

Flyers Creek

WIND FARM

Environmental Assessment

CHAPTER 10

Flora and Fauna



10. Flora and Fauna

This chapter of the Environmental Assessment provides:

- a description of the existing ecological characteristics of the Flyers Creek Wind Farm locality
- the potential impacts of the project on the flora and fauna
- the controls to be integrated in the project to mitigate the potential impacts (Section 10.6)

10.1 Introduction

The potential ecological impacts of the wind farm development relate to the construction activities associated with limited clearing of native vegetation and habitat disturbance and the operational impacts that are predominantly associated with potential for avifauna to strike the rotating turbine blades. The assessment of these potential impacts and the significance of any impacts required the input of relevant specialists.

Accordingly, specialist ecologists were engaged to assess the potential impact of the project on the natural ecosystems of the area and to provide relevant background information to enable informed planning decisions to be made. The specialists were chosen on the basis of their knowledge of the issues presented by wind farm projects and advanced standing in their specialty field.

Kevin Mills and Associates (KMA) was engaged to examine and assess potential impacts on flora and fauna, excluding bat fauna. Comprehensive field surveys were undertaken during November, 2008, February 2009 and October 2010 and relevant databases and literature were also reviewed. The KMA assessment is provided as Appendix D.

Greg Richards and Associates (GRA) was engaged to examine and assess potential impacts on bat species. GRA undertook a preliminary desktop assessment for the site based on his considerable prior experience specific to the region, knowledge of bat species and extensive database of species distribution. The desktop assessment included a review of habitat of the site. On-site monitoring for bat species was undertaken during October – November, 2008 and March, 2009 when temperatures were suitable for bat species to be active. The GRA assessment is provided as Appendix E.

As part of the assessments, both ecologists have related their findings to relevant databases and the ecological features of the site and provided an assessment and any recommendations arising from their assessment. The assessments have included the full extent of the site including turbine sites, substation site and likely routes for new access tracks and underground cables. The findings of the assessment reports are summarised in the following sections.


In respect of the EPBC Act, KMA concluded that:

“In our opinion, the proposed wind farm is not likely to have a significant impact on matters of national environmental significance listed under the Environment Protection and Biodiversity Conservation Act. Referral to the Commonwealth Minister for the Environment for assessment and approval is therefore not warranted.”

The KMA report (Appendix D) also contains a set of recommendations that are aimed at avoiding and limiting potential impacts on flora and fauna arising from the proposal. These are especially aimed at protecting the remnant woodland and trees and other habitats in the project area.

Based on the 2008 and 2009 field assessments and subsequent survey of the bat fauna, only one threatened species was detected, the Yellow Bellied Sheathtail bat. For this species, GRA concluded that:

“No significant impact upon the local population of the Yellow-bellied Sheathtail Bat was expected, due to the small size of remnants, its occasional occurrence and very low activity in the area”.



The set of recommendations presented in the KMA and GRA reports have been used to prepare the mitigation measures set out at the end of this Chapter. These measures are also incorporated in the Project's 'Statement of Commitments' as set out in Chapter 19.

10.2 Flora

This section draws on the flora information reported by KMA. The flora assessment describes the project area as having good quality soils that once supported widespread forest/woodland. These forests and woodlands have been extensively cleared and are now only represented by scattered paddock trees and remnant patches of trees, with much of the area being completely treeless. Through most of the pastoral land, there is very little native understorey vegetation with little native ground cover or native shrubs. Some of the road-sides retain stands of trees. The locations of woodland remnants are shown in Figure 10.1.

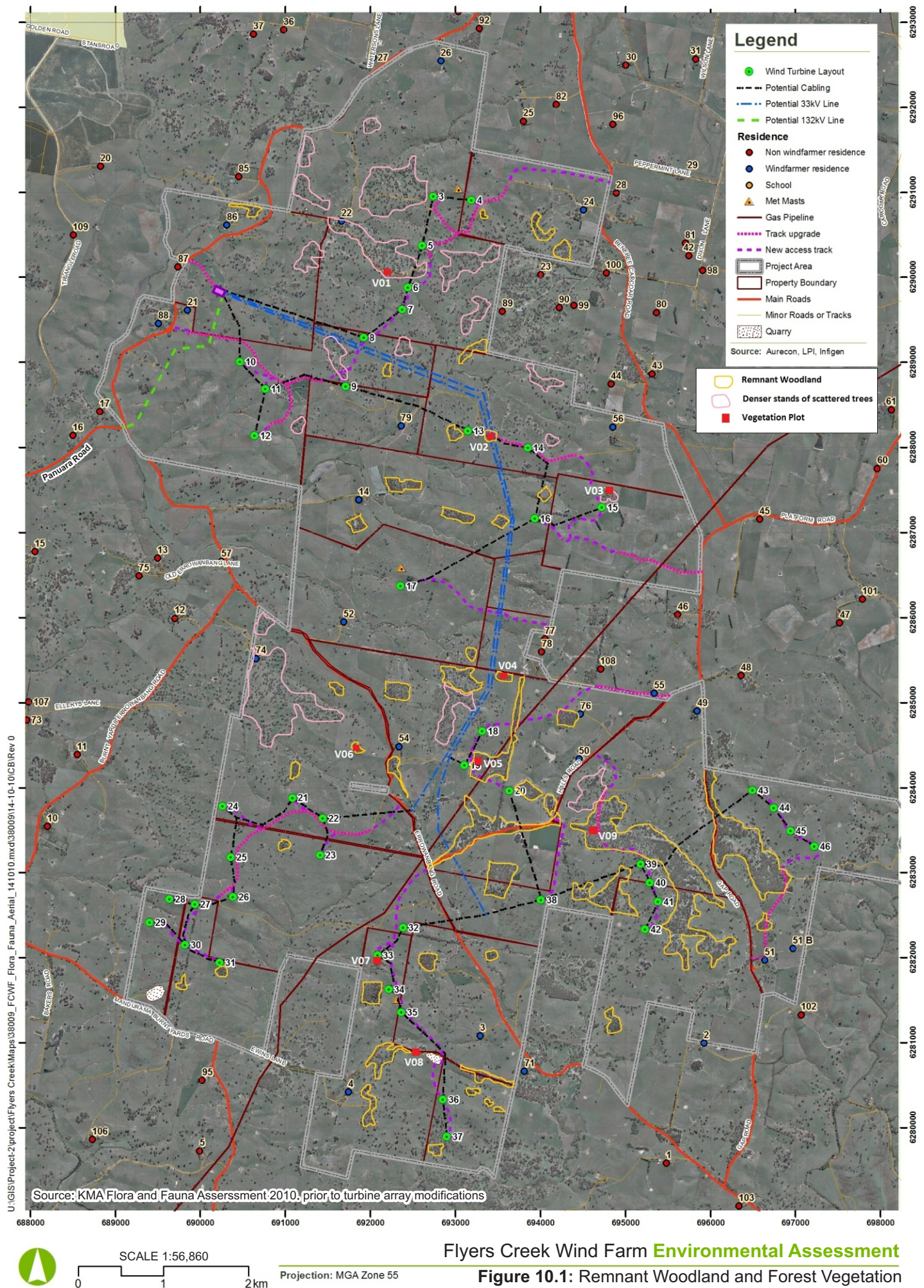
The former forest and woodland were dominated in most places by Yellow Box *Eucalyptus melliodora* and Blakely's Red Gum *Eucalyptus blakelyi*. These forests and woodlands are part of the very extensive community complex known as White Box – Yellow Box – Blakely's Red Gum Woodland (Box – Gum Woodland), that extended along the central tablelands of NSW. The other key tree species in the area are Bundy *Eucalyptus goniacalyx*, Broad-leaved Peppermint *Eucalyptus dives* and Red Stringybark *Eucalyptus macrorhyncha*. White Box *Eucalyptus albens* which grows to the west of the wind farm site, is rare on the wind farm site.

