologist at the detailed design stage. As long as our recommendations are followed, the wind farm is not likely to modify or remove a significant area of known habitat for threatened animal species.

*(d) whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community*

#### Yellow Box Woodland

The stands of this woodland and the associated native grassland are already highly fragmented. The proposed wind farm avoids these areas and will not result in any further isolation or fragmentation of this vegetation.

#### Threatened Plants

No threatened plants are known to occur in the project area. Those habitats most likely to support such species, particularly good quality woodland and native grassland, will not be affected by the wind farm.

#### Threatened Animals

The wind farm project does have the potential to fragment and further isolate some habitats utilised by threatened fauna, such as woodland and stands of Black She-oak. However, such habitats can readily be avoided by the development. This can be ensured through the involvement of an ecologist in the detailed design stage.

*(e) whether critical habitat will be affected*

The is no critical habitat declared within the project area.

(f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or similar protected areas) in the region

#### Yellow Box Woodland

The Yellow Box - Blakely's Red Gum community is not adequately reserved in the region; very little is within conservation reserves.

#### Threatened Plants

Not relevant; no threatened plants are known from the project area.

#### Threatened Animals

None of the threatened animals mentioned in this report is adequately represented within conservation reserves in the region.

(g) whether the development or activity is of a class of development or activity that is recognised as a threatening process  
a key threatening process.

A "threatening process" is "a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities". "Key threatening processes" are listed under Schedule 3 of the Act.

To date, the NSW Scientific Committee has listed 22 key threatening processes under the Act. This is essentially a list of the main threats to the biota of New South Wales, and is a reasonable list of threatening processes for consideration under this section of the "eight-part test". The applicability of these processes to the development proposal has been summarised below.

<u>Key Threatening Process</u>	<u>Relevance to Proposal</u>
Alteration to the natural flow regimes of rivers, etc.	Not relevant.
Anthropogenic Climate Change	Positive effect.
Bushrock removal	Yes, will occur.
Clearing of native vegetation	Yes, will occur.
Competition and grazing by feral European Rabbit	Not relevant.
Competition from Feral Honey Bees	Not relevant.
High frequency fire resulting in the disruption of life cycle processes	Not relevant.
Importation of Red Imported Fire Ants	Not relevant.
Infection by Psittacine Circoviral Disease in Parrots	Not relevant.
Infection of frogs by amphibian chytrid	Not relevant.
Infection of native plants by <i>Phytophthora cinnamomi</i>	Not relevant
Invasion of native plant communities by <i>Chrysanthemoides monilifera</i>	Not relevant.
Invasion of native plant communities by exotic perennial grasses	Not relevant.



Loss and/or degradation of sites used for hill-topping by butterflies	May be relevant.
Predation by <i>Gambusia holbrooki</i>	Not relevant.
Predation by the European Red Fox	Not relevant.
Predation by the Feral Cat	Not relevant.
Predation from the Ship Rat on Lord Howe Island	Not relevant.
Removal of dead wood and dead trees	Yes, will occur.
Introduction of the Large Earth Bumblebee	Not relevant.
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments	Not relevant.
Impact of Feral Pigs	Not relevant.

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The development of the Capital Wind Farm will involve several recognised threatening processes. These need not be significant if care is taken in designing and constructing the wind farm. The most important criteria is to limit the clearing of woodland and other native vegetation and the disturbance to major rock outcrops.

*(h) whether any threatened species, population or ecological community is at the limit of its known distribution*

None of the species or communities discussed in this report would be at its limit of distribution in the project area.

#### **Conclusion, Threatened Species Conservation Act**

The development of the wind farm is not likely to have a significant effect on any threatened species, populations or ecological communities listed under the *Threatened Species Conservation Act*, or their habitats. The preparation of a Species Impact Statement is therefore not warranted.

#### **6.4 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT**

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) specifies that approval is required from the Commonwealth Minister for the Environment for actions that have, will have or are likely to have a significant impact on a matter of “national environmental significance”.

The Act identifies six matters of national environmental significance; these are:

- i. declared World Heritage Areas,
- ii. declared RAMSAR wetlands,
- iii. listed threatened species and ecological communities,
- iv. listed migratory species,
- v. nuclear actions,
- vi. the environment of Commonwealth marine areas, and
- vii. listed places of Natural Heritage.

Actions on or outside Commonwealth land that have, will have or are likely to have a significant impact on the environment on or outside Commonwealth land must also be

referred to the Commonwealth Minister for assessment and approval, as well as the actions of Commonwealth agencies inside or outside the Australian jurisdiction that have, will have or are likely to have a significant impact on the environment inside or outside the Australian jurisdiction.

