APPENDIX 12

Bango Wind Farm Part 3A Ecological Assessment

Environmental Resource Management Australia Pty Ltd

UPDATES TO THE ENVIRONMENTAL IMPACT STATEMENT

During the preparation of this Environmental Impact Statement, a number of changes occurred.

Please consider these changes while reviewing this Appendix.

- The Assessment Type of the Bango Wind Farm has transitioned from Part 3A, after its repeal, and is now being assessed as a State Significant Development under Part 4 of the EP&A Act. Any reference to a Part 3A assessment in attached technical assessments may be disregarded, and considered as State Significant Development;

- Rugby Wind Farm, a wind farm that was proposed to the north of the Project has been withdrawn. Where references are made to cumulative impacts with the Rugby Wind Farm, please disregard these;

- Slight changes have occurred to the Rye Park Wind Farm layout, a wind farm under development to the east of the Project. The changes made to the layout are not significant and therefore sit within the cumulative impact assessment undertaken for this EIS. The revised layout has been considered in the Environmental Noise Assessment and Landscape Visual Impact Assessment. Where further references are made to the Rye Park Wind Farm layout, these will be incorporated into future documentation where required;

- Four turbines at the south east extent of the Project, situated in the Mt Buffalo cluster have been removed through consultation with landowners. This change has been highlighted in maps and a review of all technical assessments has deemed that the removal of the four turbines has resulted in a reduced. This change will be incorporated into future documentation. These wind turbines are identified as “removed wind turbines” in the Project maps in Volume 2; and

- A number of changes were made to the residence information for the Project, as a result of construction of houses and change in occupancy status of existing buildings. These changes have been incorporated into the EIS.

- There are a small number of transcription errors in Table 6.7 Fauna Habitat Impacts, however, correct figures are presented in Volume 1 and in Annex F of this document.

Level 1, 60 Leichhardt Street
Spring Hill QLD 4000
AUSTRALIA

PO Box 1400
Spring Hill QLD 4004
AUSTRALIA
www.erm.com

Telephone: +61 7 3839 8393
Facsimile: +61 7 3839 8381

To	Siobhan Isherwood – Wind Prospect CWP Renewables
From	Dr David Dique
Ref/Job Number	0170898
Subject	Bango Wind Farm – Ecology Technical Note for Proposed Increase to Blade Tip Height
Date	06/09/16

PURPOSE

ERM has been engaged by Wind Prospect CWP Renewables on 01 September 2016 to provide ecological advice pertaining to a relatively small increase in blade tip height for the proposed Bango Wind Farm. Despite the EIS having been compiled, this adjustment in the Project Description may have implications for the previous findings of the impact assessment contained in the *Bango Wind Farm Ecological Impact Assessment Report*. Specifically, this updated ecological advice focuses on the potential impact to bird and bat species associated with collision mortality and rotor strike.

BACKGROUND

Wind Prospect CWP Renewables Pty Ltd proposes to construct and operate a renewable energy facility in the Southern Tablelands region of NSW entitled Bango Wind Farm ('the Project'). The Project is bordered by Boorowa to the north, Yass 20 km to the south and Binnalong 17 km to the south west. The nearest township is Rye Park, which is located approximately 4 km to the north east.

The Project incorporates the construction and commissioning of up to 122 wind turbine generators (WTGs), the construction of underground electrical interconnections, electrical compounds including substations and switching stations and connection to the existing TransGrid electricity transmission network via an overhead transmission line. The final number and position of WTGs and electrical infrastructure has been refined through an iterative design process, with adjustments made with respect to social, environmental and/or engineering constraints.

From July 2012 to February 2013, ERM undertook an Ecological Impact Assessment of the Bango Wind Farm on behalf of Wind Prospect CWP Renewables. The assessment outlined the potential direct and indirect impacts of the Bango Wind Farm on ecological values across the Study Area. The Study Area was defined as a buffer of 100 m radius around the Development Footprint.

The previous Ecological Impact Assessment considered turbines with a blade tip height of 192 metres and a rotor diameter of 144 metres. It is understood that Wind Prospect CWP Renewables is proposing to change the blade tip height to 200m (4% increase), with the maximum rotor diameter to remain at 144 metres. This adjustment increases the distance from ground to the bottom of the blade tip from 64m to 72m and increases the height from 194 metres to 200 metres.

ECOLOGICAL IMPACT ASSESSMENT

Below is a summary of considerations of potential ecological impacts based on the proposed design changes. Particular consideration is given to the risk of injury and fatality posed to bird and bat species.

a) Impacts on Birds

It is unlikely that the proposed change in blade tip height will increase the level of risk for bird species across the Study Area. The results of the 'Bird Utilisation Surveys' of the previous assessment report (see *Table 1*) identified that a total of 26 birds (2%) were recorded flying at the 40 to 150 metre height range, and no birds were documented flying at 150 – 200 metres or greater than 200 metres during the surveys. The remaining 1,309 birds (98%) observed were flying at a height that is outside of any potential rotor strike zone.

Table 1: Number of Birds Recorded at Respective Height Classes

Height Classes	Number of Birds
0 – 20 metres	1250
20 – 40 metres	59
40 – 150 metres	26
150 – 200 metres	0
>200 metres	0

Source: ERM 2013, Bango Wind Farm Ecological Impact Assessment Report, p. 103

b) Impacts on Bats

It is unlikely that the adjustment in turbine height will lead to an increase in potential impact to bat species. The previous Ecological Impact Assessment highlighted a low risk associated with collision/barotrauma as bats fly in the sweep zone, based on a "worst case" scenario of a rotor-swept height of 25m from the ground. Therefore, the increase to 72m from the ground will likely reduce the potential impact to yellow-bellied sheathtail and eastern bentwing bats.

CONCLUSION

This technical note has identified that the blade tip height increased from 192 metres to 200 metres is unlikely to change the findings of the impact assessment for bird and bat species as has been reported in the previous Ecological Impact Assessment.

We trust that this technical note is sufficient for Wind Prospect CWP Renewables purposes. Should you have any queries regarding the above, do not hesitate to contact the David Dique on 0421 930 586 or david.dique@erm.com.

Yours sincerely,
for Environmental Resources Management Australia Pty Ltd

Dr David Dique
Partner

Bango Wind Farm

Ecological Impact Assessment

For Wind Prospect CWP

May 2013

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Bango Wind Farm

Ecological Impact Assessment

Wind Prospect CWP

May 2013

Approved by:	*Mark Branson*
Position:	Project Manager
Signed:	
Date:	*15 May, 2013*
Approved by:	*Murray Curtis*
Position:	Partner Director
Signed:	
Date:	*15 May, 2013*

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOGRAPHS

LIST OF ABBREVIATIONS

Abbreviation	Description
ACT	Australian Capital Territory
APZ	Asset Protection Zone
AHD	Australian Height Datum
ANSWW	Atlas of NSW Wildlife
ARI	Average Recurrence Interval
AusWEA	Australian Wind Energy Association
BBAM	BioBanking Assessment Methodology
BEP	Bushfire Emergency Plan
BIS	Botanical Identification Service
BOM	Bureau of Meteorology
BUS	Bird utilisation surveys
BVT	BioMetric Vegetation Type
CAP	Catchment Action Plan
CCC	Community Consultative Committee
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
CMP	Conservation Management Plan
CS	Collector Substation
DBH	Diameter at Breast Height
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change (formerly DEC)
DECCW	Department of Environment, Climate Change and Water (now OEH)
DEWHA	Commonwealth Department of Department of the Environment, Water, Heritage and the Arts (now DSEWPC)
DGRs	Director-General's requirements
DI&I	Department of Industry and Investment
DNG	Derived Native Grassland
DoP	NSW Department of Planning
DoPI	Department of Planning and Infrastructure
DPI	NSW Department of Primary Industries
DSEWPC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities.
EA	Environmental Assessment
EARs	Environmental Assessment Requirements
EEC	Endangered Ecological Community
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ERM	Environmental Resources Management Australia Pty Ltd
ERP	Emergency Response Plan
EWP	Elevated Work Platform
FM Act	Fisheries Management Act 1994
GIS	Geographic Information System
GPS	Global Positioning System
GSM	Golden Sun Moth
ha	Hectares
HBT	Hollow-bearing trees
IBA	Important Bird Area
IBRA	Interim Biogeographic Regionalisation for Australia
IDO	Interim Development Order
km	Kilometres
km /hr	Kilometres per hour
kph	Kilometres per hour
KTP	Key threatening process

Abbreviation	Description
kV	Kilovolt
LEP	Local Environment Plan
LGA	Local Government Area
LPMA	Land and Property Management Authority (formerly Department of Lands)
m	Metres
m3	Metres cubed
ML	Mega litres
mm	millimetres
MNES	Matters of National Environmental Significance
MRET	Mandatory Renewable Energy Target
MW	Mega Watt
NAAB	New Atlas of Australian Birds
NES	National Environmental Significance
NOW	NSW Office of Water
NPWS	National Parks and Wildlife Service (now part of DECCW)
NSW	New South Whales
NW Act	Noxious Weeds Act 1993
NV Act	*Native Vegetation Act 2003*
OEH	NSW Office of Environment and Heritage (formerly DECCW)
OEMP	Operations Environmental Management Plan
PAA	Project Application Area
PMST	Protected Matters Search Tool
RBVT	Revised Biometric Vegetation Type
RFS	Rural Fire Service
RMS	Roads and Maritime Service
rpm	Revolutions per minute
RSA	Rotor sweep area
SCRA	Southern Comprehensive Regional Assessment
SEPP	State Environmental Planning Policy
SEPP Major Development	*State Environmental Planning Policy (Major Development) 2005*
SOC	Statement of Commitments
SLoc	Shallow Soils
SS	Switching Station
TEC	Threatened Ecological Community
TSC Act	NSW Threatened Species Conservation Act 1995
UHF	Ultra-High Frequency
Wind Prospect	Wind Prospect CWP Pty Ltd
WMP	Weed Management Plan
WONS	Weeds of National Significance
WPCWP	Wind Prospect CWP Pty Ltd
WTG	Wind Turbine Generator
YEbi, YEct	Yellow Earths
°C	Degrees Celsius

EXECUTIVE SUMMARY

Wind Prospect CWP Pty Ltd (WPCWP) propose to construct and operate a renewable energy facility in the Southern Tablelands region of NSW entitled Bango Wind Farm (the Project). The Project is bordered by Boorowa to the north, Yass 20 km to the south and Binnalong 17 km to the south west. The nearest township is Rye Park, which is located approximately 4 km to the north east.

The Project incorporates the construction and commissioning of up to 122 wind turbine generators (WTGs), the construction of underground electrical interconnections, electrical compounds including substations and switching stations and connection to the existing TransGrid electricity transmission network via an overhead transmission line. The final number and position of WTGs and electrical infrastructure has been refined through an iterative design process, with adjustments made with respect to social, environmental and/or engineering constraints. The Development Footprint that has been assessed in this report incorporates two different layout options, of which only one will be constructed, ie this report assesses the worst case scenario.

The ecological assessment commenced in July 2012 and continued to February 2013. During this time, the Project design underwent progressive refinement in response to identification of ecological constraints. Therefore, the ecological assessment covered land which is now outside of the current Study Area. The information gathered during all surveys undertaken has been retained within this report to provide an indication of ecological values and condition in the Locality.

The Study Area comprises private farming properties, primarily used for livestock grazing and cropping. Some areas have a long history of pasture improvement, cropping and grazing. Other areas have not been ploughed or cultivated and scattered areas of exposed rock occur amongst the grasslands. In areas of heavy grazing, native flora cover is minimal and such areas are dominated by exotic pasture species.

Native vegetation occurs throughout the Study Area in conditions varying from patches of intact woodland and open forest, to degraded stands of native trees and isolated paddock trees. Intact native woodland and open forest are generally restricted to ridgetops and roadsides. Derived native grassland occurs in areas of less intensive grazing.

METHODOLOGY

Flora and fauna field investigations have been conducted across the Study Area by ERM from July 2012 to February 2013. Vegetation communities throughout the Study Area were mapped in accordance with the BioMetric Vegetation Types (BVT) for the Lachlan Catchment Management Authority. Flora surveys included vegetation quadrats, vegetation quality assessments and meandering transects targeting threatened flora. Fauna assessments included fauna habitat assessment and general searches for fauna, with targeted surveys for frogs, birds, bats and other mammals. Surveys were undertaken during the appropriate season to optimise species detection.

A range of bird survey techniques were used and all were undertaken in accordance with the AusWEA Interim Bird Risk Assessment Standards (2005). Bird surveys included targeted surveys for threatened birds, bird utilisation surveys (BUS) and bird census surveys. The BUSs were undertaken from 14 November 2012 through to 23 February 2013 to capture data during the Superb Parrot breeding season. Point and transect surveys within areas of suitable habitat for the Superb Parrot were undertaken throughout the survey period from 1 August 2012 through to the 13 December 2012. Area searches and transects surveys were conducted through areas of suitable habitat for the Swift Parrot in the early morning and afternoon. Bird census surveys for woodland birds were carried out during early morning or late afternoon in areas of suitable habitat.

Bat surveys were undertaken using anabat detectors and recorders to record the echolocation calls of micro-bats. Harp traps were deployed in areas of woodland and in open areas adjacent to woodland.

Mammal data was collected by incidental observation or by direct means using remote cameras, nocturnal spotlighting and mammal trapping. Remote cameras were deployed in woodland habitats. Arboreal mammal trapping was undertaken in areas of remnant woodland with numerous hollow bearing trees, specifically targeting the Squirrel Glider. Call playback and spotlighting were undertaken for frogs, owls and nocturnal mammals.

RESULTS

Two BVTs were recorded in the Study Area, both occurring in varying conditions, including as derived native grassland. These BVTs are interspersed with areas of exotic pasture, planted vegetation and cropping. One threatened ecological community was mapped and assessed within the Study Area: White Box - Yellow Box - Blakely's Red Gum Woodland. White Box - Yellow Box - Blakely's Red Gum Woodland is listed as an endangered ecological community (EEC) under the NSW Threatened Species Conservation Act 1995 (TSC Act) and as a critically endangered ecological community (CEEC) under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Field investigations identified 127 flora taxa in the Study Area, 97 (76%) of which were indigenous and 30 (24%) of which are introduced. Many of these species are characteristic of the open forests, grassy woodlands, derived native grasslands and

pasture in the Locality. One threatened flora species was recorded in the Locality during field surveys: Yass Daisy (Ammobium craspedioides), which is listed as Vulnerable under both the EPBC Act and TSC Act. A population comprising over 200 individuals was recorded approximately 750 m to the west of the Study Area. Numerous exotic species occur in the Study Area, two of which are listed as Declared Noxious Weeds under the NW Act in both Boorowa and Yass Valley LGAs.

A variety of fauna habitat types occur in the Study Area, including woodlands, native grasslands and exotic grasslands. Habitat features in these areas include hollow bearing trees, paddock trees, woodland, tussock grasslands, disused mines, farms dams and creek lines. In the survey period, a total of 152 fauna species were recorded. Of these, one fauna species is listed as Endangered under the TSC Act and Critically Endangered under the EPBC Act. A further 11 fauna species are listed as Vulnerable under the TSC Act, and one species listed as Migratory under the EPBC Act. This data is presented in the table below.

Class	Species	Common Name	Status TSC Act	Status EPBC Act
Bird	Chthonicola sagittata	Speckled Warbler	V	-
Bird	Circus assimilis	Little Eagle	V	-
Bird	Climacteris picumnus	Brown Treecreeper	V	-
Bird	Daphoenositta chrysoptera	Varied Sittella	V	-
Bird	Merops ornatus	Rainbow Bee-eater	-	Mi
Bird	Petroica boodang	Scarlet Robin	V	-
Bird	Polytelis swainsonii	Superb Parrot	V	V
Bird	Pomatostomus temporalis	Grey-crowned Babbler	V	-
Bird	Stagonopleura guttata	Diamond Firetail	V	-
Insect	Synemon plana	Golden Sun Moth	E	CE
Mammal	Miniopterus schreibersii oceanensis	Eeastern bentwing Bat	V	-
Mammal	Petaurus norfolcensis	Squirrel Glider	V	-
Mammal	Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V	-

Status: CE = Critically Endangered, E = Endangered, V = Vulnerable, Mi = Migratory

IMPACT ASSESSMENT

The potential impacts to native biodiversity associated with the construction and operation of wind farms includes the following direct impacts:

- *removal of vegetation during construction:*
- *removal and disturbance of flora and fauna habitat during construction; and*
- *injury or death of fauna during construction and operation.*

Potential indirect impacts are related to the following:

- *fragmentation of ecological communities and habitat; and*
- *habitat avoidance.*

As these have the potential to impact on threatened species and ecological communities, Assessments of Significance against Section 5A of the Environmental Planning and Assessment Act 1979 (EP&A Act) (also known as the seven part test) were undertaken for species and ecological community identified as Known, Likely and Potential to occur within the Study Area. The seven part tests concluded that the Project is unlikely to have a significant impact on any of the threatened species.

Careful consideration has been given to minimisation of impacts, including avoidance, mitigation and offsetting measures. Avoidance of impacts has been applied through modifications to the wind farm layout. A range of general and species specific mitigation measures will be implemented to minimise impacts to native flora and fauna during both the construction and operation phases.

Residual impacts include vegetation and habitat removal and collision risk for birds and bats. The Development Footprint covers a total area of 251.18 ha. The Permanent Impact area covers 135.41 ha. The Temporary Impact area includes 115.77 ha that will be rehabilitated upon completion of construction. Of the total Development Footprint, 122.48 ha comprises exotic pasture, cropping, planted vegetation or bare ground. The remaining 128.70 ha comprises native vegetation. With regard to habitat types, 6.58 ha of native woodland, 42.69 ha of native grassland and 55.5 ha of exotic grassland occur in the permanent Development Footprint. Fifteen hollow bearing trees occur in the permanent Development Footprint and may be removed. A collision risk model was used to calculate the collision risk for the four threatened / locally important birds that have the potential to fly within the rotor swept area. The risk model concluded that the impact of collision to these bird species is considered negligible when compared with the total number of individuals recorded during the surveys.

WPCWP has committed to development and implementation of an offset strategy. This will be prepared using the results of a BioBanking Assessment that has been undertaken for the Project in accordance with the BioBanking Assessment Methodology.

CONCLUSIONS

This ecological impact assessment has identified the ecological features of the Bango Wind Farm site and assessed the potential impacts to threatened species and ecological communities. The proposed wind farm has the potential to impact on a number of threatened species and ecological communities. Avoidance, mitigation and offsetting measures have been applied in order to minimise potential impacts as much as possible and meet the 'improve or maintain' principle.

1 INTRODUCTION

Wind Prospect CWP Pty Ltd (WPCWP) proposes to construct and operate a renewable energy facility in the Southern Tablelands region of NSW entitled Bango Wind Farm (the Project). The Project is bordered by Boorowa to the north, Yass 20 km to the south and Binnalong 17 km to the south west (see *Figure 1.1*). The nearest township is Rye Park, which is located approximately 4 km to the north east.

The Project incorporates the construction and commissioning of up to 122 wind turbine generators (WTGs), the construction of underground electrical interconnections, electrical compounds including substations and switching stations and connection to the existing TransGrid electricity transmission network via an overhead transmission line. The final number and position of the WTGs and electrical infrastructure has been refined through an iterative design process and adjustments made with respect to social, environmental and/or engineering constraints.

Environmental Resources Management Pty Ltd (ERM) was commissioned by WPCWP to undertake an Ecological Impact Assessment (EIA) of the Project. This EIA aims to detail the potential direct and indirect impacts of the Bango Wind Farm on ecological values across the Study Area. The Proposal is to be assessed under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.1 KEY TERMS

This section defines the key terms used to define the Project.

1.1.1 Project Application Area

The term "Project Application Area" (PAA) refers to the area in which the proponent (WPCWP) has applied to develop the Project. The PAA is bound by parcels of land associated with the Development Footprint, as shown in *Figure 1.1*.

1.1.2 Study Area

The "Study Area" is the area which has been assessed for ecological values related to the Project; defined as a buffer of 100 m radius around the Development Footprint. The Study Area is shown in *Figure 1.2*.

1.1.3 Development Footprint

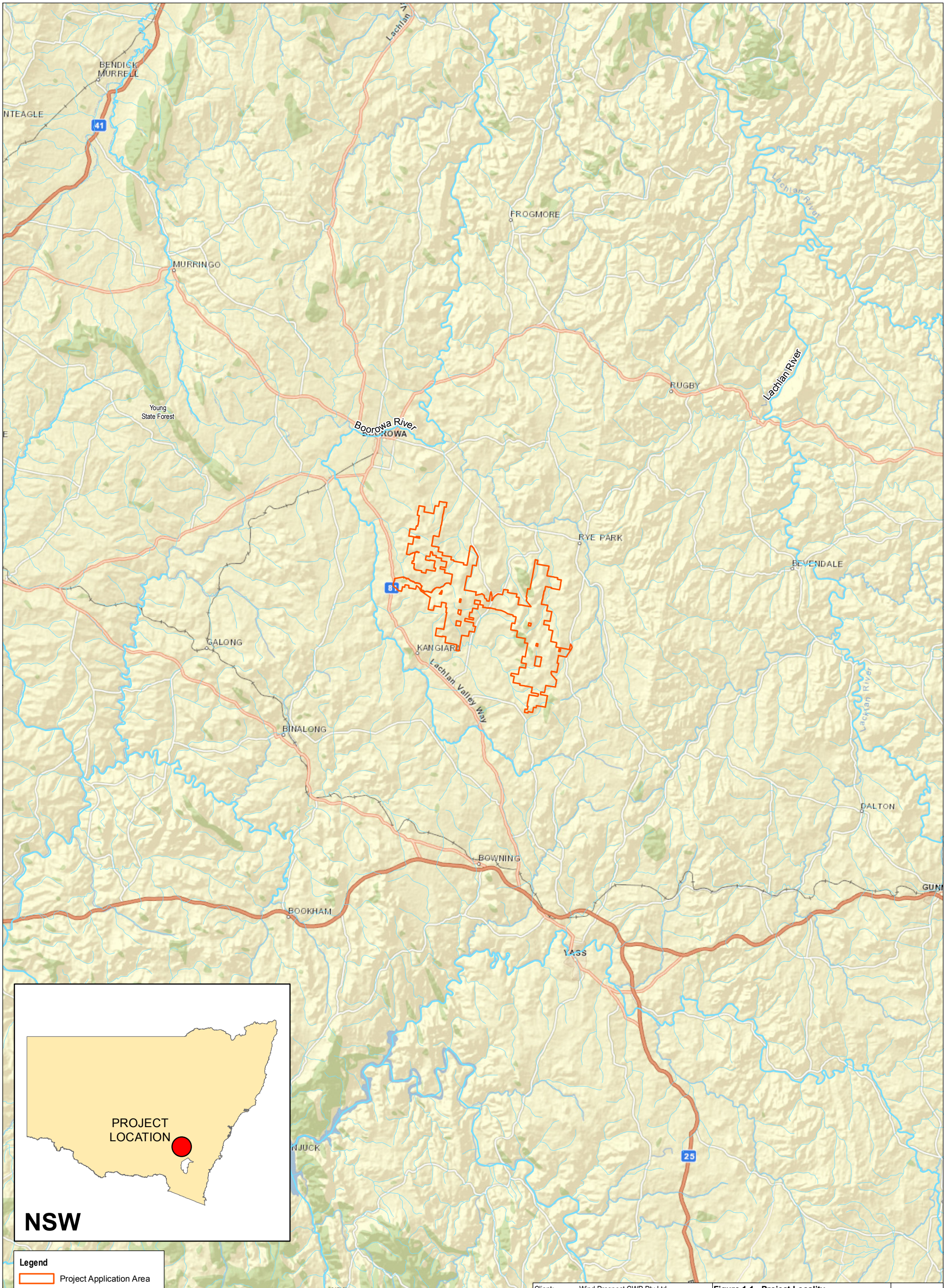
The "Development Footprint" is the area in which physical disturbance is proposed for the development of the Project and includes the location of infrastructure and any required easements including WTGs, access tracks including passing bays and cuttings, overhead power lines including stanchions and their associated easements, underground electrical reticulation routes, electrical compounds (switching stations and substations), office facilities, laydown areas and weather masts. The Development Footprint is located wholly within the PAA.

1.1.4 Clusters

The Project comprises three clusters of WTGs which are geographically associated. The Mt Buffalo Cluster incorporates the east of the Project, the Kangiara Cluster incorporates the centre of the project, while the Langs Creek Cluster incorporates the north west of the Project (refer to *Figure 1.2*).

1.1.5 Locality

The term "Locality" is used to discuss the context of the Project within the broader landscape; defined as the area contained within a buffer of 10 km around the Study Area.



Client:	Wind Prospect CWP Pty Ltd		**Figure 1.1 - Project Locality**
Drawing No:	0170898hv_BEIA_G001_R0.mxd		Bango Wind Farm Ecological Impact Assessment
Date:	02/05/2013	Drawing Size: A3	
Drawn By:	TC	Reviewed By: MB	
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.			Environmental Resources Management ANZ Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

Boorowa
Langs Creek Cluster
Lachlan Valley Way
Boorowa Road
Rye Park
Harrys Creek Road
Rye Park-Dalton Road
Kangiara Cluster
Tangmangaroo Road
Kangiara
Wargeila Road
Moorsby Lane
Mt Buffalo Cluster
Laverstock
Laverstock Road

Legend

- Study Area
- Wind Turbines Layout 1
- Wind Turbines Layout 2
- Overhead Electrical Lines
- Access Tracks
- Substation Options
- Site Compounds
- Project Application Area
- Wind Farm Clusters
- Glanmire Stewardship Block
- Yambacoona Stewardship Block
- Towns and Localities
- Sealed Road
- Unsealed Road

N

0 0.5 1 1.5Km

1:75,000 at A3

Wind Farm Layout: Wind Prospect CWP
Roads, Contours: Geoscience Australia
Basemap: Bing Maps

Client:	Wind Prospect CWP Pty Ltd	
Drawing No:	0170898hv_BEIA_G002_R0.mxd	
Date:	02/05/2013	Drawing Size: A3
Drawn By:	TC	Reviewed By: MB

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 1.2 - Wind Farm Layout

Bango Wind Farm Ecological Impact Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

1.2 REGIONAL ENVIRONMENTAL CONDITIONS

The Study Area is located in the Southern Tablelands of NSW within the Lachlan River Catchment Management Authority (CMA) and is found on the boundary of the South Western Slopes and South Eastern Highlands Bioregions in both Boorowa Local Government Area (LGA) and Yass LGA.

The following chapters provide a general overview of the regional environmental conditions, based on a literature review.

1.2.1 Climate

The Study Area experiences a temperate climate. Mean maximum temperatures (recorded at the Bureau of Meteorology's (BoM) Boorowa Post Office Weather Observation Station between 1947 and 1969) range from 42.8°C in January to 16.1°C in June. Mean minimum temperatures range from 17.4°C in January and February to -3.2°C in June.

The mean annual rainfall for the station is 612.6 millimetres (mm) with annual rainfall being largely consistent year round with slight increases in the months from June to October.

1.2.2 Hydrology

The Study Area is located within the Lachlan River catchment; the Boorowa River runs from the south of the PAA, around the western border to the north of the PAA, where it eventually meets the Lachlan River. There are a number of creeks in the vicinity of the PAA that drain to the Boorowa River. These include; Ryans Creek, Gotham Creek, Pipelay Creek, Harrys Creek, Kangiara Creek and Langs Creek.

These creeks and a number of smaller drainage lines within the Study Area were observed to be in a range of differing conditions, based largely upon current and historical land use practices. Large sections of riparian vegetation along these watercourses have been cleared leading to some areas of erosion along the banks. Heavy use by livestock has also contributed to streambank erosion. The local hydrology within the Study Area is limited to small creeks and drainage lines and small to medium sized man made farm dams.

1.2.3 Geology and Soils

Soils of the Goulburn 1:250 000 mapsheet were mapped by Hird (1991). Several polygons within the PAA have not been attributed, however, of those that have, two soil groups (three soil landscapes) have been mapped: Shallow Soils (SLoc) and Yellow Earths (YEbi, YEct). Approximately 50% of the area mapped as Shallow Soils is covered in vegetation. The Yellow Earths have been more extensively cleared.

The Yass 1:100 000 Geology Map (Calquhoun et al. 2008) shows a majority of the PAA is underlain by two major geology units. Being:

- *Hawkins Volcanics* from the *Douro Group*. This geology is described as *blue grey massive medium- to coarse-grained often welded porphyritic crystal vitric biotite-cordierite-garnet rhyolitic to dacitic ignimbrite with occational quartz and diorite xenoliths. Flow banded, vesicular rhyodacitic to dacitic lava, volcanic sandstone, minor rhyodacitic agglomerate and rhyolitic lapilli tuff are also present*; and

- Quaternary age *colluvial gravel, sand and silt* from the *Cainozoic Units*.

The Hawkins Volcanics geology formations dominate the eastern section of the PAA with the colluvial gravel, sand and silt formations found more commonly in the western portion of the PAA.

The Study Area is comprised of undulating hills and valleys interspersed with steeply rising ridgelines. Small rocky outcrops and areas of exposed rock are common throughout the Study Area. The elevation of the sites assessed during this study ranges from approximately 550 - 760 m AHD. Elevation, geology and soil type, as well as aspect influence the vegetation types found in different parts of the Study Area.

1.2.4 Land Use and Disturbance History

European settlement of the Boorowa region occurred during the early- to mid-1800's, with agriculture becoming the dominant industry of the area. Overall, the environment in the Study Area has been modified substantially, largely due to current and historical clearing and agricultural activities.

Prior to European settlement, the Study Area consisted of a mixture of open forest and grassy woodland (Keith 2004). Currently, approximately 91% of the Study Area is cleared of tree cover or has had tree cover substantially reduced. Areas of woodland and open forest range from intact areas, to areas undergoing natural regeneration and woodland areas in which the understorey and groundcover are substantially modified.

The Study Area comprises private farming properties, primarily used for livestock grazing and cropping. Some areas have a long history of pasture improvement, cropping and grazing. Other areas have not been ploughed or cultivated and scattered areas of exposed rock occur amongst the grasslands. In areas of heavy grazing, native flora cover is minimal and such areas are dominated by exotic pasture species. Derived native grassland occurs in areas of less intensive grazing. The rolling nature of the terrain has resulted in fairly even clearing on the slopes and valleys within the Study Area, with intact native woodland areas generally restricted to the ridge tops and roadsides.

1.2.5 Vegetation

Vegetation in the southern and eastern sections of the Study Area has previously been mapped in 2005 as part of the Southern Comprehensive Regional Assessment (SCRA) (Gellie 2005) and Native Vegetation of the Boorowa Shire mapping (NPWS 2002). Based on this vegetation mapping, three broad native vegetation types occur within the Study Area as follows:

- Eucalyptus open forest;
- Eucalyptus grassy woodland; and
- native grassland.

1.2.6 Protected Areas

The closest protected area is Mundoonen Nature Reserve, approximately 22 km to the south east of the Mt Buffalo Cluster. There are no other protected areas in the Locality.

Sections of the 'Glanmire' and 'Yambacoona' properties are included in the Environmental Stewardship Program for Box Gum Grassy Woodland. The Environmental Stewardship Program provides funding to private landholders to maintain and/or improve the condition and extent of specific Matters of National Environmental Significance (NES). The section of the 'Glanmire' property under the Environmental Stewardship Program comprises 200.93 ha and its eastern and northern boundaries adjoin sections of the Study Area in the Kangiara Cluster (refer *Figure 1.2*). The section of the 'Yambacoona' property under the Environmental Stewardship Program comprises 78.99 ha and its southern boundary adjoins sections of the Study Area, also in the Kangiara Cluster (refer *Figure 1.2*).

1.3 PURPOSE OF THIS REPORT

The purpose of this report is to provide technical ecological information relevant to the Study Area to inform the environmental impact assessment for the Project. This report identifies the ecological features of the Study Area and assesses the potential impacts on these features as a result of the Project.

The report aims to meet the Director Generals Requirements (DGRs), specifically to:

- identify and describe the conservation significance of ecological communities, flora, fauna and wildlife habitat within the Study Area;
- assess the type and degree of impacts on terrestrial ecological communities known to, or considered likely to occur in the Study Area;

- assess the type and degree of consequences of the impacts to flora and fauna of conservation significance known to, or considered likely to occur in the Study Area;
- identify measures to avoid impacts and consequences of the Project to terrestrial ecological values;
- identify mitigation measures to ameliorate the impacts and consequences of the Project on terrestrial ecological values; and
- identify offset strategies where impacts cannot be avoided or mitigated.

1.4 PERSONNEL AND QUALIFICATIONS

A number of environmental specialists have contributed to this ecological study including 14 ecologists from ERM, one ecologist from WPCWP and four subcontractors, as identified in *Annex A*. Relevant qualifications and experience for all personnel are also provided in *Annex A*. ERM personnel were involved in all field surveys and operate under Scientific Licence number SL100196 and Animal Research Authority number 12/2246.

2 PROJECT DESCRIPTION

This chapter presents a detailed description of the works associated with the construction and operation phases of the Project, and also outlines a number of changes that have been made to the Project throughout the course of the design process.

2.1 LOCATION AND SITE DESIGN

When first announced in February 2011, the Project consisted of up to 200 WTGs and ancillary structures spread over 30 different properties. The 330 kV overhead transmission line 5 km north of Yass was being considered as the power export connection point. Since being announced, the Project has been revised to take into account findings from key assessments and consultation with interested stakeholders. This has resulted in a significant reduction in the extent of the wind farm and a re-design of the wind turbine layout to arrive at the two configurations presented in this report.

The Project now comprises a wind farm with two potential WTG layouts; one consisting of up to 122 wind turbines (Layout Option 1) and the other up to 96 wind turbines (Layout Option 2), together with ancillary structures spread over 15 different properties. One, or a combination of these WTG locations will be used in the construction of the Project, to be determined following final WTG selection post-consent. This report addresses both Layout Options together, to assess the worst-case impacts associated with the range of WTGs available in the market.

The Project will consist of the following components:

- the installation of up to 122 WTGs (Layout Option 1) or up to 96 WTGs (Layout Option 2) with a maximum blade tip height of 192 m (refer to *Section 2.2.3*);
- a collector substation (CS) comprising cable marshalling, switchgear, high voltage transformers and associated protection and communications assets;
- a switching station (SS) comprising switching and protection devices, busbars, circuit breakers, isolators and communication assets;
- approximately four separate site compound and lay down areas (part temporary, part permanent), including site operations facilities and services buildings;
- underground transmission lines (up to 132 kilovolt (kV)) and control cables within and between each of the wind turbines and Clusters, connecting to the CS and SS;

- overhead transmission lines (up to 132 kV double circuit) and control cables within and between the wind turbines and Clusters, in single or multiple lines, connecting to the CS and SS;
- at least four separate on-site access roads from the public road network;
- crane hardstand areas, turning heads and passing bays for the erection, assembly, commissioning, maintenance, recommissioning and decommissioning of the wind turbines;
- up to six permanent wind monitoring masts (potentially including the retention of existing temporary monitoring masts);
- appropriate wind farm signage both during the construction and operational phases of the proposed development; and
- ancillary facilities.

Typical dimensions of the Project components are presented in *Table 2.1*.

Table 2.1 Project Components and Approximate Dimensions (based on greatest impact)

Project Component	Approximate Dimensions
Permanent	
WTG footings (maximum footprint)	25 m x 25 m
WTG assembly / crane hardstand areas	25 m x 60 m
Collector substation (CS)	150 m x 150 m
Site compounds *(the extent of permanent section retained within temporary compound)*	75 m x 75 m
On-site access: new roads	6 m x 83 km
Overhead transmission lines / easement [1]	30 m x 0.86 km (1 x 33 kV) 45 m x 7.82 km (2 x 33 kV) 75 m x 0.65 km (2 x 33 kV, 1 x 132 kV)
Switching station (SS)	220 m x 160 m
Wind monitoring masts	1 m x 1 m (5 per mast)

[1] The final constructed easement width is up to 75 m for the internal overhead transmission lines, depending on their configuration. The maximum easement widths for each transmission line section have been assessed in detail and used in the calculation of the Development Footprint impact area. The actual impact area has been estimated to be 5% of this total area given the low level of impacts associated with installing the overhead transmission lines and the sparse vegetation cover along the selected routes.

Project Component	Approximate Dimensions
Temporary (during construction)	
Earthworks alongside permanent infrastructure (roads / hardstands) [2]	12 m x 83 km (est.)
Underground transmission lines[3]	3 m x 61 km
Concrete /asphalt batching plant	50 m by 100 m
Rock crushing facility	50 m by 100 m
Site compound and office	150 m by 200 m

A full description of all Project components is provided in Chapter 3 of the Project EA. The following sections provide a summary of the Project components for consideration in relation to ecological values and potential impacts.

The Layout Options have been designed with respect to a number of technical, environmental and social factors and more detailed site assessments. Each layout ensures optimum, undisturbed use of the measured and predicted wind resource, after accommodating constraints, for the range of WTGs currently being considered for the Project.

Given the scale of the Project it is likely that 'Clusters' of wind turbines will be constructed and commissioned in stages, which is discussed in more detail below. Consequently, the Project is divided into three main Clusters (*Table 2.2, Figure 1.2*).

Table 2.2 Wind Turbine Clusters

Wind Turbine Clusters	Maximum Number of Wind Turbines (Layout Option 1)	Maximum Number of Wind Turbines (Layout Option 2)	General location
Mt Buffalo Cluster	58	45	Eastern Cluster
Kangiara Cluster	34	29	Central Cluster
Langs Creek Cluster	30	22	North Western Cluster

[2] Construction of the on-site access road network will require earth works that are beyond the limits of the permanent road impact within the Study Area. This is required to level areas of steep gradient to a design suitable for safely transporting Project components into position. Civil engineering designs have been prepared for both Layout Options based on available contour and geotechnical data, to include impacts associated with permanent road, hardstand and turning head areas in addition to the area considered the extent of the earthworks.

2.2 *WIND FARM INFRASTRUCTURE*

It is not yet known which model of wind turbine will be used for the Project as final wind turbine selection will occur through a competitive tender process pending Development Consent. However, in terms of generation capacity, the wind turbines currently available in the market place which are under consideration for this Project will be at least 1.5 MW in capacity. By way of example, the Suzlon S88, 2.1 MW machine (as installed at the Capital Wind Farm, east of Lake George, NSW) is typical of the type of wind turbine that could be used. *Photograph 2.1* below displays a picture of a typical wind turbine, detailing the component parts.

Photograph 2.1 Components of a Wind Turbine

2.2.1 *Turbine Rotor*

The wind turbines that will potentially be used for the Project will be three-bladed, semi-variable speed, pitch regulated machines with rotor diameters between 74 m and 144 m and a swept area of 4,300 to 16,286 square metres (m^2). The lowest possible swept height would be 25 m, however, it is more likely to be greater than 30 m, depending on the turbine model.

2.2.2 *Towers and Blades*

The supporting structure is comprised of a reducing cylindrical tower made out of either a welded steel shell or a concrete steel hybrid, fitted with an internal ladder or lift. The largest tower height under consideration is 120 m with an approximate diameter at the base of 4.5 m and 3 m at the top. It is important to note that the maximum blade length suitable for this tower height is 72 m which establishes the maximum proposed blade tip height of 192 m.

2.2.3 *Blade Tip*

The blade tip will comprise the highest point of the wind turbine when in a vertical position. Given the wind turbines under consideration, a blade tip height of 192 m is considered to be the maximum.

2.2.4 *Nacelle*

The nacelle is the housing constructed of steel and fibreglass that is mounted on top of the tower and can be 12 m long, 4.5 m high and 4.5 m wide.

2.2.5 *Footings*

Impact assessments undertaken for the Project assume the use of the largest foundation footprint for all wind turbines, ie, slab (gravity) foundations, using the greatest on-ground footprint. A typical foundation size of 25 by 25 m is being considered as worst case for Layout Option 1, which reflects the largest known foundation impact based on currently available wind turbines. It is possible that larger foundations up to 30 m by 30 m could be used for Layout Option 2, but the resultant overall impact is lower due to the fewer number of wind turbines and, therefore, foundations and hardstands required for that layout. Slab (gravity) foundations would involve the excavation of approximately 750 cubic metres (m^3) of ground material to a depth of approximately 2.5 m, based on a 21 m diameter circular foundation (refer to *Photograph 2.2* for an example of a gravity footing).

Photograph 2.2 Typical Gravity Footings

2.2.6 *Crane Hardstand and Assembly Areas*

Site access roads would have areas of hardstand (approximately 25 by 60 m) adjacent to each wind turbine for use during component assembly and by cranes during installation. The clearing of native vegetation for the construction of on-site access roads and hardstand areas will be minimised where practicable. If clearing is found to be unavoidable, this will be appropriately managed and carried out in accordance with the Conditions of Approval. *Photograph 2.3* shows a typical hardstand area adjacent to the wind turbine footing.

Photograph 2.3 Typical hardstand area adjacent to a rock anchor footing

2.2.7 *Monitoring Masts*

There is currently one temporary 60 m wind monitoring mast installed 5.8 km to the south east of the PAA, recording wind data for Project development and planning. Up to six permanent wind monitoring masts, up to 120 m high, are proposed to be installed on-site. Locations for these masts are yet to be determined and will be influenced by the final wind turbine selection, but may include the locations of the existing temporary monitoring masts.

2.3 *ELECTRICAL INFRASTRUCTURE*

The electrical works, including those incorporated in the wind turbine structures, will involve:

- up to 122 wind turbine transformers (Layout Option 1) or up to 96 wind turbine generators (Layout Option 2);
- the establishment of a 150 by 150 m collector substation with 33 to 132kV step up transformers, circuit breakers and isolators;

- the establishment of a 160 by 220 m switching station with 132kV circuit breakers, isolators, metering, protections and communications assets;

- approximately 61 km of up to 33kV entrenched underground transmission lines and control cables;

- approximately 9 km of up to 132kV double circuit overhead transmission lines, some sections running in two or three parallel line configurations (see *Figure 2.1*); and

- establishment of a typical operation facilities building to house control and communications equipment.

The electrical and control cables from the Langs Creek, Kangiara and Mt Buffalo Clusters will comprise a mix of underground and overhead transmission lines and will connect directly into the CS. It is intended that the CS and SS will be adjacent to each other, so no interconnecting electrical transmission lines will be required. *Photograph 2.4* shows a typical overhead transmission line that could be implemented in this Project.

Photograph 2.4 Double-circuit overhead 33 kV transmission line

Underground routes will generally be between the wind turbines and follow the route of the internal on-site access roads (refer to *Photograph 2.5* below). The final route will minimise vegetation clearing and avoid potential erosion and heritage sites, and will also depend on the ease of excavation, ground stability and cost.

Photograph 2.5 Laying underground transmission line within the road network

Approximately 9km of overhead transmission line will be required to connect the wind turbines to the CS and SS. Voltages ranging from 33kV to 132kV may be constructed in single or double-circuit configurations depending on the wind turbine selected for the site and any staging considerations. It may be necessary to run some overhead lines in parallel, due to the power export requirements of a particular cluster, contained within overlapping easements to minimise the impact area. The overhead transmission lines can be up to 50 m in height, comprising of two cross arms with insulators with a typical span length as shown in *Table 2.3*.

Table 2.3 Transmission Line Specifications

Voltage	Easement Width	Height of Pole	Typical Span Distance (Pole to Pole)
330kV	60 m	50 m	300 – 400 m
132kV	45 m	35 m	200 – 300 m
66kV	30 m	30 m	150 – 25 m
33kV	30 m	20 m	150 m

Note: All easement widths account for a double circuit on a single pole

Depending on the size of wind turbine selected for the Project, it may be necessary to run two or more overhead transmission lines in parallel within the Study Area, from each Cluster to the CS and from the SS to the point of connection. In this case, two or more overhead transmission lines will follow the same centre line as shown on the map and their easements will overlap to minimise the impact of the easement corridor. For example, two 33kV overhead transmission lines (each with a 30 m easement) running in parallel would require a total easement of 45 m (sharing a 15 m overlap). Alternatively, a 132kV and two 33kV overhead transmission lines would require a 75 m easement (retaining the greater easement requirements of 45 m for the 132kV transmission line, plus the two 33kV easements overlapping).