Most paddocks have been extensively pasture improved, having been fertilised and sown with exotic species for many years. Common pasture species include the grasses, Phalaris, **Phalaris* sp., Ryegrass **Lolium* sp., Barley Grass **Hordeum* sp. and Brome Grasses **Bromus* spp.; all are common throughout the area. Where large, old trees remain there is invariably an exotic grassland understorey, mostly of improved pasture.

The most common trees are Yellow Box *Eucalyptus melliodora*, Bundy *Eucalyptus goniacalyx* and Blakely's Red Gum *Eucalyptus blakelyi*. Broad-leaved Peppermint *Eucalyptus dives* is scattered across the southern part of the area on soils derived from old sedimentary rocks, where also Red Stringybark *Eucalyptus macrorhyncha* forms occasional stands. On low-lying flats in the south, thickets of Blakely's Red Gum *Eucalyptus blakelyi* grow in patches here and there; these likely originate from a heavy seeding and regeneration of seedlings approximately 20 years ago. In the west, such as on the Cadia Mine site, White Box *Eucalyptus albens* is quite common, while Snow Gum *Eucalyptus pauciflora* and Candlebark *Eucalyptus rubida* grow in a few places. Along the creek at Cadia Mine, River Oak *Casuarina cunninghamiana* is common. Willows *Salix* spp. are common along many creeks and on valley flats but in places eradication of willows is evident.

Small patches of native grassland occur mostly on rocky sites and road sides. The grassland contains a low diversity of native species, invariably being dominated by Corkscrew *Austrostipa scabra* or Weeping Grass *Microlaena stipoides*. Other typical and relatively common native species include Wallaby Grasses *Austrodanthonia* spp., Swamp Dock *Rumex brownii* and Oxalis *Oxalis perennans*.

KMA undertook a database review and floristic survey for the project area and its surrounds to identify as many as possible of the native plant species present. Plant species recorded in or near the project area have been listed in Appendix D and include a total of 50 natives and 72 exotics (introduced) recorded during the site survey. No threatened species were recorded within the project area and no threatened plants have been recorded within 20 kilometres of the project area (NSW Wildlife Atlas). Given the highly disturbed character on the whole area, particularly the widespread exotic ground cover, it seems unlikely that any threatened species occurs on the wind farm site.



The vegetation communities recorded in the project area are listed in Table 10.1. These include woodland, native grassland/pasture and exotic grassland.

Table 10.1 – Vegetation communities of the project area

Community	Key species	Occurrence
Yellow Box – Blakely's Red Gum Woodland	Yellow Box <i>Eucalyptus melliodora</i> , Bundy <i>Eucalyptus gonicalyx</i> and Blakely's Red Gum <i>Eucalyptus blakelyi</i> .	Most of the remnant trees, patches of trees and occasional patch of native grassland in the area. Part of a community complex found extensively across central western New South Wales
	Broad-leaved Peppermint <i>Eucalyptus dives</i> and Red Stringybark <i>Eucalyptus macrorhyncha</i>	Scattered across the southern part of the area on soils derived from old sedimentary rocks and form occasional stands
Native Grassland - Native Pasture	Corkscrew <i>Austrostipa scabra</i> , Weeping Grass <i>Microlaena stipoides</i> , Wallaby Grasses <i>Austrodanthonia</i> spp., Swamp Dock <i>Rumex brownii</i> and Oxalis <i>Oxalis perennans</i> .	Little native grassland in the area with patches on rocky outcrops and roadsides.
Exotic Grasses	Phalaris, * <i>Phalaris</i> sp., Ryegrass * <i>Lolium</i> sp., Barley Grass * <i>Hordeum</i> sp. and Brome Grasses * <i>Bromus</i> spp.	Exotic grasses are common throughout the project area and understory of paddock trees.

KMA also conducted tree hollow surveys of the project area. The survey shows that in total, 41 trees on the ridgetops were surveyed and 70 hollows counted. Of these trees, 36 were living trees and five were dead trees.

Five noxious weed species were also recorded in the project area as shown in Table 10.2.

Table 10.2 – Noxious weeds of the project area

Common Name	Taxonomic Name	Control Category ¹
Blackberry	<i>Rubus fruticosus</i> sp. agg.	4
Scotch Thistle	<i>Onopordium acanthium</i>	4
Serrated Tussock	<i>Nassella trichotoma</i>	4
St John's Wort	<i>Hypericum perforatum</i>	4
Sweet Briar	<i>Rosa rubiginosa</i>	4

Note: ¹ - See Appendix F- 4 for an explanation of the control categories.

The vegetation present for each of the wind turbine groups, the substation site and cable and overhead line routes is further described in Appendix D.

10.2.1 Access to the project area

Regional vehicular access to the district is proposed to be gained via the Mid Western Highway which provides a main transport link between Bathurst and Cowra and passes close to Carcoar. Local vehicular access to the site of the wind farm is proposed to be gained initially via Errowanbang Road (south of Carcoar) and Gap Road and then on site via multiple new or upgraded access tracks from entry points on Errowanbang Road, Beneree-Flyers Creek Road, Gap Road and Halls Road. Detailed design of site entry access points, tracks and underground cable will be in consultation with the project ecologist and will adopt the principles of "avoid" and "minimise" loss of native vegetation.