Environment Australia has published *Administrative Guidelines for Determining whether an Action has, will have, or is likely to have a Significant Impact on a Matter of National Environmental Significance under the Environmental Protection and Biodiversity Conservation Act 1999* (Environment Australia 2000), to assist proponents to decide whether a proposed action should be referred to the Minister for assessment and approval.

Some of the criteria in the guidelines refer to the concept of “habitat critical to the survival of a species or ecological community”. The guidelines state, “habitat critical to the survival of a species or ecological community . . . includes the critical habitat for any species or community identified in recovery plans for those species/communities and the critical habitat on the Register maintained by the Minister for the Environment under the Act. However, there may not be recovery plans in place for all listed species and communities, as plans take some time to prepare. Similarly, the Register may not be comprehensive. The absence of a recovery plan or the fact that an area may not be listed on the Register of Critical Habitat does not mean that there is no habitat critical to the survival of the species or community.”

“Habitat critical to the survival of a species or ecological community may include areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal,
- for succession,
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species/community.”

“Habitat critical to the survival of a species or ecological community will depend largely on the particular requirements of the species/community in question. For example, areas only incidentally used by a vulnerable species, and which the species is unlikely to be dependent upon for its survival or recovery, are not areas of habitat critical to the survival of a species or ecological community.”

“Some of the criteria below refer to actions likely to lead to a “long-term decrease” in the size of a population or a “long-term adverse effect” on a community. Depending on the level of endangerment and the nature of the action, not all actions which create an immediate decrease in the population of a naturally listed threatened species or impact on a community will have long-term consequences. For example, an act which causes injury or death to only one or a very small number of a species will not, except in the case of the most endangered of species, generally lead to a long-term or irreversible decrease in the population that normal processes, rates of mortality and recruitment could not buffer.”

The potential for the proposed Capital Wind Farm near Tarago to have a significant impact on the listed species and ecological communities is assessed below, by applying the criteria in the Commonwealth's *Administrative Guidelines* (Environment Australia 2000).

### Criteria for Endangered Species

An action has, will have, or is likely to have a significant impact on an endangered species if it does, will, or is likely to:

- lead to a long-term decrease in the size of a population, or
- reduce the area of occupancy of the species, or
- fragment an existing population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of a population, or
- modify, destroy, remove, or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat\*, or
- interferes with the recovery of the species.

The Regent Honeyeater is the only endangered species expected to occur in the project area; these birds are nomadic and roam widely across the tablelands, turning up at a locality every now and then. The prime habitat of this honeyeater is the lowland woodland containing trees such as Yellow Box. These stands of trees will not be affected by the project. The wind farm is therefore not likely to cause a decrease in the population size of the Regent Honeyeater, reduce their area of occupancy, fragment the population, adversely affect habitat critical to the species' survival, disrupt the breeding cycle or reduce the availability or quality of habitat available. The development of the wind farm is therefore not likely to have a significant impact on this endangered species.

### Criteria for Vulnerable Species

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- lead to a long-term decrease in the size of an *important population* of a species, or
- reduce the area of occupancy of an *important population*, or
- fragment an existing *important population* into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of an *important population*, or
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat\*, or
- interferes substantially with the recovery of the species.

(\*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.)

An *important population* is one that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal,
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

No vulnerable species are known or expected to occur in the development areas. The development of the wind farm is not likely to cause a decrease in the size of an important population of vulnerable species, or reduce their area of occupancy, etc. The development of the wind farm is therefore not likely to have a significant impact on vulnerable species.

### **Criteria for Endangered Ecological Communities**

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered ecological community if it does, will, or is likely to:

- lead to a long-term adverse affect on an ecological community, or
- reduce the extent of a community, or
- fragment an occurrence of the community, or
- adversely affect habitat critical to the survival of an ecological community, or
- modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the community's survival, or
- result in invasive species that are harmful to the critically endangered or endangered community becoming established in an occurrence of the community\*, or
- interfere with the recovery of an ecological community.

(\*Introducing an invasive species into the occurrence may result in that species becoming established. An invasive species may harm a critically endangered or endangered ecological community by direct competition, modification of habitat, or predation.)

Yellow Box Woodland, as part of the Grassy White Box Woodlands complex, has been listed as an endangered ecological community under the EPBC Act; see Sections 3.2 and 5.5. This woodland can readily be avoided and protected on the sites near the development areas through appropriate project design and management; recommendations to this end are provided in Section 7. If these recommendations are followed, then the proposed wind farm will have none of the above impacts on the woodland community.