A facilities building will be constructed at the same location as the CS. The general location has been chosen to minimise the length of overhead and underground transmission lines and to minimise the visibility of the facilities building and CS.

2.4 *SITE ACCESS WORKS*

The PAA can be reached via the south from the Hume Highway utilising local roads north of Yass, including the Lachlan Valley Way, Boorowa Road, Tangmangaroo Road and Wargeila Road.

Access routes and points for over-size and over-mass vehicles (primarily those vehicles carrying wind turbine and electrical components) have been investigated from the south. The southern access route comprises the Hume Highway onto the Lachlan Valley Way, passage south east of Boorowa and into the PAA via Boorowa Road, Hopefield Lane, Harry's Creek Road, Tangmangaroo Road and Wargeila Road.

All entrances to the PAA from the existing arterial roads will be designed to allow long vehicles to safely exit from or re-enter the road whilst minimising the disruption to traffic. Further consultation will be undertaken with Council and the NSW Roads and Maritime Service (RMS) to confirm the final design.

Other access consists of new on-site access roads between wind turbines, also comprising hardstand and turning head areas. The on-site access roads will follow existing farm tracks, where practicable, that traverse the ridgelines and plateaus. All roads leading from the arterial roads and all on-site access roads are likely to require a full or partial upgrade to accommodate the construction traffic loads, as well as for maintenance purposes during operation.

Some additional temporary roads or tracks may also be required for construction of the overhead transmission lines and for access to erosion control sites. The erosion control sites will benefit from the use of excess rock excavated from wind turbine footings and will be chosen based on the availability of excess material, the need for erosion repair, and minimising the distance for material transport.

2.5 *UTILITY SERVICES*

The Project will be connected to TransGrid's 132 kV transmission network and when not generating will draw a minor amount of electricity from the grid. Backup and emergency power at the CS will be supplied by on-site batteries and a standalone diesel generator. Auxiliary power at the SS will be supplied by a local 11 kV distribution line or on-site generator.

2.6 *RESOURCE REQUIREMENTS*

Resource requirements are typical of any new development site, including the provision of cement, gravel, sand, water and road base material. Cement for foundations will be sourced by the civil construction company awarded to undertake the Project. This may be sourced locally or from alternative suppliers.

Gravel and sand will be sourced locally and as close to the PAA where it is practicable to do so, including recycling material excavated from foundations and earthworks where possible. Both gravel and sand will be required to mix the high strength concrete to pour wind turbine foundations. Gravel will also be required to dress the wind turbine sites, and provide a low resistivity apron around the CS and SS.

Water requirements will be met by sourcing water from within the Locality as long as a zero share licence can be obtained under the current water sharing plan. Where available, groundwater will be purchased from involved or adjacent landowner properties who hold groundwater licences and have unused allocations. The use of regulated surface water allocations from the nearby Wyangala Dam may also be an option. This source is controlled by State Water and its use would be subject to further discussions post consent. If water cannot be sourced locally, then it will be brought to site by external water suppliers under contract to the Project.

Road base material will be required for construction of access roads to wind turbine sites and the substations. Part of the road base requirement may be sourced from material extracted from wind turbine footings with the remainder sourced on-site (subject to permitting) or imported to the PAA. Where additional material is required, local supplies of the same geological type could be sourced from the quarries indicated above, local landowner gravel supplies or external aggregate suppliers.

Given the scale of the Project it is anticipated that there will be no waste material exported from the PAA during construction. Top soil cleared during the construction phase will be used for remediation, and rock excavated from wind turbine footing preparations will be used for road base, back fill for foundations and/or erosion control purposes as far as practicable. Ancillary waste, such as packaging associated with component and stock pile deliveries, will be disposed of according to local Council requirements and will form part of the CEMP.

2.7 *WIND FARM DEVELOPMENT*

2.7.1 *Anticipated Project Timeline*

Approval is sought for the final positioning of up to 122 wind turbines and associated infrastructure within a radius of 100 m of the locations based on two preferred layouts. The actual timing of construction will principally be driven by the length of time taken to obtain other permits and authorisations, attaining Board approval/Project financing for commencement and the long lead times for wind farm components. However, preconstruction works are expected to begin in 2015, with construction beginning in late 2015/early 2016 and operations to begin in 2017. This project is expected to operate for approximately 18 years, where decommisiioning or equipment replacement will occur.

2.7.2 *Pre-Construction Works*

Prior to the main construction commencing, a number of enabling works and further site planning would be undertaken by the selected Contractor, including:

- detailed site investigation including geotechnical investigations involving a series of trial pits and/or boreholes;
- detailed contour surveys;
- upgrading the surfaces of local roads and on-site access roads where required;
- widening the junctions or corners of local roads, entrance / access points where required;
- widening the existing gateways, or inserting new gateways as necessary along fence lines;
- stripping and careful storage of existing soil from the areas which would be affected by construction activities, including the tower bases, CS and SS locations, on-site access road areas, crane hardstand and assembly areas;
- the construction of a secure site compound, with Project owner and subcontractor field offices (portables), parking bays, and toilet facilities (temporary). A 75 by 75 m area will be retained permanently for the duration of the Project;
- erection of signage on roads;
- enabling works for the locating of a mobile concrete/asphalt batching plant(s) (temporary, if required);

- enabling works for the locating of a rock crushing plant(s) (temporary, if required);
- environmental survey and refinement (if necessary) of the EMP as required under the Development Consent;
- survey of critical land boundaries and pegging of infrastructure locations;
- detailed cultural heritage and flora/fauna surveys across the entire Study Area (if required);
- preparation of works procedures and Project Implementation Plan; and
- engineering design works and submission for Building Rules Consent.

2.7.3 Construction Works

Construction activities include activities that cross over with pre-construction works and involve;

- the construction of temporary ancillary facilities;
- the construction of footings and crane hardstands;
- earth works for access roads, where access roads will require surfacing in otder to cater for construction traffic and machinery and;
- approximately six permanent wind monitoring masts (as required);
- overhead and underground cabling; and
- the construction of up to 122 wind turbines, where the WTG components would be delivered on heavy vehicles and constructed on site.

Construction activity is likely to occur over a period of approximately 18 to 30 months with rehabilitation following the completion of works.

2.7.4 Operation

Once operational, the Project would be monitored both by on-site staff and through remote monitoring. Aspects of the Project operation to be dealt with by on-site staff would include safety management, environmental condition monitoring, landowner management, routine servicing, malfunction rectification and site visits. Those functions to be overseen by remote monitoring include wind turbine performance assessment, wind farm reporting, remote resetting and maintenance co-ordination. Pro-active computer control systems monitor the performance of the wind turbines and ensure that any issues are dealt with by on-site staff or contractors, as appropriate.

The SS will be operated by TransGrid, and therefore separate Conditions of Approval relating to the subsequent SS EMPs are requested.

2.7.5 Servicing and Maintenance

Maintenance staff are likely to be on-site throughout the year, making routine checks of the wind turbines on an ongoing basis. Major planned servicing would be carried out approximately twice a year on each wind turbine.

2.7.6 Refurbishment

After approximately 20 to 25 years of operation (or sooner if deemed economically viable) the blades, nacelles (top section of the wind turbine) and towers could be removed and replaced. Old blades, nacelles and towers are removed from site for recycling and new components installed on existing or new foundations, as appropriate. Refurbishment would extend the life of the Project for a further 20 to 25 years.

2.7.7 Decommissioning

At the end of the operational life of the Project, certain elements such as the WTG and all its above ground infrastructure, and unnessessary on-site access roads will be removed, where as other elements such as the tower base and underground transmission lines will be left in-situ where the ground will be reinstated to its pre-construction condition.

3 PLANNING CONTEXT

This chapter outlines the planning context of the Project including Commonwealth, State and Local Government legislation and policies of relevance to this Ecological Impact Assessment.

3.1 LEGISLATION AND POLICIES

3.1.1 Commonwealth Legislation

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Act) is the primary piece of Federal legislation relating to the environment. Under the EPBC Act any action that has, or is likely to have, a significant impact on a matter of National Environmental Significance (NES) requires approval from the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities (SEWPaC). An action is defined as a project, development, undertaking, activity (or series of activities), or alteration to any of these. Matters of NES include:

- world heritage properties;
- national heritage places;
- Ramsar wetlands of international importance;
- listed threatened species and communities;
- internationally protected migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park; and
- nuclear actions.

The Project is not located within a World Heritage area, Ramsar wetland or Commonwealth marine environment. The site also does not contain National Heritage Places, or involve nuclear actions. The Study Area contains threatened species and ecological communities which may be impacted by the proposal. As such, a referral to the Minister is required, and was submitted in March 2013.

The Project was declared a controlled action on 7 May 2013, requiring assessment and approval under the EPBC Act. The relevant controlling provisions are: listed threatened species and communities (Section 18 and 18A) and listed Migratory species (Section 20 and 20A). The Project will be assessed by preliminary documentation.

State Legislation

Environmental Planning and Assessment Act 1979

The relevant planning legislation for NSW is the *Environmental Planning and Assessment Act 1979* (EP&A Act). The EP&A Act instituted a system of environmental planning and assessment in NSW and is administered by the Department of Planning and Infrastructure (DPI). Part 3A of the EP&A Act was introduced to deal with complex major projects of State or regional significance or critical infrastructure projects. Major projects are identified either in:

- *State Environmental Planning Policy (Major Development) 2005*; or
- an order by the Minister for Planning published in the NSW Government Gazette.

The wind farm is a facility for the generation of heat and electricity with a capital investment value of more than $30 million, and therefore requires approval under Part 3A of the EP&A Act as identified within *State Environmental Planning Policy (Major Development) 2005*.

Threatened Species Conservation Act 1995

Projects determined by a statutory authority of the NSW State Government are required to be assessed in accordance with the EP&A Act, as amended by the *Threatened Species Conservation Act 1995 (*TSC Act). The TSC Act lists threatened species, populations and ecological communities under Schedules 1 and 2 of the Act, that are priorities for conservation within NSW. Schedule 3 of the TSC Act lists Key Threatening Processes for species, populations and ecological communities within NSW.

Section 5A of the NSW EP&A Act sets out seven factors to be considered during the Assessment of Significance (7-part test) when determining whether a proposed action will, or is likely to, have a significant effect on a threatened species, endangered populations or endangered ecological communities listed under the schedules of the TSC Act. A number of threatened species and ecological communities were considered to have potential habitat within the Study Area and / or Locality and were considered to have the potential to be impacted by the proposal as identified in *Chapter 5*.

Threatened Species Conservation (Biodiversity Banking) Regulation 2008

The Biodiversity Banking Scheme (BioBanking) is a voluntary scheme established under Part 7A of the TSC Act in 2008 and is supported by the *Threatened Species Conservation (Biodiversity Banking) Regulation 2008*. BioBanking enables development proponents to offset the residual impacts of their proposed project by purchasing and retiring BioBanking Credits from a BioBank Site.

The main elements of the BioBanking Scheme are:

- establishing BioBank sites on land through BioBanking agreements between the Minister for the Environment and the landowners;
- creating biodiversity credits for management actions that are carried out, or proposed to be carried out, to improve or maintain biodiversity values on BioBank sites;
- trading of credits once they are created and registered; and
- enabling the credits to be used to offset the impact of development on biodiversity values.

The BioBanking Assessment Methodology also allows proponents to quantify the magnitude of their residual biodiversity impact, for negotiation of an offset with the regulating authorities under the more traditional offset pathway, to meet the 'improve' or 'maintain' requirement. The BioBanking assessment methodology is the tool used to determine the number of biodiversity credits that must be retired to offset the impact of a development, to ensure that the development improves or maintains biodiversity values.

The Project has been assessed in accordance with the BioBanking Assessment Methodology, and the BioBanking Credit Calculator has been applied to the Project in order to determine the quantum of impacts. The BioBanking Credit Report defines the number and type of credits that would be required in order to secure a BioBanking Statement, and this information may also be used to determine a suitable offset with the regulatory authorities outside of the BioBanking Scheme.

Native Vegetation Act 2003

The objectives of the *Native Vegetation Act 2003* (NV Act) include:

- to provide for, encourage and promote the management of native vegetation on a regional basis in the social, economic and environmental interests of the State; and
- to protect native vegetation of high conservation value having regard to its contribution to such matters as water quality, biodiversity, or the prevention of salinity or land degradation.

Section 12 of the NV Act identifies that the clearance of 'native vegetation' requires approval in accordance with a development consent granted under the NV Act or in accordance with a property vegetation plan. Section 75U of the EP&A Act excludes projects approved under Part 3A of the EP&A Act from requiring "*an authorisation referred to in section 12 of this (or under any Act to be repealed by that Act) to clear native vegetation*". Therefore the NV Act does not apply to this Project.

Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* (NW Act) identifies, classifies and guides the control of noxious weeds in NSW. The NW Act defines the roles of government, councils, private landholders and public authorities in the management of noxious weeds. It also determines control actions for the various noxious weeds, according to their potential to cause harm to our local environment. There are five different "control classes" listed under the Act. Landowners are obliged to control all noxious weeds on their land according to specified "control classes". The control authorities for the Study Area are Boorowa Council and Yass Valley Council.

National Parks and Wildlife Act 1974

The objectives of the *National Parks and Wildlife Act 1974* (NP&W Act) include:

(a) 'the conservation of nature, including, but not limited to, the conservation of:

(i) habitat, ecosystems and ecosystem processes, and

(ii) biological diversity at the community, species and genetic levels, and,

(b) the conservation of objects, places or features (including biological diversity) of cultural value within the landscape, including, but not limited to:

(i) places, objects and features of significance to Aboriginal people'.

Under this Act a person must not intentionally cause damage to any habitat of or pick a threatened or protected species unless authorised under the Act. Care must be taken to minimise the impacts associated with weed management activities on threatened species, protected flora (listed in Schedule 13 of the Act) and fauna, and cultural value of the site.

Fisheries Management Act 1994

The Fisheries Management Act 1994 (FM Act) provides for the conservation, protection and management of fisheries, aquatic systems and habitats in NSW. Permits are required for any dredging or reclamation works, any harm to marine vegetation or any obstruction to fish passage.

Under the FM Act, approval is required from the NSW Department of Primary Industries (DPI) – Fishing and Aquaculture for activities involving dredging and reclamation, blockage of fish passages and development of certain waterfront land.

3.1.2 State Environmental Planning Policies

State Environmental Planning Policy (Major Development) 2005

State Environmental Planning Policy Major Development 2005 (SEPP Major Development) provides a framework to identify major developments to be assessed under the former provisions of Part 3A of the EP&A Act. Schedule 1, Clause 24 of SEPP Major Development identified facilities for the generation of heat and electricity development with a capital investment value of more than $30 million, such as the current proposal, as major projects. Therefore in accordance with the former section 75D (1) of the EP&A Act, the Minister for Planning and Infrastructure is the approval authority for the Project.

On 11 November 2009 the NSW Minister for Planning declared renewable energy generators of 30 megawatts or more to be Critical Infrastructure Projects under Section 75(C) of the EP&A Act. As the proposed Bango Wind Farm has the capacity to generate in excess of 30 megawatts the critical infrastructure provisions of the EP&A Act also apply.

State Environmental Planning Policy No 44 – Koala Habitat Protection

State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44) applies to land in the Boorowa and Yass LGAs. SEPP 44 identifies land as *potential Koala habitat* if any of the tree species listed on Schedule 2 make up 15% of the canopy in a location and as *core Koala habitat* if a resident population of Koalas is identified as occurring at the location. If land subject to a development application is identified as core Koala habitat, SEPP 44 requires that a Koala plan of management must be developed before development consent can be granted. Under Part 3A of the EP&A Act there is no requirement for a development application and accordingly there is no trigger for the need for a Koala Plan of Management. The Koala is listed as a Vulnerable species in NSW under the EPBC Act and the TSC Act; the species has been assessed in accordance with the requirements of both those Acts.

3.1.3 Other Planning Instruments

Draft NSW Planning Guidelines: Wind Farms (NSW DPI) 2011

The *Draft NSW Planning Guidelines: Wind Farms* have been prepared in consultation with the community and energy industry to provide a regulatory framework to guide investment in wind farms across NSW, while minimising and avoiding any potential impacts on local communities. The purpose of the guidelines is to:

- provide a clear and consistent regulatory framework for the assessment and determination of wind farm proposals across the state;
- outline clear processes for community consultation for wind farm developments; and

- provide guidance on how to measure and assess potential environmental noise impacts from wind farms.

Boorowa Local Environment Plan (LEP) 2012

Interim Development Order (IDO) No. 1 – Shire of Boorowa identifies that the Study Area is located within Non-Urban A and Non-Urban B zones. All development within these zones, excepting prohibited development, is permissible with Council consent. The proposed action would be described as 'generating works' which is not identified as a prohibited development and therefore, is permissible with consent.

Yass Valley Draft Local Environment Plan (LEP) 2012

Under the Yass Valley Draft LEP the project is located within land zoned Rural RU1: Primary Production. The objective of this zone is to set aside certain land for agricultural purposes and purposes incidental thereto. Environmental protection works, extensive agriculture, forestry and intensive plant agriculture are permissible without consent.

3.2 COMMONWEALTH REFERRAL OF PROPOSED ACTION

The proposed action was referred to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) on 28 March 2013 (EPBC Referral No. 2013/6810). The Minister's delegate confirmed the Project as a controlled action to be assessed by preliminary documentation in a decision notice dated 7 May 2013. This Ecological Impact Assessment has been prepared to support the assessment through preliminary documentation.

3.3 DIRECTOR GENERAL'S REQUIREMENTS

The Department of Planning (DOP) (now known as Department of Planning and Infrastructure (DoPI)) issued the Director General's Requirements (DGRs) for the Project Environmental Assessment (EA) on 31 March 2011. The DGRs are prepared in consultation with government authorities and identify a number of key environmental assessment requirements for the Project (see *Section 3.3.1*). Supplementary DGR's for the Project were issued by DoPI on 16 August 2011, which were primarily related to the community consultation process, and did not make reference to ecological matters. The DGRs for the ecological impacts of the Project are shown in *Table 3.1,* including a reference to where each requirement is addressed in this report.

Table 3.1 DGRs for Ecological Impacts of the Project

DGR for Ecological Impacts	Location in report
Ecological Impacts – the EA must include an ecological assessment considering terrestrial and aquatic ecosystems (as relevant), including groundwater dependent ecosystems, consistent with *Guidelines for Threatened Species Assessment* (DEC, 2005)	Entire report.
The EA must:	
• identify threatened species, populations and communities listed under both State and Commonwealth legislation that have the potential to occur on site. In particular, the following must be addressed: box woodland, tablelands basalt forest and natural temperature grassland communities, and crimson spider orchid, silky swainson-pea, Yass daisy, hoary sunray, small woodland birds, superb, turquoise & swift parrots, barking owl & powerful owl, raptors, squirrel glider, koala, spotted tailed quoll, bats and golden sun moth	Section 3.3.2 Chapter 5 Annex E
• map existing vegetation by vegetation/ community type and include details on existing site conditions, including whether the vegetation comprises a highly modified or over-cleared landscape and the types and quality of habitat resources available. Vegetation mapping should consider any Environmentally Sensitive Area Mapping held by Boorowa Shire Council, Yass Valley Shire and the Upper Lachlan Shire Council	Figure 5.2a – 5.2c Section 5.3
• provide details of the survey methodology employed including survey effort and representativeness for each species targeted and clear justification for species that were discounted from requiring field surveys or further assessment	Chapter 4 Section 4.2 Figure 4.1a – 4.1c Figure 4.2a – 4.2c
• demonstrate a design philosophy of impact avoidance on ecological values, and in particular, ecological values of high significance	Section 6.3
• provide a worst case estimate of vegetation to be cleared (in hectares), including quantifying impacts (in hectares) by vegetation type and threatened species habitat (as relevant)	Section 6.5.1
• assess the significance of impacts to native vegetation, listed threatened species, populations and communities and their habitats with consideration to local and region-based ecological implications, including edge effects, habitat connectivity and distribution of species. The assessment must consider impacts to in-stream and riparian ecology from works close to waterways and/ or waterway crossings. In addition, impact of the project on birds and bats from blade strikes, low air pressure zones at the blade tips (barotrauma), and alteration to movement patterns resulting from the turbines must be assessed, including demonstration of how the project has been sited to avoid and/ or minimise such impacts	Section 6.5 Section 6.6 Annex F
• include details of how flora and fauna impacts would be managed during construction and operation including adaptive management, rehabilitation/ regeneration measures and maintenance protocols	Section 6.4
• demonstrate how the project (with the incorporation of all proposed measures to avoid, mitigate and/ or offset impacts) achieves a biodiversity outcome consistent with "maintain or improve" principles. Sufficient details must be provided to demonstrate the availability of viable and achievable options to offset the impacts of the project and to secure these measures in perpetuity	Section 6.8
• address the risk of weed spread and identify mitigation measures	Section 6.4

3.3.1 Environmental Assessment Requirements

The NSW Department of Environment, Climate Change and Water (DECCW) (Now the Office of Environment and Heritage (OEH) within the Department of Premier and Cabinet) prepared Environmental Assessment Requirements (EARs) for the DoPI to consider in the preparation of the DGRs for the Project (see *Annex B*). The South East Region of the Environment Protection and Regulation Group of DECCW identified specific EARs for consideration. The EARs outlined that the impacts to biodiversity can be assessed using **either** the BioBanking Assessment Methodology (scenario one) or a detailed biodiversity assessment (scenario two). These two options were detailed as alternate scenarios within the EARs and a separate set of requirements for each scenario were provided and as such, the requirements from these two scenarios are summarised separately within *Table 3.2*, as well as an indication of where each of these EARs are addressed in this report.

EARs received from other agencies are not relevant to this ecological assessment.

Table 3.2 Environmental Assessment Requirements for Biodiversity

Environmental Assessment Requirements for Biodiversity	Location in Report
SCENARIO ONE	
• Where a BioBanking Statement is being sought, the assessment must be undertaken by an accredited BioBanking assessor and completed in accordance with the BioBanking Manual (DECCW, 2008).	Chapter 6.8 Annex H
• The EA should include a specific Statement of Commitments that reflects all requirements of the BioBanking Statement including the number of credits required and any Director General approved variations to impact Red Flags.	N/A – included in EA
• Where scenario one is being used and a BioBanking Statement is not being obtained, the EA should contain a detailed biodiversity assessment and all components of the assessment must be undertaken in accordance with the BioBanking Manual (DECCW, 2008).	N/A
• The EA should include a specific Statement of Commitments which: o is informed by the outcomes of the proposed BioBanking assessment offset package; o sets out the ecosystem and species credits required by the BioBanking Assessment Methodology and how these ecosystem and/or species credits will be secured and obtained; o if the ecosystem or species credits cannot be obtained, provides appropriate alternative options to offset expected impacts, noting that an appropriate alternative option may be developed in consultation with DECCW officers and in accordance with the DECCW policy; o demonstrates how all options have been explored to avoid red flag areas; and o includes all relevant BioBanking files, data sheets and documentation to ensure DECCW can conduct an appropriate review of the assessment.	N/A – included in EA

Environmental Assessment Requirements for Biodiversity	Location in Report
• Where appropriate, likely impacts on any adjoining and/or nearby DECCW estate reserved under the *National Parks and Wildlife Act 1974* or any marine and estuarine protected areas under the *Fisheries Management Act 1994* or the *Marine Parks Act 1997* should be considered.	N/A
• The assessment should identify and assess any relevant MNES listed under the EPBC Act and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.	Section 3.2 Chapter 7
SCENARIO TWO	
• The EA should include at a detailed biodiversity assessment, including assessment of impacts on threatened biodiversity, native vegetation and habitat. This assessment should address the matters included within the following sections.	Ecological Impact Assessment
• A field survey of the site should be conducted and documented in accordance with all appropriate available guidelines and the survey requirements provided within the DGRs.	Chapter 4 Figure 4.1a – 4.1c Figure 4.2a – 4.2c Annex E
• Determining the list of potential threatened species for the site must also be undertaken in accordance with the appropriate available guidelines and utilising desktop sources outlined within the DGRs.	Section 3.3.2 Chapter 5 Annex E
• The EA should contain the following information as a minimum:	
o the requirements set out in the Guidelines for Threatened Species Assessment (DoP, 2005);	Section 3.3
o description and geo-referenced mapping of the Study Area, including details of map datum, projection and zone, all survey locations, vegetation communities, key habitat features and reported locations of threatened species, populations and ecological communities;	Figures 1.1, 1.2, 4.1a – 4.1c, 4.2a – 4.2c, 5.1, 5.2a – 5.2c, 5.3a – 5.3c, 5.4a – 5.4c
o description of the survey methodologies used, including timing, location and weather conditions;	Chapter 4 Figure 4.1a – 4.1c Figure 4.2a – 4.2c Section 5.1 Annex E
o details, including qualifications and experience of all staff undertaking the surveys, mapping and assessment of impacts as part of the EA;	Annex A
o identification of national and state listed threatened biota known or likely to occur in the Study Area and their conservation status;	Chapter 5 Section 7.3 Annex E
o description of the likely impacts of the Project on biodiversity and wildlife corridors, including direct and indirect and construction and operation impacts. Wherever possible, quantify these impacts;	Chapter 6
o identification of the avoidance, mitigation and management measures that will be put in place as part of the proposal to avoid or minimise impacts, including details about alternative options considered and how long term management arrangements will be guaranteed;	Section 6.3,6.4 and 6.8
o description of the residual impacts of the Project;	Section 6.5
o Provision of specific Statement of Commitments relating to biodiversity.	N/A – included in EA

Environmental Assessment Requirements for Biodiversity	Location in Report
• An assessment of significance of direct and indirect impact of the Project must be undertaken for threatened biodiversity known or considered likely to occur in the Study Area based upon presence of suitable habitat. This assessment must take into account: o the factors identified in s.5A of the EP&A Act; and o the guidance provided by the Threatened Species Assessment Guideline – The assessment of Significance (DECCW, 2007).	Section 6.3 Section 6.6 Annex F
• Where an offsets package is proposed for impacts to biodiversity (and a BioBanking Statement has not been sought) this package should: o meet DECCW's Principles for the use of biodiversity offsets in NSW; o identify the conservation mechanisms to be used to ensure the long term protection and management of the offset sites; and o include an appropriate Management Plan that has been developed as a key amelioration measure to ensure appropriate management and funding of any proposed compensatory offsets.	Section 6.8
• Where appropriate, likely impacts on any adjoining and/or nearby DECCW estate reserved under the *National Parks and Wildlife Act 1974* or any marine and estuarine protected areas under the *Fisheries Management Act 1994* or the *Marine Parks Act 1997* should be considered.	N/A
• The assessment should identify and assess any relevant MNES listed under the EPBC Act and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.	Section 3.1.1 Chapter 7
OTHER REQUIREMENTS	
• The Study Area may support endangered ecological communities (EECs) and threatened species as listed under the TSC Act. Development will need to avoid EECs and provide an appropriate buffer and APZ. The EA must describe what actions will be undertaken to avoid or mitigate impacts caused by the development on all threatened species described within the Study Area.	Section 6.3, 6.4, 6.8
• The EA should clearly outline the extent to which the Development Footprint will impact on areas of native vegetation. Offsetting biodiversity and habitat loss would be required as identified in the threatened species guidelines. There are formulas associated with the "maintain and improve" principle of the Government's vegetation reforms that DECCW considers should apply.	Section 6.5.1 Section 6.8 Annex H
• The EA must consider the contribution made by the proposal to the cumulative impacts arising from the construction of multiple wind farms in the regions on threatened and other sensitive species. This assessment of cumulative impacts must consider though is not necessarily limited to, impacts upon superb parrot, soaring raptors and bats.	Chapter 6.7
• There is a need to develop a monitoring program that will enable the impacts of the wind farm during construction, post-construction and operation to be determined. This will require the collection of baseline data prior to construction commencing, as well as the establishment of suitable control sites. Early consideration of this issue may allow data collected as part of the EA to contribute to this long-term monitoring program.	N/A (data collected will inform long-term monitoring).

1. Source: DECCW EARs

OEH provided further updated advice to WPCWP in July 2012 after undertaking a site visit with WPCWP during 14 – 15 June 2012 (see *Annex B*). This included updated advice regarding the environmental assessment, offsets and monitoring. Updated survey requirements were provided for the Superb Parrot, woodland birds and diurnal birds of prey. A number of constraints related to the areas visited were also provided.

Email correspondence from OEH regarding the Grassland Earless Dragon was received in June 2012. This advice indicated that there is a low likelihood of the Grassland Earless Dragon occurring in the areas that were visited, due to a lack of habitat. Therefore, targeted survey for the species is not required unless natural grasslands (or grassy habitats near to natural grasslands) will be impacted by the Project.

3.3.2 Subject Species

For the purposes of initial assessment, OEH identified 39 species and two ecological communities that are likely to occur in the Locality, identifying them as "subject species" for the assessment, as shown in *Table 3.3*. In addition, OEH identified a further 14 species and two ecological communities as entities to be considered for inclusion as subject species in the ecological assessment, as shown in *Table 3.4*. All of the subject species shown in *Table 3.3* and *Table 3.4* have been considered for their potential to occur in the Study Area in *Chapter 6*.

Table 3.3 List of Subject Species Identified by OEH

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
FAUNA			
Anthochaera phrygia	Regent Honeyeater	CE	E
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-
Calyptohynchus lathami	Glossy Black-cockatoo	V	-
Cercartetus nanus	Eastern Pygmy Possum	V	-
Chthonicola saggitata	Speckled Warbler	V	-
Circus assimilis	Spotted Harrier	V	-
Climacteris picumnus victoriae	Brown Treecreeper	V	-
Daphoenositta chrysoptera	Varied Sittella	V	-
Dasyurus maculatus	Spotted-tailed Quoll	V	E
Epthianura albifrons	White-fronted Chat	V	-
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-
Glossopsitta pusilla	Little Lorikeet	V	-
Grantiella picta	Painted Honeyeater	V	-
Hieraaetus morphnoides	Little Eagle	V	-
Lathamus discolour	Swift Parrot	E	E
Litoria booroolongensis	Booroolong Frog	E	E
Lophoictinia isura	Square-tailed Kite	V	-
Melanodryas cucullata cucullata	Hooded Robin	V	-
Melithreptus gularis gularis	Black-chinned Honeyeater	V	-

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-
Neophema pulchella	Turquoise Parrot	V	-
Ninox connivens	Barking Owl	V	-
Ninox strenua	Powerful Owl	V	-
Nyctophilus timoriensis	Greater Long-eared Bat	V	V
Petaurus norfolcensis	Squirrel Gilder	V	-
Petroica boodang	Scarlet Robin	V	-
Petroica phoenicea	Flame Robin	V	-
Phascolarctos cinereus	Koala	V	V
Polytelis swainsonii	Superb Parrot	V	V
Pomatostomus temporalis temporalis	Grey-crowned Babbler	V	-
Saccolaimus flaviventris	Yellow Bellied Sheathtail-bat	V	-
Scoteanax rueppellii	Greater Broad-nosed Bat	V	V
Stagonopleura guttata	Diamond Firetail	V	-
Synemon plana	Golden Sun Moth	E	CE
FLORA			
Ammobium craspedioides	Yass Daisy	V	V
Caladenia concolor	Crimson Spider Orchid	E	V
Diuris aequalis	Doubletail Buttercup	E	V
Leucochrysum albicans var. tricolor	Hoary Sunray		E
Swainsona sericea	Silky Swainson-pea	V	-
ENDANGERED ECOLOGICAL COMMUNITIES			
White Box, Yellow Box, Blakely's Red Gum Woodland	Box-Gum Woodland	CE	E
Tableland Basalt Forest in the Sydney Basin and South East Highlands Bioregion	Tableland Basalt Forest	-	E
CE = Critically Endangered, E = Endangered, V = Vulnerable			

Table 3.4 Other Entities for Consideration as Subject Species

Scientific Name	Species	TSC Act Status	EPBC Act Status
FAUNA			
Botaurus poiciloptilus	Australasian Bittern	E	E
Tympanocryptis pinguicolla	Grassland Earless Dragon	E	E
Suta flagellum	Little Whip Snake	V	-
Aprasia parapulchella	Pink-tailed Worm-lizard	V	V
Delma impar	Striped Legless Lizard	V	V
Varanus rosenbergi	Rosenberg's Goanna	V	-
Rostratula benghalensis australis	Painted Snipe	E	V

Scientific Name	Species	TSC Act Status	EPBC Act Status
FLORA			
Rulingia prostrata	Dwarf Kerrawang	E	E
Swainsona recta	Mountain Swainson Pea	E	E
Prasophyllum petilum	Tarengo Leek Orchid	E	E
Rutidosis leptorrhynchoides	Button Wrinklewort	E	E
Lepidium hyssopifollum	Aromatic Peppercress	E	E
Eucalyptus robertsonii subsp. hemisphaerica	Robertson's Gun	V	V
Eucalyptus aggregata	Black Gum	V	-
ENDANGERED ECOLOGICAL COMMUNITIES			
Natural Temperate Grassland of the Southern Tablelands (NSW and ACT) (EPBC Act community)	Natural Temperate Grassland	-	E
Frost Hollow Grassy Woodland (preliminary listed)		E	-
CE = Critically Endangered, E = Endangered, V = Vulnerable			

4 METHODS

This section outlines the methodology used to undertake the ecological assessment of the Project. To identify and analyse the ecological features of the Study Area, a literature and data review of the Locality was undertaken. This informed a detailed field survey program focussed on the Study Area. Information from the literature and database review and the field survey program was used to assess the potential impacts of the Project on the ecological features in the Study Area.

It is worth noting that the proposed wind farm layout is the result of an iterative planning approach including consideration of biodiversity values at the early stages of the development planning process. This has resulted in a reduction in the number of WTGs from 200 to 122 and a reduction in the overall area of the Project. The early planning designs assessed by ERM in the ecological assessment have been amended a number of times, resulting in changes to the overall number of WTGs and the locations of ancillary facilities. As a result, field investigations covered a number of areas which are no longer part of the proposed impact area. This means that survey coverage illustrated in the figures in this chapter may include areas external to the final proposed layout, although the field investigations covered the entire footprint of the final proposed layout.

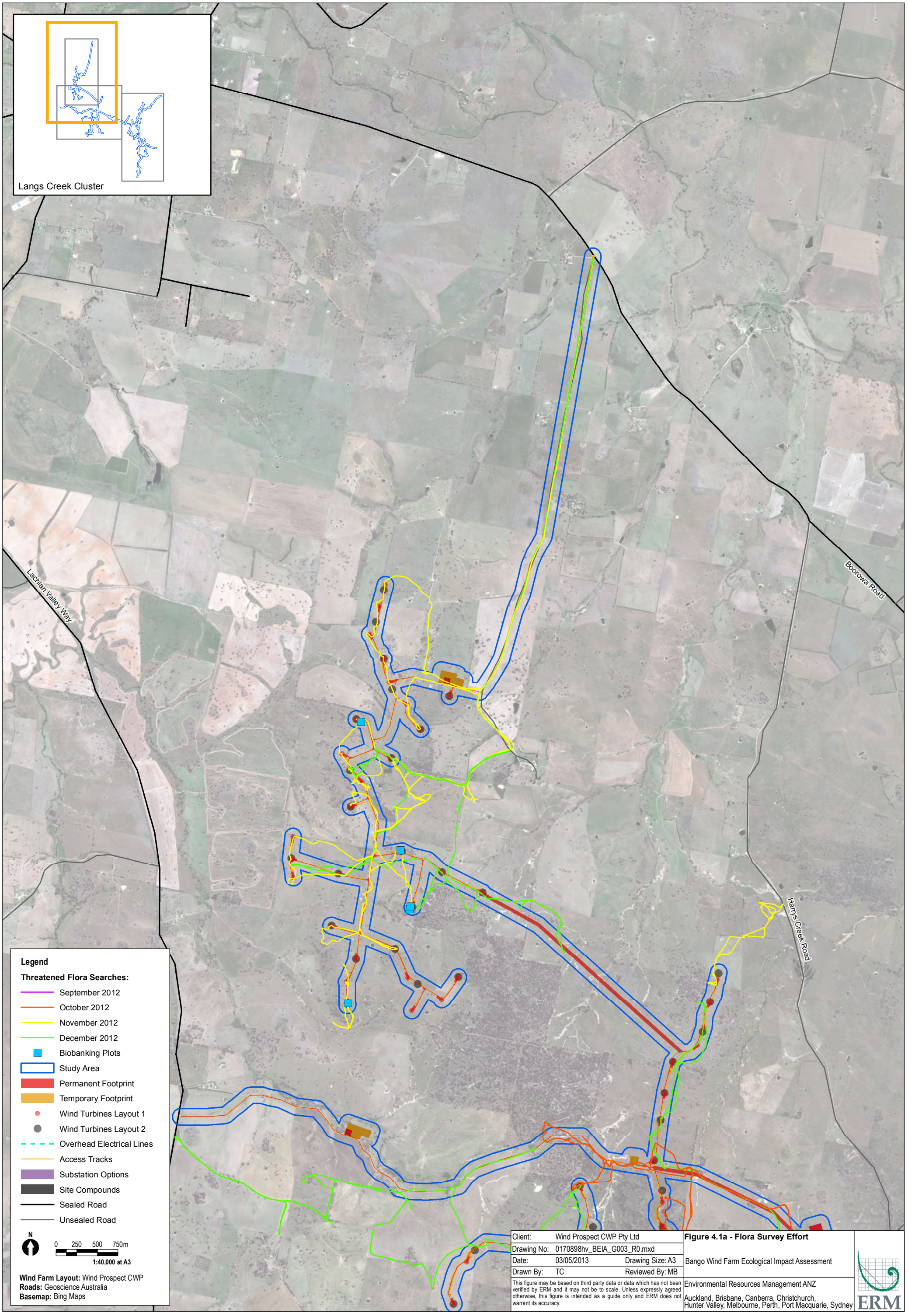
The methods used during the literature and database review and the field surveys are described in the following sections. A summary of survey timing and effort are provided in **Error! Reference source not found.** in *Section 4.2.*

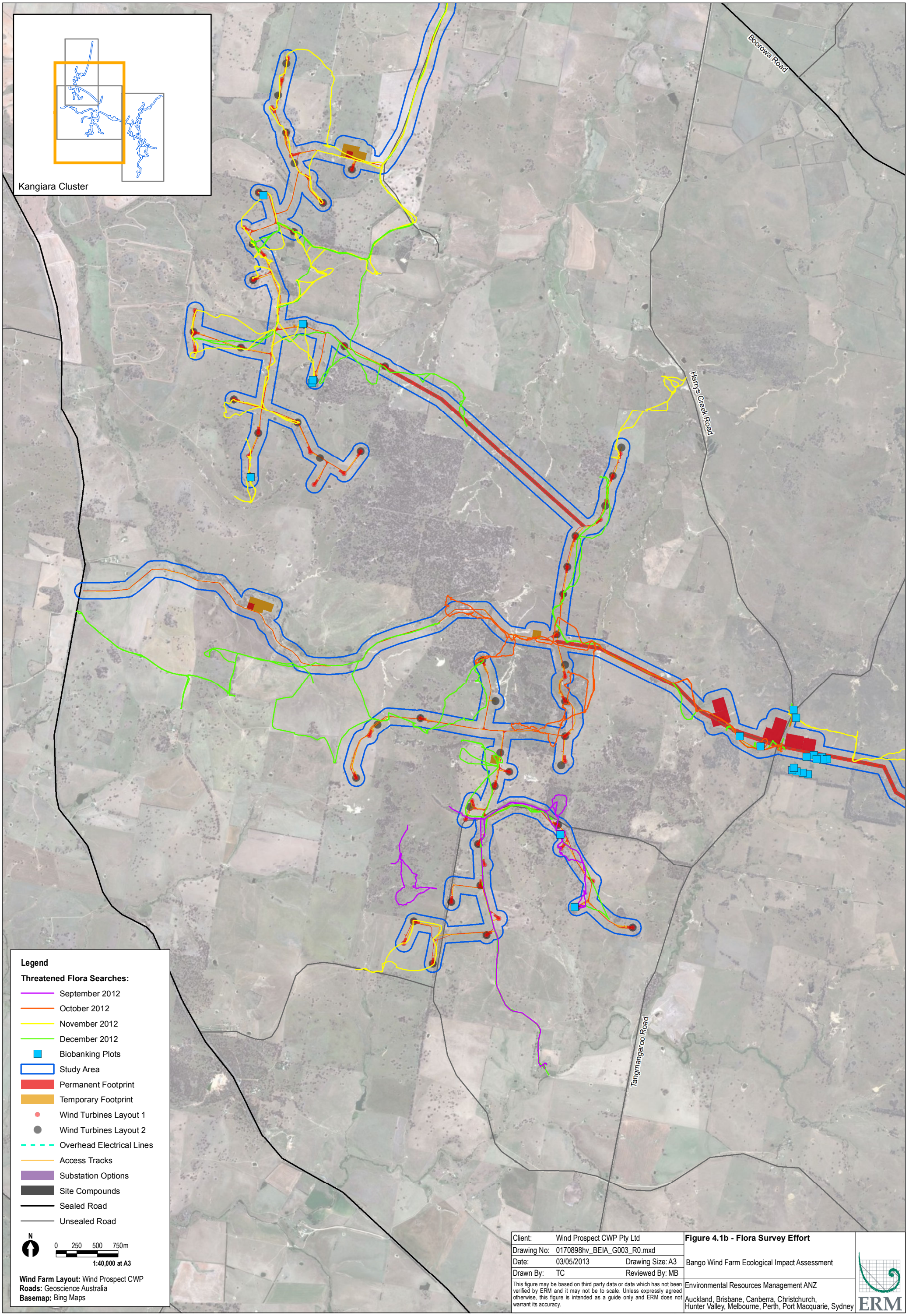
4.1 LITERATURE AND DATA REVIEW

Database searches were undertaken to identify EPBC and TSC Act listed threatened species, migratory species and Threatened Ecological Communities (TECs) and Endangered Ecological Communities (EECs) known or likely to occur in the Study Area and surrounding Locality.

Depending on the search technique for each database, searches were undertaken within an approximate 10 km buffer around the Study Area. Database searches were originally undertaken in June to August 2012 in preparation for field surveys, and were updated in March 2013 to account for any changes in species listing status and any new records available within the Locality (the searches referenced below are consistent with the information that will be presented in this report). The most recent searches of each database are outlined below:

- **Commonwealth Protected Matters Search Tool:** A search of the Protected Matters Search Tool (PMST) was undertaken on 01 March 2013. The search covered the entire Locality within 10 km of the PAA.