10.3 Fauna

Fauna surveys (excluding bats) were undertaken by KMA over three survey events during appropriate conditions when most animals are likely to be active. The survey methods are described in Appendix D and the findings are summarised below.

Bat fauna were assessed separately by Greg Richards and Associates (GRA) with ten monitoring sites surveyed during October-November 2008 and March 2009 (Appendix E). Results are summarised later in this chapter.

10.3.1 Summary of fauna survey methods

KMA undertook fauna surveys during November 2008, February 2009 and October 2010, at the same time as the flora surveys. The survey was undertaken in accordance with the *Threatened Species Survey and Assessment: Guidelines for Developments and Activities (Working Draft)* (DEC, 2004).

The weather conditions at the time of the surveys were good, with warm temperatures and little wind. Prior to the October 2010 surveys, the region had experienced good rains and the landscape was green with a fresh cover of herbaceous vegetation.

All fauna species observed, heard or detected by other means (eg signs of presence) during the surveys were identified and recorded. Species were identified by direct observation and call-recognition, and a ground search was conducted for animal scats, tracks, and diggings.

Bird surveys were carried out in accordance with the considerations and procedures set out in the documents titled *Wind Farm and Birds. Interim Standard for Risk Assessment* (AWEA, 2005) and *EPBC Policy Statement 2.3, Wind Farm Industry* (DEWHA, 2008).

The bird surveys included the general recording of species, along with some targeted surveys throughout the study area. In those areas, transects were walked and sometimes partially driven on ridges and other places in the study area. All birds, their numbers and their flying heights, were recorded during all targeted surveys. The primary aim was to survey for threatened birds as the character of the country within the study area precluded the presence of all other threatened animals known or likely to occur in the locality. The Superb Parrot was especially targeted as were other threatened passerine woodland birds.

A tree hollow survey was undertaken along the ridges where the turbines would be located due to their potential for roosts. The survey involved walking a transect recording all trees with hollows, their species name, measurement of trunk diameter at chest height and GPS location. Hollows were divided into trunk and branch hollows and into size classes, ie <10 cm, 10-20 cm, and >20 cm.

The bat fauna present at the site was separately assessed by GRA using echolocation monitoring and analysis and a review of available habitat at the site. The bat fauna assessment was designed to obtain baseline data on bat fauna species that were utilising the study area and surrounds, and to target bat fauna species listed in the Schedules of the NSW Threatened Species Conservation Act, 1995 and Commonwealth Environment Protection and Biodiversity Conservation Act, 1999. The surveys closely followed the NSW Department of Environment and Conservation Threatened Biodiversity Survey and Assessment Guidelines (working draft dated November 2004).

10.3.2 Fauna habitat

The fauna habitats within the project area are typical of the rural environment in which the wind farm is located. The landscape is characterised by grazing paddocks with scattered trees and small woodland remnants. Most of the land supports exotic grassland, including sown pasture, and scattered paddock trees with little tree regeneration. Some patches of understory occur but shrubs are virtually non-existent. In places shelter belts of native or exotic trees have been planted.

Small farm dams are scattered across the area but there are no large wetlands in the area and most watercourses are ephemeral. To the west, about five kilometres away, the Cadia Mine site contains several large artificial settling ponds, while to the east, about 18 kilometres away, is Carcoar Dam.

The most important habitats for fauna are the remnant paddock trees and stands of woodland that provide foraging and breeding sites for birds. Tree hollows are a particularly important resource for many bird species.

10.3.3 Fauna species recorded during surveys

The fauna species (other than bats) recorded during the KMA surveys have been listed in Appendix 3 of Appendix D. In total 9 mammals, 86 birds, 6 reptiles and 4 frogs were recorded in the study area.

Bat fauna surveys (based on echo-location monitoring by GRA, Appendix E) identified 10 of the 15 bat species that have been recorded in the Cadia – Orange district since 2001.

Monitoring sites for birds and bats are shown in Figure 10.2.

10.4 Conservation values of the project area

The species potentially present at the site have been reviewed by KMA (Appendix D) and GRA, (Appendix E) against various conservation listings under the Threatened Species Conservation Act, 1995 (TSC Act) and the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). KMA has also provided details of species recorded during the surveys. GRA provides details of 10 bat fauna detected at the site including one listed as vulnerable under the NSW TSC Act. The following sections review the relevance of the listings of threatened flora and fauna, endangered populations and communities and migratory species for the proposed development.

10.4.1 Threatened flora

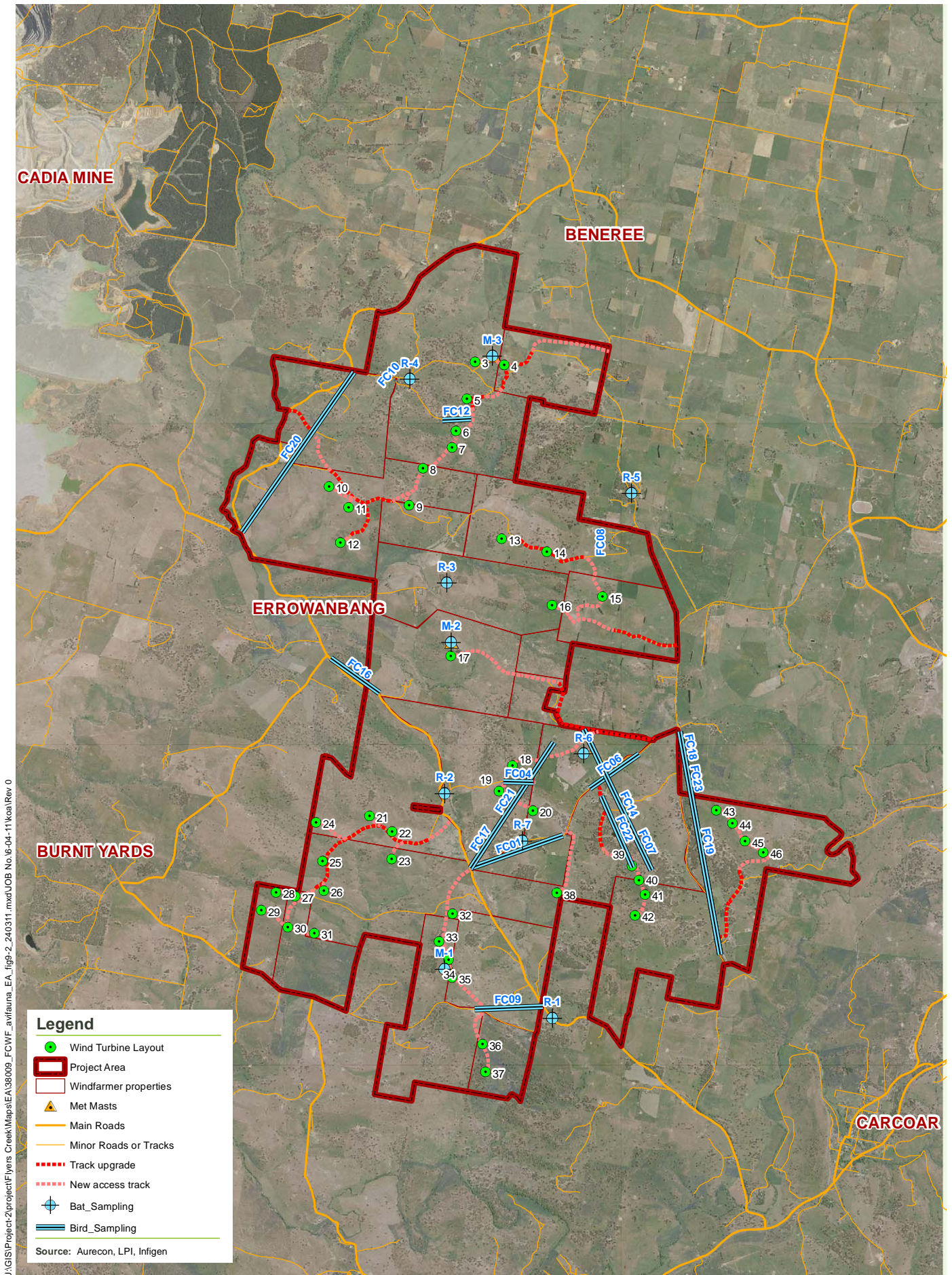
KMA states (Appendix D - Section 4.4 Threatened Plant Species) that:

“No threatened plants have been recorded within 20 kilometres of the study area (NSW Wildlife Atlas). No threatened plant species were recorded within the study area in this study. Given the highly disturbed character on the whole area, particularly the ground cover, it seems unlikely that any such species occurs on the wind farm site. Flora studies on the nearby Cadia Mine site over a period of 15 years did not locate any threatened plant species (Western Research Institute 2009).”

10.4.2 Threatened fauna

Section 6.2 *Presence of Threatened Species, etc.* of the KMA report notes the following threatened species were recorded in the study area from 2008 to 2010: Superb Parrot, Diamond Firetrail, Varied Sitella and Little Eagle.

GRA identified one vulnerable bat fauna at the site being: the Yellow-bellied Sheath-tail Bat. This bat fauna is listed as Vulnerable in the NSW Threatened Species Conservation Act, and was recorded at the central met mast for the project area, and at woodland remnants R-5 and R-6 (Appendix E). All records were from a few calls, and only on occasional nights during the survey period. Notably, this species was not recorded at any of the other seven sampling sites.



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Projection: GDA 1994 MGA Zone 55

Flyers Creek Wind Farm **Environmental Assessment**

FIGURE 10.2: Locations of avifauna sampling

10.4.3 Migratory species

In addition to threatened species, the EPBC Act allows for the listing of internationally protected migratory species, ie 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).

Section 6.3 *Migratory Species* of the KMA report states:

“Many listed internationally protected migratory species occur in the locality of the wind farm. Such species include all diurnal birds of prey (eg Nankeen Kestrel) and waterfowl (ie native ducks), species that are not threatened in Australia and are in some cases very abundant. The important sites for migratory species in Australia are large areas of habitat where these species congregate, such as extensive wetlands. Some of these species occur on the site from time to time, but there is no important habitat on the site for such species and the habitat on the site does not support an ecologically important proportion of a population of such species.”

10.4.4 Endangered populations

Table 4 *List of threatened species for the locality* of the KMA report states:

“No endangered populations occur in the locality.”

10.4.5 Critical Habitat

Table 4 *List of threatened species for the locality* of the KMA report states:

“No critical habitat occurs in the locality.”

10.4.6 Endangered ecological communities

Table 4 *List of threatened species for the locality* of the KMA report lists the following ecological community as being endangered under both the TSC Act and the EPBC Act:

“White Box - Yellow Box – Blakely’s Red Gum Woodland”

10.5 Impact of the proposal on flora and fauna

10.5.1 Summary of potential impact on native vegetation and fauna habitat

The development of the Flyers Creek Wind Farm will involve limited clearing of small areas of native vegetation across the project site for the following purposes:

- to accommodate wind turbines and provide a work area for the construction of each turbine
- to prepare the site of the substation and provide a works depot during the construction phase
- to establish access tracks to the turbines and to bury electrical cables linking the turbines.

The wind farm has been specifically designed to avoid woodland and forest as much as possible, as the biodiversity of the area is concentrated in these locations. However, some small areas of woodland/forest and scattered native trees will be removed for the reasons listed above. Rock outcrops have also been avoided, wherever possible, to protect reptile habitat. However, some small rocky areas will need to be disturbed and in these cases the habitat will be relocated.