### **Criteria for Listed Migratory Species**

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of *important habitat* of the migratory species, or
- result in invasive species that is harmful to the migratory species becoming established\* in an area of *important habitat* of the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an *ecologically significant proportion* of the population of the species.

(\*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a migratory species by direct competition, modification of habitat, or predation.)

An area of *important habitat* is:

- a) habitat utilised by a migratory species occasionally or periodically within a region that supports an *ecologically significant proportion* of the population of the species, or
- b) habitat utilised by a migratory species which is at the limit of the species range, or

c) habitat within an area where the species is declining.

Several internationally protected migratory species were recorded during this study, and others probably occur in the project area, for many common and widespread Australian species have been listed under the EPBC Act as internationally protected migratory species, including all ducks and all diurnal birds of prey. The proposed wind farm is not likely to have a significant impact on any listed migratory species, because the project area is not likely to contain *important habitat* and the project is not likely to disrupt an *ecologically significant proportion* of a population of a listed migratory species, as defined above.

### **Conclusion, Environment Protection and Biodiversity Conservation Act 1999**

The development of the Capital Wind Farm near Tarago is not likely to have a significant effect on any species or ecological communities listed under the *Environment Protection and Biodiversity Conservation Act*, or their habitats. Referral of the matter to the Commonwealth Minister for the Environment for assessment and approval is therefore not warranted.

## **6.5 FISHERIES MANAGEMENT ACT**

The NSW *Fisheries Management Act 1994*, as amended by the *Fisheries Management Amendment Act 1997*, provides for the listing of threatened species, communities and populations, the designation of habitat as "critical", and the preparation and implementation of recovery and threat abatement plans. Threatened species are listed on schedules attached to the Act.

Eleven freshwater and saltwater endangered and vulnerable fish species, one snail, one shrimp, one dragonfly, have been listed under the Act. Most of the species occur in inland waters, and some have a restricted range. Two endangered ecological communities have been listed; these occur in the lower reaches of the Murray and Darling Rivers systems. Two endangered populations are also listed; these are two species of fish that occur in the western parts of the state. the communities nor the populations occur any where near the project area.

None of the listed species, communities or populations are expected to occur in the project area. The proposed turbine sites are high on ridges, and the access roads and cable routes are away from all but minor and ephemeral watercourses, that are unlikely to support threatened species, etc.

Six key threatening processes have been listed under the Act; none of these apply to the proposed wind farm development. Although the various components of the wind farm will not encroach on any watercourses, there is potential for sediment resulting from the construction work to enter watercourses nearby, possibly adversely affecting fish and fish habitat; measures should be taken, therefore, to mitigate this potential impact.

## **6.6 KOALA HABITAT PROTECTION**

The recently restructured shires covering the project area are not listed under SEPP No. 44, but the previous shire names do appear on Schedule 1 of *State Environmental Planning*

*Policy No. 44 - Koala Habitat Protection* (SEPP 44) (New South Wales 1995), so that the Policy does apply to the new shires. SEPP 44 encourages the conservation and management of natural vegetation that provides habitat for Koalas, to ensure a permanent free-living population over the species' present range and to reverse the current trend of Koala population decline.

SEPP 44 aims to identify "potential Koala habitat", which means "areas of native vegetation where the trees of the types 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". If no Schedule 2 tree species are present or if they constitute less than 15% of the total number of trees present, then no further provisions of the Policy apply.

If more than 15% of the trees in the area are Schedule 2 tree species, then an assessment must be made by a qualified person to determine whether the area contains "core Koala habitat", a term applied to "an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population".

The following eucalypt species occur in the project area: Apple Box *Eucalyptus bridgesiana*, Broad-leaved Peppermint *Eucalyptus dives*, Red Stringybark *Eucalyptus macrorhycha*, Brittle Gum *Eucalyptus mannifera*, Yellow Box *Eucalyptus melliodora*, Snow Gum *Eucalyptus pauciflora*, Narrow-leaved Peppermint *Eucalyptus radiata*, Inland Scribbly Gum *Eucalyptus rossii*, Candlebark *Eucalyptus rubida*, Silvertop Ash *Eucalyptus sieberi*, Black Sallee *Eucalyptus stellulata* and Manna Gum *Eucalyptus viminalis*.

One of these species, Manna Gum *Eucalyptus viminalis*, is listed on Schedule 2 of the Policy as a Koala food tree. Stands of Manna Gum occur in several places in the project area, for example in the far eastern and southern parts of the Hammond Hill site. These stands of trees in the project area are "potential Koala habitat". These areas are not directly affected by the proposed wind farm.