Langs Creek Cluster
Lachlan Valley Way
Boorowa Road
Harrys Creek Road
Legend
Threatened Flora Searches:
September 2012
October 2012
November 2012
December 2012
Biobanking Plots
Study Area
Permanent Footprint
Temporary Footprint
Wind Turbines Layout 1
Wind Turbines Layout 2
Overhead Electrical Lines
Access Tracks
Substation Options
Site Compounds
Sealed Road
Unsealed Road
N
0 250 500 750m
1:40,000 at A3
Wind Farm Layout: Wind Prospect CWP
Roads: Geoscience Australia
Basemap: Bing Maps
Client: Wind Prospect CWP Pty Ltd
Drawing No: 0170898hv_BEIA_G003_R0.mxd
Date: 03/05/2013 Drawing Size: A3
Drawn By: TC Reviewed By: MB
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
Figure 4.1a - Flora Survey Effort
Bango Wind Farm Ecological Impact Assessment
Environmental Resources Management ANZ
Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney
ERM



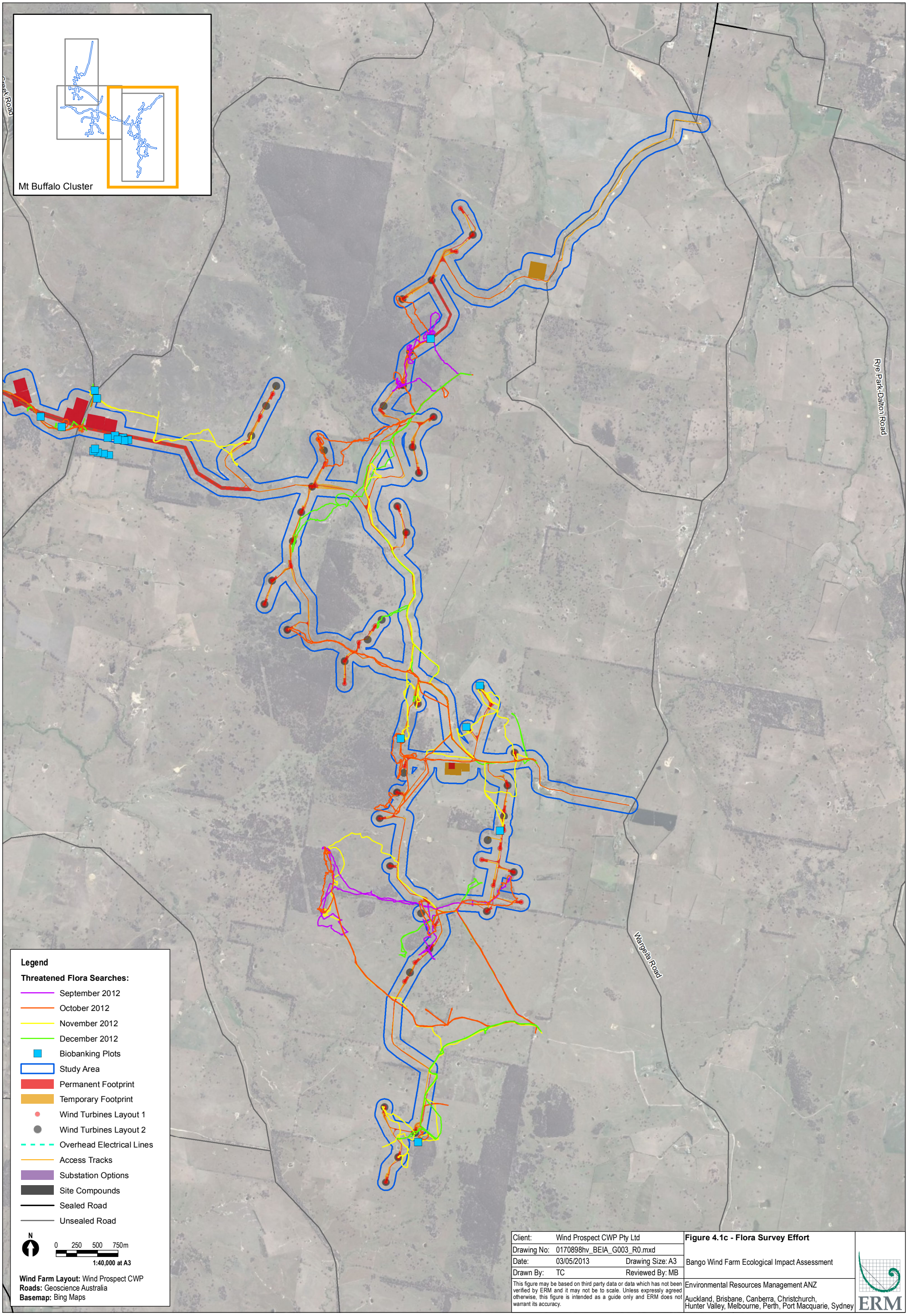
Client:	Wind Prospect CWP Pty Ltd		**Figure 4.1b - Flora Survey Effort**
Drawing No:	0170898hv_BEIA_G003_R0.mxd		
Date:	03/05/2013	Drawing Size: A3	Bango Wind Farm Ecological Impact Assessment
Drawn By:	TC	Reviewed By: MB	

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM


Mt Buffalo Cluster
Rye Park-Dalton Road
Wargeila Road
Legend
Threatened Flora Searches:
September 2012
October 2012
November 2012
December 2012
Biobanking Plots
Study Area
Permanent Footprint
Temporary Footprint
Wind Turbines Layout 1
Wind Turbines Layout 2
Overhead Electrical Lines
Access Tracks
Substation Options
Site Compounds
Sealed Road
Unsealed Road
N
0 250 500 750m
1:40,000 at A3
Wind Farm Layout: Wind Prospect CWP
Roads: Geoscience Australia
Basemap: Bing Maps
Client: Wind Prospect CWP Pty Ltd
Drawing No: 0170898hv_BEIA_G003_R0.mxd
Date: 03/05/2013 Drawing Size: A3
Drawn By: TC Reviewed By: MB
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
Figure 4.1c - Flora Survey Effort
Bango Wind Farm Ecological Impact Assessment
Environmental Resources Management ANZ
Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney
ERM

- **Atlas of NSW Wildlife:** Threatened species records were obtained from the Atlas of NSW Wildlife on 8 March 2013 for a 10 km buffer around the Study Area boundary.

- **Atlas of Living Australia:** The Atlas of Living Australia provides records of species from a range of sources, including the Australian Virtual Herbarium, Australian National Insect Collection, Australian National Wildlife Collection, BirdLife Australia, Plant Bank Records, Australian National Botanic Gardens Seedbank, and government, professional and community sources. The search of the Atlas of Living Australia was undertaken on 6 March 2013, and queried the following layers: Threatened Species (2008), Migratory Species (2008) and Threatened Communities (2008). These records are based on the species listing in 2008. Records within a 10 km buffer of the Study Area have been considered.

- **Atlas of Australian Birds:** The Atlas of Australian Birds database is administered by BirdLife Australia and a search was conducted on 6 March 2013. The search region was defined by a one degree square centred approximately in the middle of the Study Area.

- **NSW Flora Online:** The NSW Flora Online database provides records of flora species based on specimens lodged at the National Herbarium of New South Wales. The search was conducted within a rectangle defined by a 10 km buffer to the most northerly, southerly, easterly and westerly points of the Study Area. These were defined as: North -34 ° 22 ' 11.69003 "; South -34 ° 44 ' 27.87135 ", East 149 ° 0 ' 23.41823 ", and West 148 ° 37 ' 7.70285 ".

- **Bureau of Meteorology (BoM):** weather observations were obtained from BoM for the duration of the field surveys.

- **Other sources:** Other sources consulted to develop the species list include:

  - bird records from the area held by Greening Australia; and

  - map of Golden Sun Moth records and habitat (DEWHA 2009).

A review of literature relevant to the area and to the subject species was undertaken and included the following:

- *Bango Wind Farm Preliminary Environmental Assessment* (WPCWP 2011);

- *Bango Wind Farm Preliminary Ecological Investigation* (WPCWP 2012);

- *Native Vegetation of the Southern Forests: South east Highlands, Australian Alps, South west Slopes, and SE Corner Bioregions* (Gellie 2005);

- *The Native Vegetation of Boorowa Shire* (NSW National Parks and Wildlife Service (NPWS) 2002);

- *Sustainable Farms: Pathways for a Rural Landscape – Project Update July 2008 – Bats* (ANU 2008);
- *Rugby Wind Farm Ecological Impact Assessment* (ERM 2012); and
- *AGL Dalton Power Project Environmental Assessment* (URS 2011).

4.2 SURVEY EFFORT AND TIMING

The field surveys aim to establish species presence, particularly threatened species, and to record and map potential habitat for threatened species that have the potential to occur, though are not detected, in the Study Area.

A total of 67 separate days were spent in the Study Area by various field teams, equating to approximately 130 person days of effort across the Study Area during the duration of the field investigation period. A summary of the survey effort for each survey trip is shown in *Table 4.1.*

Table 4.1 Summary of Survey Effort

Survey Task	Target Species / Ecological Communities	Survey Period	Survey Effort	Habitats Surveyed	Person /Trap Hours
Endangered Ecological Communities					
Vegetation mapping (as described in *Chapter 3.2.2*).	• Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South eastern Australia • Natural Grasslands on Basalt and Fine-textured Alluvial Plains of Northern NSW and Southern QLD • Natural Grasslands on Basalt and Fine-textured Alluvial Plains of Northern NSW and Southern QLD • Tableland Basalt Forest in the Sydney Basin and South East Highlands Bioregion • White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands (EPBC Act listed) • White Box Yellow Box Blakely's Red Gum Woodland (TSC Act listed)	26 – 28 September 2012 22 – 26 October 2012 12 – 16 November 17 – 21 December 2012 24 and 26 February 2013	Fifteen 20 m x 20 m quadrats (2 ecologists) Twenty-eight BioBanking plots and transects (2 ecologists)	Native woodland, open forest and derived native grassland in the Study Area	35

Survey Task	Target Species / Ecological Communities	Survey Period	Survey Effort	Habitats Surveyed	Person /Trap Hours
Threatened Flora					
Random meander	• Crimson Spider Orchid	26 – 28 September 2012 22 – 26 October 2012 (in accordance with flowering times at both Burrinjuck Nature Reserve and Bethungra (refer *Chapter 4.3.1*))	Included in random meanders through woodland areas in the Study Area by 2 ecologists, covering a total of 28.27 km in September and 74.10 km in October.	Woodland areas in the Study Area	120 (total for random meanders)
	• Aromatic Peppercress	22 – 26 October 2012 12 – 16 November 17 – 21 December 2012	Included in random meanders through woodland and derived native grassland areas in the Study Area by 2 ecologists, covering a total of 74.10 km in October, 90.45 km in November and 109.39 km in December.	Woodland and derived native grassland areas in the Study Area	
	• Button Wrinklewort	22 – 26 October 2012 12 – 16 November 17 – 21 December 2012	Included in random meanders through woodland and derived native grassland areas in the Study Area by 2 ecologists, covering a total of 74.10 km in October, 90.45 km in November and 109.39 km in December.	Box-Gum Woodland and derived native grassland areas in the Study Area	
	• Doubletail Buttercup	22 – 26 October 2012 12 – 16 November 17 – 21 December 2012	Included in random meanders through woodland and derived native grassland areas in the Study Area by 2 ecologists, covering a total of 74.10 km in October, 90.45 km in November and 109.39 km in December.	Woodland and derived native grassland areas in the Study Area	

Survey Task	Target Species / Ecological Communities	Survey Period	Survey Effort	Habitats Surveyed	Person /Trap Hours
	• Dwarf Kerrawang	22 – 26 October 2012 12 – 16 November 17 – 21 December 2012	Included in random meanders through woodland areas in the Study Area by 2 ecologists, covering a total of 74.10 km in October, 90.45 km in November and 109.39 km in December.	Woodland areas in the Study Area	
	• Hoary Sunray	22 – 26 October 2012 12 – 16 November 17 – 21 December 2012	Included in random meanders through woodland and derived native grassland areas in the Study Area by 2 ecologists, covering a total of 74.10 km in October, 90.45 km in November and 109.39 km in December.	Woodland and derived native grassland areas in the Study Area	
	• Mountain Swainson Pea	22 – 26 October 2012 12 – 16 November 17 – 21 December 2012	Included in random meanders through woodland and derived native grassland areas in the Study Area by 2 ecologists, covering a total of 74.10 km in October, 90.45 km in November and 109.39 km in December.	Woodland and derived native grassland areas in the Study Area	
	• Robertson's Gum	22 – 26 October 2012 12 – 16 November 17 – 21 December 2012	Included in random meanders through woodland areas in the Study Area by 2 ecologists, covering a total of 74.10 km in October, 90.45 km in November and 109.39 km in December.	Woodland areas in the Study Area	
	• Silky Swainson Pea	22 – 26 October 2012 12 – 16 November 17 – 21 December 2012	Included in random meanders through woodland and derived native grassland areas in the Study Area by 2 ecologists, covering a total of 74.10 km in October, 90.45 km in November and 109.39 km in December.	Woodland and derived native grassland areas in the Study Area	

Survey Task	Target Species / Ecological Communities	Survey Period	Survey Effort	Habitats Surveyed	Person /Trap Hours
	• Tarengo Leek Orchid	22 – 26 October 2012 12 – 16 November 17 – 21 December 2012 (in accordance with flowering time at Tarengo Travelling Stock Reserve (refer *Chapter 4.3.1*))	Included in random meanders through woodland and derived native grassland areas in the Study Area by 2 ecologists, covering a total of 74.10 km in October, 90.45 km in November and 109.39 km in December.	Woodland and derived native grassland areas in the Study Area	
	• Yass Daisy	22 – 26 October 2012 12 – 16 November 17 – 21 December 2012	Included in random meanders through woodland and derived native grassland areas in the Study Area by 2 ecologists, covering a total of 74.10 km in October, 90.45 km in November and 109.39 km in December.	Woodland and derived native grassland areas in the Study Area	
Threatened Fauna					
Meanders through native grassland habitat	• Golden Sun Moth	30 November 3 – 7, 10 – 14 and 17 – 21 December 2012	Random meanders through areas of suitable habitat across the Study Area over a period of approximately 16 days by 3 ecologists, between 10 am and 3 pm.	Derived native grassland areas in the Study Area	216
Diurnal Frog Searches	• Booroolong Frog • Growling Grass Frog	November 2012 – February 2013	Habitat searches undertaken in conjunction with habitat assessments.	Creeks, waterways and soaks	

Survey Task	Target Species / Ecological Communities	Survey Period	Survey Effort	Habitats Surveyed	Person /Trap Hours
Nocturnal Frog Searches	• Booroolong Frog • Growling Grass Frog	November 2012 - February 2013	Visual and call surveys undertaken when conditions were suitable, ie warm nights after rainfall. Creeks and waterways searched for a period of one hour on each survey night by two ecologists. Two road based surveys undertaken during rain periods by two ecologists for one hour each.	Creeks and waterways	6
Pitfall Trapping	• Striped Legless Lizard	19 – 23 and 26 - 30 November 2012 3 – 7, 10 – 14 and 17 – 21 December 2012	Three suitable locations established, Cross configuration, Five pits per configuration, Two configurations per location, Monitored for a period of four weeks.	Derived native grassland	16,200
Reptile Funnel Traps	• Striped Legless Lizard	19 – 23 and 26 - 30 November 2012 3 – 7, 10 – 14 and 17 – 21 December 2012	Two suitable locations established, Used when funnels could not be utilised, Cross configuration used, 12 traps per configuration, Monitored for a period of four weeks	Derived native grassland	12,960
Tile Grids	• Striped Legless Lizard	Grid setup: August 2012 - December 2012 Monitoring November – December 2012	Three 50 grids and three 25 tile grids, Established in July 2012, Monitoring every two weeks from November 2012 to December 2012.	Derived native grassland	17,136
Reptile searches (diurnal)	• Striped Legless lizard • Pink Tailed Worm Lizard	October 2012 - February 2013	Suitable habitat surveyed, Rock turning suitable rocks.	Rocky areas	8
Bird Census Surveys	• Threatened Birds	November 2012 - February 2013	16 two hectare bird census completed at various locations throughout Study Area by two ecologists	Woodland, derived native grassland, pasture and cropped areas	34

Survey Task	Target Species / Ecological Communities	Survey Period	Survey Effort	Habitats Surveyed	Person /Trap Hours
Bird Utilisation Surveys (BUS)		July 2012 - February 2013	20 separate locations established, 15 minutes per survey, 76 surveys completed.	Woodland, derived native grassland, pasture and cropped areas	19
Camera Traps	• Threatened Mammals; Arboreal and Ground dwelling	November 2012 - December 2012	Eight remote camera traps deployed for a minimum of four weeks, Four set up for arboreal monitoring, Four set up for terrestrial monitoring.		4032
Anabat Ultrasonic Detection Units	• Threatened Bats	November 2012 - February 2013	Anabat units deployed at 13 locations, Deployed minimum two nights per location.		624
Harp Trapping		February 2013	Two Harp traps deployed at two separate locations over three nights.		72
Nocturnal Call Playback	• Threatened owls	November 2012 - December 2012	Nocturnal call playback session completed on five separate occasions by 2 ecologists in suitable conditions		10
Spotlighting	• Threatened nocturnal mammals • Threatened owls	November 2012 - February 2013	Six spotlighting sessions, 2 ecologists Three locations One hour per session	Woodland areas containing hollow bearing trees	36
Arboreal Mammal Trapping	• Squirrel Glider	February 21st – February 25th	Two trap lines were established in remnant corridor habitat. Each trap line consisted of 10 Elliot B traps set in trees approximately two to three metres above the ground. Traps were monitored for four nights.	Remnant road corridors	960
All Threatened Species					
Opportunistic Observations	All Threatened Species	July 2012 – February 2013	Opportunistic observations recorded at all times	Study Area and Locality	-

4.3 VEGETATION MAPPING

Colour aerial photographs and previous vegetation mapping were analysed to stratify the Study Area into different vegetation types. Approximate areas of woodland, grassland and cropping in the Study Area were obtained from the aerial photography and analysis of the following existing vegetation mapping:

- *Australian Alps, South west Slopes, and SE Corner Bioregions* (Gellie 2005);
- *The Native Vegetation of Boorowa Shire* (NSW National Parks and Wildlife Service (NPWS) 2002); and
- *Bango Wind Farm Preliminary Ecological Investigation* (WPCWP 2012b).

The NPWS (2002) and Gellie (2005) vegetation mapping used different nomenclature to describe the same vegetation communities. The vegetation mapping undertaken by WPCWP was based on the Gellie (2005) and NPWS (2002) mapping, supplemented by field observations in some areas. It was undertaken for an early version of the Study Area and as such, some mapped areas are no longer included in the Project. Based on the descriptions of vegetation communities provided in the above reports, the vegetation communities were matched with their equivalent BioMetric vegetation types (BVT) from the Vegetation Types Database for the Lachlan CMA (OEH 2012a). The vegetation community descriptions and mapping provided in this report is in accordance with the Vegetation Types Database.

Existing vegetation mapping was ground truthed during field visits, allowing the stratification of vegetation types to be further refined. Vegetation mapping was undertaken throughout spring and summer 2012 – 2013. The Study Area was traversed by vehicle and on foot, enabling all vegetation to be surveyed.

Fifteen 20 m x 20 m quadrats were sampled at selected sites that were representative of different vegetation types (refer *Figure 4.1*). Within each 20 m x 20 m quadrat, all species were recorded to species or subspecies level. The relative abundance of each species was recorded using the following scale of foliage projective cover (FPC):

- 1 = <5% FPC and uncommon;
- 2 = <5% FPC and common;
- 3 = 6 - 20% FPC;
- 4 = 21 - 50% FPC;
- 5 = 51 - 75% FPC; and
- 6 = 76 - 100% FPC.

BioBanking plot and transect data was also collected in these locations, in accordance with the BioBanking methodology described in *Chapter 4.4.* A further 13 BioBanking plots / transects were sampled, within which only data

relevant to the BioBanking methodology was collected (refer *Figure 4.1*). Within the 28 quadrats sampled, the dominant species in each strata informed the classification of vegetation into the different BVTs, along with consideration of other characteristic species, landscape position and soil type.

Boundaries of vegetation communities were recorded using a hand-held GPS and hand drawings on aerial photographs and digitised in a geographic information system (GIS). The area of each vegetation community within the Development Footprint was calculated based on the area of Layout Option 1 (ie the worst case scenario).

Each BVT was categorised into different condition classes, creating a series of Vegetation Zones. These Vegetation Zones are shown in the vegetation mapping and were also used in the BioBanking assessment. BVTs were assigned primary and secondary condition classes. The primary condition class is a dichotomy prescribed in the BioBanking Assessment Methodology (BBAM), which requires all native vegetation on a site to be classed as either:

- Low Condition: Native over-storey percent foliage cover less than 25% of the lower benchmark value AND less than 50% of groundcover vegetation is indigenous species; and

- Moderate – Good Condition: Native over-storey percent foliage cover greater than 25% of the lower benchmark value OR more than 50% of groundcover vegetation is indigenous species.

The condition class definitions provided above are for woody vegetation types. A secondary condition class was assigned, incorporating the definitions and criteria for derived native grasslands and threatened ecological communities described below:

- **Derived Native Grassland (DNG)**: DNG are native grasslands that comprised woodland or open forest prior to European settlement. In these areas, the majority of the woody vegetation has been cleared, however, greater than 50% of the ground cover comprises indigenous grasses and forbs. These grasslands are mapped based on their original woodland / open forest BVTs. The BVT of the grassland was determined based on the species composition of nearby intact stands of BVTs and any remaining paddock trees. BVTs also have a correlation with position in the landscape. For example, in the Boorowa Shire, woodland dominated by Blakely's Red Gum (*Eucalyptus blakelyi*) and Yellow Box (*E. melliodora*) occur along most creek lines and lower slopes, while dry forests dominated by Red Stringybark (*E. macrorhynca*) occur on ridge lines and upper slopes (NPWS 2002); and

- **Threatened Ecological Communities (TEC):** Potential EECs or critically endangered ecological communities (CEECs) under the TSC Act or EPBC Act were assessed against the relevant NSW Scientific Committee final determination and the Threatened Species Scientific Committee Listing

Advice. In the case of Box Gum Woodland, these documents define DNG differently to the general definition provided above and therefore, the general definition for DNG does not apply to grasslands derived from Box Gum Woodland.

The definitions for each condition class incorporate the above and are described in *Table 4.2*. Note that references to 'benchmark' values are to the Biometric Vegetation Types Benchmarks Database which contains data on the floristic and structural characteristics of each BVT.

Table 4.2 Condition Class Definitions

Condition Class*	Definition
Mod_Good	• Native over-storey percent foliage cover greater than 25% of the lower benchmark value; OR • more than 50% of groundcover vegetation is indigenous species.
Mod_Good-EPBC	• Native over-storey percent foliage cover greater than 25% of the lower benchmark value; OR • more than 50% of groundcover vegetation is indigenous species; AND • Meets the definition for listing under the EPBC Act.
Mod_Good-TSC	• Native over-storey percent foliage cover greater than 25% of the lower benchmark value; AND • Meets the definition for listing under the TSC Act.
Mod_Good-TSC-DNG	• more than 50% of groundcover vegetation is indigenous species; AND • the majority of the woody vegetation has been cleared; AND • Meets the definition for listing under the TSC Act.
Low	• Native over-storey percent foliage cover less than 25% of the lower benchmark value; AND • less than 50% of groundcover vegetation is indigenous species.

* Primary condition class definition is that for woody vegetation types in the BBAM (DECC 2009)

4.4 FLORA

A floristic inventory was collected through the identification of all flora species encountered in plots/meanders or incidentally in the field, either in-situ or by collecting a sample for later identification. Where positive identification was not possible a sample was sent to the Royal Botanic Gardens in Sydney (RBGSyd) for identification using the Botanical Identification Service (BIS). All samples were identified to species level where sufficient material of the individual was available. In some cases identification to genus or family level was the best possible result. Flora species nomenclature is consistent with the NSW Flora Online (PLANTNET) (RBG&DT 2012).

4.4.1 Threatened Flora

Targeted flora surveys were undertaken for the subject species identified by OEH (refer *Table 3.3* and *3.4*) and any other threatened flora species considered to have the potential to occur in the Study Area identified by database searches and the BioBanking Credit Calculator.

Random meanders were undertaken throughout the Study Area, focussing on areas of native woodland and open forest and derived native grassland. This technique allows for greater coverage of an area than plot based surveys. It involves traversing areas of suitable habitat for threatened species in a random pattern, searching for the threatened plant species that may occur (Department of Environment and Conservation (DEC (now OEH)) 2004). Random meanders were undertaken in areas of native woodland, open forest and derived native grassland in the Study Area.

Areas of suitable habitat were surveyed during the flowering season for the species, in accordance with the flowering season at reference sites (where applicable). Reference sites were used for the Crimson Spider Orchid and the Tarengo Leek Orchid. Details are provided in *Table 4.3.*

Table 4.3 Details of Flora Reference Sites

Species	Reference Site Information	ERM Survey
Crimson Spider Orchid	Information regarding the reference site was obtained from OEH. There are two known populations of the Crimson Spider Orchid that flower reliably in the vicinity of the Study Area: • Burrinjuck Nature Reserve: approximately 40 km south west of the Study Area. The reference site was not visited, however, John Briggs of OEH indicated that flowering occurs mid to late October, with leaves and buds visible in September; and • Bethungra: approximately 80 km south west of the Study Area. The reference site was not visited, however, John Briggs of OEH indicated that flowering occurs mid September (the population was recorded flowering in 2011 on 16 September). The populations are now two different species (*Arachnorchis orestes* at Burrinjuck and *Arachnorchis branwhiteii* at Bethungra), however, both are still included in the TSC Act listing for *Caladenia concolor* (pers. comm. J Briggs September 2012).	Targeted surveys were undertaken during 26 – 28 September and 22 – 26 October 2012
Tarengo Leek Orchid	A population occurs at the Tarengo Travelling Stock Reserve, approximately 7 km north west of the Study Area. This site was visited on 24 October 2012 by OEH and the species was observed to be flowering at this time (pers. comm. R Rehwinkel October 2012).	Targeted surveys were undertaken during 22 – 26 October 2012

Incidental observations of threatened flora were recorded in the Locality. Where a threatened species was observed in the Locality, its location and the boundaries of its occurrence were recorded on a GPS.

4.4.2 Introduced Flora

Flora species were identified as either native or introduced to NSW. The status of all introduced species identified in the Study Area under the NW Act was noted.

4.5 BIOBANKING

A BioBanking Assessment was undertaken in accordance with the BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECC, 2009). OEH provided advice on a simplified application of the methodology for large linear projects, which minimises the use of assessment circles to a maximum of four in each CMA area (A Remnant pers. comm. 2013). The steps involved in this method are as follows:

- create threatened species subzones as per guidance in the BioBanking Assessment Methodology and Operational Manual;
- group the percent native vegetation cover for each assessment circle into one the following four categories: <10%, 11-30%, 31-70% and 71-100%;
- when entering data into the Credit Calculator, each of the above categories is a new assessment circle. Thus, there will only be up to four assessment circles; and
- amalgamate all threatened species subzones where the following values are identical: CMA sub region, percent native vegetation cover of the 1000ha and 100ha assessment circle, vegetation community, condition and adjacent remnant area class size <5 ha, 5-25ha (including 25ha), >25-100ha (including 100ha) or >100ha.

This simplified method was used in the BioBanking assessment. The area of each BVT was calculated based on the area of Layout Option 1 (ie the worst case scenario).

The field survey was undertaken in accordance with Appendix 2 of the BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECC, 2009). This included undertaking a series of nested 20 x 50 m and 20 x 20 m plots (refer *Figure 4.1*) in which the following attributes were recorded:

- GPS coordinates;
- native plant species richness (the number of native species that occur in a 20 m x 20 m plot);
- native over-storey cover (percent cover over a 50 m transect);
- native mid-storey cover (percent cover over a 50 m transect);

- native groundcover (grasses) (percent cover over a 50 m transect);
- native groundcover (shrubs) (percent cover over a 50 m transect);
- native groundcover (other) (percent cover over a 50 m transect);
- exotic plant cover (percent cover over a 50 m transect);
- number of trees with hollows (total number within a 50 m x 20 m plot);
- over-storey regeneration (the proportion of over-storey species that are regenerating across the entire vegetation zone; and
- total length of fallen logs (within a 50 m x 20 m plot).

The BioBanking Credit Calculator Version 2.0 was used to calculate the credits required in accordance with the Draft Operational Manual for Using the BioBanking Credit Calculator v2.0, the BioBanking Assessment Methodology (BBAM) and Credit Calculator Operational Manual (DECC 2009).

4.6 FAUNA

This section describes the techniques employed to sample for threatened species identified during the literature and database review as having the potential to occur in the Study Area. Fauna field surveys commenced in July 2012 and continued to February 2013. Field surveys included habitat assessments to identify the general habitat resources that occur in the Study Area and to identify potential habitat for threatened species. Targeted surveys were undertaken to sample for threatened species. Surveys were undertaken in accordance with the OEH EARs, the *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft)* (DEC 2004) and other relevant species specific survey guidelines.

4.6.1 Fauna Habitat Assessment

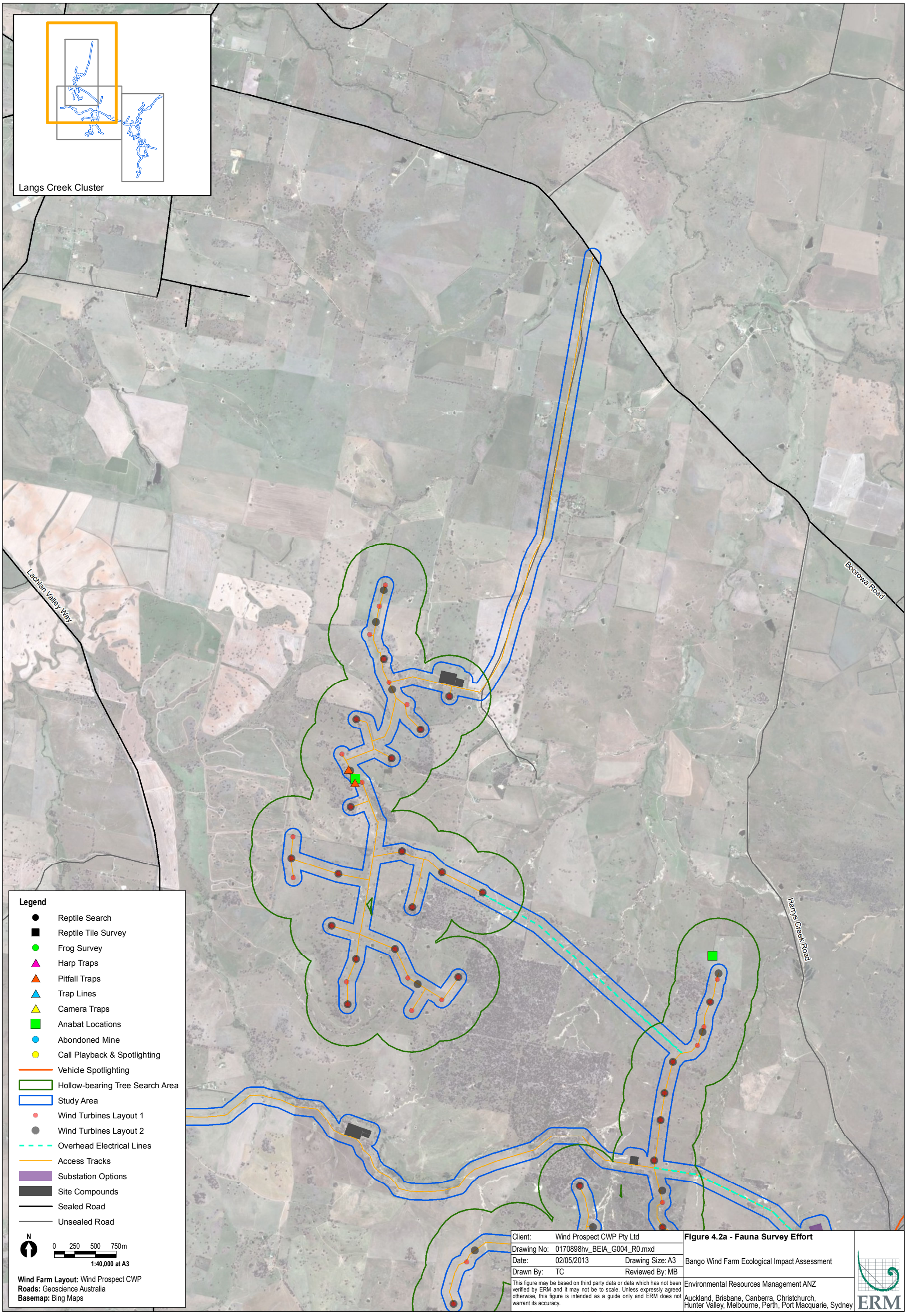
The Study Area was initially assessed through interpretation of satellite imagery. Areas supporting native vegetation and potential fauna habitat were located and then surveyed by vehicle and on foot (refer *Figure 4.2*).

Fauna habitat types were characterised in the Study Area and are described in *Chapter 5*. The quality of the fauna habitat was assessed and categorised by the presence or absence of components of the ecosystems used by different fauna groups, eg large hollow bearing trees for hollow dependent species, presence of understorey and composition of understorey for reptile, mammals and woodland birds. The habitat types were categorised using the following criteria:

- **High:** Fauna habitat components present, remnant large stands of trees with assortment of hollows in different size range classes, mid storey, ground cover and mosaic of native vegetation are intact and linkages to other remnant ecosystems are present;

- **Moderate:** Fauna habitat components are mostly present. Linkages to other remnant ecosystems are absent, or majority of fauna habitat components are absent but linkages to other remnant ecosystems are present; and

- **Low:** Fauna habitat components are absent; linkages to other remnant ecosystems are absent.


Langs Creek Cluster
Lachlan Valley Way
Boorowa Road
Harrys Creek Road
Legend
Reptile Search
Reptile Tile Survey
Frog Survey
Harp Traps
Pitfall Traps
Trap Lines
Camera Traps
Anabat Locations
Abondoned Mine
Call Playback & Spotlighting
Vehicle Spotlighting
Hollow-bearing Tree Search Area
Study Area
Wind Turbines Layout 1
Wind Turbines Layout 2
Overhead Electrical Lines
Access Tracks
Substation Options
Site Compounds
Sealed Road
Unsealed Road
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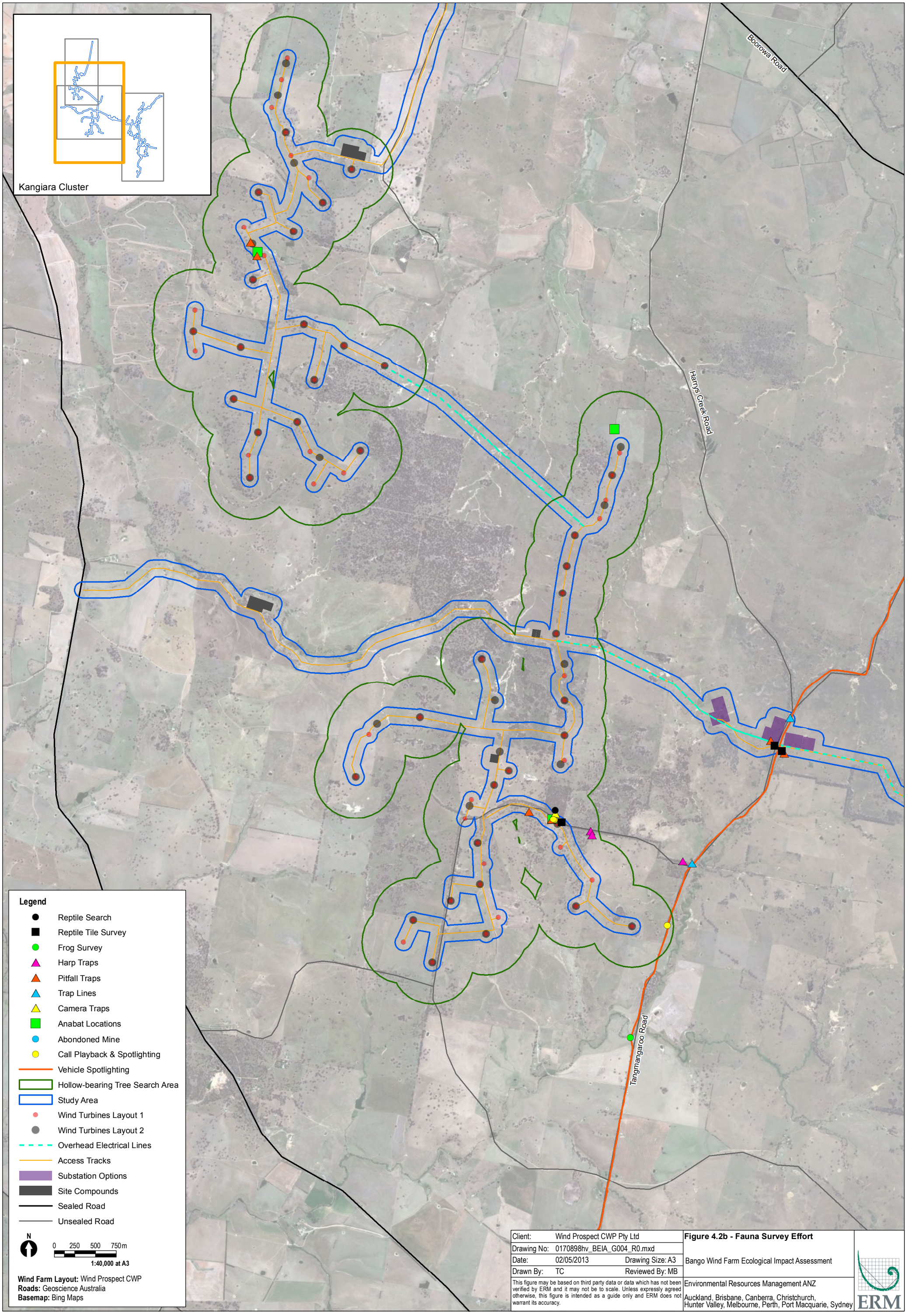
0 250 500 750m
1:40,000 at A3
Wind Farm Layout: Wind Prospect CWP
Roads: Geoscience Australia
Basemap: Bing Maps
Client: Wind Prospect CWP Pty Ltd
Drawing No: 0170898hv_BEIA_G004_R0.mxd
Date: 02/05/2013 Drawing Size: A3
Drawn By: TC Reviewed By: MB
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
Figure 4.2a - Fauna Survey Effort
Bango Wind Farm Ecological Impact Assessment
Environmental Resources Management ANZ
Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney
ERM



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Drawing No:	0170898hv_BEIA_G004_R0.mxd		
Date:	02/05/2013	Drawing Size: A3	
Drawn By:	TC	Reviewed By: MB	

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

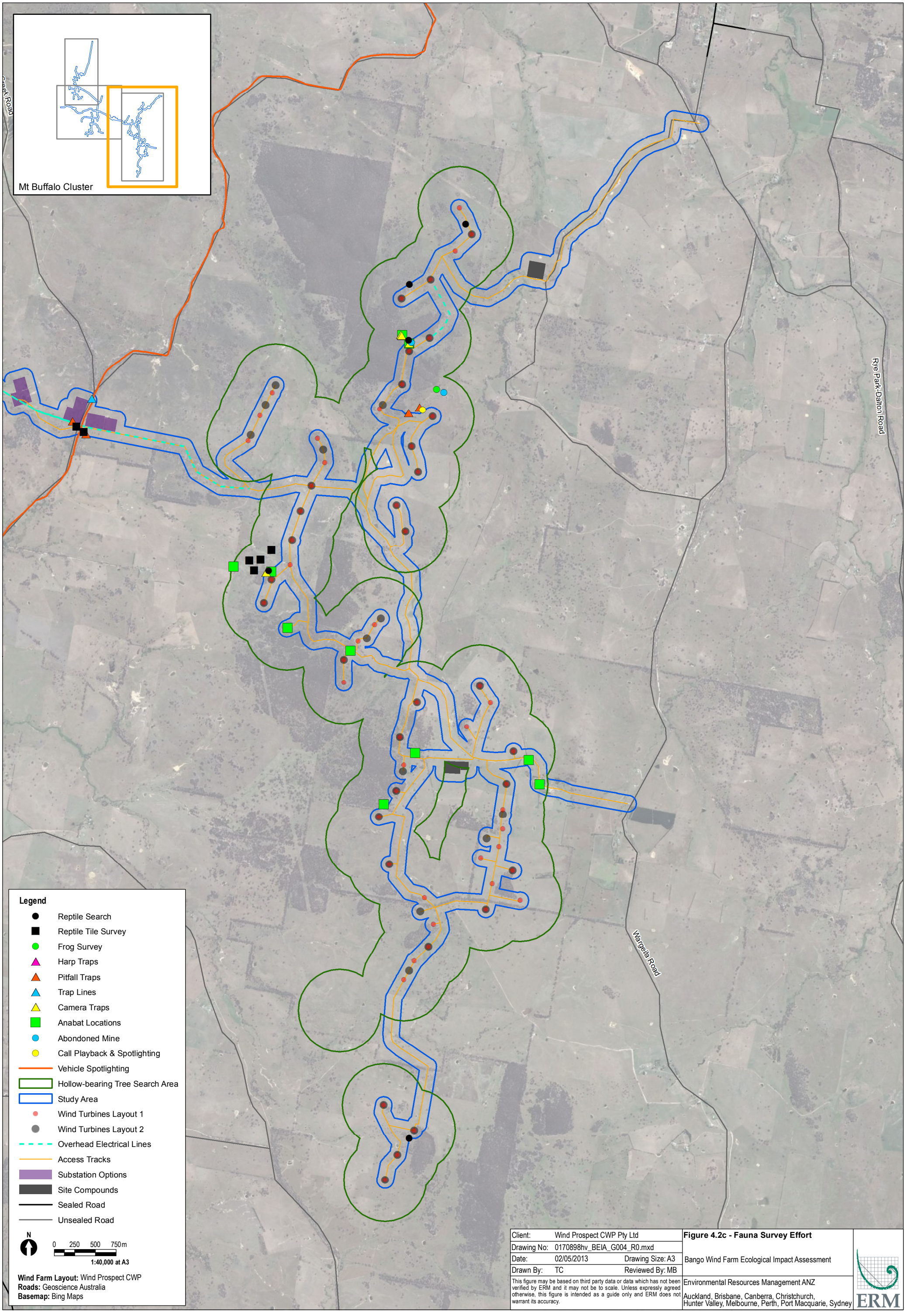
Figure 4.2b - Fauna Survey Effort

Bango Wind Farm Ecological Impact Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM



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Drawing No:	0170898hv_BEIA_G004_R0.mxd		
Date:	02/05/2013	Drawing Size: A3	
Drawn By:	TC	Reviewed By: MB	

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 4.2c - Fauna Survey Effort

Bango Wind Farm Ecological Impact Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

4.6.2 *Hollow-Bearing Tree Surveys*

A hollow bearing tree survey was undertaken from Jan 2013 to February 2013 within an area bound by a 500 m buffer around all proposed turbine locations. The survey was undertaken by two ecologists driving or walking where access was difficult. Hollow bearing trees were assessed visually, using binoculars where necessary. The total area surveyed for hollow bearing trees was approximately 4981 ha.

All hollow bearing trees with a diameter at breast height (DBH) over 50 cm within the 500 m buffer were mapped. The following information was collected during the survey;

- hollow size classes were recorded by diameter as follows; 0 – 5 cm = Small, 6 – 10 cm = Medium, 11 cm and above = Large;
- the height of the hollow from ground level;
- the species of tree;
- the height of the tree; and
- the DBH.

The information collected during the mapping of tree hollows was used to map the habitat resources (breeding and/or refuge), available for a range of hollow dependant species including Superb Parrots, large forest owls, small passerine birds, arboreal mammals and microbats.

4.7 *TARGETED FAUNA SURVEYS*

4.7.1 *Invertebrates*

Targeted surveys were undertaken for the Golden Sun Moth in accordance with the *Survey Guidelines for Detecting the Golden Sun Moth* (DEWHA 2009). Surveys were initially undertaken to assess areas of likely habitat. Surveys for moths were then undertaken during the flying season (November – January). Surveys were carried out over 12 suitable days between the hours 10:00 and 14:00 at temperatures above 20^0 C using the random meander method through areas of preferred habitat (refer *Figure 4.2*).

4.7.2 Frogs

Frog searches were undertaken in areas of observed habitat and microhabitats using nocturnal and diurnal visual encounter surveys (DEWHA 2010) either on foot or by vehicle. Target species for the surveys were the Booroolong Frog (*Litoria booroolongensis*) and the Growling Grass Frog (*Litoria raniformis*). Both of these species have been identified in the EPBC Act protected matters search tool (PMST) as having habitat that may occur within the Locality. The Booroolong Frog was also identified by OEH as likely to occur within the Locality.

The survey method involved two observers searching a 100 m transect over a period of half an hour (refer *Figure 4.2*). Nocturnal reptile and amphibian searches were undertaken during early evening. Methods included searches of both terrestrial and aquatic habitats. Surveys were only undertaken in suitable conditions for the detection of amphibian species. Surveys targeting potential habitat were undertaken on three separate occasions by two ecologists. Each terrestrial survey was completed by two ecologists with hand-held torches and head lamps meandering through and around areas of potential habitat.

A vehicle survey was completed along the length of Tangmangaroo Road on a wet evening in February. This methodology involved a slow drive along the road at approximately 8 km/hr, stopping to identify frog species on the road and periodically stopping adjacent to areas of potential frog habitat to listen for frog calls. Any threatened species identified had their position marked with a GPS point. Survey effort is presented in *Section 4.1*.