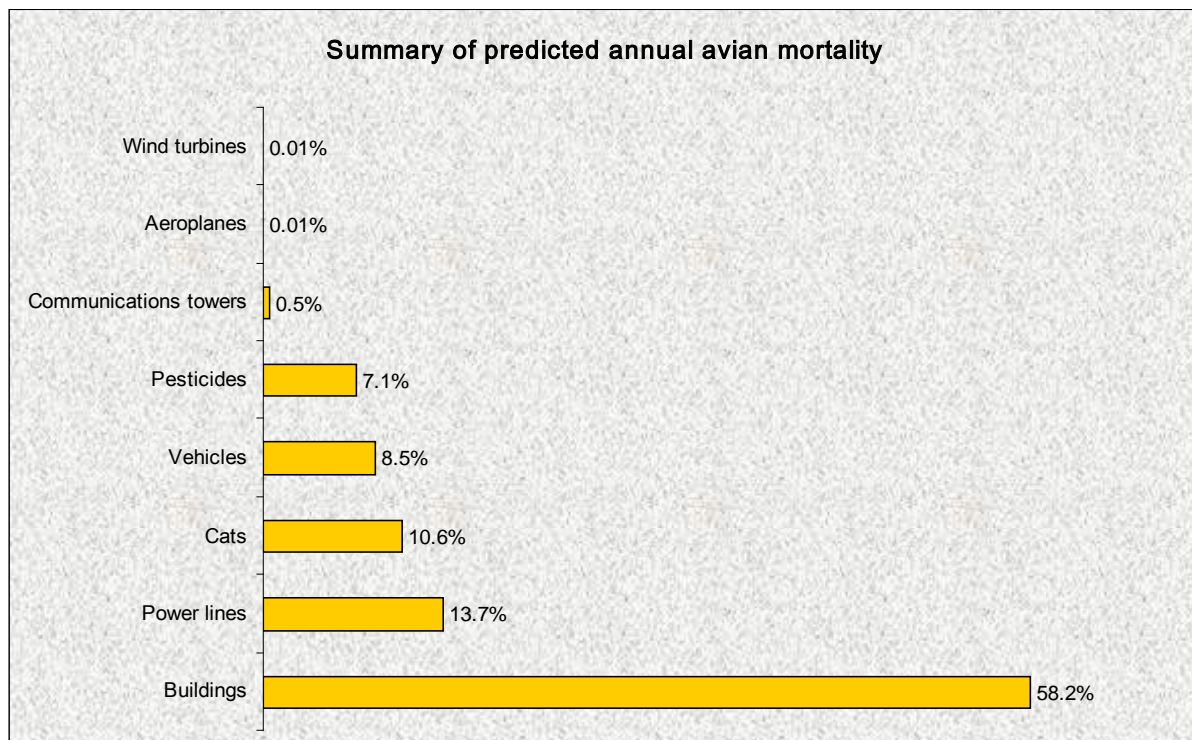
Most of the groundcover vegetation to be cleared is exotic grassland with the majority of the wind farm components, ie the turbines, substation and access routes to be sited on cleared land covered by exotic grassland types. Following assessment of the project area, KMA reported that *“there is little native grassland in the area but small patches occur mostly on rocky sites and road sides”*.

The footprint of the Flyers Creek Wind Farm is relatively small, given the extent of the project and the large area over which it is dispersed. Only about one percent of the land within the project boundary will be disturbed by the project construction. This is mainly because existing farm tracks are to be utilized for access purposes wherever possible and, elsewhere, the shortest possible routes have been selected to minimise clearing.

KMA considered that the amount of native vegetation and habitat to be cleared for the development of the wind farm to be negligible in a micro, local and regional context, and the impact on flora and fauna is expected to be correspondingly small. Nevertheless, various strategies were recommended to be implemented to further reduce the impact on flora and fauna. These have been addressed by the mitigation measures presented in Section 10.6.

10.5.2 Impact of blade-strike on birds


Wind farm developments in Europe, North America and more recently in Australia have been generally found to have very low impacts on birds particularly when compared to other man-made structures and causes of bird fatalities. As the chart below indicates, collisions with wind turbines are an order of magnitude below other man-made causes of bird fatalities.



Source: Adapted from Erickson et. al (2005)

In the UK, there have been no significant ornithological problems reported at wind farms, despite there being some 101 wind farms in operation comprising about 1234 turbines with a capacity of 979 MW in 2005 (Drewitt & Langston, 2006), mainly because they are sited away from important bird populations (Percival 2005 in Powlesland, 2009).

The potential effect of wind farms on birds may arise either from collisions by birds with operating wind turbines (referred to as blade-strike) or by disturbance of their natural habitat. This section of the Environmental Assessment deals the significance of blade-strike on bird species within the vicinity of the Flyers Creek Wind Farm Project based on assessment by KMA.



Although the overall impact of blade-strike on birds in Australia has been found to be generally low, Australian wind farms have had a relatively short history of operation. Few large wind farms have been established and monitoring has only been carried out over a relatively short period, slightly over a decade. While Australian studies on the impact of blade-strike on birds are limited, initial studies have indicated low levels of impact; however most of the studies are not publicly available. One publically available analysis performed by Environment Victoria for several Victorian wind farms found that less than 1-3 birds/year collide with a wind turbine (Environment Victoria media release, 2 March 2004).

Circumstances may vary significantly between individual wind farm sites so that each site must be assessed separately. The development of wind farms along the southern coast of mainland Australia and in Tasmania has raised the issue of impacts on the endangered Orange Bellied Parrot which has a very small population (thought to be <200) that with further adverse impact could become extinct. As such, the potential impact of wind farms on the Orange Bellied Parrots is an important issue for wind farms within the area utilised by that species. Coastal areas also often have higher numbers of shorebirds and migrating species that can raise the potential for incidences of blade-strike. Obviously, inland wind farms, like the Flyers Creek project, do not share these coastal issues.

In NSW, there is limited data on blade strike. The available data principally relates to the Crookwell and Blayney wind farms that involve 8 and 15 wind turbines respectively. Both sites were expected to have low incidences of blade strike. In the case of the Crookwell Wind Farm, no dead or injured birds or bats were found during surveys at selected turbine sites between August 1998 and January 1999 (PPI Environmental Services, 1999). Similarly, a study of local bat populations before and after the Crookwell Wind Farm commissioning did not identify any decline in bat populations (Richards, 1999). Monitoring at Blayney Wind Farm, following its commissioning, did not identify any incidences of dead or injured bats or birds. Initial avifauna monitoring for Capital Wind Farm has found low levels of impact on birds and bats and none involving threatened species.

The significance of the blade-strike issue at any site is dependent on a number of factors, including:

- the extent of the wind farm and its layout, number of turbines, size of the turbines, swept area for the turbine blades and whether or not lighting occurs on the turbines
- the habitat at the site and the species that are likely to inhabit the site or to pass through it
- whether the species is likely to fly within the zone swept by the turbine blades (rather than above or below the rotor's swept area) and any risk behaviours of the birds
- the conservation status of species present
- the mitigation measures to be applied to reduce potential for blade-strike
- weather conditions

The Australian Wind Energy Association publication (AusWEA, 2005) in its publication, "*Wind Farms and Birds: Interim Standards for Risk Assessment*" sets out a systematic and structured approach to the assessment of bird risk at individual wind farms. A hierarchy of studies has been identified involving three levels where the degree of investigation is increased in response to a lower level indicating a risk of significant impact on birds and necessitating further studies to be undertaken.

KMA has considered the potential impact on birds at the site by observing the species present and considering species that while not observed may be present from time to time. Table 4 of the KMA report lists the threatened bird species, listed under either the TSC Act or the EPBC Act, that have been recorded as being present in the study area or have potential to be present in the study area. Of the 15 threatened species listed for the project area, only four species were recorded in the project area during the three bird survey events. Of the other 11 threatened bird species listed for the locality, three were assessed as having low potential to occur while eight were assessed as having a moderate potential to occur within the project area. Based on the 11 species not being recorded during any of the three survey events, it is unlikely that they would have a high level of utilisation of the wind farm site.