While Broad-leaved Peppermint *Eucalyptus dives*, Red Stringybark *Eucalyptus macrorhycha*, Yellow Box *Eucalyptus melliodora* and Candlebark *Eucalyptus rubida* are not Schedule 2 species, they are also favoured by Koalas.

Most of the trees to be cleared are Inland Scribbly Gum *Eucalyptus rossii*, Broad-leaved Peppermint *Eucalyptus dives* and Silvertop Ash *Eucalyptus sieberi*. *Eucalyptus dives* is a secondary Koala food tree, but is very common in the area so clearing small patches, if necessary, is not likely to have a significant impact on koalas.

Stands of Manna Gum in the primary study areas were investigated for signs of Koalas, such as claw marks on tree trunks and faecal pellets below the trees, but none were found. A search for local Koala records was made in an attempt to determine the status of the species in the project area. Section 7 contains a recommendation for the protection of the Koala food trees.

## 6.7 LAND DEDICATED FOR CONSERVATION PURPOSES

There are no reserves managed by the NSW National Parks and Wildlife Service in or near the project area. A Crown reserve, known as Sweeneys Reserve, is located next to the Tarago to Bungendore Road near the south-eastern corner of the Hammonds Hill site. This reserve contains a good quality example of Yellow Box woodland. This reserve is outside the project area and will not be affected.

The directions from the DEC sought comment on the impact on dedicated wildlife refuges. Wildlife Refuges are proclaimed under the *National Parks and Wildlife Act 1974* and are dedicated for the purposes of preserving, conserving, propagating and studying wildlife, conserving and studying natural environments, and creating simulated natural environments. The Pylara Wildlife Refuge and its extension occur on the Collex land to the north of the project area. No part of the project area abuts this wildlife refuge; there is no potential for the Capital Wind Farm to impact on the wildlife refuge.

## **7 RECOMMENDATIONS**

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The following recommendations have been made to reduce the impact of the Capital Wind Farm on flora and fauna.

### **1 Turbine Sites**

- 1.1 Clearing woodland should be avoided wherever possible. Where avoidance is not possible, clearing and lopping should be kept to the bare minimum. The conservation importance of the woodland should be carefully considered when fine-tuning site selection.
- 1.2 Large rock outcrops should be avoided, because they provide valuable habitat for reptiles and other native animals; in a cleared landscape, rock outcrops are sometimes the only habitat available for reptiles.
- 1.3 If turbines are located on rock outcrops, the excavated rock should be deposited nearby in a "natural" formation to re-create habitat.
- 1.4 Construction activities on narrow ridge crests and knolls have the potential to cause erosion and have impacts on habitats down slope. Each turbine site should be clearly marked out and temporarily fenced to restrict vehicle movements, and appropriate erosion control measures should be implemented.

### **2 Access Roads and Tracks**

- 2.1 The access tracks should be located to avoid clearing woodland; any existing tracks and cleared areas should be utilised. Where clearing of any woodland is required for access tracks the advice of an ecologist should be sought for the route selection to minimise impacts on the woodland values.

- 2.2 When constructing the access tracks, care should be taken to ensure that the construction activities do not cause excessive erosion. Permanent tracks should be stabilised and temporary tracks rehabilitated to the satisfaction of the Department of Infrastructure, Planning and Natural Resources.
- 2.3 The access track to the substation site should not pass through the stand of the endangered Yellow Box Woodland (see Figure 4). Access to the site should be from north of the woodland, along the cable route, or along any other convenient route that avoids the woodland.
- 2.4 The access track across the north-eastern corner of the Hammonds Hill site should avoid the secondary native grassland in that area, which is a part of the endangered Yellow Box Woodland community. If another access is not utilised, then the existing track only should be used for access, vehicles being restricted to this track for 300 metres inside the property gate, and that no equipment or other material should be stored beside this part of the track.

### **3 Cabling - General**

- 3.1 Many kilometres of buried cable will be installed throughout out the project area to link the turbines together. The following recommendations relate to the installation of the cables.
- Disturbance should be minimised and rehabilitation undertaken as soon as possible after back-filling of trench.
  - Care should be taken on steep slopes to ensure that erosion does not occur. Any problems should be rectified immediately.
  - The on-site maintenance crew should be responsible for regularly checking the cable routes for erosion until the routes have been revegetated.
  - The cable routes should avoid the areas identified in this report as having special conservation importance. Ideally, an ecologist should assist in route selection.
- 3.2 Burying the cables has been proposed to reduce visual impact but trenching may have a greater impact on native vegetation than overhead lines. Accordingly at some locations use of overhead lines may be preferable.