4.7.3 Reptiles

Reptile surveys were combined with the diurnal and nocturnal surveys described for frogs in *Section 0*. In addition, targeted survey and trapping was undertaken in accordance with the DGRs and EARs for the Project.

Targeted surveys were undertaken for Pink-tailed Worm-lizard (*Aprasia parapulchella)* and the Striped Legless Lizard (*Delma impar),* although the survey methods also had the potential to capture other threatened species such as the Little Whip Snake (*Suta flagellum*) or Rosenberg's Goanna (*Varanus rosenbergi*). Grassland Earless Dragon (*Tympanocryptis pinguicolla*) was not surveyed using targeted surveys as the species was removed from the subject species list for this Project, following an onsite meeting and formal advice from Matt Cameron of OEH. The habitat assessment described in the sections above identified the locations within the Study Area that were considered most suitable for detection of Pink-tailed Worm-lizard and the Striped Legless Lizard.

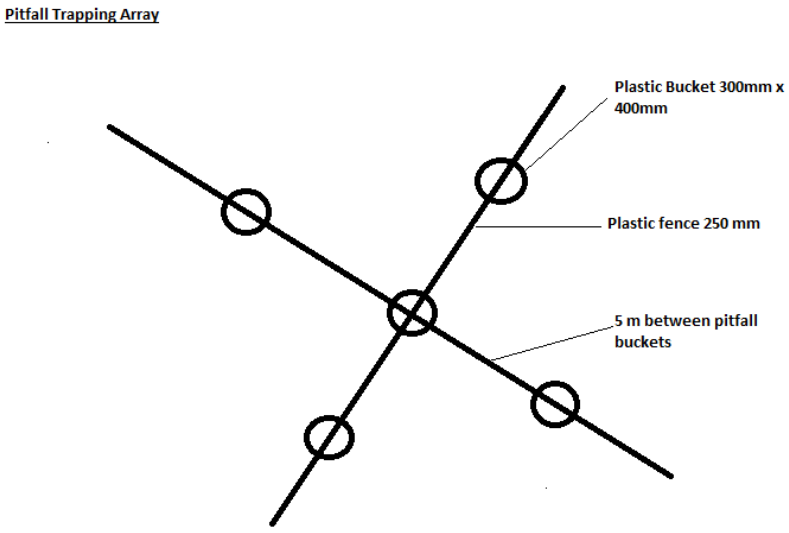
The Striped Legless Lizard is a cryptic species and may not be detected by surveys even when present at a site. Two survey methods, pitfall trapping and artificial shelter sites (tile grids) were undertaken to detect this species and other cryptic species that are difficult to locate via observational surveys. Both methodologies were consistent with the *Survey Guidelines for Australia's Threatened Reptiles 2010* (DSEWPC 2010).

The Pink-tailed Worm-lizard is another cryptic reptile that is fossorial (lives underground), and has a patchy distribution along the foothills of the western slopes of the Great Dividing Range. Most sites where Pink-tailed Worm-lizard occurs are characterised by the cover of predominantly native grasses. The presence of other plant species, including spear grasses (*Austrostipa* spp.), weeds and River Tussock (*Poa labillardieri*), decreases the likelihood of presence. Where suitable habitat was encountered random rock rolling was undertaken in theses areas (DSEWPC 2013).

Pitfall Trapping

Pitfall trapping was undertaken targeting the Striped Legless Lizard in areas where it was considered to be suitable habitat (refer *Figure 4.2*). Trapping was undertaken from 27 November 2012 to 21 December 2012. Pitfalls were set in a cross configuration (see *Figure 4.3*). Two cross configurations were used per location. Where pitfalls were unable to be dug due to underground services in the vicinity or hard ground, reptile funnel traps were deployed instead of pitfall buckets. Two reptile funnels were used as a surrogate for one pitfall bucket. A total of 40 pitfall traps were deployed over four locations. Traps were checked daily and twice daily during times of extreme hot weather where possible. Traps were set from were open and monitored four days a week for a five week period.

Figure 4.3 Pitfall Trapping Array



Artificial Shelter

Artificial shelters, or tile grids, were established in areas of identified habitat. Three tile grids consisting of 50 tiles and three tile grids consisting of 25 tiles were established in August 2012. Grids were installed at least three months prior to the initial survey/checks. Grids were placed in vegetated areas that were identified as having suitable habitat components for the target species. Each tile grid was spaced five metres apart, arranged in a grid of ten tiles by five tiles for the 50 tile grids and five by five tile grids for the 25 tile grids. Tiles were positioned on a northerly aspect where possible. Monitoring of tile grids commenced on 23 November 2012 and ran through to 25 January 2013.

4.7.4 Birds

A range of bird survey techniques were used in the ecological survey, and all were undertaken in accordance with the AusWEA Interim Bird Risk Assessment Standards (2005). These standards identify three levels of assessment:

- **Level 1**: This investigation provides an overview assessment of the risk of significant bird impacts from the operation of the wind farm. During this stage, broad habitat types are defined and their potential to support listed species is assessed. Species identified as likely to occur and for which the proposed wind farm could significantly impact are further investigated;

- **Level 2**: Targeted surveys using best-practice methods are undertaken to ascertain whether these species are present in the areas of suitable habitat. The risk to these species from the proposed wind farm is then assessed. If a risk is identified, a Level 3 assessment is warranted; and

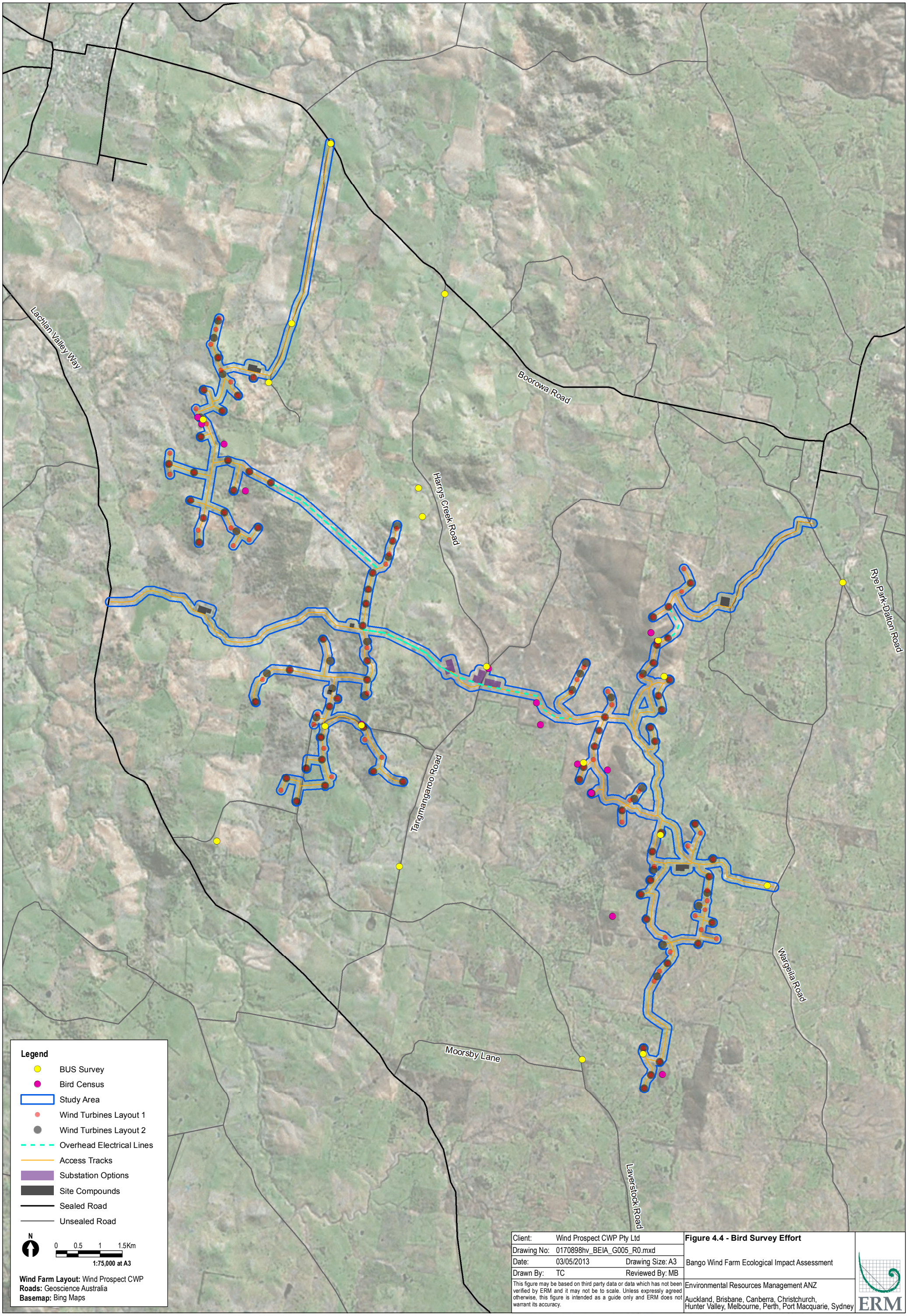
- **Level 3:** A detailed targeted assessment is completed to identify the habitats particularly important to the species. This aids the further assessment in determining whether the proposed wind farm is likely to result in a significant impact on the species and in particular the extent to which the species may interact with proposed wind turbines.

Bird Utilisation Survey

The Bird Utilisation Surveys (BUS) were undertaken from 14 November 2012 to 23 February 2013 to capture data during the Superb Parrot breeding season. Surveys were undertaken at different times of the day regardless of weather conditions. The methodology involved 15 minute fixed point, fixed radius counts at 20 survey sites spread across the Study Area (refer *Figure 4.4*). Sites were located at varying distances from habitat features such as hills/ridges, woodland and creeklines that are within areas of disturbance. Control/reference sites were also established in areas of representative habitat outside the areas of disturbance. The following data was recorded.

- all small birds within 100 m of the point;
- all large birds within 800 m of the point;
- direction of flight the species is taking;
- distance from the survey point; and
- height the species is flying at measured in 20 m bands.

The data collected from the BUS was used to assess the species at risk of collision with turbine rotors during wind farm operation, and the relative abundance of each species at risk.


Lachlan Valley Way
Boorowa Road
Harrys Creek Road
Rye Park-Dalton Road
Tangmangaroo Road
Wargeila Road
Moorsby Lane
Laverstock Road
Legend
BUS Survey
Bird Census
Study Area
Wind Turbines Layout 1
Wind Turbines Layout 2
Overhead Electrical Lines
Access Tracks
Substation Options
Site Compounds
Sealed Road
Unsealed Road
N
0 0.5 1 1.5Km
1:75,000 at A3
Wind Farm Layout: Wind Prospect CWP
Roads: Geoscience Australia
Basemap: Bing Maps
Client: Wind Prospect CWP Pty Ltd
Drawing No: 0170898hv_BEIA_G005_R0.mxd
Date: 03/05/2013
Drawing Size: A3
Drawn By: TC
Reviewed By: MB
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
Figure 4.4 - Bird Survey Effort
Bango Wind Farm Ecological Impact Assessment
Environmental Resources Management ANZ
Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney
ERM

Parrots

Two parrot species were identified as subject species requiring targeted assessment; Superb Parrot (*Polytelis swainsonii*) and Swift Parrot (*Lathamus discolor*).

Superb Parrot

Point and transect surveys within areas of suitable habitat were undertaken throughout the survey period from 1 August 2012 to 13 December 2012. A total of 17 surveys were conducted during this period in the early morning (sunrise to 10 am) and evening (4 pm to sunset) (refer *Figure 4.4*). Detection was made by sighting with binoculars or by call using a minimum of two ecologists as observers. Vehicle-based observations were also undertaken whilst commuting to, from and through the Study Area, recorded as incidental sightings often along roadside remnants. All sighting locations were recorded on a GPS. This methodology is consistent with the *Survey Guidelines for Australia's Threatened Birds* (Department of Environment, Water, Heritage and the Arts (DEWHA 2010 (now SEWPaC)) and the *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft)* (Department of Environment and Conservation (DEC 2004).

Swift Parrot

Area searches and transects surveys were conducted through areas of suitable habitat within the Study Area, in the early morning and afternoon when birds are most active and vocal. Detection was by sight using binoculars or call. Surveys were conducted in July in areas of potential foraging habitat (refer *Figure 4.4*). This methodology is consistent with both the *Survey Guidelines for Australia's Threatened Birds* (DEWHA 2010) and the *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft)* (DEC 2004).

Woodland Birds

A number of woodland birds were identified as subject species requiring survey. Surveys for woodland birds were carried out during early morning or late afternoon in areas of suitable habitat. A total of 17 surveys were undertaken within or adjacent to areas of woodland habitat (refer *Figure 4.4*). Each survey was undertaken for a minimum of one hour. Bird surveys were completed by a two observers for one hour. Birds were identified using 10 × 42 mm binoculars and from characteristic calls. A minimum of two bird surveys were completed on two separate days across the woodland survey sites. This methodology is consistent with both the *Survey Guidelines for Australia's Threatened Birds* (DEWHA 2010) and the *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft)* (DEC 2004).

4.7.5 Nocturnal Species

Nocturnal surveys were undertaken for a number of subject species including owls and arboreal mammals. Call playback for owl and nocturnal mammal species was undertaken between 9 pm and 11 pm (refer *Figure 4.2*). A total of four call playback sessions were undertaken during the survey period in optimum conditions, ie evenings with little wind or rain. The nocturnal calls of the following species were played using a megaphone.

- Koala (*Phascolarctos cinereus*);
- Squirrel Glider (*Petaurus norfolcensis*);
- Powerful Owl (*Ninox strenua*);
- Masked Owl (*Tyto novaehollandiae*); and
- Barking Owl (*Ninox connivens*).

After listening for five minutes, the calls of the above species were broadcast for approximately four minutes each and were separated by a listening period of four minutes. At the end of each four minute listening period a brief spotlighting scan was made of surrounding trees for owls that may have approached silently. The calls were broadcast in the order shown above. At the completion of the Powerful Owl call a listening period of five minutes was undertaken and followed by a final scan of the surrounding trees. Two call playback sessions were completed on two separate nights at woodland survey sites.

4.7.6 Bats

Anabat detectors and recorders (hereafter referred to as 'Anabat detectors') were used to record the echolocation calls of micro-bats. Anabat detectors (in weather proof cases) were positioned at approximately 1.5 m high on bare tree trunks and at a slope of 15 degrees above the horizontal. All detectors were programmed to begin recording at dusk and recorded echolocation calls throughout the night (regardless of the weather), automatically switching off at sunrise. Anabat detectors were set for a minimum of three nights per location. The resultant Anabat files were analysed in-house by an ERM ecologist team member with Anabat file analysis experience. Potential threatened species calls were sent to an expert for second opinion. Calls were identified at three confidence levels, definite (100 percent), probable (greater than 60 percent) and possible (less than 60 percent). Definite and probable identifications were considered positive identifications of the species, while possible identifications were considered too unreliable to confirm the presence of a species.

Mine entrances, woodland areas and open pasture were targeted during the surveys (refer *Figure 4.2*). Both Anabat units and stag watching was deployed to detect if the abandoned mines were being utilised by microbats. Anabat units were placed in woodland areas in potential flyways and also on the side of large paddock trees in open pasture areas. Stagwatching involves direct counts of nocturnal animals emerging from roost sites at dusk. This method involes two ecologists standing at angles of the potential roost to observe animals as they leave the roost.

Harp traps were deployed in areas of woodland and in open areas adjacent to woodland in February 2013 (refer *Figure 4.2*). Harp trapping was undertaken over two sessions, each consisting of two Harp Traps being set for three nights, to make a 12 night Harp Trap total. Harp Trapping is useful in conjunction with Anabat detection to differentiate species that are often difficult to differentiate by calls alone. For each harp trap survey one trap was placed in a potential flyway the other along the edge of woodland adjacent to an open area.

4.7.7 Mammals (Excluding Bats)

Mammal data was collected across the Study Area by incidental observation or by direct means utilising remote cameras, nocturnal spotlighting and mammal trapping.

Remote Cameras

Remote cameras were deployed across the Study Area in woodland habitats (refer *Figure 4.2*). Two types of camera were utilised, one an incandescent flash type camera, Scoutguard 565 F–8M, and the other a black flash camera Uovision UV–565 HD. A total of eight cameras were deployed for a period of four weeks each. Cameras were checked fortnightly to ensure position remained correct, batteries were still operational and to download image data from the cameras' SD cards. Cameras were positioned in likely runways of mammal species or were positioned to capture arboreal species. Cameras positioned to pick up terrestrial species were baited with a lure of sardines and oats and honey. Cameras positioned to capture arboreal species were baited with a lure of honey water sprayed on to the trunk of the subject tree.

Arboreal Mammal Trapping

Arboreal mammal trapping was undertaken in areas of identified habitat specifically targeting the Squirrel Glider. Two trap lines were established in remnant corridor habitat (refer *Figure 4.2*). Each trap line consisted of 10 Elliot B traps set in trees approximately two to three meters above the ground on wooden platforms. Each trap was baited with a standard mix of rolled oats, peanut butter and honey. The trunks of the trees in which the traps were set were sprayed with a mixture of honey and water daily. Traps were monitored for four nights.

Spotlighting

Walking spotlight surveys were undertaken between dusk and 1 am. Each survey comprised a single person hour of survey (two observers). Walking spotlight surveys were undertaken with hand held Fauna Tech spotlights (50 Watt). A total of four walking spotlighting surveys were undertaken in areas of woodland habitat (refer *Figure 4.2*).

Spotlight surveys were also undertaken using a vehicle to traverse Tangamangaroo Road which dissects the Study Area, which was identified as containing a long, narrow corridor of good-condition remnant woodland habitat. The survey was undertaken by two ecologists travelling at approximately 8-10 km per hour one observer using a 50 watt handheld spotlight sweeping the vegetation on either side of the road corridor. A total of two driving spotlight surveys were undertaken on Tangmangaroo Road in the vicinity of the Study Area.

4.8 INCIDENTAL RECORDS

Incidental records were taken for threatened species and new species records for the site during all times within the Locality and in the Study Area. GPS locations were taken for any threatened species observed and general location was recorded for others.

4.9 SURVEY LIMITATIONS

The general success of a survey in detecting a given species can be affected by;

- species behaviour;
- species life cycle, in particular the time of the breeding season;
- the range of survey methods used;
- the experience of the observer;
- the weather (rainfall, temperature, wind, extreme conditions);
- the type of vegetation;
- the season when the survey is undertaken;
- the time of day when the survey is undertaken; and
- the amount of time spent conducting the survey (DEC 2004).

The survey guidelines for all subject species were adhered to in order to minimise the influence of survey limitations during this study. However, while surveys were undertaken during optimal conditions as much as possible, weather conditions and other factors also contribute to the effectiveness of most survey techniques. The study was constrained to a snapshot of one season.

The size, shape and access constraints of the Study Area also caused limitations. Attending all areas of suitable habitat for a species, during optimal survey conditions for that species, was not always achievable. As a result, surveys were biased towards areas of what was considered to be better quality habitat, as these would be identified as posing the highest level of constraint to the Project, and the precautionary principle has been applied where necessary.

4.9.1 Flora and Vegetation Survey Constraints

General vegetation type and condition were noted in areas while travelling between those areas identified as better habitat. Any areas identified as being of potential conservation significance were investigated in more detail on foot. Where landuse practices appeared to be consistent within paddock boundaries and for mapping purposes, vegetation characteristics noted within these boundaries were extrapolated across the broader paddock areas where possible.

Due to the high levels of clearing and disturbance within the Study Area resulting in the modification of floristics, it is difficult to accurately determine the boundaries of particular vegetation communities within the Study Area, particularly where they occur as derived native grassland. Mapping of these areas has been based upon indicative overstorey species and observed patterns of vegetation distribution in the field. A conservative approach has been taken where communities of conservation significance occurred.

Spring flowering annual exotic grasses were common throughout the Study Area during the November survey period. The often dense cover of these species can obscure some ground cover vegetation making it difficult to detect. It is possible that some native species may have been overlooked in these areas however, due to their degraded nature it is not considered likely that any species of conservation significance would occur in those areas.

Surveys were conducted over spring/summer 2012 - 2013, thus providing a snapshot of the vegetation at that time. The composition of vegetation communities can vary depending on climatic patterns and level of agricultural activity. This is particularly the case with grassland communities, where the species composition can vary greatly. The Study Area experienced two years of higher than average rainfall in the years leading to the survey period and therefore, the species diversity within the Study Area would be assumed to be very high and representative of what occurs in the area.

4.9.2 Fauna Survey Constraints

To obtain best results, the majority of bird surveys were limited to early morning and late afternoon as these are periods when birds are most active. BUS surveys were more flexible as the data collected related to species utilisation of the site over an entire day. A reduction in the number of species detected during mid-day surveys was observable. However, this is considered unlikely to have affected the results to the point where any important species were missed, as surveys were spread over a broad area and time frame.

The tree hollow survey was undertaken during the later stages of the breeding season for the Superb Parrot. This may have impacted on the detection of breeding pairs of this species as none were detected. As such, for this report it will be considered that all hollows recorded of a suitable size class for this species would be regarded as potential breeding habitat.

The use of Anabat to detect microbats entails the identification of bats by echolocation calls. This involves considerable subjectivity, due to call variation in regions, different habitats, lack of previous reference calls and the quality of the call. Some species are easily identifiable, while others can be difficult to distinguish sharing similar frequency ranges and call shapes. Some species may not be detected by the Anabat due to range of the microphone, this is particulary important when trying to record high flying species within woodlands.

Moon phases, for call playback and spotlighting surveys, was not a limitation to the survey. Moon phase may affect the response of some owls and detection of other nocturnal species, although the actual influence of this may vary widely dependant on habitat sampled, and the season the survey was undertaken.

Weather conditions during the survey period may have had an impact on many species detectability. During the December survey period daytime temperatures reached in excess of 40 ^{0} C. During the February survey period a number days of extreme wind and rain were experienced, this would also have had an impact on the detection of some species.

In order to address any deficiencies of the survey, the precautionary principle has been adopted by assuming that a species may be present if suitable habitat occurs on site.

4.10 THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT

A Likelihood of Occurrence Assessment was undertaken for the subject species and ecological communities and other entities identified within the OEH EARs. The Likelihood of Occurrence Assessment was informed by the results of the database searches followed by targeted and observational field

investigations which have been undertaken in the Study Area by ERM since July 2012. The assessment grouped threatened ecological communities and threatened species into four likelihood categories based on the criteria outlined in *Table 4.4*.

Table 4.4 Likelihood of Occurrence Criteria

Category	Description
Known	• the species/community has been recorded in the Study Area during recent field surveys; OR • database records demonstrate that the species/community is known to occur in the Study Area.
Likely	• the species/community has been recorded in the Locality in the last 10 years, and optimal habitat exists within the Study Area
Potential	• the species/community has been recorded in the Locality in the last 10 years, but the habitat within the Study Area is sub-optimal; OR • in the case of a bird or bat species, the species may fly over the Study Area; OR • the precautionary principle has been applied to assume presence of the species/community for other reasons.
Unlikely	• the species/community has not been recorded within the Locality within the last 10 years and optimal habitat does not occur within the Study Area.

The results of the assessment are provided in *Section 5.13*.

5 RESULTS

5.1 WEATHER CONDITIONS

Three BoM weather stations occur in proximity to different sections of the Study Area as follows:

- Boorowa Post Office: located approximately 6.7 km from the north western section of the Study Area. Provides rainfall data only;
- Rye Park; located approximately 3.9 km from the eastern edge of the Study Area. Provides rainfall data only; and
- Yass (Rural Fire Service): located approximately 20 km from the southern end of the Study Area. Provides rainfall, temperature and wind speed data. The weather station has been operational since 2011 and replaced the Linton Hostel weather station in Yass, which closed in April 2011.

Table 5.1 Monthly weather observations during survey period.

Survey period	Temperature (˚C)		Wind speed (km/h)		Rain (mm)
	Lowest Daily Maximum	Highest Daily Maximum	Min	Max	Total Rainfall
July 2012	Y: 9.5	Y: 16.5	Y: Calm	Y: 28	B: 34.6 R: 42.0
August 2012	Y: 11	Y: 20.0	Y: Calm	Y: 28	B: 41.8 R: 43.4
September 2012	Y: 13.5	Y: 24.0	Y: Calm	Y: 28	B: 52.4[1] R: 44.4[1] Y: 9.2
October 2012	Y: 14.5	Y: 30.0	Y: Calm	Y: 44	B: 23.6[1] R: 25.2[1] Y: 24.0
November 2012	Y: 20.5	Y: 36.0	Y: Calm	Y: 19	R: 29.8[1] Y: 25.2
December 2012	Y: 20.0	Y: 31.5	Y: Calm	Y: 24	B: 37.6 R: 44.8[1]
January 2012	Y: 30.0	Y: 40.5	Y: Calm	Y: 24	R: 6.2[1]
February 2012	Y: 20.5	Y: 34.0	Y: Calm	Y: 37	R: 36.8[1] Y: 17.4

Weather data obtained from BoM (2013). B = Boorowa Post Office Weather Station, R = Rye Park Weather Station, Y = Yass Weather Station

The monthly mean maximum temperatures experienced during the field survey were close to the average for all years recorded at Yass (data from the closed Linton Hostel weather station was used as it provides data for a longer time period). The exceptions to this were the months of October, November and January, which were four to five degrees warmer than the monthly averages.

Rainfall during the survey period was less than average with the exception of September, which experienced close to average monthly rainfall. The start of 2012 experienced above average rainfall, following from two wet and cool years (2010 and 2011) (BoM 2013b).

While the survey period was warmer and drier than average, this was offset by the wetter, cooler than average conditions in the years and months leading to the survey period. The high rainfall experienced in the years and months prior to the survey period is likely to have resulted in a large abundance of plant species being present and high fauna activity in the Study Area.

5.2 DATABASE SEARCH RESULTS

5.2.1 Endangered Ecological Communities

Four threatened ecological communities (TECs) listed under the EPBC Act and / or the TSC Act were identified during the database searches. These TECs are shown in *Table 5.2.*

Table 5.2 Threatened Ecological Communities Identified in Database Searches

Ecological Community		EPBC Act Status	TSC Act Status
EPBC Act	**TSC Act**		
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South eastern Australia	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	E	E
Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory			
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	White Box Yellow Box Blakely's Red Gum Woodland	CE	E
Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory	-	CE	-
-	Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions	-	E

Status: CE = Critically Endangered, E = Endangered

5.2.2 *Flora*

Five threatened flora species listed under the EPBC Act and / or the TSC Act were identified during the database searches. The Atlas of NSW Wildlife and Atlas of Living Australia databases did not return any records of threatened flora species within the PAA. The closest record of a threatened flora species listed under the TSC Act is the Yass Daisy (*Ammobium craspedioides*) recorded approximately 4.5 km from the Study Area in the south west. Threatened flora records are listed in *Table 5.3.* Records of threatened species within 10 km of the Study Area are shown in *Figure 5.1.*

Table 5.3 Threatened Flora Species Identified in Database Searches

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Source
Ammobium craspedioides	Yass Daisy	V	V	PMST
Eucalyptus canobolensis	Silverleaf Candlebark	V	E	NSW Flora Online
Prasophyllum petilum	Tarengo Leek Orchid	E	E	PMST
Leucochrysum albicans var. tricolor	Hoary Sunray	-	E	PMST
Pelargonium sp. Striatellum	Omeo Stork's Bill	-	E	PMST

Status: V - listed as Vulnerable, E – listed as Endangered, CE – listed as Critically Endangered

Source: PMST= Protected Matters Search Tool

5.2.3 *Fauna*

A total of 58 threatened fauna species listed under the EPBC Act and / or the TSC Act were identified within the locality during the database searches. This included one invertebrate, two fish species, two frog species, two reptile species, 48 bird species and three mammal species. Ten species are listed as Endangered under the TSC act and a further 27 species are listed as Vulnerable. Each of the species recorded during the database searches, including their status under the EPBC Act and TSC Act are shown in *Table 5.4.* Records of threatened species within 10 km of the Study Area are shown in *Figure 5.1.*

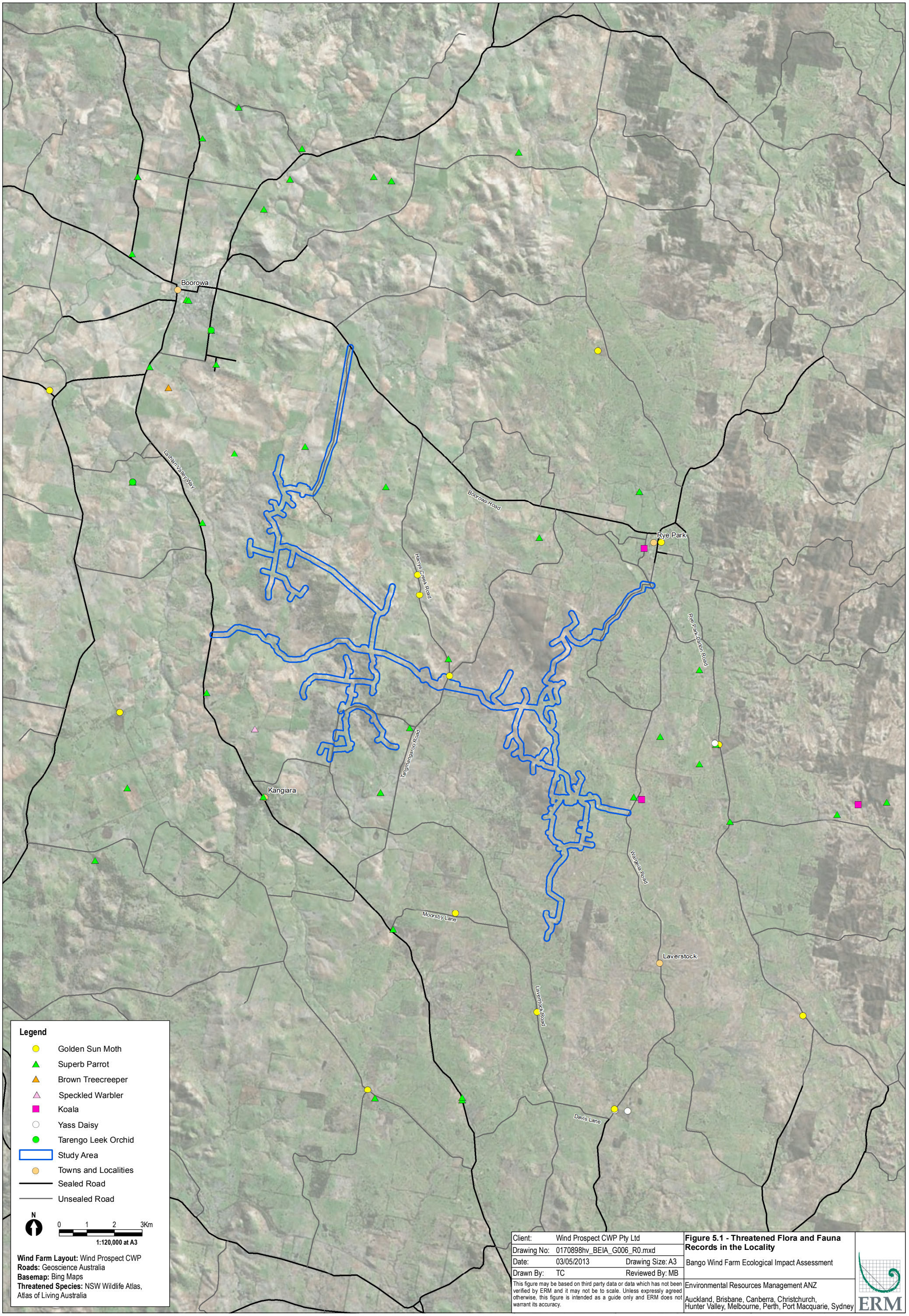
Table 5.4 Threatened Fauna Species Identified in Database Searches

Class	*Species*	CommonName	TSC Act	EPBC Act	Source
Frog	*Litoria booroolongensis*	Booroolong Frog	E	E	PMST
Frog	*Litoria raniformis*	Growling Grass Frog	E	V	PMST
Bird	*Anthochaera phrygia*	Regent Honeyeater	E	E	AAB
Bird	*Apus pacificus*	Fork-tailed Swift		Mi, Mar	PMST
Bird	*Ardea ibis*	Cattle Egret		Mi, Mar	PMST
Bird	*Botaurus poiciloptilus*	Australasian Bittern	E	E	PMST
Bird	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V		AAB
Bird	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V		AAB
Bird	*Certhionyx variegatus*	Pied Honeyeater	V		AAB
Bird	*Chthonicola sagittata*	Speckled Warbler	V		ALA
Bird	*Circus assimilis*	Spotted Harrier	V		AAB
Bird	*Climacteris picumnus (victoriae)*	Brown Treecreeper (eastern subspecies)	V	-	AAB
Bird	*Daphoenositta chrysoptera*	Varied Sittella	V		AAB
Bird	*Epthianura albifrons*	White-fronted Chat	V	-	AAB
Bird	*Gallinago hardwickii*	Latham's Snipe	E	V, Mi, Mar	PMST
Bird	*Glossopsitta pusilla*	Little Lorikeet	V	-	AAB
Bird	*Grantiella picta*	Painted Honeyeater	V	-	AAB
Bird	*Haliaeetus leucogaster*	White-bellied Sea-eagle	-	Mi, Mar	PMST
Bird	*Hieraaetus morphnoides*	Little Eagle	V	-	AAB
Bird	*Hirundapus caudacutus*	White-throated Needletail	-	Mi, Mar	PMST
Bird	*Lathamus discolor*	Swift Parrot	E	E	PMST
Bird	*Leipoa ocellata*	Malleefowl	E	V, Mi	PMST
Bird	*Melanodryas cucullata (cucullata)*	Hooded Robin	V	-	AAB
Bird	*Melithreptus gularis (gularis)*	Black-chinned Honeyeater	V	-	AAB
Bird	*Merops ornatus*	Rainbow Bee-eater	-	Mi, Mar	PMST
Bird	*Myiagra cyanoleuca*	Satin Flycatcher	-	Mi, Mar	PMST
Bird	*Neophema pulchella*	Turquoise Parrot	V	-	AAB
Bird	*Ninox connivens*	Barking Owl	V	-	AAB
Bird	*Oxyura australis*	Blue-billed Duck	V	-	AAB
Bird	*Pachycephala inornata*	Gilbert's Whistler	V	-	AAB
Bird	*Petroica boodang*	Scarlet Robin	V	-	AAB
Bird	*Petroica phoenicea*	Flame Robin	V	-	AAB
Bird	*Polytelis swainsonii*	Superb Parrot	V	V	PMST

Class	*Species*	CommonName	TSC Act	EPBC Act	Source
Bird	*Pomatostomus temporalis (temporalis)*	Grey-crowned Babbler	V	-	AAB
Bird	*Rhipidura rufifons*	Rufous Fantail	-	Mi,	PMST
Bird	*Rostratula australis*	Australian Painted Snipe	E	V, Mi	PMST
Bird	*Stagonopleura guttata*	Diamond Firetail	V	-	AAB
Bird	*Stictonetta naevosa*	Freckled Duck	V	-	AAB
Fish	*Maccullochella peelii peelii*	Murray Cod, Cod, Goodoo	-	V	PMST
Fish	*Macquaria australasica*	Macquarie Perch	E	E	PMST
Insects	*Synemon plana*	Golden Sun Moth	E	CE	PMST
Mammal	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E	V	PMST
Mammal	*Phascolarctos cinereus*	Koala	V	V	PMST
Mammal	*Nyctophilus corbeni*	Eastern Long-eared Bat	V	V	PMST
Reptile	*Aprasia parapulchella*	Pink-tailed Worm-lizard	V	V	PMST
Reptile	*Delma impar*	Striped Legless Lizard	V	V	PMST

Status: CE = Critically Endangered, E = Endangered, V = Vulnerable, Mi = Migratory, Mi, Mar = Migratory Marine

Source: AAB = Atlas of Australian Birds, PMST = EPBC Protected Matters Search Tool



Client:	Wind Prospect CWP Pty Ltd		
Drawing No:	0170898hv_BEIA_G006_R0.mxd		
Date:	03/05/2013	Drawing Size: A3	
Drawn By:	TC	Reviewed By: MB	

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 5.1 - Threatened Flora and Fauna Records in the Locality

Bango Wind Farm Ecological Impact Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

5.3 VEGETATION MAPPING

5.3.1 Existing Vegetation Mapping

Two existing vegetation mapping datasets were reviewed for the Study Area; NPWS (2002) and Gellie (2005). The mapping undertaken by NPWS (2002) was based on a desktop assessment of broad geological types, average annual temperature and average annual rainfall, followed by a series of plot based surveys in different vegetation units. The Gellie (2005) mapping was based on analysis of existing plot data. Both mapping projects focussed on areas of woodland and mapped these areas relatively accurately.

The resolution of both datasets was appropriate for the current study, allowing initial stratification of the Study Area to be undertaken for ERM's flora and fauna surveys. However, the mapping does not distinguish between differing conditions and does not identify the areas of derived native grassland that occur throughout the Study Area. These areas are unmapped in both vegetation datasets. The two vegetation datasets also use different nomenclature, neither of which are directly related to BVTs. As a result, ERM ground truthed all the vegetation in the Study Area and identified vegetation communities in accordance with BVTs to be consistent with the BBAM.

NPWS (2002) identified five vegetation communities scattered through the Study Area:

- Blakelys Red Gum - Yellow Box Grassy Woodland;
- Themeda - Bothriochloa Grassland/Open Woodland;
- Red Stringybark Dry Shrub Forest;
- Red Stringybark - Joycea tussock grass dry shrub open forest; and
- Tableland Woodland/forest.

Gellie (2005) identified three vegetation communities scattered through the Study Area.

- Northern Slopes Dry Grass Woodland;
- Tableland Dry Grassy Woodland; and
- Northern Tablelands and Slopes Dry Shrub-Grass Forest.

The above vegetation communities have been matched with an equivalent BVT, based on the vegetation community descriptions in the literature and ground truthing in the Study Area. The relationships between the vegetation communities and the BVTs are shown in *Table 5.5*.

Table 5.5 Vegetation Community Associations

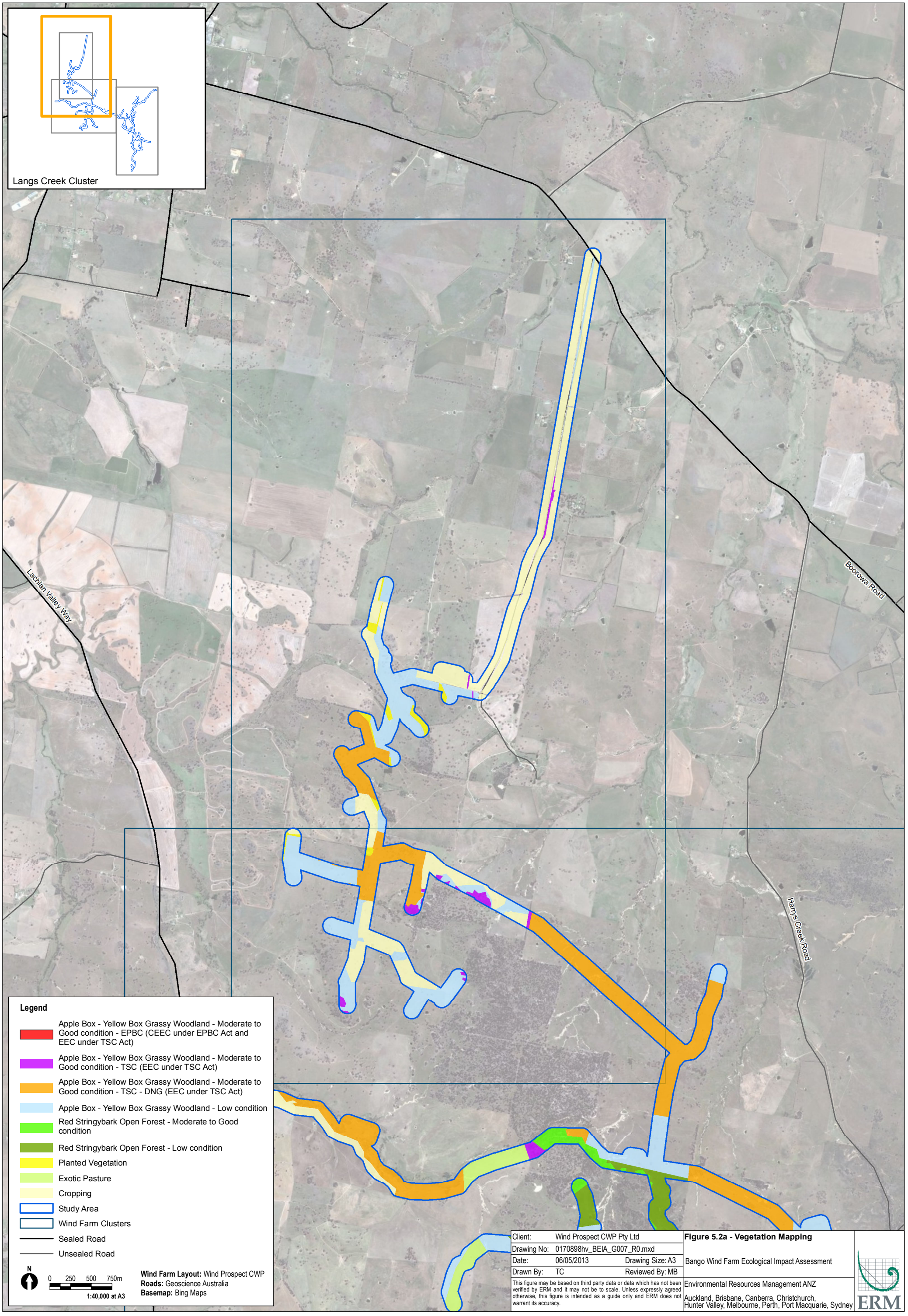
Vegetation Community	BioMetric Vegetation Type	Biometric Vegetation Type ID
Native Vegetation of the Boorowa Shire (NPWS 2002)		
• Blakelys Red Gum - Yellow Box Grassy Woodland • Themeda - Bothriochloa Grassland/Open Woodland	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	LA103
• Red Stringybark Dry Shrub Forest • Red Stringybark - Joycea tussock grass dry shrub open forest • Tableland Woodland/forest	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion	LA182
Native Vegetation of the Southern Forests (Gellie 2005)		
• Northern Slopes Dry Grass Woodland • Tableland Dry Grassy Woodland	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	LA103
• Northern Tablelands and Slopes Dry Shrub-Grass Forest	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion	LA182

5.3.2 *Vegetation Mapping Results*

Vegetation mapping undertaken by ERM identified five vegetation communities in the Study Area, including two BVTs. The five communities recorded within the Study Area were:

- Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands (Apple Box – Yellow Box Grassy Woodland);
- Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Red Stringybark Open Forest);
- Exotic Pasture;
- Cropping; and
- Planted Vegetation (native and exotic).

The BVTs have been divided into different condition classes in accordance with the definitions provided in *Table 4.2*. The distribution of these vegetation communities is shown in *Figure 5.2*. The floristic composition and structure of each of these communities is described in *Section 5.3.3*.