Generally speaking, the birds potentially at most risk from blade-strike are:

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

As the Flyers Creek Wind Farm site is distant from significant wetlands, wetland birds are expected to be at low risk from the development. Birds of prey, such as wedge-tailed eagles are indicated to be present within the vicinity of the wind farm, but from observations during site visits, they do not appear to have a consistent presence in any significant numbers. Species that flock and fly above the tree canopies are likely to be most prominent in the vicinity of woodland areas but may transit between the woodland remnants. Those birds that fly at low levels such as canopy height will be below the lowest height of the area swept by the turbine blades which will range from a minimum of at least 30 metres up to a maximum of 150 metres in height.

Species that flock and fly above the tree canopy appear to be the main avifauna category of relevance for the project site. The Superb Parrot has been observed in the project area and is generally seen flying between woodland remnants or flying close to the tops of the remnant trees. This species is less likely to be impacted by blade strike than if its habitat were impacted by removal of roosts in trees. As such it appears the retention of the large trees with hollows representing habitat for the Superb Parrot (other than those in close proximity to turbines) is considered to be the best means of aiding the conservation of this threatened species. It has been recommended that prior to construction commencing, a targeted survey of the Superb Parrot be undertaken in September to December to coincide with the breeding season as stated in Appendix D. Wedge tailed eagles may also be at risk from time to time, but this species is not listed under either the TSC or EPBC Acts. Additionally, some studies suggest that these birds soon adapt to the presence of the turbines and actively avoid them.

Although most of the literature on this issue is based on overseas studies, the principles and findings are generally applicable to Australian conditions. The overseas studies have found that the magnitude of the impact 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).

While the Flyers Creek Wind Farm site can be regarded as a generally low risk site in respect of the risk of blade-strike, a number of measures can be adopted to further minimise the risk as follows.

- removal of a limited number of large dead trees providing potential resting sites for raptors or potential nest sites for threatened bird species within 100 metres of turbine sites
- no lambing to occur in the vicinity of turbines
- carcasses to be removed from areas around turbines so as not to attract birds of prey

KMA expects that the impact of blade-strike on birds at the Flyers Creek Wind Farm will be negligible; the project area is a dry upland location a considerable distance from any large water bodies and no turbines are in gaps between mountain ranges

Should air safety lighting be required on the nacelles it will be installed with consideration of visual impact for surrounding rural residences and to minimise its potential to attract avifauna. Shielding of obstacle lights is permitted, provided it does not compromise their operational effectiveness. Due to the flashing, rather than static, nature of obstacle lighting used and the shielding to reduce its visibility, such lights are unlikely to attract large numbers of birds that could then be impacted by the blades. Chapters 9 and 16 address the issues of obstacle lighting.

10.5.3 Impact of blade strike on bats

There is limited knowledge about the extent of collision by Australian bats with wind turbines; however the preliminary information indicates that impact levels are low. Carcass surveys for the inland sites in NSW at Crookwell and Blayney wind farms did not identify any incidences of blade strike for bats. Bat species population studies (Richards, 1998/99) undertaken before and after the installation of the Crookwell Wind Farm also did not identify any adverse impact on bat populations in the vicinity of the wind farm. More recent monitoring at Capital Wind Farm has shown low levels of bats impacted for several months during 2010 and the species affected were not classed as threatened.

Victorian studies have only shown low levels of incidence. Monitoring surveys conducted between 2000 and 2003 at the Codrington Wind Farm (14 turbines) recorded only two individuals killed by collision and at the Toora Wind Farm (12 turbines); six White-striped Freetail Bats and one Chocolate Wattled Bat were killed. This equates to 0.04 and 0.14 bat deaths per turbine per year at Codrington and Toora respectively (Environment Victoria, 2004).

Two surveys of bat species were undertaken at the Flyers Creek Wind Farm site in October/November 2008 and March 2009. Ten bat species were identified during the surveys, one of which, the Yellow-bellied Sheathtail Bat, is listed as vulnerable under the NSW TSC Act. However, as previously stated in this chapter, GRA concludes that the proposed wind farm would be expected to have no significant impact upon the local or regional population of this bat for reasons that are detailed in Appendix E.

While the Eastern Bentwing Bat is known to occur in the region, no Eastern Bentwing Bats were recorded during either Flyers Creek bat survey, despite the second survey (March 2009) occurring at the time of year when the breeding population would be dispersing from their wintering caves. While these survey results do not preclude the possibility that Eastern Bentwing Bats utilise the site, they do indicate that it is unlikely that Eastern Bentwing Bats frequent the site in ecologically significant numbers. Nevertheless, as recommended by GRA, the proponent has undertaken a third bat survey during the March/April 2011 timeframe to further inform the Eastern Bentwing Bat's, (and other species'), utilisation of the proposed wind farm site.

In total, 280 bat calls were recorded by five Anabat detectors located at the meteorological masts representative of the proposed turbine locations. A much greater number of bat calls, over 7000, were recorded at 7 detectors placed at various woodland remnants within, and near, the project site. Therefore, it is clear that bat utilisation of the primarily cleared hills where the turbines are to be located is significantly lower than the woodland remnants which are predominately at lower elevations. In addition, as shown in Table 6 of Appendix E, the number of bat calls recorded at detectors raised ~50 metres high on the wind masts were about 5 times less than the detectors located at the base of the masts. Therefore, the bat calls recorded at the bottom of the rotor swept area of the turbines were significantly less frequent than near ground level.

Studies of bat flight behaviour in the vicinity of turbines showed that only a small percentage are involved in collisions, some exhibit avoidance behaviour and the bulk appear to stay clear of the turbines indicating an awareness of the turbines (Horn and Arnett, 2005 in GRA, 2008).

10.5.4 Threatened Species Conservation Act

The report by KMA notes that the assessment process under the NSW Threatened Species Conservation (TSC) Act 1995, commonly known as the 'seven part test' is not used for assessment of proposed developments under Part 3A of the *Environmental Planning and Assessment Act 1979*. The *Guidelines for Threatened Species Assessment* (Guidelines) is instead used for assessment of such proposals. The *Guidelines* outlines the process for assessing impacts on threatened species, populations and communities listed as threatened under the *Threatened Species Conservation Act 1995* (NSW) or the *Fisheries Management Act 1994* (NSW).

The assessment by KMA was undertaken in accordance with the Guidelines and concluded that:

Threatened Plant Species

"The surveys of the study area did not find any threatened plant species and none are expected to occur there. The highly modified land, much of which is pasture improved with little native vegetation, and the exotic grassland cover of most areas, precludes the likelihood of threatened plants occurring in the study area. No such species have been recorded locally."