### **4 The Substation**

- 4.1 The substation site is covered in native pasture and exotic grassland of little conservation value; however, excessive earthworks should be avoided and steps should be taken to protect the nearby drainage line.

### **5 Impact on Birds of Prey**

- 5.1 Steps can be taken to reduce the chance that birds of prey will fall victim to blade-strike:
- the turbines should have no perching sites;



- dead animals (e.g. sheep carcasses) should be removed as soon as possible within 200 metres of the turbines;
- lambing should not occur in paddocks with turbines;
- roadkills should be removed if they are within 200 metres of the turbines;
- the turbines and other facilities should not have lights, other than safety lights for aircraft, because they may attract owls and bats;
- tall dead trees within 200 metres of turbines should be removed to remove perching opportunities;
- buildings, poles or other structures should not be constructed within 200 metres of the turbines because they provide perching opportunities for birds of prey.

## 6 Impact on Other Species

- 6.1 Any pine trees within 200 metres of the turbines should be removed, because they attract flocks of Yellow-tailed Black-Cockatoos.
- 6.2 No large dams should be constructed within one kilometre of the turbines.
- 6.3 No Koala food trees should be cleared, especially Manna Gum *Eucalyptus viminalis*. These trees are mainly on the eastern and southern edge of the Hammond Hill site. An ecologist should be involved in the final detailed design stages to ensure that the wind farm infrastructure does not impinge upon stands of Manna Gum.

## 7 General

- 7.1 As a general rule, large trees, dead or alive, should not be removed; large trees often have a high habitat value. Large, isolated native trees should be removed only if absolutely necessary. Removing tall dead trees near the turbines, as described in Recommendation 6.1, is acceptable. It is noted that these trees, located on exposed ridge tops, are unlikely to have hollows as they are such small trees. Field observations suggest that very few such trees would in fact need to be removed.
- 7.2 If trees are to be planted around the substation and/or near other facilities, e.g. for screening purposes, then only local native tree species should be selected.
- 7.3 A soil and water management plan should be prepared for the project; this should be developed in consultation with the Department of Infrastructure, Planning and Natural Resources.

## 8 Compensation Measures

- 8.1 Because woodland on some of the properties may be cleared, the following compensation measures are proposed.

The high value Yellow Box Woodland and secondary grassland in the north-eastern and south-eastern corners of the Hammond Hill site (see Figure 4) should be fenced

to exclude stock. The management of these areas should be discussed with the Department of Environment and Conservation.

## 9 Monitoring

- 9.1 An environmental officer should be appointed for the construction phase of the project, whose role would be to implement the above recommendations.
- 9.2 Given the lack of information on the impact of wind turbines on native fauna in Australia, the monitoring of impacts on native birds should be an important aspect of any proposal. This is particularly true for large wind farms like this one, which will be the largest in the state.
- 9.3 The Australian Wind Energy Association (AWEA) is currently developing a set of protocols for surveying wind farms for victims of blade-strike. A monitoring program should be developed for the Capital Wind Farm project, based on the AWEA document. The adequacy of the proposed monitoring program should be considered by the Department of Environment and Conservation prior to implementation.

## 8 CONCLUSION

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This investigation has described the flora and fauna of a large study area on the southern tablelands north of Bungendore, where it is proposed to develop the Capital Wind Farm. An extensive field survey was a part of the study are the flora and fauna, as well as the vegetation communities and habitats, present within the project area are described in detail. Particular attention was given to the immediate areas around the proposed wind farm facilities such as turbine sites, access roads and cable routes.

An assessment was undertaken in accordance with the *NSW Threatened Species Conservation Act 1995* and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*. In both cases, it was concluded that there would not be a significant impact on listed threatened species, populations or communities and that the preparation of a Species Impact Statement (SIS) or referral to the Commonwealth Minister for the Environment were not warranted.

A set of recommendations is provided that are aimed at avoiding and limiting the impact on the natural environment. These are especially aimed at protecting the woodland and other important habitats found in the project area.

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## APPENDICES

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- 1 List of Plant Species for the Primary Study Areas
  - 2 Vegetation Survey Sheets
  - 3 List of Animal Species for the Project Area
  - 4 Bird Survey Sheets
  - 5 Final Determination for White box – Yellow Box – Blakely's Red Gum Woodland
  - 6 Photographs of the Project Area
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