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Date:	06/05/2013	Drawing Size: A3	
Drawn By:	TC	Reviewed By: MB	

Figure 5.2a - Vegetation Mapping

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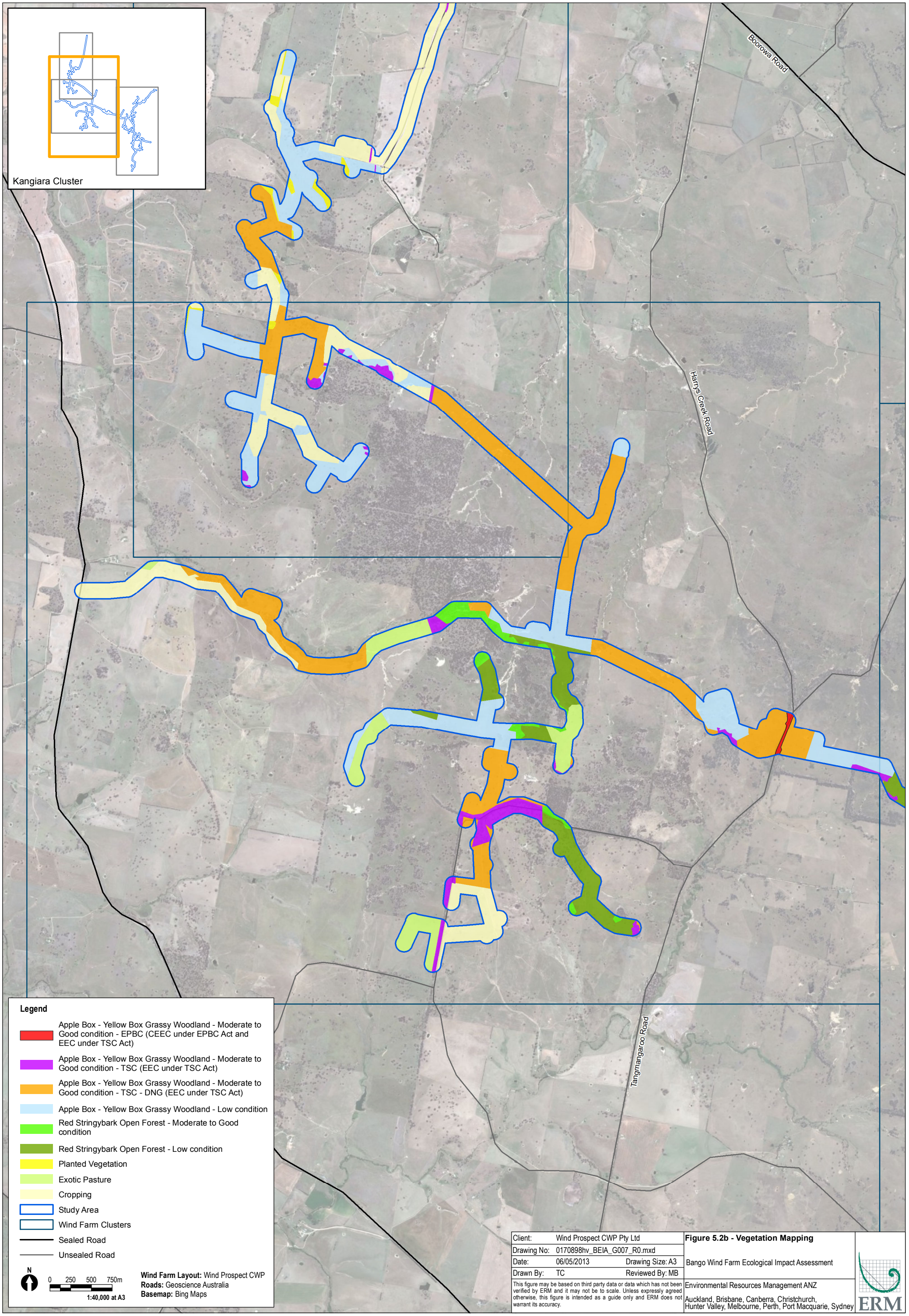
Kangiara Cluster
Boorowa Road
Harrys Creek Road
Tangmangaroo Road
Legend
Apple Box - Yellow Box Grassy Woodland - Moderate to Good condition - EPBC (CEEC under EPBC Act and EEC under TSC Act)
Apple Box - Yellow Box Grassy Woodland - Moderate to Good condition - TSC (EEC under TSC Act)
Apple Box - Yellow Box Grassy Woodland - Moderate to Good condition - TSC - DNG (EEC under TSC Act)
Apple Box - Yellow Box Grassy Woodland - Low condition
Red Stringybark Open Forest - Moderate to Good condition
Red Stringybark Open Forest - Low condition
Planted Vegetation
Exotic Pasture
Cropping
Study Area
Wind Farm Clusters
Sealed Road
Unsealed Road
N
0 250 500 750m
1:40,000 at A3
Wind Farm Layout: Wind Prospect CWP
Roads: Geoscience Australia
Basemap: Bing Maps
Client: Wind Prospect CWP Pty Ltd
Drawing No: 0170898hv_BEIA_G007_R0.mxd
Date: 06/05/2013 Drawing Size: A3
Drawn By: TC Reviewed By: MB
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Figure 5.2b - Vegetation Mapping
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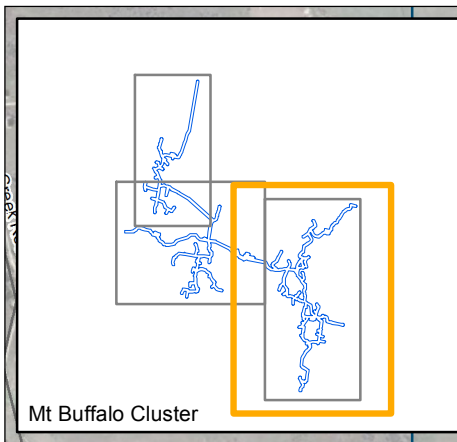

Rye Park-Dalton Road

Wargeila Road

Legend

- Apple Box - Yellow Box Grassy Woodland - Moderate to Good condition - EPBC (CEEC under EPBC Act and EEC under TSC Act)
- Apple Box - Yellow Box Grassy Woodland - Moderate to Good condition - TSC (EEC under TSC Act)
- Apple Box - Yellow Box Grassy Woodland - Moderate to Good condition - TSC - DNG (EEC under TSC Act)
- Apple Box - Yellow Box Grassy Woodland - Low condition
- Red Stringybark Open Forest - Moderate to Good condition
- Red Stringybark Open Forest - Low condition
- Planted Vegetation
- Exotic Pasture
- Cropping
- Study Area
- Wind Farm Clusters
- Sealed Road
- Unsealed Road

N

0 250 500 750m

1:40,000 at A3

Wind Farm Layout: Wind Prospect CWP
Roads: Geoscience Australia
Basemap: Bing Maps

Client:	Wind Prospect CWP Pty Ltd		
Drawing No:	0170898hv_BEIA_G007_R0.mxd		
Date:	06/05/2013	Drawing Size: A3	
Drawn By:	TC	Reviewed By: MB	

Figure 5.2c - Vegetation Mapping

Bango Wind Farm Ecological Impact Assessment

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5.3.3 Vegetation Community Descriptions

Apple Box – Yellow Box Grassy Woodland

The Apple Box – Yellow Box Grassy Woodland in the Study Area comprises a canopy dominated by Yellow Box (*Eucalyptus melliodora*). The main associated canopy species are Apple Box (*E. bridgesiana*) and Blakelys Red Gum (*E. blakelyi*). A mid-storey was not recorded in this vegetation type. The groundcover is dominated by native grasses such as Snowgrass (*Poa sieberiana*), Weeping Grass (*Microlaena stipoides*) and several species of Speargrass (*Austrostipa* sp.) and Wallaby Grass (*Rytidosperma spp.*).

In the Study Area, Apple Box – Yellow Box Grassy Woodland occurs on lower slopes and gullies (refer *Figure 5.2*). It is associated with the more fertile soils in the Study Area and, as these areas are conducive to agriculture, large areas of Apple Box – Yellow Box Grassy Woodland have been cleared and its distribution in the Study Area is patchy. It occurs as isolated remnants in paddocks and as narrow linear strips along public roads and paper roads. Apple Box – Yellow Box Grassy Woodland has a similar patchy distribution across the Locality.

The condition of Apple Box – Yellow Box Grassy Woodland varies across the Study Area from areas of intact grassy woodland to those comprising only a native grassy groundcover. The most intact occurrences comprise a canopy of mature Eucalypts of two or more species and a diverse groundcover of native grasses and herbs. These occurrences are restricted to narrow linear strips along public road reserves. Other relatively intact areas comprise a canopy of mature Eucalypts and a groundcover dominated by native grasses with very few native herbs. Occurrences of Apple Box – Yellow Box Grassy Woodland that are more degraded comprise stands of Yellow Box over a groundcover dominated by exotic pasture species.

Apple Box – Yellow Box Grassy Woodland also occurs as DNG, ie grassland areas where the majority of woody vegetation has been cleared, however, greater than 50% of the ground cover comprises indigenous grasses and forbs. The more intact areas of derived native grassland are dominated by native grasses, particularly Speargrass (*Austrostipa* sp.) and Wallaby Grass (*Rytidosperma spp.*) with scattered native herbs. Areas of derived native grassland that are more degraded comprise patches of Speargrass (*Austrostipa* sp.) and Wallaby Grass (*Rytidosperma spp.*) interspersed with patches of exotic pasture and very few native herbs.

The majority of the above occurrences of Apple Box – Yellow Box Grassy Woodland meet the criteria for listing as an EEC under the TSC Act (refer *Section 5.1.2* and *Figure 5.2*). A small proportion also meets the criteria for listing as a CEEC under the EPBC Act (refer *Section 5.1.2* and *Figure 5.2*).

Four condition classes are mapped for this BVT, as shown in *Table 5.6.*

Table 5.6 Condition Classes

Condition Class	Description	Area in Study Area (ha)	TEC
Apple Box – Yellow Box Grassy Woodland - Mod_Good-EPBC	Native over-storey percent foliage cover greater than 25% of the lower benchmark value; OR more than 50% of groundcover vegetation is indigenous species; AND Meets the definition for listing under the EPBC Act.	2.27	CEEC under the EPBC Act EEC under the TSC Act
Apple Box – Yellow Box Grassy Woodland - Mod_Good-TSC (See Photograph 5.1)	Native over-storey percent foliage cover greater than 25% of the lower benchmark value; AND Meets the definition for listing under the TSC Act.	65.27	EEC under the TSC Act
Apple Box – Yellow Box Grassy Woodland - Mod_Good-TSC-DNG (See Photograph 5.2)	More than 50% of groundcover vegetation is indigenous species; AND The majority of the woody vegetation has been cleared; AND Meets the definition for listing under the TSC Act.	313.00	EEC under the TSC Act
Apple Box – Yellow Box Grassy Woodland – Low	Native over-storey percent foliage cover less than 25% of the lower benchmark value; AND Less than 50% of groundcover vegetation is indigenous species.	469.57	-

Photograph 5.1 Yellow Box Grassy Woodland - Mod_Good-TSC

Photograph 5.2 Yellow Box Grassy Woodland - Mod_Good-TSC-DNG

Red Stringybark Open Forest

The Red Stringybark Open Forest comprises a canopy dominated by Red Stringybark (*Eucalyptus macrorhynca*) and *E. rossii* (Scribbly Gum). The mid-storey is sparse and comprises scattered low native shrubs such as Hoary Guinea-flower (*Hibbertia obtusifolia*), Urn Heath (*Melichrus urceolatus*) and Daphne Heath (*Brachyloma daphnoides*). The groundcover is sparse, comprising scattered Snowgrass and native herbs such as Twining Fringe Lily (*Thysanotus patersonii*), Tall Bluebell (*Wahlenbergia stricta* subsp. *stricta*) and a number of native orchids including the Waxlip Orchid (*Glossodia major*), Slender Sun Orchid (*Thelymitra pauciflora*), Pink Finger Orchid (*Caladenia carnea*) and Swan Greenhood (*Pterostylis cycnocephala*). In areas in which the canopy has been partially or completely removed, the groundcover is dominated by native grasses such as Speargrasses and Wallaby Grasses with patches of Kangaroo Grass (*Themeda australis*) and Nodding Blue Lily (*Stypandra glauca*).

Red Stringybark Open Forest is associated with skeletal soils and occurs on dry hills and crests of hills (refer *Figure 5.2*). In the Study Area, it is patchy and restricted to these landscape types.

The stands of Red Stringybark Open Forest that occur on crests of hills in the Study Area are generally undisturbed and comprise an intact canopy, mid-storey and groundcover of native species. Other occurrences have undergone clearing and comprise a canopy of scattered remnant Red Stringybark over a groundcover of native grasses. This vegetation type also occurs as DNG, dominated by Speargrasses and Wallaby Grasses with occasional Red Stringybark.

This BVT is not commensurate with any EECs or CEECs listed under the EPBC Act or the TSC Act.

Two condition classes are mapped for this BVT, as shown in *Table 5.7.*

Table 5.7 Condition Classes

Condition Class	Description	Area in Study Area (ha)	TEC
Red Stringybark Open Forest - Mod_Good (See Photograph 5.3)	Native over-storey percent foliage cover greater than 25% of the lower benchmark value; OR more than 50% of groundcover vegetation is indigenous species.	99.24	-
Red Stringybark Open Forest – Low	cover less than 25% of the lower benchmark value; AND Less than 50% of groundcover vegetation is indigenous species.	238.72	-

Photograph 5.3 Red Stringybark Open Forest - Mod_Good

Exotic Pasture

Exotic pasture comprises areas of grassland with greater than 75% exotic species and all or most of the indigenous vegetation has been removed (Benson 1996). Areas of pasture are widespread across the Study Area (refer *Figure 5.2*), particularly on lower slopes and gullies where the soil is generally more fertile. These areas have undergone pasture improvement and are dominated by exotic pasture species. They are predominantly used for cattle and sheep grazing. Common species in areas of exotic pasture include Clover species (*Trifolium* sp.), Sheep Sorrel (*Acetosella vulgaris*), Barley Grasses (*Hordeum* sp.), Rye Grass (*Lolium* sp.) and Brome species (*Bromus* sp.). Weed species such as Paterson's Curse (*Echium plantagineum*) and Scotch Thistle (*Onopordum acanthium*) are largely restricted to areas of exostic pasture. Where native species persist in areas of exotic pasture, they comprise scattered Speargrasses and Wallaby Grasses. Exotic pasture covers 415.38 ha of the Study Area.

Cropping

Cropping refers to areas that have previously or are currently undergoing intensive ploughing and cultivation of crops. Common crops in the area are wheat, oats, canola and triticale. These areas can include isolated native trees occurring as individuals or small stands of up to five trees. The native mid-storey and groundcover have been completely cleared and, due to the intensive nature of the ground disturbance, a native understorey is unlikely to regenerate naturally. Cropping covers 261.33 ha of the Study Area.

Planted Vegetation

Areas of planted vegetation include both native and exotic plantings and have been planted as wind breaks and erosion control measures. As such, planted vegetation generally occurs in linear narrow corridors. Exotic plantings almost exclusively comprise Pine Trees (*Pinus radiata*). Native plantings include both indigenous and non-indigenous species and comprise a mix of *Eucalyptus* and *Acacia* species. Areas of planted native vegetation are usually fenced off from livestock and as such, an understorey of native grasses occurs. Planted vegetation covers 15.37 ha of the Study Area.

5.3.4 Endangered Ecological Communities

The majority of the Apple Box – Yellow Box Grassy Woodland in the Study Area meets the description for White Box Yellow Box Blakely's Red Gum Woodland (Box-Gum Woodland), which is an EEC under the TSC Act (refer *Figure 5.2*). This includes 380.54 ha in the Study Area and 45.52 ha in the permanent Development Footprint.

The EEC is characterised by the presence of one or more of the following species: White Box (*Eucalyptus albens*), Yellow Box and Blakely's Red Gum. The EEC includes modified and degraded sites as follows:

- sites where the main canopy species are present, ranging from an open woodland formation to a forest structure and the groundcover is predominantly composed of exotic species; and
- sites where the canopy species have been removed and only the grassy groundlayer and some herbs remain (OEH 2012b).

The occurrences of Apple Box – Yellow Box Grassy Woodland in the Study Area were assessed against the *White Box Yellow Box Blakely's Red Gum Woodland Identification Guidelines* (NPWS undated) and the NSW Scientific Committee Final Determination (OEH 2011a). The majority of Apple Box – Yellow Box Grassy Woodland in the Study Area meets the criteria for Box-Gum Woodland listed under the TSC Act. This includes the areas that comprise a canopy of mature Eucalypts of two or more species and a diverse groundcover of native grasses and herbs, areas comprising a canopy of mature Eucalypts and a groundcover dominated by native grasses, stands of Yellow Box over a groundcover dominated by exotic pasture species and grasslands derived from Apple Box – Yellow Box Grassy Woodland.

A small proportion of the Apple Box – Yellow Box Grassy Woodland also meets the description for White Box - Yellow Box - Blakely's Red Gum grassy woodlands and derived native grasslands (Box-Gum Grassy Woodlands and Derived Native Grasslands), which is a CEEC under the EPBC Act (refer *Figure 5.2*). A total of 2.27 ha of the CEEC occurs in the Study Area, of which 0.26 ha occurs in the permanent Development Footprint. This is discussed in *Chapter 8*.

5.4 FLORA

5.4.1 General Description

Field investigations identified 127 flora taxa in the Study Area, 97 (76%) of which were indigenous and 30 (24%) of which are introduced (refer *Annex C*). Many of these species are characteristic of the open forests, grassy woodlands, derived native grasslands and pasture in the Locality. The most frequently occurring canopy species were Red Stringybark and Yellow Box and the most frequently occurring native groundcover species were Speargrasses and Wallaby Grasses. The exotic species recorded are common in areas of improved pasture.

5.4.2 Threatened Flora

One threatened flora species was recorded in the Locality during field surveys: Yass Daisy (*Ammobium craspedioides*) which is listed as Vulnerable under both the EPBC Act and TSC Act. A population comprising over 200 individuals was recorded approximately 750 m to the west of the Study Area in the Mt Buffalo Cluster (refer *Figure 5.3*).

A Likelihood of Occurrence Assessment was undertaken for the remaining species and 10 species are considered to be likely or have the potential to occur in the Study Area (refer to *Annex E*). The remaining species are considered unlikely to occur due to a lack of the species' preferred habitat within the Study Area (refer to *Annex E*).

5.4.3 Exotic Flora

Numerous exotic species occur in the Study Area, two of which are listed as Declared Noxious Weeds under the NW Act in both Boorowa and Yass Valley LGAs, as shown in *Table 5.8*. There are five declaration classes under the NW Act, each describing the type of threat the weed poses, its extent, potential to spread and control requirements. Species declared as Class 4 weeds pose a potentially serious threat to primary production, the environment or human health, are widely distributed and are likely to spread in the area or to another area. Their growth must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction (Department of Primary Industries (DPI) 2013).

Table 5.8 **Declared Noxious Weeds in the Study Area**

Scientific Name	Common Name	Declaration Class	Location
Echium sp.	Paterson's Curse	4	Scattered in grazed / ploughed paddocks
Onopordum acanthium	Scotch Thistle	4	Scattered in grazed / ploughed paddocks

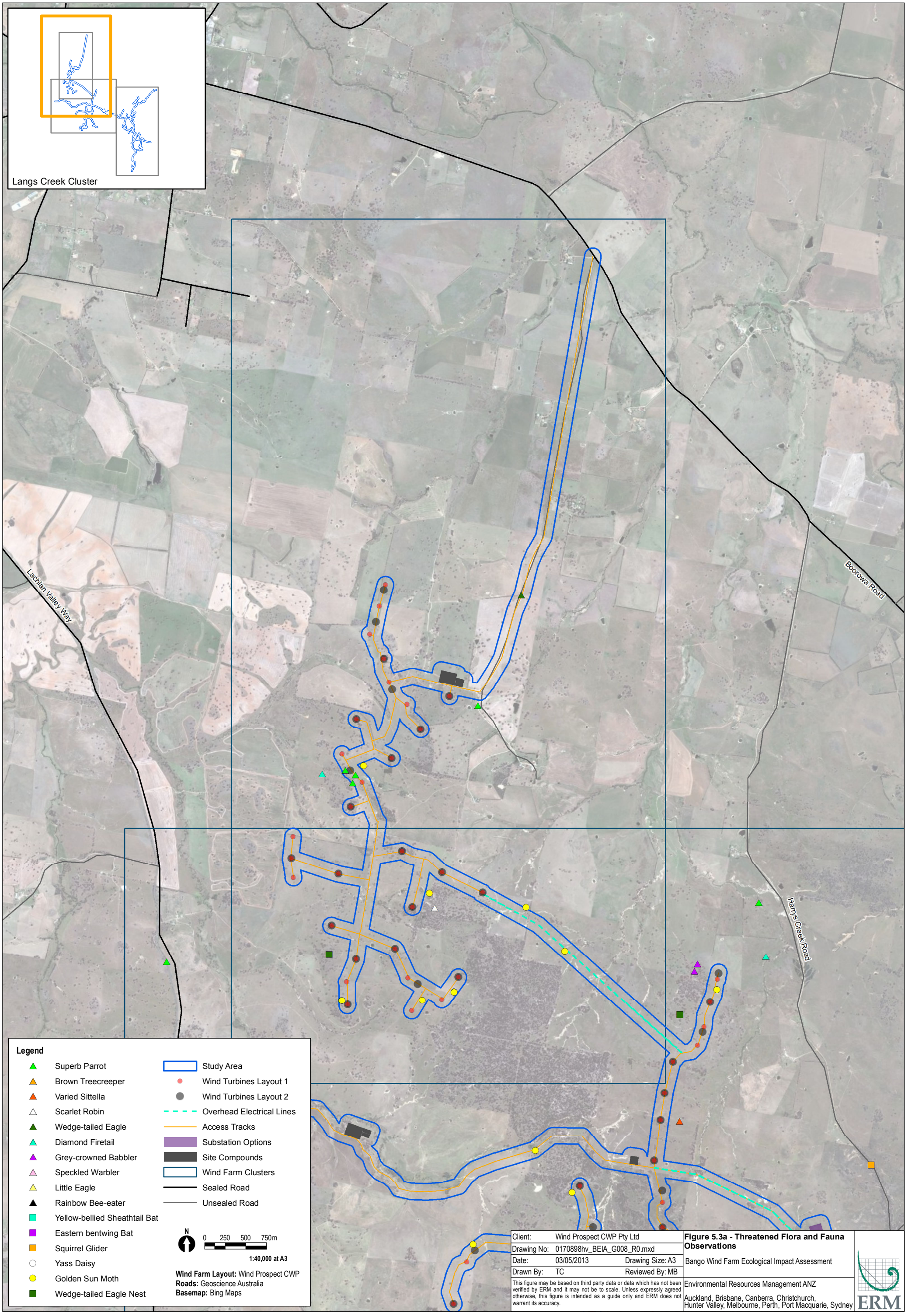
Langs Creek Cluster
Lachlan Valley Way
Boorowa Road
Harrys Creek Road
Legend
Superb Parrot
Brown Treecreeper
Varied Sittella
Scarlet Robin
Wedge-tailed Eagle
Diamond Firetail
Grey-crowned Babbler
Speckled Warbler
Little Eagle
Rainbow Bee-eater
Yellow-bellied Sheathtail Bat
Eastern bentwing Bat
Squirrel Glider
Yass Daisy
Golden Sun Moth
Wedge-tailed Eagle Nest
Study Area
Wind Turbines Layout 1
Wind Turbines Layout 2
Overhead Electrical Lines
Access Tracks
Substation Options
Site Compounds
Wind Farm Clusters
Sealed Road
Unsealed Road
N
0 250 500 750m
1:40,000 at A3
Wind Farm Layout: Wind Prospect CWP
Roads: Geoscience Australia
Basemap: Bing Maps
Client: Wind Prospect CWP Pty Ltd
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Figure 5.3a - Threatened Flora and Fauna Observations
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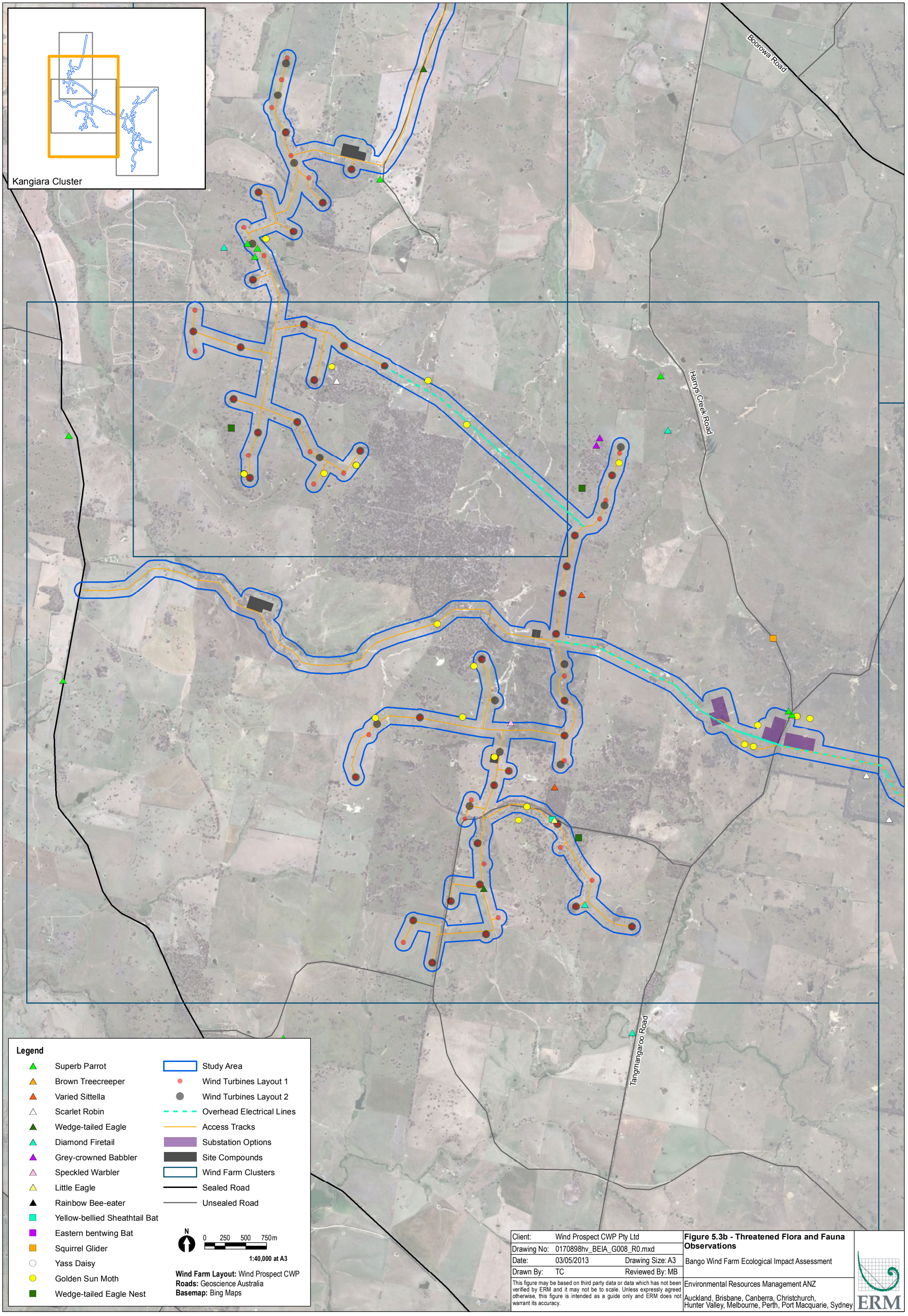

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Figure 5.3b - Threatened Flora and Fauna Observations

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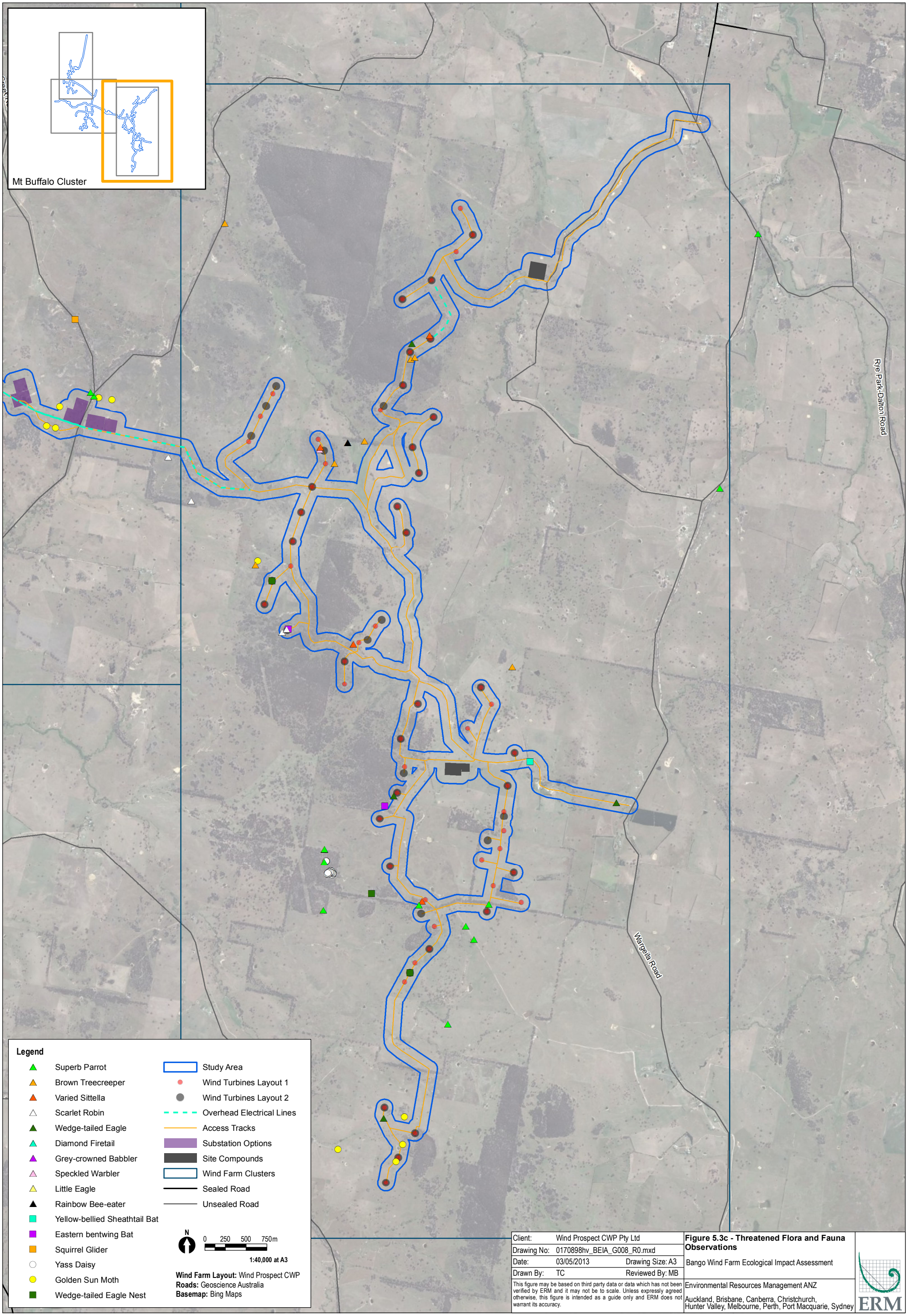
Mt Buffalo Cluster
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Scarlet Robin
Wedge-tailed Eagle
Diamond Firetail
Grey-crowned Babbler
Speckled Warbler
Little Eagle
Rainbow Bee-eater
Yellow-bellied Sheathtail Bat
Eastern bentwing Bat
Squirrel Glider
Yass Daisy
Golden Sun Moth
Wedge-tailed Eagle Nest
Study Area
Wind Turbines Layout 1
Wind Turbines Layout 2
Overhead Electrical Lines
Access Tracks
Substation Options
Site Compounds
Wind Farm Clusters
Sealed Road
Unsealed Road
N
0 250 500 750m
1:40,000 at A3
Wind Farm Layout: Wind Prospect CWP
Roads: Geoscience Australia
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Figure 5.3c - Threatened Flora and Fauna Observations
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5.5 *FAUNA HABITAT*

Fauna habitat types in the Study Area comprise native woodlands, native grasslands, exotic grasslands and aquatic habitats. Within these habitat types, a variety of fauna habitat features exist, including hollow bearing trees, paddock trees, tussock grasslands, disused mines, farms dams and creek lines.

During the survey period approximately 313 ha of Native Grassland, 166.78 ha of Native Woodland and 708.29 ha of Exotic Grassland habitats were recorded within the Study Area (*Table 5.9*), habitat types and features within these habiat types are discussed in the following sections.

Table 5.9 ***Fauna Habitats Recorded in Study Area***

Habitat type	Area in Study Area (ha)	Condition
Native Grassland	313	Moderate to good, has been impacted by grazing insome places.
Native Woodland	166.78	Moderate to good in places
Exotic Grassland	708.29	Moderate to degraded in places
Total	1188.07	
Native Grassland habitat is made up of BVT Box Gum Woodland Moderate to Good DNG		
Native Woodland is made up of BVT's Box Gum Woodland Mod –Good and Red Stringybark Open Forest Mod – Good		
Exotic Grassland consists of BVT's, Box Gum Woodland-Low and Red Stringybark Open Forest-Low		

5.5.1 *Native Woodlands*

Native woodland habitat is commensurate with the following BVT condition classes:

- Apple Box – Yellow Box Grassy Woodland - Mod_Good-EPBC;
- Apple Box – Yellow Box Grassy Woodland - Mod_Good-TSC; and
- Red Stringybark Open Forest - Mod_Good.

Within the Study Area, woodland habitat generally occurs in small scattered patches and linear corridors along roadsides. Some of the woodland patches in the Study Area are part of larger tracts of woodland that extend beyond the Study Area. These larger tracts occur in the Kangiara and Mt Buffalo clusters.

Habitat features in areas of Apple Box – Yellow Box Grassy Woodland include foraging, breeding and shelter resources such as a variety of nectar and / or seed producing native species, hollow bearing trees, grassy groundcover, fallen logs, leaf litter and occasional small areas of exposed rock (see *Photograph 5.4*). Some patches of Apple Box – Yellow Box Grassy Woodland have a degraded understorey and features such as a native grassy groundcover and leaf litter are reduced.

Areas of Red Stringybark Open Forest also include a variety of nectar and / or seed producing native species, hollow bearing trees, fallen logs and leaf litter. These areas also comprise a sparse shrub layer and areas of exposed rock are abundant.

Areas of planted native vegetation also provide habitat resources for native species as they comprise nectar and / or seed producing plants for foraging and shelter. These areas also comprise stepping stones between areas of native woodland habitat.

Photograph 5.4 Remnant Apple Box – Yellow Box Grassy Woodland

5.5.2 Native Grasslands

Native grassland habitat is commensurate with the following BVT condition classes:

- Apple Box – Yellow Box Grassy Woodland - Mod_Good-TSC-DNG; and
- Apple Box – Yellow Box Grassy Woodland – Low; and

- Red Stringybark Open Forest - Low.

Grassland habitat is widespread in the Study Area, covering the majority of lower slopes and valleys. Areas of Apple Box – Yellow Box Grassy Woodland - Mod_Good-TSC-DNG comprise the most intact native grassland habitats, with a high proportion of native grasses and some native herbs providing foraging resources (see *Photograph 5.5*). Tussock forming native grasses also occur, providing shelter for a variety of native species. The Apple Box – Yellow Box Grassy Woodland – Low and Red Stringybark Open Forest – Low have a reduced native grass component, however, they still comprise a foraging and shelter resource.

Other habitat features in native grasslands comprise scattered paddock trees with hollows, scattered fallen logs and areas of exposed rock.

Photograph 5.5 Native Grassland Habitat

5.5.3 Exotic Grasslands

Exotic grasslands are commensurate with the areas mapped as exotic pasture and cropping. The native and exotic grasses and herbs that occur in the exotic pasture areas provide a foraging resource for native species. When areas of cropping are seeding, this provides an abundant foraging resource for native species (see *Photograph 5.6*). Scattered hollow bearing trees and some areas of exposed rock also occur in these areas.

Photograph 5.6 Exotic Grassland Habitats (Cropping)

5.5.4 Hollow bearing trees

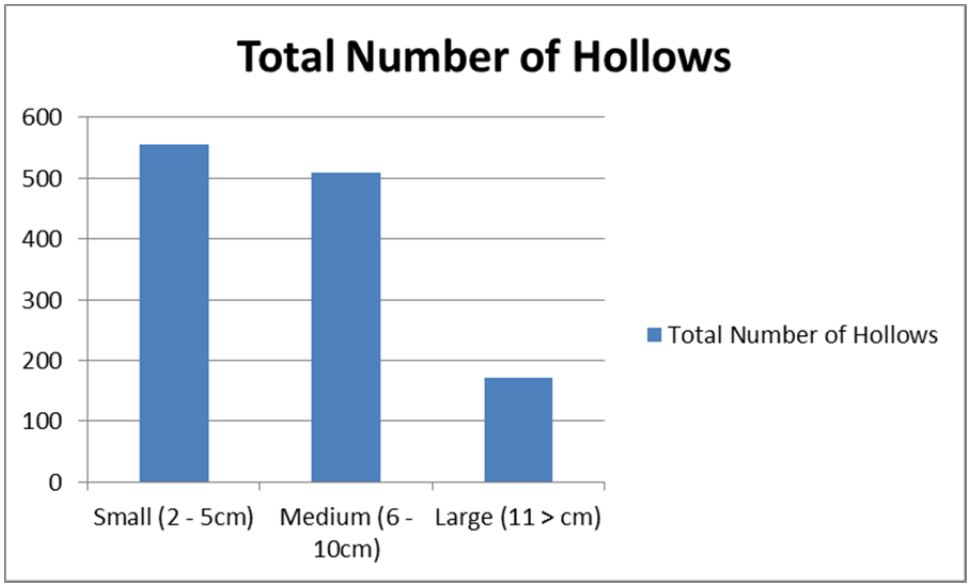
Hollow bearing trees within the Study Area are found in remnant woodland and on pastoral land as scattered paddock trees. The total area surveyed for hollow bearing trees was approximately 4981 ha. A total of 449 hollow bearing trees were identified within 500 m of proposed turbine locations (refer *Figure 5.5*). A total of 1237 hollows were recorded, made up of 556 Small hollows, 509 medium hollows and 172 large hollows. The hollow bearing tree density in the area surveyed equates to an overall value of approximately 0.09 hollow bearing trees per hectare. However, the density of hollow bearing trees in undisturbed woodland was closer to 7–17 hollow-bearing trees per hectare (OEH 2012).

The dominant hollow bearing tree species were Scribbly Gum, Red Stringybark, Yellow Box and Blakely's Red Gum. Hollow bearing trees provide important roosting habitat for arboreal mammals such as Possums and Squirrel Gliders, as well as insectivorous bats, Superb Parrots, and large forest owls. A breakdown of the data collected is shown in *Table 5.10*. The distribution of the total number of hollows in their respective size classes is represented in *Figure 5.5*.

Table 5.10 Breakdown of Tree Hollow Data

Size Class	Small (2 - 5cm)	Medium (6 - 10cm)	Large (11 > cm)
Total number of hollows	556	509	172
Average height of hollow (m)	5.4	4.1	2.4
Height range min (m)	2	3	2
Height range max (m)	11	9	9

Figure 5.4 Distribution of Hollows recorded by Size Classes



5.5.5 Exposed rock

Areas of exposed rock occur on hill tops and slopes and within paddocks in the Study Area. The majority of the exposed rock consisted of granite outcrops on the hills and slopes. These rocks provide habitat for reptile species, such as Cunningham's Skink (*Egernia cunninghami*) as shown in *Photograph 5.7.* The majority of the properties surveyed during the survey period had isolated outcrops of rocks. Most of the woodland slopes were rocky and the presence of the rock has dictated the landuse in these areas. Many of the hills and slopes that had been cleared for grazing have substantial rock areas and shallow soils and are not suitable for cropping. Habitat for the Pink-tailed Worm-lizard in these areas is limited due to the quality of the habitat which has been impacted by the historical landuse in these areas. The area has a long farming history and as such, many of the areas of rocky habitat have been heavily grazed over long periods of time.

Photograph 5.7 Cunningham's Skink (Egernia cunninghamii) on rock outcrop

5.5.6 Farm dams

Many farm dams occur within the Study Area. The majority of these are small and have limited to no fringing vegetation, however, they provide habitat for water bird species including the Eurasian Coot (*Fulica atra*), Grey Teal (*Anas gracilis*) and Australasian Grebe (*Tachybaptus novaehollandiae*), and are a drinking water source for a variety of native species. The majority of the farm dams investigated during the field survey have a long history of being used for stock watering and as such, limited habitat remains to support threatened amphibian species such as the Growling Grass Frog.

5.5.7 Creek lines

Creeklines and drainage lines were observed and investigated during the surveys. These streams are predominantly ephemeral in nature and may provide habitat for amphibian species such as the Striped Marsh Frog (*Limnodynastes peronii*) and Spotted Grass Frog (*Limnodynastes tasmaniensis*). The areas investigated on the higher slopes were steep drainage lines. These areas are ephemeral with rocky substrate as bed, and any small pondages of water quickly dried up during the survey period. The creek line in the lower area along Tangmangaroo Road had more permanent pools with a sandy substrate on the bed, vegetation in the riparian area was a mixture of native and exotic species. The flow in this creek was very slow and by the end of the survey period flow had decreased substantially. Due to the ephemeral nature of the creeks and the lack of key habitat features within the Study Area it is unlikely that these areas would provide suitable habitat to support the Booroolong Frog (*Litoria booroolongensis*).

5.5.8 Tussock grasslands

Tussock grasslands provide important habitat for reptile species including the Striped Legless Lizard, as well as the Golden Sun Moth. Tussock forming grass species in the Study Area include Kangaroo Grass (*Themeda australis*), Speargrasses, Poa Tussocks (*Poa sp.*), and Wallaby Grasses. Areas of native grass within the Study Area are derived from Apple Box – Yellow Box Grassy Woodland and Red Stringybark Open Forest.

5.5.9 Disused Mines

Two disused mines were identified in the Study Area. Both of these mines were located on the Taree property and appeared to be shallow and collapsed (*Photograph 5.8*). The mines were probably established in the 1950s and have been unused for the better part of 40 years (Malcolm Curthoy pers. comm 2012). As such, one of the mines entrances was collapsed and another was a vertical entrance that had filled with water. The mines were investigated for signs of occupation by fauna species. Stagwatching and Anabat detectors were deployed in proximity to the mine entrances. Very little activity was recorded from these sites. Such low activity would indicate that the disused mines were not being utilised as roosts for fauna species at the time of the surveys. From these investigations it was concluded unlikely that these mines would provide suitable roost sites for cave dependant bat species such as the Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis).*

Photograph 5.8 Disused Mine (Taree property)

5.5.10 *Superb Parrot Habitat Enhancement Sites*

Greening Australia Capital Region has assisted several landholders within the Study Area to establish Superb Parrot habitat enhancement sites. Enhancement included revegetation, remnant protection, or patch enhancement and restricted grazing. Three landholders within the Study Area currently have Superb Parrot habitat enhancement sites on their properties and ten additional sites within 6 km of the Study Area have also been established by Greening Australia Capital Region.

5.6 *INVERTEBRATES*

Targeted surveys were undertaken for the Golden Sun Moth (GSM), which is listed as Critically Endangered under the EPBC Act and Endangered under the TSC Act. A total of 103 male GSM and one female GSM (see *Photograph 5.9*) were recorded at 22 sites during the survey period, as shown in *Figure 5.3.* The highest number of GSM observed at a given site was 23 individuals, with the majority of sites having 10 or fewer GSM.

Photograph 5.9 Female GSM recorded in the Study Area

5.7 *FROGS*

Frog searches were undertaken in areas of observed habitat and microhabitat both on foot and by vehicle, and frogs were regularly captured in pitfall traps. The target species for the surveys were the Boorroolong Frog (*Litoria booroolongensis*) and the Growling Grass Frog (*Litoria raniformis*). A total of 132 frogs from seven species were recorded during field surveys. This includes 124 frogs captured in pitfall traps, and eight frogs observed during nocturnal frog searches. None of the target threatened frog species were observed during field surveys. *Table 5.11* lists the species recorded during the field surveys. The most commonly recorded species was the Spotted Grass Frog (*Limnodynastes tasmaniensis*), followed by the Smooth Toadlet (*Uperoleia laevigata*) and Eastern Pobblebonk (*Limnodynastes dumerilii*) (see *Photograph 5.10*). The least common species recorded was the Peron's Tree Frog (*Littoria peronii*).