Threatened Animal Species

"Several threatened woodland birds were found in the study area and a few others no doubt occur there from time to time. Woodlands are the most important habitat for these species, as well as hollow-bearing trees. The impact of the wind farm on these species is not likely to be significant, as long as woodlands are avoided and the removal of hollow-bearing trees are minimised. The loss of a few trees containing hollows is not likely to be detrimental to the Superb Parrot, as long as appropriate measures are taken in the design and construction of the wind farm such that tree loss is minimized. Observations on site indicate that this is achievable."

Threatened Communities

"Most of the woodland remnants are part of the Yellow Box - Red Gum listed endangered ecological community. These can be avoided through appropriate layout of the project. The quality of the occasional patches of native grassland, that was originally part of the woodland, is low to very low. This grassland exhibits low native plant species diversity and is dominated by one or two grasses. Stands of woodland are quite rare in the area."

GRA reviewed the potential for impact on threatened species, in particular the Yellow-bellied Sheath-tail bat (*Saccolaimus flaviventris*). Based on the low numbers that were recorded during surveys at the project area and the small size of habitat remnants present compared to the size that is necessary to support significant populations of the Yellow-bellied Sheath-tail Bat, GRA concluded that no significant impact on the local population of this species was expected. No other threatened bat species were indicated to be significantly impacted.

The Large Footed Myotis (*Myotis Macropus*) was not recorded during the surveys and was not expected due to the lack of suitable habitat at the project area.


The Eastern Bentwing Bat (*Miniopterus schreibersii*) has potential to be present in the area but was not recorded during the surveys. The project area is at the margin of its range and the result was not unexpected.

10.5.5 Environment Protection and Biodiversity Conservation Act

The Commonwealth Environment Protection and Biodiversity Conservation Act, 1999 specifies that approval is required from the Commonwealth Minister for the Environment and Heritage for actions that have, will have or are likely to have a significant impact on a matter of "national environmental significance". Matters of national environmental significance are listed threatened species and communities, migratory species protected under international agreements, RAMSAR wetlands of international importance, the Commonwealth marine environment, World Heritage properties, National Heritage places, and nuclear actions.

In relation to EPBC matters, the KMA report states that:

"In our opinion, the proposed wind farm is not likely to have a significant impact on matters of national environmental significance listed under the Environment Protection and Biodiversity Conservation Act. Referral to the Commonwealth Minister for the Environment for assessment and approval is therefore not warranted."



GRA concluded that:

“Consideration of the potential impacts relevant to EPBC Act matters has been undertaken and with the incorporation of the mitigation measures outlined in this report it is considered that a referral under the Act is not warranted.”

Nevertheless, the proponent will undertake to make an EPBC referral later this year.

10.5.6 Land dedicated for conservation purposes

There are no reserves managed by the NSW National Parks and Wildlife Service in or close to the project area.

10.5.7 Offsetting

As indicated by the NSW Office of Environment and Heritage¹ (Previously DECCW), “*offsetting is a practical tool for decision makers who balance the relative environmental, social and economic merits of development proposals*”. Offsets are addressed in Section 75JA of the EP&A Act and Part 7A of the Threatened Species Conservation Act 1996. The regulatory schemes use a range of mechanisms to secure offsets including biobanking agreements, biodiversity certification agreements and property vegetation plans.

A number of principles have been provided by the NSW Office of Environment and Heritage considering environmental impacts and developing offset proposals. In general the principle suggest that impacts should be avoided first by using prevention and mitigation measures and where impacts cannot be avoided offsets should be used. These offsets must be quantifiable, where the impacts and benefits must be reliably estimated and should be agreed with the relevant authority prior to the impact occurring


As stated in Appendix D, Section 7.3, KMA assessed that the woodland and grassland in the study area do not meet the minimum criteria set by the Commonwealth for their listed woodland and derived grassland community. The proponent has taken the environmental constraints into account when designing the project, and therefore, vegetation considered to be important (i.e. patches of remnant woodland and stands of hollow-bearing trees) are avoided where possible. Micrositing of turbines and tracks will further minimise impacts on the environment. It is however inevitable that some vegetation and a number of trees will be removed during the construction phase of the project.

However, it is currently estimated that the maximum loss of native tree vegetation, some of which has a native understorey, is about 1.1 hectares. As such, a proposed offset strategy is provided below, if it is determined that offsets are required. This is an estimation as final figures for vegetation disturbance and removal can only be determined when the final project design is available. As indicated in Section 3.1, the total project area is 6,082 hectares and the total project footprint is estimated to be 32 hectares.

10.5.8 Proposed offset strategy

As stated in Appendix D, Section 7.3, the woodland and grassland in the study area have been assessed as not meeting the minimum criteria set by the Commonwealth for their listed woodland and derived grassland community. Therefore, any disturbance or removal of native trees is very unlikely to have an ecologically significant impact.

¹ <http://www.environment.nsw.gov.au/biocertification/offsets.htm>



Once the layout is finalised and prior to construction, the proponent, in consultation with a suitably qualified ecologist would quantify actual impacts and the possible offsets. This is likely to include the following activities:

- A full assessment of the ecological values and potential habitat of the areas being impacted. This would include an assessment of the condition of the vegetation and habitat and an assessment of the conservation status.
- Establishing an accurate estimate of trees and vegetation to be removed to ensure a suitable offset extent. As recommended in Appendix D, a register of all trees removed would be maintained. This would include the locations of the trees, the species of trees and number of each species of tree. This information would be reviewed by an ecologist for assessing the adequacy of any offset relating to tree clearing.
- Identification of the most suitable offset option(s). This would include, for example, the identification of ecologically suitable stand or stands of woodland which could be fenced from grazing and allowed to regenerate and/or planted with suitable native species. Some potential sites for woodland offsets within the project boundary include areas within the woodland remnants north of Halls Road and on either side of Gap Road as shown in Figure 10.1.
- Determining the location and the total area of the woodland stand(s) in consultation with an ecologist and with the relevant authority, in consideration of the condition of any vegetation communities and habitat removed.
- Developing an appropriate management strategy for the long term viability of the offsets, to include monitoring and maintenance activities. This would include security of tenure and financial arrangements for the conservation management of proposed offsets.