Table 5.11 Frog species recorded

Scientific Name	Common Name	TSC Status	EPBC Status
Crinia parinsignifera	Beeping Froglet	-	-
Crinia Signifera	Common Eastern Froglet	-	-
Limnodynastes dumerilii	Eastern Pobblebonk	-	-
Limnodynastes peroni	Striped Marsh Frog	-	-
Limnodynastes tasmaniensis	Spotted Grass Frog	-	-
Littoria peronii	Peron's Tree Frog	-	-
Uperoleia laevigata	Smooth Toadlet	-	-

Photograph 5.10 Eastern Pobblebonk (Limnodynastes dumerilii)

5.8 REPTILES

A total of 12 reptile species were recorded. Trapping recorded a total of 38 individuals from five species, with seven additional species observed during surveys (*Table 5.12*). The most commonly trapped species in pitfall traps was the Southern Rainbow Skink (*Carlia tetradactyla*). The majority of these captures were from the Taffs Hill pitfall arrays. The Patternless Delma (*Delma inornata*) was also captured at the Taff's Hill pitfall arrays (see *Photograph 5.11*). One Lace Monitor (*Varanus varius*) was also recorded by a remote camera (see *Photograph 5.12*). No threatened reptiles were observed during field surveys.

Table 5.12 Reptiles recorded

Scientific Name	Common Name	EPBC Status	TSC Status
Carlia tetradactyla	Southern Rainbow skink	-	-
Delma inornata	Patternless Delma	-	-
Lampropholis Delicata	Dark-flecked Garden Sunskink	-	-
Morethia boulengeri	South-eastern Morethia Skink	-	-
Egernia cunninghamii	Cunningham's Skink	-	-
Ctenotus taeniolatus	Copper-tailed Skink	-	-
Pogona barbata	Eastern Bearded Dragon	-	-
Pseudechis porphyriacus	Red-bellied Black Snake	-	-
Pseudonaja textilis	Eastern Brown Snake	-	-
Tiliqua rugosa	Shingleback	-	-
Tiliqua scincoides	Blue Tongue Skink	-	-
Varanus varius	Lace Monitor	-	-

Photograph 5.11 Patternless Delma (Delma inornata)

Photograph 5.12 Lace Monitor recorded using remote camera

5.9 BIRDS

Field surveys identified a total of 108 species of birds, 104 of which were native Australian birds. The BUS identified over 1300 individuals. Bird surveys conducted in woodland or adjacent to woodland areas recorded 99 species of bird. A full list of the species recorded is included in *Annex C.*

5.9.1 Threatened Birds

Eight threatened species and one migratory bird species, Rainbow Bee-eater (*Merops ornatus*) (see *Photograph 5.13*) were identified within the Study Area (refer to *Table 5.13* and *Figure 5.3*). The Diamond Firetail (*Stagonopleura guttata*) and Superb Parrot were the most commonly encountered threatened species. Superb Parrot was observed at numerous locations across the Study Area during the breeding season, however, it was not recorded after the end of the breeding season. The Diamond Firetail was regularly observed in small flocks in low roadside vegetation, particularly along Harry's Creek Road and Tangmangaroo Road, and also in the eastern parts of the Study Area. A group of eight or more Grey-crowned Babblers (*Pomatostomus temporalis temporalis*) were observed on a property within the Langs Creek Cluster on a western facing hill in an open area with scattered woodland. The Varied Sittella (*Daphoenositta chrysoptera*) and Brown Treecreeper (*Climacteris picumnus victoriae*) were observed in both woodland habitats as well as in paddock trees adjacent to woodland. The Scarlet Robin (*Petroica boodang*) was only observed in woodland areas.

Table 5.13 Threatened and Migratory Bird Species recorded in the Study Area

Scientific Name	Common Name	EPBC Act	TSC Act
Chthonicola sagittata	Speckled Warbler	-	V
Circus assimilis	Spotted Harrier	-	V
Climacteris picumnus victoriae	Brown Tree-creeper	-	V
Daphoenositta chrysoptera	Varied Sitella	-	V
Merops ornatus	Rainbow Bee-eater	Mi	-
Pomatostomus temporalis temporalis	Grey-crowned Babbler	-	V
Petroica boodang	Scarlet Robin	-	V
Polytelis swainsonii	Superb Parrot	V	V
Stagonopleura guttata	Diamond Firetail	-	V

Status: V – Vulnerable, Mi - Migratory

Photograph 5.13 Rainbow Bee-eater (Merops ornatus) recorded in the Study Area

5.9.2 Bird Utilisation Surveys

This section details the results of the BUS undertaken from November 2012 to February 2013. The comprehensive results of the BUS are provided in Annex D.

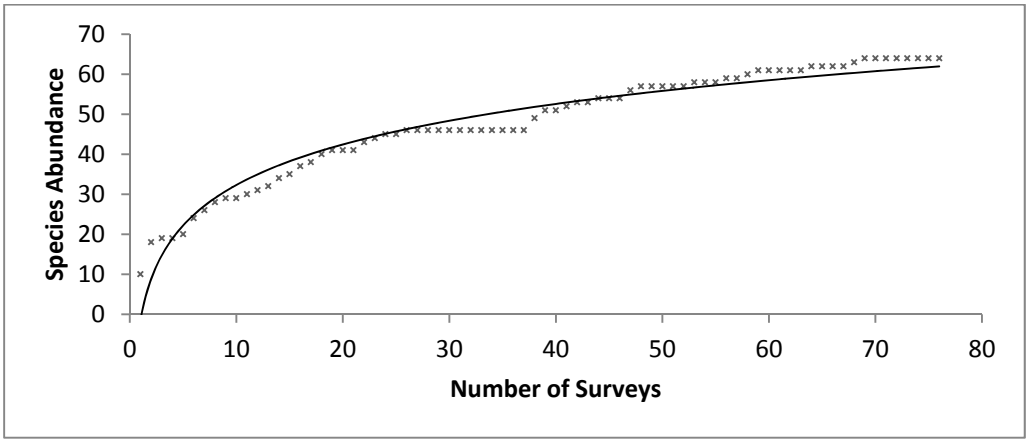
A total of 1335 birds were recorded from 76 surveys at 20 different sites. There were 68 different species identified, with the most abundant being the Australian Magpie (*Corvus coronoides*) (79), Crimson Rosella (*Platycercus elegans*) (49), Sulphur-crested Cockatoo (*Cacatua galerita*) (44) and the Superb Parrot (*Polytelis swainsonii*) (41). The Superb Parrot is listed as Vulnerable under the EPBC Act and the TSC Act.

Other threatened species recorded during the BUS were Brown Treecreeper *(Climacteris picumnus)* (Vulnerable under the TSC Act), Spotted Harrier (*Circus assimilis*) (Vulnerable under the TSC Act), Diamond Firetail (*Stagonopleura guttata*) Vulnerable under the TSC Act and the Rainbow Bee-eater (*Merops ornatus*) Migratory under the EPBC Act.

The majority of birds observed during the BUSs were flying moderate to short distances between trees, perching or moving on to the next tree or group of trees. Peak activity was generally recorded in the mornings or late afternoon surveys or on arrival to site when birds were flushed from the immediate area into the surrounding trees. Flocks of birds such as Eastern Rosellas (*Platycercus eximius*), Crimson Rosellas and Sulphur Crested Cockatoos were observed moving across the landscape generally following the contour of the ground. Birds were rarely observed to fly directly above the ridge tops.

A species accumulation curve illustrates that the number of species recorded rose rapidly within the first 10 surveys conducted and then began to taper (Refer to *Figure 5.6*). After completion of the 76 surveys the number of new species recorded declined, however, had not fully reached asymptote.

Figure 5.5 Species Accumulation Curves for All Species Recorded



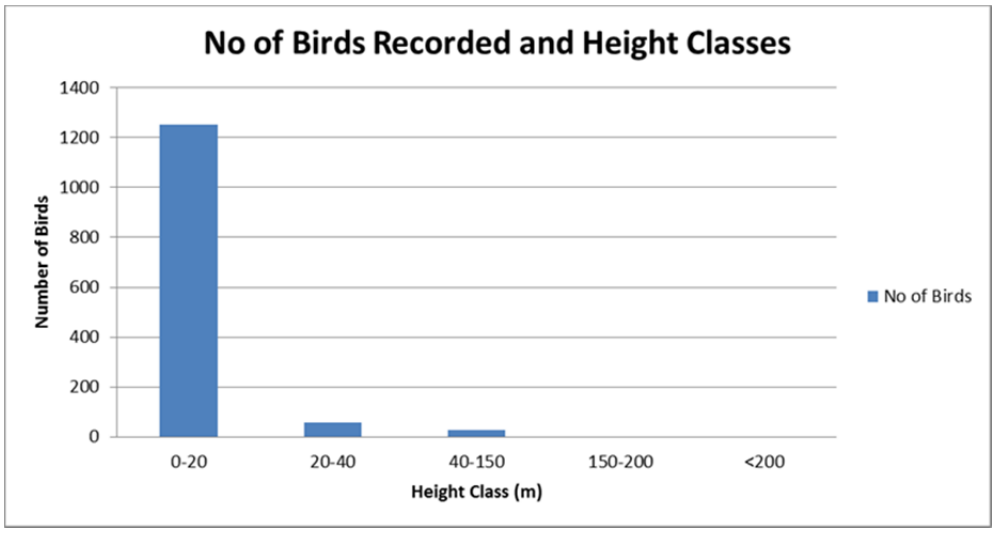
Height Categories of Species Recorded

Birds were recorded flying at five height classes, 0 – 20 m, 20 – 40 m, 40 – 150 m, and greater than 200 m. A total of 1250 birds were recorded flying at 0 – 20 m, 59 were recorded flying at 20 – 40 m, 26 were recorded flying at 40 – 150 m, none were recorded flying at 150 – 200 m or greater than 200 m during the surveys.

A total of 57 different bird species were recorded flying at 0 – 20 m, sixteen different bird species were observed flying at 40 -150 m, ten different species were recorded flying at 20 – 40 m and nine species were recorded flying at 40 – 150 m during the BUS surveys *Figure 5.7.*

Of the birds recorded in large numbers, very few exhibited direct movement through the landscape as would be expected of some true migratory species. The Wedge-tailed Eagles and other raptors were typically observed circling and soaring rather than direct movements.

Figure 5.6 Number of birds recorded at respective height classes



Threatened Species Recorded

A total of 164 individual threatened birds from six different species were recorded from 16 of the 20 survey sites. One of of the threatened species was recorded flying in the 20 – 40 m height class, the other two were recorded at the 40 -150 m height class. A breakdown of the data collected for the threatened species recorded at respective height classes is shown in *Table 5.14*. This table illustrates that the most abundant threatened species recorded was the Superb Parrot (148). A total of 147 Superb Parrots were recorded flying at 0 – 20 m, one Superb Parrot was recorded 20 – 40 m. The Little eagle and Spotted Harrier were both recorded at the 40 – 150 m height class as would be expected for these raptors. The Diamond Firetail and Brown Treecreeper were both observed in the 0 – 20 m height class as woodland birds it would be very rare to record either of these species at above the 20 m height class in the terrain where the surveys were undertaken. Superb Parrots were typically observed moving to or from areas to forage. Foraging areas tended to be those used for cropping grain. After the month of January the Superb Parrot was rarely recorded within the Study Area. This coincided with the harvesting of grain and the end of the breeding season for the Superb Parrot.

Table 5.14 Height Classes recorded of threatened species

		Height Classes				
Threatened species	Individuals recorded	0-20 (m)	20-40 (m)	40-150 (m)	150-200 (m)	<200 (m)
Superb Parrot	148	147	1	-	-	-
Brown Treecreeper	2	2	-	-	-	-
Spotted Harrier	1	-	-	1	-	-
Diamond Firetail	1	1	-	-	-	-
Rainbow Bee-eater	11	11	-	-	-	-
Little Eagle	1	-	-	1	-	-

5.10 OTHER BIRDS

The Wedge-tailed Eagle can be seen perched on trees or poles or soaring overhead to altitudes of up to 2000 m. Wedge-tailed Eagles build their nest in a prominent location with a good view of the surrounding countryside. It may be built in either a live or dead tree, but usually the tallest one in the territory. The density of active nests depends on the abundance of prey and other resources. In most years, nests are usually 2.5 km - 4 km apart. If conditions are particularly good, the distances apart may be less than 1 km because the birds require smaller areas to find sufficient food (Australian Museum 2012).

The Wedge-tailed Eagle has been previously recorded within the Locality with records of this species west and south of Boorowa, north and south of Rye Park Road (OEH 2013). During the field surveys this species was recorded in six locations (*Figure 5.3*) during bird census surveys, BUS and opportunistic observations. Six nest sites were recorded within the Study Area and have been mapped in *Figure 5.3*. One of these nests was recorded as active at the time of the September survey; it is not clear whether the other nests were active or inactive during the survey period.

5.11 BATS

A total of 13 species of microbat were detected using Anabat detectors (refer *Table 5.15* and *Figure 5.3*). A total of 546 recognisable passes were analysed from four Anabat units over the survey period. A further three microbat species were identified by capture as a result of harp trapping, including Lesser Long-eared Bat (*Nyctophilus geoffroyii*) as shown in *Photograph 5.14*, the Little Forest Bat (*Vespadelus vulturnus*) and the Southern Forest Bat (*Vespadelus regulus*),

Table 5.15 Bat species recorded

Species	Common Name	Status TSC Act	Status EPBC Act	Observation Type
Austronomus australis (syn. *Tadarida australis)*	White-striped Freetail Bat	-	-	U
Chalinolobus gouldii	Gould's Wattled Bat	-	-	U
Chalinolobus morio	Chocolate Wattled Bat	-	-	U
Miniopterus schreibersii oceanensis	Eeastern bentwing Bat	V	-	U
Mormopterus sp	Freetail Bat	-	-	U
Mormopterus sp 2	Eastern Freetail Bat	-	-	U
Mormopterus sp 4	Southern Freetail Bat	-	-	U
Nyctophilus geoffroyii	Lesser Long-eared Bat	-	-	U, T
Nyctophilus sp	Long Eared Bat	-	-	U
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V	-	U
Vespadelus darlingtoni	Large Forest Bat	-	-	U
Vespadelus regulus	Southern Forest Bat	-	-	U, T
Vespadelus vulturnus	Little Forest Bat	-	-	U, T

Status, V = Vulnerable

Observation Type, U = Ultrasonic, T = Trapped

Photograph 5.14 Lesser Long-eared Bat captured in the Study Area

5.11.1 *Threatened Bats*

Of the 13 species of microbat identified, two are listed as Vulnerable under the TSC Act: the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) and the Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*). The Eastern Bentwing Bat was recorded as a definite identification on an Anabat unit on 23 October 2012, and again as a probable identification on 22 October 2012 (*Figure 5.3*). Both recordings were taken from units placed on the Mt Buffalo property in Red Stringybark dominated woodland or on the edge of Red Stringybark dominated woodland. This species has a preference for using caves and abandoned mines as roosts.

The Yellow-bellied Sheathtail Bat was recorded as a definite identification on an Anabat unit on the 21 November 2012, which was placed on a stag on the edge of a creekline on the Taffs Hill property. The vegetation at this location consisted of scattered trees on derived native grassland. The primary land use in this area was grazing of both sheep and cattle. This species was also recorded as a probable identification on on 22 February 2013. This unit was placed on a small stag on a hill where the vegetation comprises scattered trees and cleared pasture. The primary land use in this area was grazing.

5.12 *MAMMALS (EXCLUDING BATS)*

A total of nine native mammal species were identified during spotlighting, trapping, camera trapping and as incidental observations (refer *Table 5.16*). This includes four macropod species, three arboreal species, the Short-beaked Echidna (*Tachyglossus aculeatus*) and the Yellow-footed Antechinus (*Antechinus flavipes*). An additional five exotic mammal species were observed, including the European Hare (*Lepus europaeus*), Brown Hare (*Lepus capensis*), Rabbit (*Oryctolagus cuniculus*), Pig (*Sus scrofa*) and European Red Fox (*Vulpes vulpes*) as shown in *Photograph 5.15*.

Table 5.16 Mammals recorded

Scientific Name	Common Name	TSC Status	EPBC Status
Antechinus flavipes	Yellow-footed Antechinus	-	-
Lepus europaeus	European Hare*	-	-
Macropus giganteus	Eastern Grey Kangaroo	-	-
Macropus robustus	Common Wallaroo	-	-
Macropus rufogriseus	Red-necked Wallaby	-	-
Oryctolagus cuniculus	Rabbit*	-	-
Petaurus norfolcensis	Squirrel Glider	V	-
Pseudocheirus peregrinus	Common Ringtail Possum	-	-
Sus scrofa	Pig*	-	-
Tachyglossus aculeatus	Short-beaked Echidna	-	-
Trichosurus vulpecula	Common Brushtail Possum	-	-
Vulpes vulpes	European Red Fox*	-	-
Wallabia bicolor	Swamp Wallaby	-	-

V = Vulnerable, * = Introduced species

Photograph 5.15 European Red Fox captured on a remote camera

5.12.1 Threatened Mammals

One threatened mammal species was recorded, the Squirrel Glider (Vulnerable, TSC Act). The individual was recorded during spotlighting in February 2013, as shown in *Photograph 5.16*. The Squirrel Glider was in mature Apple Box – Yellow Box Grassy Woodland adjacent Tangmangaroo Road (see *Figure 5.3*). The immediate area contained few tree hollows; however was only a few hundred metres from an area with many hollow bearing trees. Targeted trapping in the Study Area did not capture any additional Squirrel Gliders.

Photograph 5.16 Squirrel Glider observed in the Locality

5.13 THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT

The results of the threatened species Likelihood of Occurrence Assessment are provided in full within *Annex E*.

A summary of the results are provided in a series of tables below (*Table 5.17, Table 5.18, Table 5.19* and *Table 5.20*). The threatened species that are Known, Likely or have the Potential to occur within the Study Area have been assessed under the NSW TSC Act Assessment of Significance (7 part test) in *Section 6.6* and *Annex F*. Species and communities listed under the EPBC Act which have been determined as Known, Likely or Potential to occur within the Study Area through the Likelihood of Occurrence Assessment have also been assessed under the Commonwealth *Significant Impact Assessment Guidelines 1.1 Matters of NES*, the results of which are presented in *Chapter 7* and *Annex J*.

Table 5.17 Likelihood of Occurrence Summary: Ecological Communities

Community Species Name	TSC Act Status	EPBC Act Status	Likelihood
White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland	E	CE	Known
Tableland Basalt Forest in the Sydney Basin and South East Highlands Bioregions	E		Unlikely – suitable habitat does not occur

1. CE = Critically Endangered; E= Endangered

Table 5.18 Likelihood of Occurrence Summary: Subject Species

Common Name	Species Name	TSC Act Status	EPBC Act Status	Likelihood
Plants				
Yass Daisy	*Ammobium craspedioides*	V	V	Likely
Crimson Spider Orchid	*Caladenia concolor*	E	E	Potential
Doubletail Buttercup	*Diuris aequalis*	E	V	Potential
Hoary Sunray	*Leucochrysum albicans var. tricolor*		E	Potential
Silky Swainson-pea	*Swainsona sericea*	V		Potential
Invertebrates				
Golden Sun Moth	*Synemon plana*	E	CE	Known
Frogs				
Booroolong Frog	*Litoria booroolongensis*	E	E	Unlikely - due to the lack of swamps, Lignum/Typha and River Red Gum swamps or billabongs along floodplains and river valleys throughout the Study Area.

Common Name	Species Name	TSC Act Status	EPBC Act Status	Likelihood
Growling Grass Frog	*Litoria raniformis*	V	E	Unlikely - due to the ephemeral nature of the creeks and streams throughout the Study Area.
Birds				
Regent Honeyeater	*Anthochaera phrygia*	CE	E	Likely
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V		Potential
Glossy Black-cockatoo	Calyptorhynchus lathami	V		Potential
Spotted Harrier	*Circus assimilis*	V		Known
Brown Treecreeper	*Climacteris picumnus victoriae*	V		Known
Varied Sittella	*Daphoenositta chrysoptera*	V		Known
White-fronted Chat	*Epthianura albifrons*	V		Potential
Little Lorikeet	*Glossopsitta pusilla*	V		Potential
Painted Honeyeater	*Grantiella picta*	V		Potential
Little Eagle	*Hieraaetus morphnoides*	V		Known
Swift Parrot	*Lathamus discolor*	E	E	Potential
Square-tailed Kite	*Lophoictinia isura*	V		Potential
Hooded Robin	*Melanodryas cucullata cucullatta*	V		Potential
Black-chinned Honeyeater	*Melithreptus gularis gularis*	V		Likely
Turquoise Parrot	*Neophema pulchella*	V		Potential
Barking Owl	*Ninox connivens*	V		Potential
Powerful Owl	*Ninox strenua*	V		Potential
Scarlet Robin	*Petroica boodang*	V		Known
Flame Robin	*Petroica phoenicea*	V		Likely
Superb Parrot	*Polytelis swainsonii*	V	V	Known
Grey-crowned Babbler	*Pomatostomus temporalis temporalis*	V		Known
Speckled Warbler	*Pyrrholaemus sagittatus*	V		Known

Common Name	Species Name	TSC Act Status	EPBC Act Status	Likelihood
Diamond Firetail	*Stagonopleura guttata*	V		Known
Mammals				
Koala	*Phascolarctos cinereus*	V	V	Potential
Eastern Pygmy Possum	*Cercartetus nanus*	V		Unlikely - no suitable habitat exists.
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	Unlikely - woodland is highly fragmented.
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V		Unlikely - few areas have trees taller than 20 m.
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V		Known
Greater Long-eared Bat	*Nyctophilus corbeni*	V	V	Unlikely - No records have been identified within 20 km of the Study Area
Yellow Bellied Sheathtail-bat	*Saccolaimus flaviventris*	V		Known
Greater Broad-nosed bat	*Scoteanax rueppellii*	V		Unlikely - No records within within the Locality
Squirrel Glider	*Petaurus norfolcensis*	V		Known

1. CE = Critically Endangered, E = Endangered, V = Vulnerable

Table 5.19 Likelihood of Occurrence Summary: Other Entities

Species/Community Status	Likelihood of Occurrence	Assessment of impact required?
Plants		
Robertson's Gum *Eucalyptus robertsonii subsp. Hemisphaerica* TSC Act - V EPBC Act - V	Potential – suitable habitat present in woodlands on the site.	Yes
Aromatic Peppercress *Lepidium hyssopifolium* TSC Act - E EPBC Act - E	Potential - suitable habitat present in woodlands and secondary grassland.	Yes
Tarengo Leek Orchid *Prasophyllum petilum* TSC Act - E EPBC Act - E	Potential – recorded within the Locality, sub-optimal habitat exists within the Study Area.	Yes
Dwarf Kerrawang *Rulingia prostrate* TSC Act - E EPBC Act - E	Unlikely – suitable habitat absent from the Study Area.	No

Species/Community Status	Likelihood of Occurrence	Assessment of impact required?
Mountain Swainson Pea *Swainsona recta* TSC Act - E EPBC - E	Potential - suitable habitat present in woodlands with an undisturbed understory.	Yes
Black Gum *Eucalyptus aggregata* TSC Act - V -	Unlikely – suitable habitat does not occur. The site does not support any of the associated cold-adapted Eucalypts and is at a lower altitude than other known populations.	Yes

Species/Community Status	Likelihood of Occurrence	Assessment of impact required?
Button Wrinklewort *Rutidosis leptorrhynchoides* TSC Act - E EPBC Act – E	Potential - suitable habitat present in woodlands with an undisturbed understory and secondary grassland. Areas of suitable habitat were surveyed during the flowering season for the species.	Yes
Reptiles		
Pink-tailed Worm-lizard *Aprasia parapulchella* TSC Act - V EPBC Act - V	Unlikely – limited areas of suitable habitat occur.	No
Striped Legless Lizard *Delma impar* TSC Act - V EPBC Act - V	Potential limited areas of suitable habitat occur.	Yes
Grassland Earless Dragon *Tympanocryptis pinguicolla* TSC Act - E EPBC Act - E	Unlikely - areas of derived native grassland dominated by *Austrodanthonia* and *Themeda australis* occur within the Study Area however in a disturbed and fragmented state.	No
Little Whip Snake *Suta flagellum* TSC Act - V	Unlikely - areas of Derived native grassland exist and sub prime habitat exists on slopes. Site has been heavily grazed and habitat fragmented.	No
Rosenberg's Goanna *Varanus rosenbergi* TSC vAct - V	Potential - habitat occurs only in small fragmented patches.	Yes
Birds		
Australasian Bittern *Botaurus poiciloptilus* TSC Act - E EPBC Act – E	Unlikely – due to absence of densely vegetated wetlands within the Study Area and lack of records in the Locality.	No
Australian Painted Snipe *Rostratula australis* TSC Act - E EPBC Act - V, Mi	Unlikely – suitable habitat does not occur within the Study Area and no previous records exist for the Locality.	No
CE = Critically Endangered, E = Endangered, V = Vulnerable, Mi = Migratory		

Table 5.20 Likelihood of Occurrence Assessment Results: Additional Species Identified in Database Searches

Species/Community Status	Likelihood of Occurrence	Assessment of impact required?
Plants		
Eucalyptus canobolensis Silver-leaf Candlebark TSC Act - V EPBC Act - E	Unlikely - Optimal or sub optimal habitat absent from the Study Area.	No
Pelargonium sp. Striatellum (G.W. Carr 10345) Omeo Stork's Bill TSC Act - E EPBC Act – E	Unlikely – Optimal or sub optimal habitat absent from the Study Area.	No

Species/Community Status	Likelihood of Occurrence	Assessment of impact required?
Fish		
Maccullochella peelii peelii Murray Cod, Cod, Goodoo EPBC Act - V	Unlikely – No optimal or sub optimal habitat present.	No
Macquaria australasica Macquarie Perch FM Act - E EPBC Act – E	Unlikely – No optimal or sub optimal habitat present.	No
Ecological Communities		
EPBC Act listing: Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South eastern Australia Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory TSC Act listing: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions TSC Act – E EPBC Act - E	Unlikely – suitable habitat does not occur. Not mapped or recorded in the Study Area.	No
Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory EPBC Act - CE	Unlikely – suitable habitat does not occur. Not mapped or recorded in the Study Area.	No
Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions TSC Act - E	Unlikely – suitable habitat does not occur. Not mapped or recorded in the Study Area.	No

Status: CE = Critically Endangered, E = Endangered, V = Vulnerable

5.14 RESULTS SUMMARY

Five vegetation communities were recorded in the Study Area, including two BVTs that occur in varying condition. The remaining vegetation communities largely comprise exotic species and do not meet the description of any BVTs. The majority of the Apple Box – Yellow Box Grassy Woodland meets the description for the Box-Gum Woodland EEC listing under the TSC Act and a small proportion also meets the description for the Box-Gum Grassy Woodlands and Derived Native Grasslands CEEC listing under the EPBC Act.

A total of 127 flora species were recorded in the Study Area. Nine threatened flora species listed under the EPBC Act and / or the TSC Act were considered likely to, or have the potential to, occur in the Study Area. Of these, none were recorded in the Study Area, however, one was recorded in the Locality (see *Table 5.20*).

A total of four fauna habitat types were recorded in the Study Area including native woodlands, native grasslands, exotic grasslands and aquatic habitats. Within these habitat types, a variety of fauna habitat resources were identified, including hollow bearing trees, paddock trees, tussock grasslands, disused mines, farms dams and creek lines.

A total of 152 fauna species were recorded in the Study Area. Thirty two threatened fauna species were considered likely to, or have the potential to, occur in the Study Area. This includes one invertebrate, one frog, three reptiles, 23 birds and four mammals. Of these, a total of 15 were recorded within the Study Area including one invertebrate, ten birds and three mammals (see *Table 5.20*). One migratory species listed under the EPBC Act was recorded in the Study Area (see *Table 5.20*).

A summary list of the threatened species recorded is shown in *Table 5.20*. This information combined with the known records of threatened species and potential for a species to occur within the Study Area has formed the basis for the impact evaluation in *Chapter 6* of this report.

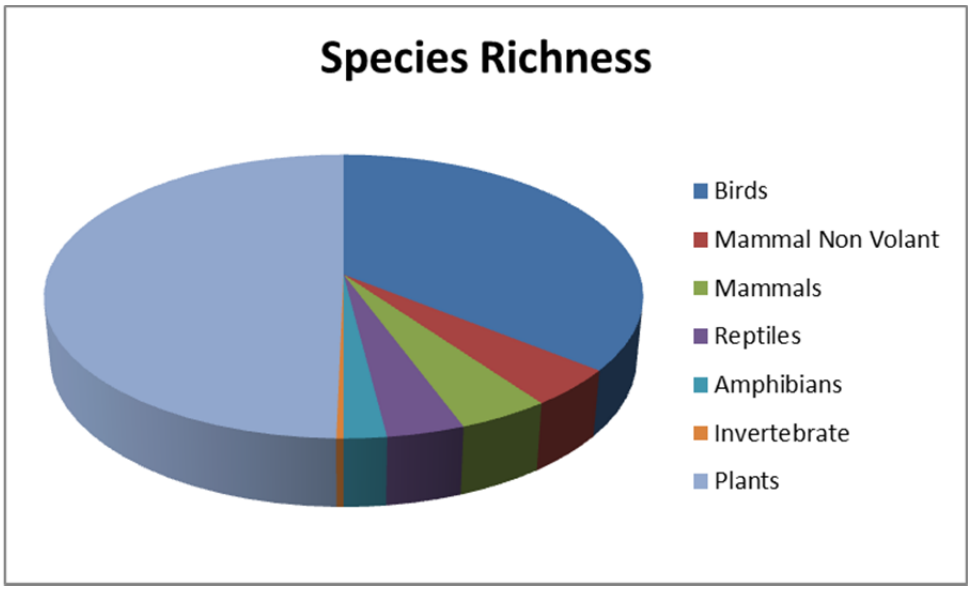
Table 5.21 Summary of Threatened Species Recorded

Taxon	Scientific Name	Common Name	Status TSC Act	Status EPBC Act
Plant	*Ammobium craspedioides*	Yass Daisy	V	V
Invertebrate	*Synemon plana*	Golden Sun Moth	E	CE
Bird	*Chthonicola sagittata*	Speckled Warbler	V	-
Bird	*Circus assimilis*	Little Eagle	V	-
Bird	*Climacteris picumnus*	Brown Treecreeper	V	-
Bird	*Daphoenositta chrysoptera*	Varied Sittella	V	
Bird	*Merops ornatus*	Rainbow Bee-eater	-	Mi
Bird	*Petroica boodang*	Scarlet Robin	V	-
Bird	*Polytelis swainsonii*	Superb Parrot	V	V
Bird	*Pomatostomus temporalis*	Grey-crowned Babbler	V	-
Bird	*Stagonopleura guttata*	Diamond Firetail	V	-
Mammal	*Miniopterus schreibersii oceanensis*	Eeastern bentwing Bat	V	-
Mammal	*Petaurus norfolcensis*	Squirrel Glider	V	-
Mammal	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail Bat	V	-

Status: CE = Critically Endangered, E = Endangered, V = Vulnerable, Mi = Migratory

The surveys and observations carried out over the Study Area recorded a total of 280 different species. A species richness chart (*Figure 5.8*), based on the number of different species recorded over the survey period has been constructed to show the relative species richness within the Study Area during the survey period. The graph shows that plants were the most commonly recorded group with birds, mammals (flying), non-volant mammals, reptiles relatively equal in species richness with amphibians and invertebrates being recorded the least. Note that this information does not take into account the number of records per individual species and survey limitations may have impacted on the detection of some species.

Figure 5.7 Species Richness Chart



6 IMPACT EVALUATION

This section provides an evaluation of the potential impacts associated with the proposed Project. It discusses the components of the Project which are likely to lead to ecological impacts, the avoidance and mitigation measures which have been put in place to minimise the Project's residual impacts, and the nature and extent of potential impacts associated with each stage of the Project. Assessments of Significance against Section 5A of the EP&A Act (also known as the seven part test) were undertaken for 39 species and one ecological community, as discussed in *Section 6.6* and presented in full in *Annex F*. Offset calculations and proposed measures are discussed in the final section of this chapter, although it is acknowledged that the provision of offsets can not be considered in the determination of project-related impacts.

6.1 PROPOSED DEVELOPMENT

The Project is comprised of a number of components which would impact on the ecological features of the Study Area. An overview of the components is provided in *Table 6.1* and detailed descriptions are provided in the following sections.

Table 6.1 Project components

Project Component	Approximate Dimensions
Permanent	
WTG footings (maximum footprint)	25 m x 25 m
WTG assembly / crane hardstand areas	25 m x 60 m
Collector substation (CS)	150 m x 150 m
Site compounds *(the extent of permanent section retained within temporary compound)*	75 m x 75 m
On-site access: new roads	6 m x 83 km
Overhead transmission lines / easement [4]	30 m x 0.86 km
(Typical pole spacing as per **Table 3.3** of **Section 2.4.4**)	(1 x 33 kV)
	45 m x 7.82 km
	(2 x 33 kV)
	75 m x 0.65 km
	(2 x 33 kV, 1 x 132 kV)
Switching station (SS)	220 m x 160 m
Wind monitoring masts	1 m x 1 m
	(5 per mast)

[4] The final constructed easement width is up to 75 m for the internal overhead transmission lines, depending on their configuration. The maximum easement widths for each transmission line section have been assessed in detail and used in the calculation of the Development Footprint impact area. The actual impact area has been estimated to be 5% of this total area given the low level of impacts associated with installing the overhead transmission lines and the sparse vegetation cover along the selected routes.

Project Component	Approximate Dimensions
Temporary (during construction)	
Earthworks alongside permanent infrastructure (roads / hardstands) [5]	12 m x 83 km (est.)
Underground transmission lines[6]	3 m x 61 km
Concrete /asphalt batching plant	50 m by 100 m
Rock crushing facility	50 m by 100 m
Site compound and office	150 m by 200 m

6.1.1 Wind Turbine Generators (WTGs)

Up to 122 WTGs are proposed to be constructed as part of the Project. Each WTG requires a 25 m x 25 m concrete footing and a 25 m x 60 m WTG assembly / crane hardstand area. The hardstand is required as a crane pad to construct each turbine on site and will remain in situ after construction to allow for future maintenance or possible removal of each turbine. The supporting structure is comprised of a reducing cylindrical tower of up to 120 m, with an approximate diameter at the base of 4.5 m and 3 m at the top. Rotors will be three-bladed with diameters between 74 m and 144 m and a swept area of 4,300 to 16,286 square metres (m^2). The lowest possible swept height would be 25 m, however, it is more likely to be greater than 30 m, depending on the turbine model.

Installation of the WTGs would involve the excavation of approximately 750 m^3 of ground material to a depth of approximately 2.5 m (based on a 21 m diameter circular foundation). Approximately 200 m^3 would, if suitable, be used as backfill around the wind turbine base. Remaining excavation material will be used for the on-site road infrastructure, where necessary. The majority of the WTGs are proposed in areas of pasture, cropping and DNG. Some WTGs would also require clearing of woodland vegetation.

[5] Construction of the on-site access road network will require earth works that are beyond the limits of the permanent road impact within the Study Area. This is required to level areas of steep gradient to a design suitable for safely transporting Project components into position. Civil engineering designs have been prepared for both Layout Options based on available contour and geotechnical data, to include impacts associated with permanent road, hardstand and turning head areas in addition to the area considered the extent of the earthworks.

[6] Underground transmission lines are a temporary impact and where feasible will be installed either within or adjacent to on-site access roads and earthworks. The trenches for the cables are backfilled with excavated material and covered with topsoil post installation. Suitable rehabilitation measures will be implemented.

6.1.2 Collector Substation

The CS will occupy an area approximately 150 by 150 m and will be surrounded by a 3 m high security fence, surmounted by strands of barbed or razor wire. The transformer(s) within the CS may contain upwards of 50,000 L of oil. The 2.25 ha area for the CS includes a provision for a 20 m Asset Protection Zone. A facilities building will be constructed at the same location as the CS. The proposed CS location occurs in areas of pasture, cropping or DNG.

6.1.3 Switching Station

The SS will occupy an area approximately 160 by 220 m and will be surrounded by a 3 m high security fence, surmounted by strands of barbed or razor wire. The 3.52 ha area includes a provision for a 20 m Asset Protection Zone. The proposed SS location occurs in areas of pasture, cropping or DNG.

6.1.4 Site Access Works

Site access requires site entry roads and onsite access roads. All entrances to the PAA from the existing arterial roads will be designed to allow long vehicles to safely exit from or re-enter the road whilst minimising the disruption to traffic.

Other access consists of new on-site access roads of up to 6 m between wind turbines, also comprising hardstand and turning head areas. The on-site access roads will follow existing farm tracks, where practicable, that traverse the ridgelines and plateaus. All roads leading from the arterial roads and all on-site access roads are likely to require a full or partial upgrade to accommodate the construction traffic loads, as well as for maintenance purposes during operation.

Construction of the on-site access road network will require earth works to level areas of steep gradient to a design suitable for safely transporting Project components into position. Access roads are largely proposed through areas of pasture, cropping and DNG, however, some sections also pass through woodland areas.

6.1.5 Transmission Lines

The electrical and control cables from the Langs Creek, Kangiara and Mt Buffalo Clusters will comprise a mix of underground and overhead transmission lines and will connect directly into the CS.

Underground routes will generally be between the WTGs and follow the route of the internal on-site access roads. Installation would involve the cutting or excavation of trenches to a depth of up to 0.45 m wide and 1.2 m deep for the laying of the underground transmission lines.

Approximately 9 km of overhead transmission line will be required to connect the WTGs to the CS and SS. The final constructed easement width is up to 75 m for the internal overhead transmission lines, depending on their configuration. The actual impact area has been estimated to be 5% of this total area given the low level of impacts associated with installing the overhead transmission lines and the sparse vegetation cover along the selected routes. Overhead transmission lines are largely proposed through areas of pasture, cropping and DNG, however, some sections also pass through woodland. A section of the overhead transmission line passes through Box-Gum Woodland and would require clearing of native vegetation.

6.2 POTENTIAL IMPACTS OF PROJECT

There are a range of potential impacts associated with wind farm developments including direct and indirect impacts, as discussed in the following sub-sections.

6.2.1 Habitat Loss

Habitat loss is a direct consequence of earthworks and construction activities which is classified in this report as either temporary loss or permanent loss. Habitat loss is the direct impact which is most easy to quantify, based upon the Development Footprint of the Project, involving all aspects of the Project components. The Development Footprint is made up of the components discussed in *Section 6.1*. In order to minimise the impacts on vegetation and habitat the proponent has applied a range of safeguards through avoidance and mitigation measures outlined in *Section 6.3* and *Section 6.4*.

The habitat loss associated with the Project is quantified in *Section 6.5*.

6.2.2 Collision-related mortality

Operational wind farms pose a collision risk to birds and bats where rotor strike can cause injury and/or death, as well as alienation of habitat through avoidance of WTGs. Fatalities and injuries are usually caused by a collision with the moving blades (blade strike), or with turbine infrastructure, such as guy lines and powerlines. Lighting on wind farm turbines may also increase the likelihood of blade strike to insectivourous bat species by attracting insects to within the RSA, thus causing bats to forage within this area and interact with the rotors.

Impacts on Birds

The main potential impacts on bird species from an operational wind farm are:

- direct mortality associated with rotor collisions and collisions with other associated infrastructure including towers, guy wires and transmission lines; and

- indirect impacts relating to habitat loss through the effects of installation of wind farm facilities.

Rotor strike is reasonably well studied in Europe and the Americas where flocking seasonal migratory birds are common, whereas literature relating to rotor strike in Australia is relatively scarce. Alienation of habitat is also a key consideration which is related to rotor strike, as it indicates a measure of "avoidance" of WTGs by birds and bats. The avoidance rate for birds in Australia is generally considered to be in the order of 95% to 99% (Smales 2005a). This avoidance effect essentially leads to a loss of habitat within the footprint of the proposed development.

Collision risk depends on a wide range of factors as summarised below:

- high collision rates have been recorded at several large wind farms located in areas where large concentrations of birds are present (e.g. Altamont Pass in California, USA, Tarifa, and Navarra in Spain). High collision rates are particularly evident for large soaring raptors, near areas used by large numbers of roosting or foraging birds, migratory flyways or local fly paths or areas with high bird use. No large concentrations of birds were recorded in the Study Area and the area is not known to form part of any significant migratory routes for large numbers of birds;

- turbines constructed linearly in long strings result in more collision mortality than turbines that are constructed in clusters. The turbine layout for the proposed wind farm generally consists of clusters of turbines along ridgelines and scattered high points. The large size of individual turbines and subsequent large spacing between each turbine limits the potential impacts of the precincts with linear layouts;

- large birds with poor manoeuvrability (such as larger waterbirds) are generally at greater risk of collision with wind turbines. Species that habitually fly at dawn, dusk or at night are also less likely to detect and avoid turbines. There were no records of significant numbers of large waterbirds in the Study Area. Wedge-tailed Eagles were the only large bird with poor manoeuvrability identified in the Study Area and this species is considered to be common within the Locality and the broader NSW region; and

- bird collision risk may vary on a seasonal basis due to bird migration or breeding. This is true for the Superb Parrot which occurs in the Study Area in high densities during the breeding season (spring – summer) and migrates northward during winter as evidenced by the data in this study.

Studies on the interactions between wind farms, birds and bats have been undertaken across the world for decades. In the United States it is estimated that between 100 million to over a billion birds are killed annually by collisions with wind farms (NWCC 2001).

In Australia studies tend to focus on the impacts to threatened species. A report produced for the Department of Environment and Heritage in 2005 carried out modelling to guage the cumulative impacts of wind farm developments on the Swift Parrot, across its range in south eastern Australia. The modelling used provides a measure of the potential risk at different rates at which birds might avoid collisions (Smales 2005a). The report concluded that the number of Swift Parrots that the model predicts might be killed on average per annum at each wind farm, according to three avoidance rates modelled a cumulative total of between 0.08 and 0.13 Swift Parrots per year are predicted to be killed by collisions at all of the sites the population is likely to encounter within its natural range. This equates to slightly more or less than a single parrot killed every ten years (Smales 2005a). Therefore, the cumulative impacts of collision with turbines on the overall population of Swift Parrots as predicted by the modelling for all current and presently proposed wind farms as of 2005 within the species' range are very small (Smales 2005a).

In North America and Europe most bird collisions at wind farms are attributed to migrating birds. Many Northern hemisphere species are distinctly migratory, however most Australian species are nomadic, moving long distances in response to rainfall and drought at a continental scale. The data collected in this study indicates that birds flying at RSA height were dominated by common inland species such as Galah and Crimson Rosella. Given the abundance and wide distribution of the species recorded flying and RSA height, population scale impacts are not considered likely within the Study Area.

Impacts on Bats

Limited data is available on wind farm impacts on bats in Australia. Several hypotheses have been suggested in an attempt to determine how and why bats are killed by wind turbines (BL&A 2001a). These include:

- sensory failure where bats are unable to visually or acoustically detect moving turbine blades (non-echo locating bats are less able to avoid collision);

- roost attraction where bats may mistake turbines for a roost;

- acoustic attraction where bats are attracted to sounds generated by turbines;

- insect concentration such that bats are attracted to lit areas such as wind farms because of higher insect activity;

- food resources, in that wind farms tend to be built in areas where insects are concentrated (e.g., hilltops and ridges), thus in prime foraging habitat for bats. Open spaces around turbines may also create favourable foraging habitats; and

- decompression – sudden changes in air pressure created by turbine turbulence which can cause barotraumas in some species (BL&A 2011).

In Australia, bats display some migratory behaviour but migrations are local and not considered to cover significant distances (BL&A 2011). The Eastern Bentwing-bat migrates annually to maternity caves, where the females breed and hibernate. Males remain dispersed throughout suitable habitat, and females emerge following the breeding period, to disperse across the landscape. The nearest known breeding colony of the threatened Eastern Bentwing-bat is at Church Cave, over 60 km south of the Study Area. Due to the distance from the maternity site, and the fragmentation of suitable habitat in the Study Area, it is not expected that significant numbers of individuals congregate in the Study Area at any stage. Therefore the proportion of Eastern Bentwing-bat that would be at risk of rotor collision impacts in the Study Area is relatively low.