10.6 Mitigation measures

The Flyers Creek Wind Farm has been designed to utilise land that has been cleared and is currently used for grazing. As far as possible, the design aims to minimise further clearing of remnant woodland and to retain as much potential fauna habitat, as practicable. These objectives have required that the siting of turbines and access tracks avoid sensitive areas and that a range of mitigation measures be incorporated in the project Environmental Management Plan.

Having regard to the recommendations of KMA (2011) and GRA (2011), it is proposed to adopt the following measures to protect the remaining native vegetation and significant habitat and to assess potential impacts on aerial fauna:

The principal way in which the impact of the wind farm will be minimised is by micro-siting the facilities to avoid removing woodland and native trees. This should be achieved as follows:

- an ecologist be involved in determining the micro-siting of turbines or for routing of access tracks and cable routes where tree removal may be involved. The micro-siting will be to retain valuable habitat trees and reduce the potential for loss of woodland remnants
- priority be given to retaining hollow-bearing trees because of their high habitat value and inability to replace them in the short term.
- where it is necessary for trees are to be removed they will be cut down in the presence of an ecologist, outside the breeding season of most fauna species and. Clearing of trees with hollows is to be avoided where practicable but if required, trees will be lowered gently to the ground with hollows on the upper side to allow and resident fauna the opportunity to escape the tree.
- a register of all tree removal will be maintained including details of tree locations, type, size and numbers. This information is to be reviewed by an ecologist for assessing the adequacy of any offset relating to tree removal.

- targeted monitoring in 2011 at the time of the year when Eastern Bentwing Bats migrate from the breeding caves (March-April) with detectors at relevant turbine locations to confirm that this species is not present in significant numbers at the wind farm site.
- Prior to construction commencing, a targeted survey of the Superb Parrot will be undertaken in the breeding season (September to December) by a qualified biologist. The method provided in Appendix D will be employed in this survey. DECCW will be consulted in the event that any nesting trees are identified.
- In the event that a sufficient number of trees and vegetation cannot be avoided, a suitable offset metric and a suitable offset strategy will be determined in consultation with DECCW.

Specific areas where clearing is to be carefully planned, in consultation with an ecologist, and managed including pre-clearing reviews, monitoring and review include the following locations:


- Turbine site 3 – avoid scattered trees
- Access track and cable routes between Turbines 4 and 6 – avoid scattered trees
- Vicinity of Turbine 9 – avoid scattered trees
- Access route to Turbine 16 – follow edge of trees
- Siting of Turbines 18 and 19 and associated tracks – avoid scattered trees
- Cable route for Turbine 20 to avoid clumps of remnant woodland
- Turbine site 33 – minimise clearing of trees
- Access track to Turbine 39 – minimise clearing of scattered trees
- Turbine site 39 – avoid nearby cluster of trees
- Cable route Turbine 39 to Turbine 43 to follow route that minimises clearing
- 33kV overhead line to avoid tree clearance wherever practicable, proposed route to be pegged and reviewed by ecologist (east of substation, in vicinity of Turbines 18 and 19, southern end to reach point of connection with underground cable circuits)

Several small creeks may be crossed by access tracks and/or cable routes. Where the crossings are necessary the crossings will be designed to avoid erosion and the movement of soil into watercourses. The main risk area for erosion is for the cable route between Turbine 39 and Turbine 43 and consideration may be given to having this section of underground cable replaced by a section of overhead transmission line.

Construction of the access tracks, cable routes and the hardstands, will be undertaken in accordance with a Soil and Water Management Plan and where required location specific erosion and sediment control plans. Permanent tracks will be stabilised as soon as possible and temporary tracks and buried cable routes rehabilitated to the satisfaction of the relevant government department and landowner.

As an offset for removing trees, it is recommended that a suitable stand or stands of woodland be fenced from grazing and allowed to regenerate. The location of the woodland stand(s) should be determined in consultation with an ecologist and the extent of any clearing should be related to the extent of the offset area adopted.

Weed control on the properties generally is not the responsibility of the operator or contractors associated with the wind farm. However, measures shall be implemented to ensure that the construction phase activities of the proposed wind farm incorporate measures to prevent new weeds being introduced to the site or invasive weeds by spreading to new locations on the properties involved. This is particularly important in regard to the spreading of invasive weeds to



new locations. Any weed propagation on land disturbed by the project will be subject to control measures during the site restoration phase until the former pasture status has been established.

The construction phase will be monitored by a qualified environmental auditor or environmental specialist in accordance with a Construction Environmental Management Plan. Issues to be monitored include:

- soil stabilisation works and their effectiveness;
- advice on micro-siting of wind farm components;
- creation of rocky habitat where rock is excavated.

In general, large rock outcrops should be avoided, because they provide habitat for reptiles and other native animals and in a largely cleared landscape such as the project area, rock outcrops are sometimes the only habitat available for reptiles. Where practicable, micro-siting of turbine sites will avoid rocky areas and if located among rock outcrops, the excavated rock will be deposited nearby in a 'natural' formation to re-create rocky habitat.


Many kilometres of buried cable will be installed throughout the wind farm site to link turbines to the wind farm substation. The following measures relate to the installation of these cables:

- Disturbance should be minimised and rehabilitation undertaken as soon as possible after back-filling of the trench.
- The on-site construction/maintenance crew will be responsible for regularly checking the cable routes for erosion until the routes have been stabilised and satisfactorily revegetated.
- Additional care will be taken on steep slopes to ensure that erosion does not occur. Any problems will be rectified immediately.
- The property owners and/or relevant government authority will be consulted to identify a suitable cover crop for sites requiring seeding to accelerate revegetation.

Measures that will be taken to minimise the potential to impact on birds of prey, ie minimise the probability of blade-strike include:

- the turbines will have no perching places
- dead animals (eg sheep carcasses) within 200 metres of a turbine will be removed as soon as practicable
- the landowner will be consulted in relation to options for lambing to occur in paddocks without turbines
- roadkills on site access tracks should be removed if they are within 200 metres of a turbine
- the turbine and other facilities should not have lights, other than safety lights for aircraft navigation as required by government authorities, to minimise attracting nocturnal birds and bats
- buildings, poles or other structures should not be constructed within 200 metres of turbines as they provide perching opportunities for birds of prey.

Monitoring the impact of blade-strike on birds and bats should be undertaken for a period of 12 months after the wind farm commences operation and the results reported to the Department of Planning and DECCW. The Bird and Bat monitoring plan will form part of the Operational EMP and be subject to the approval of the Department of Planning.



The proponent or its contractor should not construct any large dams within one kilometre of turbines.

If trees and other plants are planted around buildings and other facilities for screening purposes or aesthetics, then ideally these will be locally indigenous species, however landowner preferences will also guide the selection.