The only mortality rate data in the public domain in Australia is that from Woolnorth wind farm of 1.86 bats per turbine per year, published by Hydro-Tasmania. This rate range is comparable to that recorded for most North American and European Wind farms (BL&A 2011).

6.2.3 Barotrauma

The decompression hypothesis proposes that many bats are killed by barotrauma that is caused by rapid air-pressure reduction near moving turbine blades (Baerwald 2008). Barotrauma involves tissue damage to air-containing structures caused by rapid or excessive pressure changes, pulmonary barotrauma is lung damage due to expansion of air in the lungs that is not accommodated by exhalation (Baerwald 2008). As with any airfoil, moving wind- turbine blades create zones of low pressure as the air flows over them. Animals entering these low pressure areas may suffer barotrauma (Baerwald 2008).

Species most at risk of barotrauma within the Study Area are species of microbats. Eight species of microbats are nationally listed as threatened and are protected under the EPBC Act 1999. Sixteen species are listed as threatened under the NSW TSC Act (ABS Undated). Two of these have been recorded within the Study Area. All reported fatalities of bats from wind

turbines, in Australia and overseas, have been microbats (ABS Undated). Where reliable data are available, the bat deaths reported range from 1.6 per turbine per year to over 90 bats per turbine per year (ABS Undated).

Within the Study Area, the microbat species most at risk of mortaility due to the effects of barotrauma are the Eastern Bentwing Bat and the Yellow-bellied Sheathtail Bat, both of which were positively identified from the field surveys. Both of these species are relatively high flying and prefer to forage above canopy height. Both of these species have high dispersion rates, with the Yellow bellied Sheathtail Bat having a migratory pattern moving from wintering ares in the north to summer habitat areas in the south. The Eastern Bentwing has been recorded to forage up to 25 km from a roost site.

6.2.4 Alienation of habitat

The alienation of habitat involves changes in behaviour of species. Species may respond to the introduction of wind turbine infrastructure by avoiding breeding or foraging resources and habitat utilisation such as avoidance of areas where turbines are located due to the unfamiliar object being perceived as a potential threat.

Careful planning to avoid the placement of turbine clusters in or near areas of high habitat values will minimise the risk of the alienation of habitat to key threatened woodland species such as the Brown Treecreeper, and Scarlet Robin. The potential impacts to the Superb Parrot are not yet known and hard to predict as this species' movement patterns and use of the Study Area are not fully understood.

6.3 AVOIDANCE OF IMPACTS

When first announced in February 2011 the Project consisted of up to 200 wind turbines and ancillary structures spread over 30 different properties. The 330 kV overhead transmission line 5 km north of Yass was being considered as the power export connection point. The Project therefore extended over a much larger area, from Boorowa to just north of Yass during the initial design phase. Information regarding biodiversity and other factors has been considered during the design process and has resulted in a significant reduction in the extent of the wind farm and a re-design of the wind turbine layout to arrive at the two configurations presented in this report.

The initial Project design took into account broad scale ecological features, with WTGs and associated infrastructure generally sited to avoid areas of remnant woodland vegetation and riparian areas. The ecological surveys have informed micro-siting of turbines and infrastructure to take into account site-specific environmental issues and minimise on-ground ecological impacts. Factors considered include:

- areas of native vegetation, particularly those that are in good condition and / or meet the description of an EEC or CEEC;
- habitat features for native fauna, including hollow bearing trees, exposed rock and native tussock grassland; and
- wildlife corridors.

This approach resulted in the removal of WTGs and project-related infrastructure at several locations across the PAA. The key adjustments made specifically to account for biodiversity values are outlined in *Table 6.2*.

Table 6.2 Avoidance measures adopted into the Project Design

Project Feature	Original Location	Adjusted Location	Reason
Main access road to the Kangiara Cluster	Tangmangaroo Road, starting at the intersection with the Lachlan Valley Way and continuing to the intersection with Harrys Creek Rd	Removed. Access is now proposed directly off the Lachlan Valley Way.	To avoid removal or modification of intact roadside stands of Box-Gum Woodland along Tangmangaroo Road. The stands provide habitat for threatened species, including the Squirrel Glider, which was recorded in this area.
Substations	Within Box Gum Woodland DNG in the Kangiara Cluster	Moved to nearby grassland with a lower percent coverage of native species	To avoid removal of Box Gum Woodland DNG and potential GSM habitat.
Six WTGs and associated access tracks	Within the Environmental Stewardship Block on 'Glanmire'	Removed	To avoid removal or modification of an area of Box Gum Woodland that is being managed under the Environmental Stewardship Program.
One WTG	Adjacent to a stand of Box-Gum Woodland in the Kangiara Cluster	Removed	To avoid areas adjacent to Box Gum Woodland that have a high potential of being within the flight path of the Superb Parrot.
Turbines and access tracks	Within a remnant of Red Stringybark Open Forest in the Mt Buffalo cluster	Moved to the edge of remnant woodland and nearby grassland	To avoid removal and fragmentation of remnant native woodland.

6.4 MITIGATION MEASURES

This section describes the mitigation measures which are proposed in order to minimise the impacts of the Project on ecology as a result of construction and operation of the Project. The mitigation measures are defined separately for the construction phase and the operational phases of the Project. There is some overlap in these mitigation measures.

6.4.1 *Construction Phase*

Measures to reduce general impacts to ecological features associated with construction activities have been considered during the ecological assessment in order to avoid and minimise impacts to biodiversity wherever feasuible. Management of construction related impacts will be facilitated through the development and implementation of a Construction Environmental Management Plan (CEMP), outlining the roles and responsibilities of parties in implementing the mitigation actions. General mitigation measures to address envirommental issues during the Project construction phase are presented within the relevant sections of the EA. This section describes the mitigation measures which are specific to biodiversity values of the Study Area.

The proposed biodiversity mitigation measures for the construction phase of the Project are outlined in *Table 6.3*.

6.4.2 *Operational Phase*

Management of impacts to ecological features associated with the operational phase will be facilitated through the development and implementation of an Operational Environmental Management Plan (OEMP). General mitigation measures to address envirommental issues during the Project operational phase are presented within the relevant sections of the EA. This section describes the mitigation measures which are specific to biodiversity values of the Study Area for operation only.

The proposed biodiversity mitigation measures for the operational phase of the Project are outlined in *Table 6.4*.

Table 6.3 Proposed Mitigation Measures – Construction Phase

Issue	Description	Approach	Management Actions	Responsible Party
Weeds	The spread of weeds is a high risk with any large scale development that extends over a large geographic area.	Minimise spread	Stringent weed management measures will be defined within the CEMP and will be implemented during construction to prevent and managed weed invasion. Management measures will include (but not be limited to): • where a specific weed risk has been identified, all machinery, equipment and vehicles are to be washed down before entry and egress of the Project site; • piling of soil that may contain seeds of exotic species at least 50 m away from creeks, drainage lines and other areas of native vegetation, to prevent spread into adjacent areas during rainfall or wind events; • topsoil recovery will be undertaken in areas that have a high proportion of native vegetation and few weeds in the ground layer of vegetation; • all construction staff and sub-contractors educated on noxious weeds present at the Project site and ways to prevent spread; • where practical, topsoil that is limited in weeds to be harvested to salvage the native soil seed bank and reintroduced into disturbed areas. Otherwise, revegetate with locally native endemic species characteristic of the cleared vegetation type; • control of perennial weed grasses within the disturbance zone for 3 to 5 years after construction; • where practical, and in consultation with host landowners, manage stock access during periods of revegetation; and • imported soil and rubble to be certified as free of weeds and weed seeds.	Proponent in consultation with ecologist and associated landowners

Issue	Description	Approach	Management Actions	Responsible Party
Loss of biodiversity	Biodiversity loss is anticipated as a direct result of clearance for construction activities.	Minimise Impact	Development of a CEMP that will ensure vegetation clearing is minimised as far as practical during construction. This will be aimed to minimise impacts to threatened species known or predicted to occur within the Study Area. Management measures will include: • all site staff are to be inducted on the procedures of the CEMP in relation to flora and fauna; • the area to be cleared at the site will be clearly demarcated using flagging or fencing, and mapped on construction plans, to prevent breaches of the construction boundary; • laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of native vegetation and habitat; • vehicles will remain on formed roads or tracks designed specifically for the purposes of the wind farm construction where possible; • care will to be taken when working near wooded areas to prevent damage to adjacent tree roots and indirect impact to habitat areas; • trenches will be excavated at least 15 m away from the base of trees where possible to prevent root damage; • where practical, suitable fencing to be erected along trenches to prevent fauna falling in; • habitat features such as logs, large rocks and fallen hollows within the proposed clearance footprint will be relocated to adjacent areas to supplement habitat where possible; • any individual hollows removed will be replaced with artificial hollows within adajacent suitable habitat. • pre-clearance protocol to be designed to identify how hollow-bearing fauna will be surveyed for and managed during clearing;	Proponent in consultation with ecologist, OEH and DSEWPC

Issue	Description	Approach	Management Actions	Responsible Party
			• Environmental Compliance Manager or field officer qualified in the handling of fauna to be present on-site during clearing to capture and re-release fauna (where appropriate); • regular checking of trenches by the Environmental Compliance Manager to ensure any captured fauna are released according to the CEMP *(Note: this will not be carried out during the operation phase)*; • pre-clearance surveys undertaken to determine if roosts, nests or dens are present in any trees proposed for clearing; • native vegetation that is removed will be chipped and mulched for on-site use where practical; • where practical, native vegetation greater than 3 m in height to be retained during transmission line construction; and • rehabilitation of internal access roads that are not required following construction to be undertaken.	
Loss of biodiversity	In order to account for the residual impacts of the Project which can not be avoided or minimised, offsets are proposed.	Offset impacts	An appropriate offset package will be secured within 12 months of commencing construction to compensate for the loss of habitat within the Study Area as outlined within the EA. Final calculation of the offset area will be carried out during the pre-construction phase once turbine selection has taken place and the final Development Footprint is confirmed.	Proponent in consultation with ecologist, OEH, SEWPaC and associated land owners
Habitat Loss – Golden Sun Moth	Based on the infrastructure layout, which is considered to be a worst case scenario in terms of extent, 82.48 ha of GSM habitat will be removed (with an additional 18.4 ha disturbed and rehabilitated after construction).	Minimise impact	The CEMP will include specific measures to adress loss of habitat for Golden Sun Moth. Management will include measures such as:	Proponent in consultation with ecologist, OEH and DSEWPC

Issue	Description	Approach	Management Actions	Responsible Party
			• movement through and disturbance to mapped GSM habitat will be minimised during the flying period, from November to January, if possible; • areas of habitat will be delineated by barrier tape (or similar) to clearly demarcate these areas and limit risk of vehicles traversing through habitat accidently; and • all vehicle movements will be contained to roads and tracks where possible.	
Habitat Loss – Box-Gum Woodland	Based on the infrastructure layout, which is considered to be a worst case scenario in terms of extent, 0.26 ha of Box-Gum Grassy Woodland (which meets the description of the EEC and CEEC) will be removed.	Minimise and manage impacts	The CEMP will include specific measures to address loss of habitat for Box-Gum Grassy Woodland and Derived Native Grassland. Management will include measures such as: • impacts will be minimised by siting the transmission lines and easements in areas that are already cleared for existing driveways and access gates where possible; • where hollow bearing trees are removed the material will be placed in adjacent habitat; • any hollows removed should be replaced with artificial hollows within adajacent suitable habitat; • clearing will be restricted to the canopy and mid-storey; and • remaining Box-Gum Grassy Woodland areas (including areas of DNG) will be delineated by barrier tape (or similar) to clearly demarcate these areas and limit the risk of vehicles or machinery causing damage to these areas.	Proponent in consultation with ecologist, OEH and DSEWPC

Issue	Description	Approach	Management Actions	Responsible Party
Fauna Mortality	Vegetation clearance and vehicle activity have the potential to cause mortality of fauna.	Pre-clearance protocol	The CEMP will define the pre-clearance protocol involving nocturnal surveys to evaluate the presence of any fauna within identified hollow bearing trees. When identified a qualified ecologist experienced in tree clearance should be present when hollow bearing trees are being removed to mitigate any impacts to fauna. Fencing will be erected along open trenches to prevent fauna falling into open cavities. Trench monitoring will be undertaken to rescue trapped fauna and the frequency and details of monitoring will be outlined in the CEMP. The CEMP will define management measures to reduce fauna mortality on roads and access tracks including speed limits and appropriate signage.	Proponent in consultation with ecologist, OEH and DSEWPC
Erosion, Runoff and Dust	The Project has the potential to influence erosion, runoff and dust within the Study Area. A range of mitigation measures are proposed to manage these impacts.	Manage impacts	Erosion and sediment control measures will be included in the CEMP to limit runoff to adjacent habitat areas and watercourses. Details will include devices to be installed, monitoring requirements and corrective actions. Management measures will include: • all erosion and sedimentation control devices regularly checked, cleared and repaired, particularly after periods of heavy rainfall; • rehabilitation and stabilisation methods to limit erosive and dust generation potential of earth areas exposed that are not required for permanent infrastructure; • disturbed soil surfaces should be stabilised as soon as practical after works have ceased in the area; • stockpiles will be covered to prevent the loss of material during high wind and rain events, and appropriate sediment barrier fencing will be used in areas to inhibit the flow of sediment into surrounding areas; and • stock pile locations will consider shelter from the wind where practical.	Proponent in consultation with erosion and sediment specialist

Issue	Description	Approach	Management Actions	Responsible Party
Hazardous Materials	Hazardous materials such as oils will be used during the construction and operational phases of the proposed action.	Prevent spills and manage risk	Storage of hazardous materials will be in designated areas specifically designed and constructed for containment. Emergency spill response procedures, including the location of spill kits, will be outlined in the project CEMP. Hazardous materials will be handled and stored according to regulatory requirements and Australian Standards AS1940.	Proponent in consultation with OEH / EPA

Table 6.4 Proposed Mitigation Measures – Operational Phase

Issue	Description	Approach	Management Actions	Responsible Party
Turbine Collisions or Barotrauma	Turbine collisions and barotrauma have been identified as a potential ongoing impact during the operation of the wind farm. A bird and bat monitoring program is proposed to manage this impact.	Bird and Bat Monitoring	A specific Bird and Bat Monitoring Plan will be developed with the objective of minimising the impacts of the operational wind farm on threatened bird species. The Bird and Bat Monitoring Plan will outline the required monitoring measures, key thresholds for determining permissible impacts and corrective actions that are required in order to achieve the objectives of the plan. The plan will also outline the roles and responsibilities for the proponent, operator and agencies in implementing, assessing and enforcing the plan. The plan will be developed in consultation with DSEWPC and OEH to ensure the plan meets the requirements of each agency. The frequency of report strike data will be determined during the preparation of the monitoring programme. The adaptive management measures that could be implemented should strike thresholds be reached, will be negotiated with OEH and SEWPaC when significant strike rates are detected. Bird and bat strike monitoring will be undertaken with consideration for the monitoring guidelines provided by the Australian Wind Energy Association (Brett Lane & Associates 2005).	Proponent in consultation with ecologist, OEH and DSEWPC
Hazardous Materials	Hazardous materials such as oils will be used during the construction and operational phases of the proposed action.	Prevent spills and manage risk	Storage of hazardous materials will be in designated areas specifically designed and constructed for containment. Emergency spill response procedures, including the location of spill kits, will be outlined in the project Operational Management Plan. Hazardous materials will be handled and stored according to regulatory requirements and Australian Standards AS1940.	Proponent in consultation with OEH / EPA

6.5 *RESIDUAL IMPACTS*

This section quantifies the direct residual impacts that are anticipated to occur as a result of the Project, following consideration of the avoidance and mitigation measures implemented for the Project. Indirect impacts which could not be quantified are discussed further in the Assessments of Significance (*Section 6.6*).

6.5.1 *Habitat Loss*

Vegetation clearance

Vegetation clearance will be required for the construction of the Project. Permanent vegetation relates to all areas associated with the permanent footprint of the Project including WTGs, access tracks, substations and overhead powerlines. Temporary impact relates to the area surrounding the permanent footprint which is required for construction. Mitigation measures will include revegetation, spreading mulched or cleared vegetation and spreading native grass seed with local species to enable the temporary impact area to return to a natural state.

The Development Footprint covers a total area of 251.18 ha. The Permanent Impact area covers 135.41 ha. The Temporary Impact area includes 115.77 ha that will be rehabilitated upon completion of construction.

Of the total Development Footprint, 122.48 ha comprises exotic pasture, cropping, planted vegetation or bare ground. The remaining 128.70 ha comprises native vegetation, as shown in *Table 6.3*. *Table 6.3* shows the breakdown of areas for both permanent and temporary impacts.

Table 6.5 Area of Each BVT in Development Footprint

BVT	Area in Study Area (ha)	Total Area in Development Footprint (ha)[1]	Permanent Impact Area (ha)	Temporary Impact Area (ha)
Box Gum Woodland - Mod_Good-EPBC	2.27	0.26	0.26	-
Box Gum Woodland - Mod_Good-TSC	65.27	3.08	2.57	0.51
Box Gum Woodland - Mod_Good-TSC-DNG	313.00	49.16	42.69	6.47
Box Gum Woodland - Low	469.57	48.94	38.11	10.83
Red Stringybark Open Forest - Mod_Good	99.24	5.28	3.75	1.53
Red Stringybark Open Forest - Low	238.72	21.98	17.39	4.59
Total	**1188.07**	**128.7**	**104.77**	**23.93**

1. The area of each BVT within the Development Footprint was calculated based on the area of Layout Option 1.

As shown in *Table 6.3,* vegetation removal will include 6.58 ha of woodland / open forest (comprising Box Gum Woodland - Mod_Good-EPBC, Box Gum Woodland - Mod_Good-TSC and Red Stringybark Open Forest - Mod_Good) and 49.16 ha of DNG. This includes 0.26 ha of Box-Gum Woodland that meets the description for the CEEC as listed under the EPBC Act and 45.52 ha of Box-Gum Woodland that meets the description for the EEC as listed under the TSC Act. The remaining area comprises Red Stringybark Open Forest. The remaining areas comprise native vegetation in low condition, ie the majority of the canopy has been removed and the groundcover comprises less than 50% native vegetation.

Vegetation removal results in a direct reduction in the extent of native vegetation types and flora and fauna habitat in the Study Area. The native vegetation in the Study Area is already highly fragmented; in particular Box-Gum Woodland comprises a highly cleared BVT, with an estimated 95% cleared in the Lachlan CMA (OEH 2012a). An estimated 25% of Red Stringybark Open Forest has been cleared in the Lachlan CMA (OEH 2012a).

In addition to the direct impact of removal of native vegetation, indirect impacts to adjacent and nearby native vegetation can result from vegetation removal. This includes the operation of edge effects, whereby a vegetation community's susceptibility to factors such as weed invasion and erosion are increased due to its increased exposure to surrounding disturbed environments. The vegetation community becomes less resilient and able to undergo natural regeneration.

As the Development Footprint comprises small and linear components spread over a large area, the effects of vegetation removal are minimal in comparison to large developments in small areas. The majority of the Project infrastructure has been sited to avoid areas of woodland and open forest, with the results of the ecological field surveys being considered throughout the iterative design process. This has resulted in avoidance of most areas of intact Box-Gum Woodland and habitat for threatened species. As such the connectivity of the Study Area to the surrounding Locality is unlikely to be impacted. The Study Area does not form part of a larger tract of woodland or open forest. The majority of vegetation to be removed comprises derived native grassland, exotic pasture or cropping, with only a small proportion of native woodland / open forest.

As the majority of vegetation to be removed is in a degraded condition, its removal would not impact on the viability of ecological communities or native flora species in the Study Area. It is unlikely to impact seed dispersal, animal movements or remove habitat features that are essential to species survival. The threatened species that are likely to be impacted by vegetation removal are discussed in *Section 6.4.*

A number of mitigation measures will be implemented during both the construction and operation phases to further reduce the impacts of the Project, as described in *Section 6.4.*

Fauna Habitats

The residual impacts on fauna habitats include the direct removal of habitat, fragmentation of habitats, and habitat becoming alienated for some species. Fauna habitat types recorded in the Study Area comprise of native woodlands, native grasslands, exotic grasslands and aquatic habitats. Within these habitat types, a variety of fauna habitat features exist, including hollow bearing trees, paddock trees, tussock grasslands, disused mines, farms dams, rocky outcrops and creek lines.

Approximately 313 ha of native grassland has been identified within the Study Area, this habitat type has the potential to provide habitat for threatened species such as the Striped Legless Lizard and the Pink-tailed Worm-lizard, where there are features such as rocky outcrops. Of the 313 ha identified within the Study Area, 49.16 ha has been recorded within the Development Footprint and of that, approximately 42.69 ha will be permanently removed for the placement of WTGs, construction of access tracks, substations and overhead powerlines. Approximately 6.47 ha of this habitat type will be reinstated after construction of the wind farm.

Approximately 166.78 ha of native woodland have been identified within the Study Area. This habitat type supports a range of threatened species such as woodland bird species, reptiles and mammal species. Key features recorded within this habitat type include hollow bearing trees and also rocky outcrops. Of the 166.78 ha of native woodland identified within the Study Area, 8.62 ha has been identified within the project footprint. Of the 8.62 ha within the project footprint approximately 6.58 ha will be permanently impacted upon for the placement of WTG's, crane pads access tracks and powerline easments. A further 2.04 ha will be reinstated following the finalization of the project.

Exotic grassland was the most commonly recorded habitat type with 708.29 ha being recorded throughout the Study Area. This habitat type was generally in poor condition as a result of past and current land management practices such as grazing. Important features within these areas are paddock trees which provide important breeding habitat for bird species such as the Superb Parrot and the Wedge-tailed Eagle. Other features restricted mainly to the slopes and ridges include rocky outcrops which provide some refuge for reptile species. Of the 708.29 ha identified within the Study Area a total of 70.92 ha has been recorded within the development footprint and of that 55.5 ha will be permanently impacted upon for the placement of WTG's, crane pads, accdess tracks, substations and construction compounds. Of the 55.5 ha 15.42 ha will be reinstated following construction of the wind farm.

Table 6.4 shows the breakdown of areas of habitat types that will be impacted permanently and temporarily.

Table 6.6 Fauna Habitats Impacted

Habitat type	Area in Study Area (ha)	Total Area in Development Footprint (ha)[1]	Permanent Impact Area (ha)	Temporary Impact Area (ha)
Native Grassland	313	49.16	42.69	6.47
Native woodland	166.78	8.62	6.58	2.04
Exotic Grassland	708.29	70.92	55.5	15.42
Total	1188.07	128.7	104.77	23.93

1. The area of each habitat type within the Development Footprint was calculated based on the area of Layout Option 1.

Approximately 449 hollow bearing trees that are predominately paddock trees have been mapped within 500 m of turbine infrastructure (see *Table 6.7*) as part of targeted Superb Parrot habitat mapping. Of the 449 trees recorded the project has the potential to impact upon 15 of those through the construction of access tracks, crane pads, construction compounds and powerline easements.

Careful planning taking the environmental values of the Study Area into consideration has resulted in the citing of the WTG's, access tracks, substation footprints and construction compounds to avoid woodland remnants and hollow bearing paddock trees where possible, that have the potential to provide shelter and or breeding habitat thus reducing the impacts of fragmentation of woodland. The potential loss of rocky habitats is generally associated with the construction pads on the upper slopes throughout the Study Area. Where possible, loss of rocky habitat will be avoided through inspection of areas at the final design stage.

Mitigation measures to minimise the impacts on fauna habitats include replacement of cleared habitat features such as rocks, hollows and timber into adjacent areas, retention of large hollow bearing trees, and replacement of hollows with artificial hollows with adjacent habitat and revegetation of impact area to return to a natural state. *Table 6.7* outlines the quantitative impacts to individual species and or species groups.

Table 6.7 Fauna Habitat Impacts

Species	Impact	Habitat Type	Total in Study Area (ha)	Total Impacted Area (ha)
Superb Parrot	Habitat removal	Box Gum Woodland Stringybark Woodland, Hollow Bearing Trees	166.78 – 449 (HBT)	6.58 - 15(HBT)
Powerful Owl, Barking Owl	Habitat removal	Box Gum Woodland, Red stringy bark open forest, Hollow Bearing Trees	166.78 - 449(HBT)	6.58 - 15(HBT)
Woodland Birds	Habitat removal	Box Gum Woodland, Red stringy bark open forest, Hollow Bearing Trees	166.78 – 449 (HBT)	6.58 – 15 (HBT)

Species	Impact	Habitat Type	Total in Study Area (ha)	Total Impacted Area (ha)
Regent Honeyeater, Swift Parrot	Habitat removal (Foraging only)	Box Gum Woodland, Red Stringybark Open Forest	166.78	6.58
Turquoise Parrot, Gang-gang Cockatoo	Habitat removal Hollow Bearing trees	Box Gum Woodland, Red Stringybark Open Forest	166.78 – 449 (HBT)	6.58 – 15 (HBT)
White-fronted Chat	Habitat removal	Natural Temperate Grassland and grassland derived from Box-Gum Woodland	313	42.69
Squirrel Glider	Habitat removal, Fragmentation	Box Gum Woodland, Hollow Bearing Trees	2.26	0.26
Koala	Habitat removal, Fragmentation	Box Gum Woodland, Red stringy bark open forest	166.78	6.58
Striped Legless Lizard	Habitat removal, disturbance	Open Box Gum Woodland, Native grassland	313	42.69
Pink-tailed Worm lizard	Habitat removal, disturbance	Open Box Gum Woodland, Native grassland.	313	42.69
Rosenbergs goanna	Habitat removal, disturbance	Woodland Habitats including Box Gum Woodland, Red Stringybark Open Forest.	166.78	6.58
Spotted Harrier Little Eagle Square-tail Kite	Habitat removal, Blade strike	Woodland Habitats including Box Gum Woodland, Red Stringybark Open Forest.	166.78	6.58
Golden Sun Moth	Habitat removal	DNG, Low condition Box Gum Woodland	782.57	98.1
Bats	Habitat removal, Blade Strike	Hollow Bearing Trees	166.78 - 449 (HBT)	6.58 – 15 (HBT)

HBT = Hollow Bearing tree

The proximity of infrastructure to key habitat features, such as hollow-bearing trees, rocky outcrops or water bodies would impact on fauna during construction. Fauna may also be impacted by disturbance during the operational phase of a wind farm. Noise, light flicker and vibration may have impacts during sensitive periods, such as the breeding season for some species, or lead to alienation of habitat. The extent of impact depends on turbine design, wind farm layout as well as ecological characteristics of particular species.

Wildlife Corridors

The wind turbies and infrastructure have been located to avoid the removal of large tracts of forest or woodland that would be associated with key wildlife corridors within the Study Area and Locality.

Overhead transmission line easements have the potential to impact on wildlife corridor connectivity by fragmeting tracts of forest or woodland. Potential fragmentation or isolation of these habitats has been largely avoided for the majority of the alignment by utilising cleared areas or existing easements wherever possible.

Aquatic Habitats

The majority of the creeklines and drainage areas throughout the Study Area are ephemeral in nature. Infrastructure such as access tracks have largely been sited to avoid waterways. Crossings of creeks and streams would affect riparian and aquatic habitats during the construction phase, and would result in stream bank and stream bed disturbance. Crossings that impede fish passage are a danger and can result in a major loss of breeding and foraging habitat by fragrementation.

Where creek crossings would be required for road construction and an existing crossing would be upgraded, the removal of riparian vegetation at creek crossings would be largely limited to road construction and upgrades of existing roads. Impacts to riparian and aquatic vegetation would be minimised by reducing disturbance of areas at creek crossings and siting of crossings to avoid mature and native riparian vegetation. Additionally, mitigation measures can be undertaken to address these risks. Best practice erosion and sediment controls would be implemented during creek works, including silt fencing and avoidance of works during rain or high flows. The selection of the type of crossing and construction methods would comply with relevant DI&I (Fisheries) guidelines, to ensure that potential impacts would be minimised. Instream habitat would be left in place or relocated nearby within the same creek system.

6.5.2 Collision Risk

The impact of collision risk on bird species has been quantified by carrying out a bird risk collision model. The model has been based on data recorded by the BUS surveys and this information forms stage one of the bird risk collision analysis.

RSA Height

RSA height refers to the area containing Rotor Swept Area (RSA), ie the area between the tips of the rotor blades of a WTG. For analysis of the data collected durng the BUS, a minimum height of the rotor blade above the ground of 20 m was adopted, with the highest point of the blade being up to

150 m. WPCWP indicated that 25 m would represent a worst case scenario and the final height is more likely to be greater than 30 m. The analysis presented in this report is therefore a conservative 'worst-case' approach.

Sixteen different bird species were observed flying at RSA height during the BUS surveys. A total of 85 individual birds were recorded flying at and above RSA height, which is 6.4% of the number of birds recorded (*Table 6.6*). The remaining 93.6% of birds recorded were flying below the RSA height. A species accumulation curve was created (*Figure 6.1*) for species recorded flying at and above RSA height. This illustrates a pronounced asymptote indicating that the surveys had reached a point where no more new species were being recorded flying at RSA height.

Figure 6.2 illustrates the abundance of birds recorded Flying at RSA height and at how many different sites they were recorded. The species which were most abundant flying at RSA height were the Sulphur Crested Cockatoo (29) Australian Raven (13) and Australian Magpie (8). The Wedge-tailed Eagle (*Aquila Audax*) was recorded at four different sites. This species was recorded across the Study Area and is not likely to be restricted to particular habitat types. Typically they were observed singly or in pairs. The majority of the other abundant species were recorded at only one or two sites, however were recorded in flocks.

Table 6.8 Bird Species Data

Data	Numbers	%
Birds at RSA	85	6.4
Birds Below RSA	1250	93.6
Birds Above RSA	0	0
Total	1335	

Figure 6.1 Species Accumulation Curves for Species Recorded at RSA Height

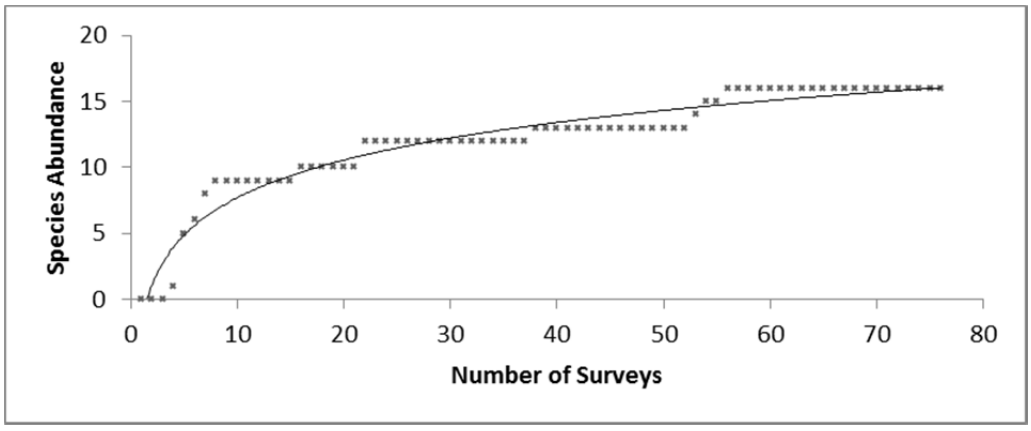
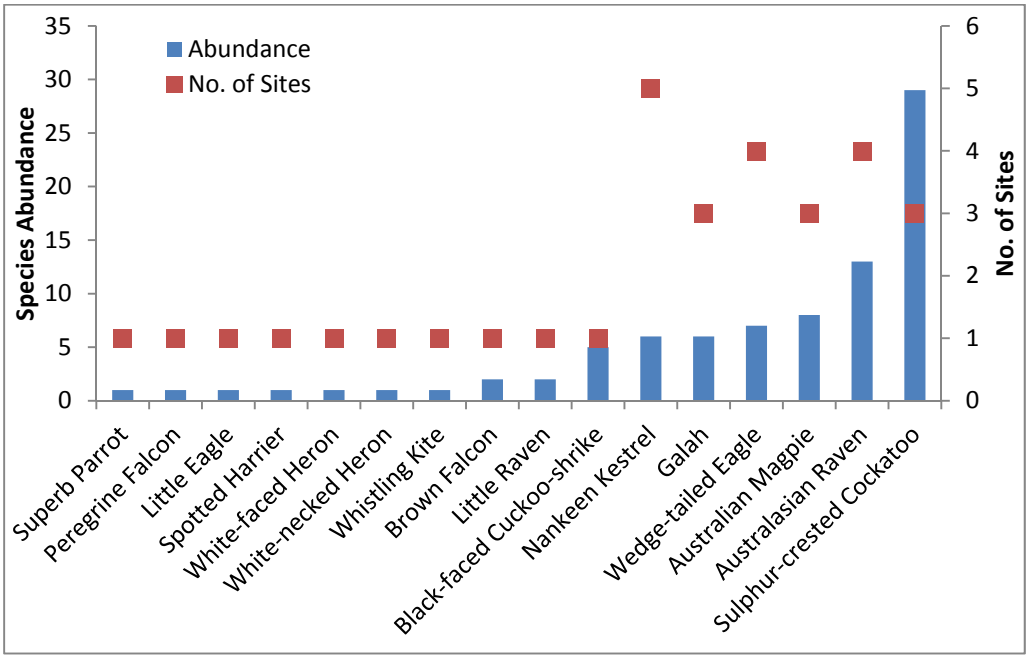


Figure 6.2 ***Abundance of Species Flying at RSA Height and the Frequency Species are Recorded at Each Site***



Threatened Species Recorded

A breakdown of the data collected for the threatened species recorded is shown in *Table 6.7*. This table illustrates that the most abundant threatened species recorded was the Superb Parrot (148) from a total of eight different BUS sites. One Superb Parrot was recorded at RSA height during the surveys which is 0.7 % of the total number recorded. *Table 6.7* also shows that 147 (99.3%) of the Superb Parrots recorded during the BUSs were flying below RSA height. A total of 164 individual threatened birds from six different species were recorded from 16 of the 20 survey sites. Three (1.8%) of the threatened species were recorded flying at RSA height. A total of 161 birds (98%) of those identified were recorded at below RSA height. Superb Parrots were typically observed moving to or from areas to forage. Foraging areas tended to be those used for cropping grain. After the month of January the Superb Parrot was rarely recorded within the Study Area. This coincided with the harvesting of grain and the end of the breeding season for the Superb Parrot.

Table 6.9 Threatened Species Data Analysis

Threatened species	Individuals recorded	Number of Sites	Individuals at RSA height	% at RSA height	Number of Sites recorded at RSA height	Individuals below RSA	% below RSA height	Number of Sites recorded below RSA height
Superb Parrot	148	8	1	0.7	1	147	99.3	8
Brown Treecreeper	2	1	0	0	0	2	100	1
Spotted Harrier	1	1	1	100	1	0	0	0
Diamond Firetail	1	1	0	0	0	1	100	1
Rainbow Bee-eater	11	4	0	0	0	11	100	4
Little Eagle	1	1	1	0	1	0	0	0
Total	164	16	3	1.8	3	161	98.2	14

Collision Risk Model

Collision risk was estimated for the threatened species recorded within the Study Area. This assessment was carried out on those threatened species identified flying at RSA height using data collected from the BUS. Some bird species were not included in the assessment because all individuals recorded during the BUS were below the RSA height during the surveys and thus the risk cannot be determined by the adopted calculations. The bird species assessed include the Superb Parrot, Spotted Harrier, Little Eagle and Wedge-tailed Eagle.

In this assessment the Collision Risk Model (CRM) developed for Scottish National Heritage is used to calculate the collision risk (see *Annex G* for detailed methodology adopted). CRM has been generally accepted to estimate bird collision risk in impact assessment of bird for various wind farm development projects. In addition, we have estimated the risk in two different situations. The first situation is that birds fly as if the wind turbine structures and rotors were not there and take no avoiding action (ie death). In reality most birds do take avoiding action and therefore the collision risk is usually adjusted by the avoidance factor. The avoidance rate accounts for the behaviour of birds avoiding collision with a WTG, and is a standard element in the calculation of collision risk (Smales 2005).

Two avoidance factors were used in the CRM for the Project. A conservative avoidance rate of 95% was applied as the baseline. A less conservative 99% avoidance rate was also applied, which is the avoidance factor which has been applied to numerous CRMs in Australia, including those developed for migratory parrot assessments for DSEWPC (i.e. Smales 2005).

The following presents the results of individual assessment for each species, followed by an overall assessment of the impact. The calculations of collisions are detailed in *Annex I. Table 6.8* below presents the summary results of the number of collisions predicted in each season for each species.

Table 6.10 Number of Bird Collisions Predicted (Number per Month) within the Study Area

Species	Number of Collisions per month at 95 % and 99 % avoidance rates							
	November		December		January		February	
Avoidance Factor	95 %	99 %	95 %	99 %	95 %	99 %	95 %	99 %
Superb Parrot	0.027	0.0055	0	0	0	0	0	0
Little Eagle	0.028	0.0057	0	0	0	0	0	0
Spotted Harrier	0	0	0.024	0.0048	0	0	0	0
Wedge-tailed Eagle	0.046	0.0092	0.012	0.0024	0.22	0.044	0.14	0.028

Superb Parrot

Within the Study Area the Superb Parrot were sighted in November and December only during the surveys and only one individual was recorded at RSA height during this time. The number of collisions predicted was 0.55 birds in November under no avoidance situation. After applying the 95% avoidance factor, the number of collisions predicted is 0.027, with the more realistic avoidance rate of 99 % this fell to 0.0055 birds for the month of November based on the data collected. The number predicted under the 99% avoidance rate is considered negligible when compared with the total number of individuals recorded during the surveys (~0.004% of 148 individuals). The impact of collision to this bird species is therefore not considered adverse.

Little Eagle

Within the Study Area the Little Eagle was sighted once in November during the surveys and was recorded at RSA height. The number of collisions predicted was 0.57 birds in November under no avoidance situation. After applying the 95% avoidance factor, the number of collisions predicted is 0.028, with the more realistic avoidance rate of 99 % this fell to 0.0057 birds for the month of November based on the data collected. The number predicted under the 99% avoidance rate is considered negligible when compared with the total number of individuals recorded during the surveys (~0.57% of 1 individual). The impact of collision to this bird species is therefore not considered adverse.

Spotted Harrier

Within the Study Area the Spotted Harrier was sighted once in November at RSA height. The number of collisions predicted was 0.48 birds in November under no avoidance situation. After applying the 95% avoidance factor, the number of collisions predicted is 0.024, with the more realistic avoidance rate of 99 % this fell to 0.0049 birds for the month of November based on the data collected. The number predicted under the 99% avoidance rate is considered negligible when compared with the total number of individuals recorded during the surveys (~0.49 % of 1 individual). The impact of collision to this bird species is therefore not considered adverse.

Wedge-tailed Eagle

Within the Study Area the Wedge-tailed Eagle was sighted in November, December, January and February at RSA height. The number of collisions predicted was 0.95 birds in November, 0.24 in December, 4.40 in January and 2.83 in February under no avoidance situation. After applying the 95% avoidance factor, the number of collisions predicted is 0.046 birds in November, 0.012 in December, 0.22 in January and 0.14 in February. With the more realistic avoidance rate of 99 % this fell to 0.0093 birds for the month of November, 0.0024 in December, and 0.044 in January and 0.028 in February based on the data collected. The number predicted under the 99% avoidance rate is considered negligible when compared with the total number of individuals recorded during the surveys (~0.28 % of 1 individual). The impact of collision to this bird species is therefore not considered adverse..

6.6 ASSESSMENT OF SIGNIFICANCE

This section provides and Assessment of Significance of threatened species and communities considered Known, Likely or potential to occur within the Study Area, as identified in the Likelihood of Occurrence Assessment in *Section 5.13*.

6.6.1 Threatened Species

A Likelihood of Occurrence Assessment was undertaken which grouped threatened ecological communities and threatened species into four likelihood categories, as outlined in *Section 5.10*.

The species listed in *Table 6.9* were classified as known within the Study Area, as likely to occur within the Study Area or with the potential to occur within the Study Area. Assessments of Significance under Section 5A of the EP&A Act (seven part tests) were undertaken for these species.

Table 6.11 Threatened Species Assessed under the TSC Act

Scientific Name	Common Name	TSC Act	EPBC Act
EECs			
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	EEC	CEEC
Flora			
Ammobium craspedioides	Yass Daisy	V	V
Caladenia concolor	Crimson Spider Orchid	E	E
Diuris aequalis	Doubletail Buttercup	E	V
Eucalyptus robertsonii subsp. Hemisphaerica	Robertson's Gum	V	V
Lepidium hyssopifolium	Aromatic Peppercress	E	E
Leucochrysum albicans var. tricolor	Hoary Sunray	-	E
Prasophyllum petilum	Tarengo Leek Orchid	E	E

Scientific Name	Common Name	TSC Act	EPBC Act
Rutidosis leptorrhynchoides	Button Wrinklewort	E	E
Swainsona recta	Mountain Swainson Pea	E	E
Swainsona sericea	Silky Swainson-pea	E	-
Invertebrates			
Synemon plana	Golden Sun Moth	E	CE
Reptiles			
Aprasia parapulchella	Pink-tailed Worm-lizard	V	V
Delma impar	Striped Legless Lizard	V	V
Varanus rosenbergi	Rosenberg's Goanna	V	-
Birds			
Anthochaera phrygia	Regent Honeyeater	CE	E
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-
Circus assimilis	Spotted Harrier	V	-
Chthonicola sagittatus	Speckled Warbler	V	-
Climacteris picumnus victoriae	Brown Treecreeper - eastern subspecies	V	-
Daphoenositta chrysoptera	Varied Sittella	V	-
Epthianura albifrons	White-fronted Chat	V	-
Glossopsitta pusilla	Little Lorikeet	V	-
Grantiella picta	Painted Honeyeater	V	-
Hieraaetus morphnoides	Little Eagle	V	-
Lathamus discolour	Swift Parrot	E	E
Lophoictinia isura	Square-tailed Kite	V	-
Melanodryas cucullata cucullata	Hooded Robin - south-eastern form	V	-
Melithreptus gularis gularis	Black-chinned Honeyeater - eastern subspecies	V	-
Neophema pulchella	Turquoise Parrot	V	-
Ninox connivens	Barking Owl	V	-
Ninox strenua	Powerful Owl	V	-
Petroica boodang	Scarlet Robin	V	-
Petroica phoenicea	Flame Robin	V	-
Polytelis swainsonii	Superb Parrot	V	V
Pomatostomus temporalis temporalis	Grey-crowned Babbler - eastern subspecies	V	-
Stagonopleura guttata	Diamond Firetail	V	-
Mammals			
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-
Petaurus norfolcensis	Squirrel Glider	V	-
Phascolarctos cinereus	Koala	V	V
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-

CE = Critically Endangered, CEEC = Critically Endangered Ecological Community, E = Endangered, V = Vulnerable

Assessments of Significance were undertaken for one EEC and 39 threatened species including:

- ten threatened plants;
- one threatened moth;
- three threatened reptiles;

- twenty one birds; and
- four mammals (including two bats).

The Project will result in direct and indirect impacts to all the threatened species and the EEC due to direct clearing of vegetation, removal and modification of habitat, the risk of collision with rotors and barotrauma. However, as a result of the application of avoidance and mitigation measures, the Project is unlikely to result in a significant impact to any of the species or the EEC. A summary of the results of the seven part tests for each species or group of species is provided below.

Box-Gum Woodland

Box-Gum Woodland occurs throughout the Study Area in varying conditions. The Project will involve clearing of a small area of intact woodland and larger areas of DNG. This will reduce the extent of the EEC, however, as the majority of the intact Box-Gum Woodland will be retained in the Study Area, the Project is unlikely to have a significant impact on the EEC.

Plants

The threatened plants were not recorded in the Study Area during field surveys, however, potential habitat for all ten threatened plants occurs. Areas of potential habitat will be removed or modified as part of the Project, the majority of which comprises grassland habitat. Areas of similar habitat occur throughout the Study Area and Locality and the removal of this habitat is unlikely to significantly impact these species. As the Development Footprint is narrow and linear, it is unlikely to affect fragmentation, seed dispersal and vegetative reproduction to the extent that it will significantly impact these species, should they occur in the Development Footprint.

Golden Sun Moth

This species was recorded during field surveys in native grassland areas throughout the Study Area. The proposal would result in the removal of habitat and also result in the fragmentation of existing habitat. To mitigate these impacts a Flora and Fauna Management Plan would be implemented outlining measures to minimise disturbance to mapped GSM habitat, to conduct works outside of the flying period and delineating habitat by barrier tape to limit the risk of vehicles traversing through habitat accidently. The preservation of key sites would further mitigate any impacts to this species. With the mitigation measures implemented it is unlikely that the proposal would result in a significant impact on the Golden Sun Moth.

Lizards

None of these species were recorded during field surveys, however, the Study Area may provide potential habitat for these species. Potential impacts to these reptiles include removal of habitat. A portion of woodland habitat that is preferred habitat for Rosenberg's Goanna would be removed as part of the project. This is unlikely to increases the levels of fragmentation within the Study Area as it is already highly fragmented. The project has avoided impacts on large tracts of woodland by the relocation of turbines and infrastructure to minimise impacts on woodland and associated grasslands. Furthermore, the demarcation of key habitat areas for the Striped Legless Lizard and Pink-tailed Worm-lizard would ensure these habitats be preserved and improved. Through the implementation of mitigation measures to avoid disturbance to areas of key habitat for these species, it is unlikely that the Project would have a significant impact on these species.

Woodland Birds

The proposal would not significantly impact on the Brown Treecreeper, Diamond Firetail, Varied Sittella Flame Robin, Scarlet Robin, Grey-crowned Babbler, Speckled Warbler or Hooded Robin. Habitat loss for these species would constitute removal of a small amount of woodland and forest. Hollow-bearing trees and fallen timber would be retained where possible to mitigate impacts. Furthermore, habitat loss would be offset by preserving and improving large areas of woodland that are in moderate to good condition.

Swift Parrot and Regent Honeyeater

The Project is unlikely to have a significant impact on the Regent Honeyeater or the Swift Parrot. The project would result in the removal of a small portion of the total habitat available to these species. The resources available within the Study Area would be regarded as sub optimal and this is shown by the lack of records of these species within the Locality. The Study Area does not represent an area of optimal breeding habitat for either of these species as both of these species have well known breeding areas. The presence of either of these species within the Study Area would be regarded as a stopover and would generally be in small numbers. Therefore the collision risk with a turbine rotor to these species would be considered very low.

Little Lorikeet and Black-chinned Honeyeater

The proposal would not significantly impact on the Little Lorikeet or Black-chinned Honeyeater. Habitat loss for these species would constitute removal of a small amount of woodland and forest. Hollow-bearing trees and fallen timber would be retained where possible to mitigate impacts. As these species are very mobile, the impact of habitat fragmentation would not significantly impact these species. Furthermore, habitat loss would be offset by preserving and improving large areas of woodland that are in moderate to good condition.

Turquoise Parrot and Gang-gang Cockatoo

The proposal would not significantly impact on the Turquoise Parrot or Gang-gang Cockatoo. Habitat loss for these species would constitute removal of a small amount of woodland and forest. Hollow-bearing trees and fallen timber would be retained where possible to mitigate impacts. The Study Area does not constitute as known breeding habitat for either of these species and as such no known breeding habitat would be removed or modified. These species both have foraging habitats that rely on terrestrial resources. As these species move from resource to resource they are unlikely to fly at RSA height and would therefore be at little risk of collision with a wind turbine. Both of these species are very mobile thus the impact of habitat fragmentation would not significantly impact these species. Furthermore, habitat loss would be offset by preserving and improving large areas of woodland that are in moderate to good condition.

White-fronted Chat

The Project is unlikely to have a significant impact on the White-fronted Chat. The Project would involve the removal of a small amount of habitat that is available to the White-fronted Chat within the Study Area. To offset potential impacts to this species mitigation measures will be adopted to minimise the impacts of vegetation removal. Habitat loss would be offset by preserving and improving large areas of woodland that are in moderate to good condition.

Superb Parrot

The Project would result in the removal of a small portion of foraging and breeding habitat for this species. Field surveys recorded this species throughout the Study Area, thus showing that the resources within the Study Area are important for the survival of this species. This species was recorded once flying at RSA height during the BUS which took place over the species breeding season. The Superb Parrot was observed mostly flying at below RSA height, thus is generally unlikely to be at risk of a collision with a turbine. Habitat removal would be very minor in comparison to the resources available to these species. The Project would impact on potential breeding habitat, however, it would be generally regarded to be below a threshold which would be considered as a significant impact. It is concluded that the Project would not result in a significant impact to the Superb Parrot, however, this species is considered to be a local key species and would be monitored as part of a bird and bat monitoring program.

Raptors

Whilst the Project would reduce vegetated habitat for nesting by 8.62 ha for these three raptors, much of the vegetation on the steep slopes and paddock trees throughout the site would be retained. Potential Little Eagle nesting habitat on the higher slopes is unlikely to be impacted as much of the taller trees in these locations would be retained. The Spotted Harrier is unlikely to be impacted by turbine collision as they generally fly below RSA height. The Square-tailed Kite and Little Eagle could be impacted by collision as they both forage in the sweep zone however, as raptors are known to avoid turbines, it is likely that mortality rates would be minimal. The Project would not significantly impact on the Square-tailed Kite or Spotted Harrier. It is unlikely that the Project would significantly impact on the Little Eagle, however, this species is considered to be a key species and would be monitored as part of the bird and bat monitoring program.

Owls

The Project would not significantly impact on the Powerful Owl or the Barking Owl provided mitigation measures are implemented. Habitat loss for these species is largely through loss of hollow-bearing trees and stags as breeding resources. Hollow-bearing trees and stags would be retained where possible to mitigate impacts. The Project has been designed to avoid large tracts of remnant habitat. Furthermore, habitat loss would be offset by preserving and improving these large areas of woodland.

Bats

Whilst the proposal would reduce potential roosting habitat for the Yellow Bellied Sheathtail bat and foraging habitat for both of these bat species, the loss of habitat would be very small incomparison to the resources available in the greater Study Area. The Yellow-bellied Sheathtail Bat and Eastern Bentwing Bat could be impacted by turbine collision/barotrauma as they fly in the sweep zone. The Yellow-bellied Sheathtail Bat is likely to occur in low numbers and therefore unlikely to be impacted at a population level. Potential impacts to this species are not likely to be significant. Impacts to the Eastern Bentwing Bat would also be minor as this species was only recorded at two sites and not in great numbers. There is also no evidence to suggest this species utilises the site heavily for foraging from a known nearby maternity cave. It is therefore unlikely that the proposal would significantly impact on the Eastern Bentwing Bat, however, this species is considered to be a key species and would be monitored as part of the bird and bat monitoring program.

Koala

The Project would result in the removal of a small portion of sub optimal habitat for the Koala. A small portion of this sub optimal habitat would be fragmented to make way for infrastructure. The Koala is a very mobile species and readily takes to the ground to move through the landscape. The clearance of a small amount of sub optimal habitat is unlikely to fragment existing habitat or isolate an existing population of this species within the Study Area. Furthermore the adoption of mitigation measures to retain large tracts of woodland would further reduce any impacts to this species. The Project is unlikely to significantly impact on the Koala.

Squirrel Glider

The Squirrel Glider was recorded during the field surveys. The greatest impact to this species would be habitat fragmentation. The hollow bearing trees to be removed would not constitute optimal breeding habitat for this species thus would be unlikely to significantly impact on the lifecycle of this species. The removal of a portion of habitat within the road corridor may increase the level of habitat fragmentation on this species by impeding movement through the road corridor. If mitigation measures such as the retention of as many large trees as possible, and the replacement of hollows with artificial hollows within adjacent habitat in the area of impact are implemented, it is unlikely that the proposal would have a significant impact on the Squirrel Glider.

6.6.2 Key Threatening Processes

Key threatening processes (KTP) are processes that threaten, or could threaten, the survival or evolutionary development of species, populations or ecological communities. KTPs adversely affect two or more threatened species, populations or ecological communities, or cause species, populations or ecological communities that are not currently threatened to become threatened (OEH 2011). KTPs are listed under Schedule 3 of the TSC Act. The Project will result in the operation of the following KTPs:

- Clearing of native vegetation; and
- Removal of hollow bearing trees.

The impacts of this as they relate to threatened species and ecological communities in the Study Area are discussed in the Assessments of Significance provided in *Annex F.*

6.7 *CUMULATIVE IMPACTS*

Cumulative impacts refer to the impacts that accumulate over time as a result of successive projects in the same area. Consideration of cumulative impacts assesses the impacts of the Project in the context of all the existing and future projects in the area. There are no existing wind farms in the vicinity of the Study Area, however, one has been approved and three are proposed in the vicinity of the Bango Wind Farm including:

- Rugby Wind Farm (proposed, 52 WTGs, the nearest turbine will be approximately 10.6 km to the north east of the Project);
- Rye Park Wind Farm (proposed, >100 WTGs, the nearest turbine will be approximately 6.8 km to the east of the Project);
- Conroys Gap Wind Farm (approved, 15 WTGs, the nearest turbine will be approximately 22 km to the south of the Project); and
- Yass (proposed, up to 152 WTGs, the nearest turbine will be approximately 17.8 km to the south of the Project).

These Wind Farms and the Bango Wind Farm occur within a key breeding area for the Superb Parrot (Birdlife International 2013)

Cumulative impacts associated with multiple wind farms include on ground impacts, such as clearing of vegetation and habitat, and impacts to the airspace used by birds and bats.

Apple Box – Yellow Box Grassy Woodlands and other associated grassy woodlands that meet the description of the listed Box Gum Woodland and derived native grassland EEC and CEEC occur throughout the region. All these vegetation types are highly cleared vegetation types in the Lachlan CMA. The cumulative impact of clearing of these vegetation types would result in further reduction and possible fragmentation of the EEC and CEEC. However, the extensive clearing that has been undertaken in the area for agricultural purposes allows the majority of WTGs and other infrastructure to be sited in areas that do not comprise intact Box Gum Woodland or intact vegetation types. This principle of avoidance has been applied as much as possible to this Project. Furthermore, offsets will include Apple Box – Yellow Box Grassy Woodland, thus resulting in protecting areas of this vegetation type in perpetuity.

The Wedge-tailed Eagle is not listed under the TSC Act or the EPBC Act, but is considered to be a species that is particularly susceptible to the impacts of wind farms in NSW (Alison Treweek, OEH, pers. comm). Potential impacts to the Wedge-tailed Eagle include loss of breeding habitat in the form of large trees being removed, and death or injury from rotor collisions. The Wedge-tailed Eagle was recorded seven times at four locations during the BUS in the Study Area. Rotor collisions are a potential risk for this species, and evidence

certainly indicates that mortality occurs at operational wind farms in NSW. This species was the fourth most common species recorded flying at RSA height within the Study Area and is therefore susceptible to the impacts of rotor strike, which may cause mortalities and affect individuals within the Study Area.

A study completed on the Tasmanian Wedge-tailed Eagle (*Aquila audax fleayi*), modelled cumulative impacts of seven wind farms on the Tasmanian Wedge-tailed Eagle across the species' range (Smales et al 2005). The study concluded that the *cumulative impacts of collision with turbines on the overall population of Tasmanian Wedge-tailed Eagles…for current and presently proposed wind farms within the species' range, are very small and it is thus highly likely that their effects would be masked by normal fluctuations in the population due to natural environmental variables* (Smales et al 2005). It is therefore postulated that significant cumulative impacts on the common non-threatened mainland form of the Wedge-tailed Eagle could occur, but evidence indicates that it is unlikely, particularly given the species' abundance throughout NSW.

The operation of a number of wind farms in the area is likely to increase the chance of blade strike for birds and bats and has the potential to increase habitat alienation. The proposed layout has incorporated consideration of areas that are ecologically sensitive and avoid potential migration paths of native species. Turbine clusters have been sited to avoid occurring in or near areas of high habitat values.

6.8 OFFSET MEASURES

The residual impacts of the Project have been analysed using the BioBanking Credit Calculator, in order to determine the size and nature of an appropriate offset, in accordance with the BioBanking Regulation. The BioBanking Assessment is summarised below, with the full assessment including Credit Report provided in *Annex H*.

6.8.1 BioBanking Assessment Methodology

A BioBanking Assessment of the Project was undertaken by Accredited BioBanking Assessor Evelyn Craigie, following the BBAM, in accordance with the methods described in *Chapter 4.5*.

The relevant BioBanking Assessment details are provided in *Table 6.10*.

Table 6.12 BioBanking Assessment Details

Component	Data
Proposal ID	0089/2012/0333D
Assessor Name/Accreditation Number	Evelyn Craigie/0089
Assessment Type	Development
Catchment	Lachlan
Sub-catchment	Upper Slopes
Mitchell Landscape	Boorowa Volcanics

Assessment Circles

Initially eighteen x 1000 ha and 100 ha assessment circles were used to cover the entire Development Footprint. The percent native vegetation cover was estimated in each of the eighteen 1000 ha and 100 ha circles into one of three categories: <10%, 11-30% and 31-70% (none of the assessment circles had a percent native vegetation cover of > 70%). The circles and their vegetation zones (and associated Threatened Species Subzones) within the circles in each of the three categories were amalgamated.

Vegetation Zones

Vegetation zones are relatively homogenous areas of the same vegetation type and similar condition. Each vegetation zone should be a distinct vegetation type (according to the Vegetation Types Database) and similar broad condition state, i.e. moderate / good or low (DECC 2009). There are six vegetation zones across the site, as shown in *Table 6.11*.

Table 6.13 Vegetation Zones

BVT Code	Vegetation Zone	Equivalent Endangered Ecological Community (listed under the TSC Act)
LA103	Box Gum Woodland - Mod_Good-EPBC	White Box Yellow Box Blakely's Red Gum Woodland
LA103	Box Gum Woodland - Mod_Good-TSC	White Box Yellow Box Blakely's Red Gum Woodland
LA103	Box Gum Woodland - Mod_Good-TSC-DNG	White Box Yellow Box Blakely's Red Gum Woodland
LA103	Box Gum Woodland - Low	-
LA182	Red Stringybark Open Forest - Mod_Good	-
LA182	Red Stringybark Open Forest - Low	-

The Development Footprint area is based on the permanent Development Footprint and does not include areas of temporary disturbance.

6.8.2 *Biobanking Credit Requirements*

The BioBanking credit calculator provides a credit report showing the ecosystem and species credits required to offset the development. In summary, the proposal requires 1827 ecosystem credits and 2240 species credits. This output should be read in conjunction with the BioBanking assessment report included as *Annex* H.

The BioBanking Credit Converter was used to convert the Ecosystem Credit and Species Credit requirements into an equivalent amount of hectares required for the offset. The Ecosystem Credit and equivalent number of hectares required for the offset is shown in *Table 6.14*. The Species Credit and equivalent hectare requirements are shown in *Table 6.15*.

Table 6.14 Ecosystem Credit requirements and their equivalent in hectares

BVT Code	BVT name	Area in Study Area (ha)	Area in Development Footprint (ha)	Required Credits	Equivalent Hectares required
LA103	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	850.11	83.63	1428	153.5
LA182	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion	337.96	21.14	399	42.9

1. Data is based on the Credit Report provided in Annex H and the BioBanking Credit Converter

Table 6.15 Species Credit requirements and their equivalent in hectares

Species Name	Common Name	TSC Act Status	Extent of impact	Tg* value	Number of credits required	Equivalent hectares required
Hieraaetus morphnoides	Little Eagle	V	6.58	0.74	89	15
Circus assimilis	Spotted Harrier	V	6.58	0.74	89	15
Synemon plana	Golden Sun Moth	E	82.48	0.40	2062	344

*1. *Tg value relates to the species' response to environmental gain, as defined in the BioBanking Credit Calculator.*

6.8.3 *Offset Site Investigations*

The results of the BioBanking Assessment have informed preliminary offset site investigations. The credit requirement for each BVT was converted to hectares, using the credit to hectare converter developed by OEH, as shown in *Table 6.14*. The area generated for each BVT was then matched with equivalent vegetation types within the Locality, based on CMA scale vegetation mapping (DECC 2008) (see).

The species credit requirement was also converted to hectares, using the credit to hectare converter (see *Table 6.15*).

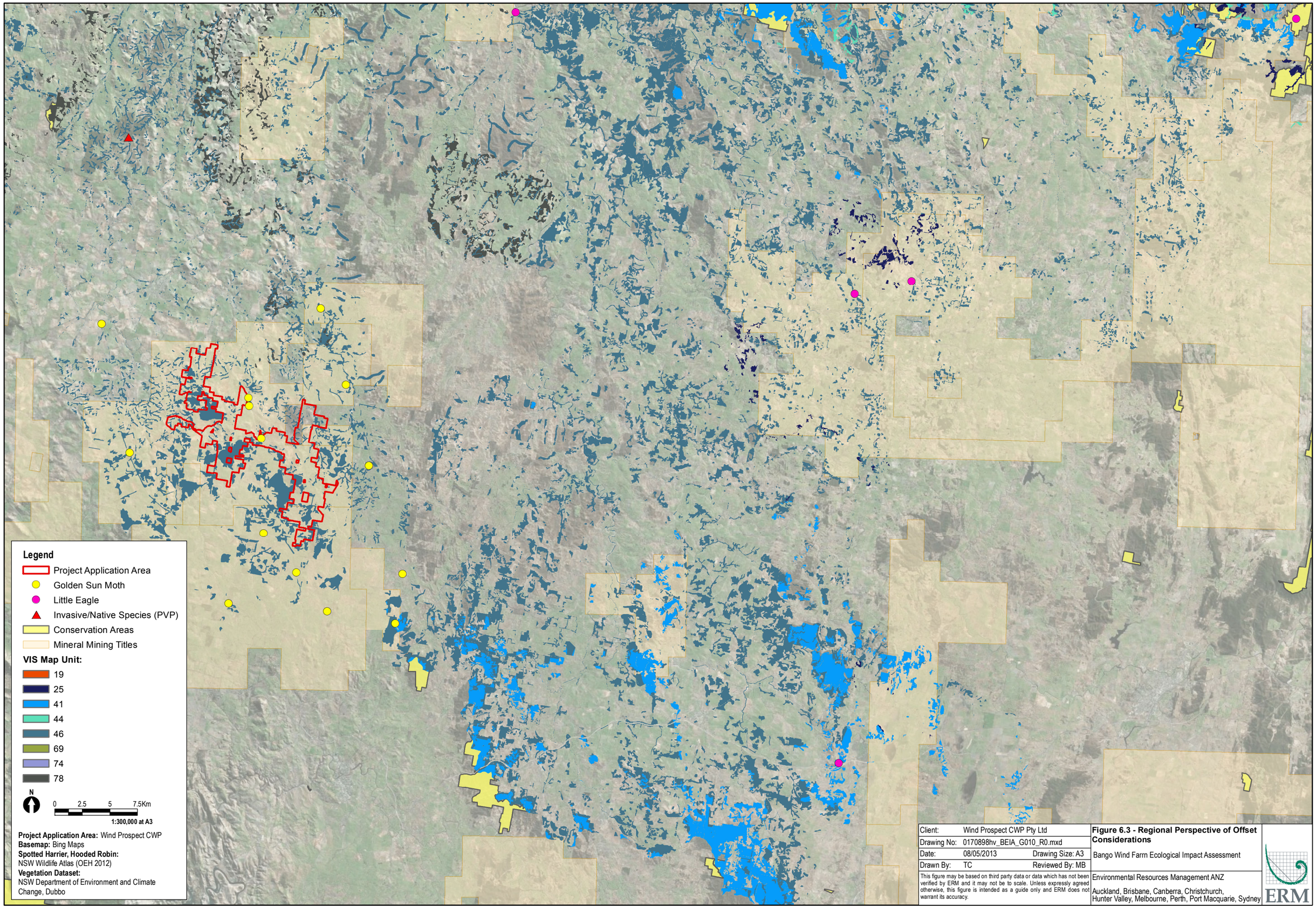
Identification of potential offset sites was further refined using the following spatial information: rivers and streams, mining leases, urban areas, National Parks and Reserves, State Forests, CMA Region and Subregion, vegetation mapping datasets, cadastre, existing offsets, conservation corridors and priority areas and Property Vegetation Plan (PVP) locations. A search was also undertaken to determine the potential presence of threatened species requiring species credits, using the Atlas of NSW Wildlife.

Several potential sites have been highlighted for further investigation as to their suitability in providing the required offsets (see *Figure 6.1* and *6.2*). Work is ongoing to identify further properties with suitable habitat to ensure the required offset is available prior to the start of construction. In determining priority sites for offsets, the following points will be considered:

- sites should contain the correct mix and area of the required vegetation types to limit multiple offset sites if possible;
- sites should have large lot sizes or multiple lots owned by the same owner to limit the number of potential landholders who may participate in offsets;
- sites should contain records of or habitat for species credits;
- sites close to National Parks or State Forests should be given priority as these areas provide connectivity within the landscape;
- sites with mining leases would require consent from the lessee when establishing a BioBank site on a property;
- sites likely subject to open cut mining should be avoided; and
- sites with Property Vegetation Plans may have significant discounts to credits generated under the BioBanking scheme.

Table 6.16 Impacted and Matched Vegetation Types for Offsetting Analysis

Impacted Vegetation Types			Matched Vegetation Types		
Veg Type ID	**Veg Type**	**Required Offset (ha)**	**Veg Type ID**	**Veg Type**	**ArcGIS (VIS Map Unit)**
LA103	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	153.5	LA103	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	44
			LA113	Black Sallee - Tussock Grass open woodland of the South Eastern Highlands	25
			LA120	Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277)	46
			LA121	Blakely's Red Gum moist sedgey woodland on flats and drainage lines of the South Eastern Highlands and South Western Slopes	Unmapped
			LA145	Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201)	69
			LA194	Riverine Inland Grey Box grassy woodland of the semi-arid (warm) climate zone (Benson 237)	74
			LA205	Snow Gum - Candle Bark grassland/woodland of the South Eastern Highlands	Unmapped
			LA219	White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266)	78
			CW102	*Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands*	44
			CW138	*Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201)*	69
			CW215	*White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions*	Unmapped
LA182	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion	42.9	LA182	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	41
			LA183	Red Stringybark - White Box grassy open forest of the South Western Slopes	Unmapped
			LA223	White Cypress Pine woodland on sandy loam soils on the plains of central NSW (wheatbelt) (Benson 70)	19



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Date:	08/05/2013	Drawing Size: A3
Drawn By:	TC	Reviewed By: MB

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

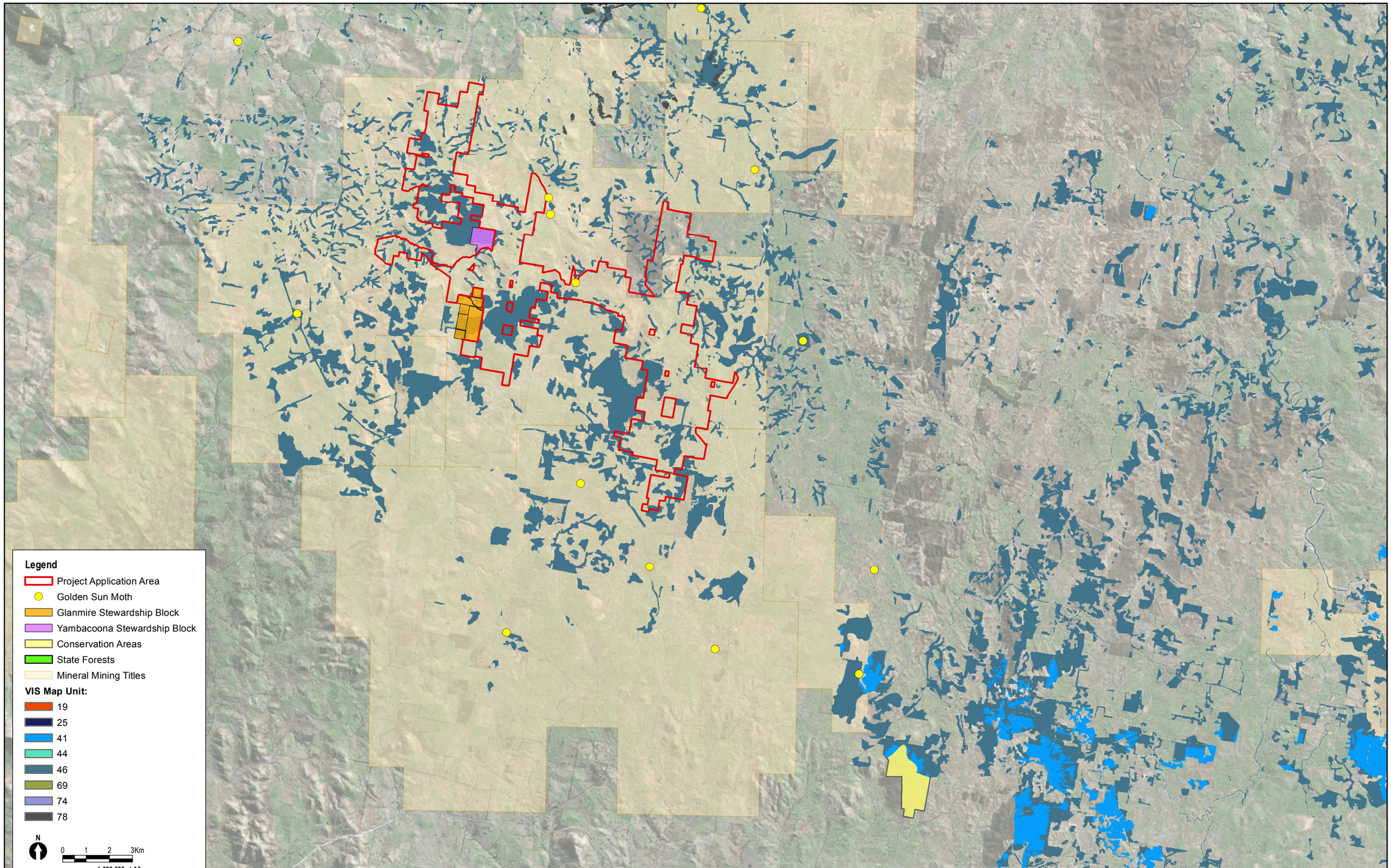
Figure 6.3 - Regional Perspective of Offset Considerations

Bango Wind Farm Ecological Impact Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM



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Drawing No:	0170898hv_BEIA_G011_R0.mxd		
Date:	08/05/2013	Drawing Size: A3	
Drawn By:	TC	Reviewed By: MB	

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 6.4 - Local Perspective of Offset Considerations

Bango Wind Farm Ecological Impact Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

7 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

This chapter presents the methods, results and impact assessment for Matters of National Environmental Significance (NES) that have the potential to be impacted by the Project. There is some overlap and duplication with what has been presented in previous sections, however, it is appropriate to present this chapter as an independent section for assessment by DSEWPC.

This section forms the basis of the Significant Impact Assessment in accordance with the Commonwealth Significant Impact Guidelines for Matters of NES (DEWHA 2009a). The Significant Impact Assessment is provided in full in *Annex J.*

7.1 METHODS

This section describes the methods employed to assess the ecological values of the Study Area. At the commencement of the study, a desktop assessment was undertaken to identify the key ecological values which were likely to occur within the Study Area. The information gained during the desktop study was then reviewed and analysed to identify the key species and communities for field survey. The full methods employed during this ecological study are described in *Chapter 4* of this report. The following sections describe only those methods which were adopted to specifically address Matters of NES.

7.1.1 Desktop Assessment

A search of the Protected Matters Search Tool (PMST) was undertaken on 1 March 2013. The search covered the entire Locality within 10 km of the Study Area. The search did not identify any World Heritage Properties, National Heritage Places, the Great Barrier Reef Marine Park, or Commonwealth Marine Areas that relate to the search area.

In summary, the PMST identified that the search area:

- is upstream of three Wetlands of International importance;
- is likely to, or may contain three threatened ecological communities;
- is likely to, or may contain habitat for 19 threatened species; and
- is likely to, or may contain habitat for 9 migratory species.

The full PMST report is included in *Annex I.*

7.1.2 Field Survey

Vegetation

Existing vegetation mapping was ground truthed during field visits, allowing the stratification of vegetation types to be undertaken. Vegetation mapping was undertaken throughout spring and summer 2012 – 2013. The Study Area was traversed by vehicle and on foot, enabling all vegetation to be surveyed.

Fifteen 20 m x 20 m quadrats were sampled at selected sites that were representative of different vegetation types (refer *Figure 4.1*). Boundaries of vegetation communities in varying condition were recorded using a hand-held GPS and hand-drawings on aerial photographs and digitised in a geographic information system (GIS).

Flora

A floristic inventory was collected through the identification of all flora species encountered in plots/meanders or incidentally in the field, either in-situ or by collecting a sample for later identification. Where positive identification was not possible a sample was sent to the Royal Botanic Gardens in Sydney (RBGSyd) for identification using the Botanical Identification Service (BIS). All samples were identified to species level where sufficient material of the individual was available. In some cases identification to genus or family level was the best possible result.

Targeted flora surveys were undertaken for threatened species. Areas of suitable habitat were surveyed during the flowering season for the species, in accordance with the flowering season at reference sites (where applicable).

Fauna Habitats

Field assessment commenced in July 2012 and continued to February 2013. The Study Area was initially assessed through interpretation of satellite imagery. Areas supporting native vegetation and potential fauna habitat were located and then surveyed by vehicle and on foot. Fauna habitat types were characterised in the Study Area and the quality of the fauna habitat was assessed and categorised.

A hollow bearing tree survey was undertaken from Jan 2013 to February 2013 within an area bound by a 500m buffer around all proposed turbine locations. The survey was undertaken by two ecologists driving or walking where access was difficult. Hollow bearing trees were assessed visually, using binoculars where necessary. The total area surveyed for hollow bearing trees was approximately 4981 ha.

Invertebrates

Targeted surveys were undertaken for the Golden Sun Moth in accordance with the *Survey Guidelines for Detecting the Golden Sun Moth* (DEWHA 2009). Surveys were initially undertaken to assess areas of likely habitat. Surveys for moths were then undertaken during the flying season (November – January). Surveys were carried out over 12 suitable days between the hours 10:00 and 14:00 at temperatures above 20^0 C using the random meander method through areas of preferred habitat (refer *Figure 4.2*).

Frogs and Reptiles

Frog searches were undertaken in areas of observed habitat and microhabitats using nocturnal and diurnal visual encounter surveys (DEWHA 2010) either on foot or by vehicle. Target species for the surveys were the Booroolong Frog (*Litoria booroolongensis*) and the Growling Grass Frog (*Litoria raniformis*). Both of these species have been identified in the PMST as having habitat that may occur in the Locality.

Reptiles

Reptile surveys were combined with the diurnal and nocturnal surveys described for frogs. In addition, targeted survey and trapping was undertaken for the Pink-tailed Worm-lizard (*Aprasia parapulchella)* and the Striped Legless Lizard (*Delma impar),* although the survey methods also had the potential to capture other threatened species such as the Little Whip Snake (*Suta flagellum*) or Rosenberg's Goanna (*Varanus rosenbergi*). Grassland Earless Dragon (*Tympanocryptis pinguicolla*) was not surveyed using targeted surveys, after the species was removed from the subject species list for this Project, following an onsite meeting and formal advice from Matt Cameron of OEH.

Birds

A range of bird survey techniques were used in the ecological survey and all were undertaken in accordance with the AusWEA Interim Bird Risk Assessment Standards (AusWEA 2005). Bird surveys consisted of bird utilisation survey (BUS) and targeted surveys for woodland birds. All birds observed incidentally throughout the field surveys were identified and it was noted if they were flying within the Rotor Swept Area height range, which was identified as being between 25 and 200 meters. The following sections describe the methods of the bird surveys undertaken.

Bird utilisation survey

The Bird Utilisation Surveys (BUS) were undertaken from 14 November 2012 through to 23 February 2013 to capture data during the Superb Parrot breeding season. Surveys were undertaken at different times of the day regardless of weather conditions. The methodology involved 15 minute fixed

point, fixed radius counts at 20 survey sites spread across the Study Area (refer *Figure 4.4*). Sites were located at varying distances from habitat features such as hills/ridges, woodland and creeklines that are within areas of disturbance. Control/reference sites were also established in areas of representative habitat outside the areas of disturbance.

Superb Parrot

Point and transect surveys within areas of suitable habitat were undertaken throughout the survey period from 1 August 2012 through to 13 December 2012. A total of 17 surveys were conducted during this period in the early morning (sunrise to 10 am) and evening (4 pm to sunset) (refer *Figure 4.3*). Detection was made by sighting with binoculars or by call utilising a minimum of two ecologists as observers. Vehicle-based observations were also undertaken whilst commuting to, from and through the Study Area, recorded as incidental sightings often along roadside remnants. All sighting locations were recorded on a GPS.

Swift Parrot

Area searches and transects surveys were conducted through areas of suitable habitat within the Study Area, in the early morning and afternoon when birds are most active and vocal. Detection was by sighting using binoculars or call. Surveys were conducted in July in areas of potential foraging habitat where identified (refer *Figure 4.3*).

Woodland Birds

A total of 17 surveys were undertaken within or adjacent to areas of woodland habitat (refer *Figure 4.3*). Each survey was undertaken for a minimum of one hour. Bird surveys were completed by a two observers for one hour. Birds were identified using 10 × 42 mm binoculars and from characteristic calls. A minimum of two bird surveys were completed on two separate days across the woodland survey sites.

Bats

Anabat detectors and recorders were used to record the echolocation calls of micro-bats. Anabat detectors were set for a minimum of three nights per location. Mine entrances, woodland areas and open pasture were targeted during the surveys (refer *Figure 4.2*). Both Anabat units and stag watching was deployed to detect if the abandoned mines were being utilised by microbats. Harp traps were deployed in areas of woodland and in open areas adjacent to woodland in February 2013 (refer *Figure 4.2*). Harp trapping was undertaken over two sessions, each consisting of two Harp Traps being set for three nights, to make a 12 night Harp Trap total. For each harp trap survey one trap was placed in a potential flyway the other along the edge of woodland adjacent to an open area.

Mammals (Excluding Bats)

Mammal data was collected across the Study Area by incidental observation or by direct means utilising remote cameras, nocturnal spotlighting and mammal trapping. Mammal surveys were udnertaken from November 2012 to February 2013.

Incidental Records

Incidental fauna observations were recorded throughout all survey periods by turning over logs and other ground debris when habitat conditions appeared appropriate. Records of mammal scats, tree scars, tracks and other signs (e.g. diggings, shelter sites and burrows) were recorded incidentally as they were encountered throughout the Study Area.

Survey Limitations

As with all ecological assessments, a range of limitations are likely to have influenced the results of this study. The survey guidelines for all targeted species were adhered to in order to minimise the influence of survey limitations, although external factors such as weather conditions and land access contribute biases in survey results. These limitations are detailed in *Section 4.9.*

7.2 RESULTS

7.2.1 Desktop Assessment

Wetlands of International Importance

No declared Ramsar wetlands occur in the Study Area or the Locality. However, the following three declared Wetlands of International Significance have been identified downstream of the search area by the PMST:

- Banrock Station wetland complex - located approximately 770 km to the west of the Study Area. The site is a floodplain wetland complex comprising areas of freshwater and areas of secondary salinised floodplain with discrete wetland basins and channels. The site supports a high diversity of ecological communities (DSEWPC 2011a);

- Coorong and Lakes Alexandrina and Albert Wetland - located approximately 885 km to the south-west of the Study Area, in South Australia. The site is a long, shallow, brackish to hypersaline lagoon. It supports some threatened ecological communities and species, as well as extensive and diverse wetland assemblages (DSEWPC 2011b); and

- Riverland - located in South Australia, approximately 730 km to the west of the Study Area. The site incorporates a series of creeks, channels, lagoons, billabongs, swamps and lakes. The wetland is an important habitat for a large number of migratory and waterbirds (DSEWPC 2011c).

Threatened Ecological Communities

The PMST identified three ecological communities that are likely to, or may, occur within 10 km of the Study Area:

- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South eastern Australia (Endangered);
- Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory (Endangered); and
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Critically Endangered).

Threatened Species

The PMST identified that the search area is likely to, or may contain the species listed in *Table 7.1.*

Table 7.1 Threatened Species with the Potential to Occur within search area (PMST)

Species Name	Common Name	EPBC Act Status*
Plants		
Ammobium craspedioides	Yass Daisy	V
Caladenia concolor	Crimson Spider Orchid	E
Diuris aequalis	Doubletail Buttercup	V
Eucalyptus robertsonii subsp. *hemisphaerica*	Robertson's Gum	V
Lepidium hyssopifolium	Aromatic Peppercress	E
Leucochrysum albicans var. *tricolor*	Hoary Sunray	E
Pelargonium sp. Striatellum (G.W. Carr 10345)	Omeo Stork's Bill	E
Prasophyllum petilum	Tarengo Leek Orchid	E
Rulingia prostata	Dwarf Kerrawang	E
Rutidosis leptorrhyncoides	Button Wrinklewort	E
Swainsona recta	Mountain Swainson Pea	E
Insects		
Synemon plana	Golden Sun Moth	CE
Amphibians		
Litoria booroolongensis	Booroolong Frog	E
Litoria raniformis	Growling Grass Frog	V
Reptiles		
Aprasia parapulchella	Pink-tailed Worm-lizard	V
Delma impar	Striped Legless Lizard	V
Birds		
Botaurus poiciloptilus	Australasian Bittern	E
Lathamus discolor	Swift Parrot	E
Leipoa ocellata	Malleefowl	V, Mi
Polytelis swainsonii	Superb Parrot	V

Rostratula australis	Australian Painted Snipe	V, Mi,
Fish		
Maccullochella peelii peelii	Murray Cod, Cod, Goodoo	V
Macquaria australasica	Macquarie Perch	E
Mammals		
Nyctophilus corbeni	Eastern Long-eared Bat	V
Petrogale penicillata	Brush-tailed Rock-wallaby	V
Phascolarctos cinereus	Koala	V
**CE=Critically Endangered; E = Endangered; V = Vulnerable; Mi=Migratory; Ma=Marine*		

7.2.2 *Field Survey*

BioMetric Vegetation Types

Two BioMetric Vegetation Types were identified in the Study Area, along with three other vegetation communities that do not meet the description of any BVTs:

- Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands (Apple Box – Yellow Box Grassy Woodland);
- Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Red Stringybark Open Forest);
- Exotic Pasture;
- Cropping; and
- Planted Vegetation (native and exotic).

One TEC was identified in the Study Area: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box-Gum Grassy Woodland and Derived Grassland). This vegetation community occurs widely throughout the Study Area, but is patchy and in some areas it occurs as a derived native grassland. Patches of Yellow Box (*Eucalyptus melliodora*) with Blakelys Red Gum (*Eucalyptus blakelyi*) and other eucalypts occur across the Study Area. However, the understorey condition is generally poor and as such, the majority of these woodland patches do not meet the Commonwealth condition thresholds for this TEC. The current proposed layout avoids these woodland areas. Patches of grassland derived from Box Gum Woodland occur throughout the Study Area. The majority of these areas also do not meet the Commonwealth condition thresholds for Box-Gum Grassy Woodland and Derived Grassland.

A total of 2.27 ha of Critically Endangered White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland is considered to occur within the Study Area in one discrete patch along Tangmangaroo Road (see *Figure 5.2*). A total of 0.26 ha of this vegetation is expected to be impacted

by the proposed action for the construction of permanent Project infrastructure. The area of the CEEC within the Development Footprint was calculated based on the area of Layout Option 1 (ie the worst case scenario).

Natural Temperate Grassland has not been recorded in the Study Area. Areas of native grass within the Study Area are derived from Box-Gum Grassy Woodland and other Eucalypt Woodlands.

Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia have not been recorded in the Study Area.

Flora

One threatened flora species was recorded in the Locality during field surveys: Yass Daisy (*Ammobium craspedioides*) which is listed as Vulnerable under both the EPBC Act. A population comprising over 200 individuals was recorded approximately 750 m to the west of the Study Area in the Mt Buffalo Cluster (refer *Figure 5.3*).

Fauna

A range of fauna habitats were identified and surveyed during field investigations between July 2012 and February 2013. These habitats include Woodland, Native Grassland and Exotic Grassland. A range of habitat features occurred within these habitat types including Exposed Rock, Fallen Timber, Exotic Grassland and Roosting habitat for Bats. Detailed habitat descriptions can be found in *Section 5.5.*

Of the 153 fauna species recorded, a total two threatened species listed under the EPBC Act were confirmed within the Study Area, including one invertebrate (Golden Sun Moth) and one bird (Superb Parrot). One migratory species was recorded in the Study Area (Rainbow Bee-eater). The area of each habitat type within the Development Footprint was calculated based on the area of Layout Option 1.

7.2.3 Likelihood of Occurrence

Details the EPBC Act listed threatened species and communities that were identified by the PMST and their likelihood of occurrence within the Study area are provided in *Table 7.2.*

Table 7.2 Threatened species likelihood assessment

Species Name	Common Name	Likelihood of occurrence within Study Area	EPBC Act Status*
Ammobium craspedioides	Yass Daisy	Likely – recorded during recent field surveys in the Locality and optimal habitat occurs in the Study Area.	V

Caladenia concolor	Crimson Spider Orchid	Potential - Optimal habitat present in woodlands with an undisturbed understory.	E
Diuris aequalis	Doubletail Buttercup	Likely - Optimal habitat present in woodlands with an undisturbed understory and secondary grassland.	V
Eucalyptus robertsonii subsp. hemisphaerica	Robertson's Gum	Potential - Optimal habitat present in woodlands on the site.	V
Lepidium hyssopifolium	Aromatic Peppercress	Potential - Optimal habitat may be present in woodlands and secondary grassland.	E
Leucochrysum albicans var. tricolor	Hoary Sunray	Potential - Optimal habitat present in woodlands with an undisturbed understory and secondary grassland.	E
Pelargonium sp. Striatellum (G.W. Carr 10345)	Omeo Stork's Bill	Unlikely – Optimal or sub optimal habitat absent from the Study Area.	E
Prasophyllum petilum	Tarengo Leek Orchid	Potential – Optimal may be habitat present in woodlands with an undisturbed understory.	E
Rulingia prostata	Dwarf Kerrawang	Unlikely – Optimal and or sub optimal habitat absent from the Study Area.	E
Rutidosis leptorrhyncoides	Button Wrinklewort	Potential – Optimal or sub optimal habitat present in woodlands with an undisturbed understory and secondary grassland.	E
Swainsona recta	Mountain Swainson Pea	Potential - Optimal habitat may be present in woodlands with an undisturbed understory	E
Insects			
Synemon plana	Golden Sun Moth	Known – species has been recorded within the Study Area during recent surveys	CE
Amphibians			
Litoria booroolongensis	Booroolong Frog	Unlikely - Optimal or sub optimal habitat does not occur within the Study Area.	E
Litoria raniformis	Growling Grass Frog	Unlikely – Optimal or sub optimal habitat does not occur within the Study Area.	V
Reptiles			
Aprasia parapulchella	Pink-tailed Worm-lizard	Potential – Limited areas of sub optimal habitat occur.	V
Delma impar	Striped Legless Lizard	Potential – Limited areas of optimal habitat occur.	V
Birds			
Apus pacificus	Fork-tailed Swift	Unlikely – Sub optimal habitat	Mi, Mar
Ardea ibis	Cattle Egret	Potential - Cattle Egrets may utilise the pasture and croplands, during wetter periods.	Mi, Mar
Botaurus poiciloptilus	Australasian Bittern	Unlikely - due to absence of densely vegetated wetlands within the Study Area.	E

Gallinago hardwickii	Latham's Snipe	Potential - may fly over the Study Area. Dams within the Study Area are unlikely to provide suitable foraging habitat.	Mi, Mar
Haliaeetus leucogaster	White-bellied Sea-eagle	Potential - may fly over the Study Area, however, suitable habitat does not occur in the Study Area.	Mi, Mar
Hirundapus caudacutus	White-throated Needletail	Potential - may fly over the Study Area. Species has not been recorded in the Locality.	Mi, Mar
Lathamus discolor	Swift Parrot	Potential – Sub optimal habitat is restricted to some of the woodland areas.	E
Leipoa ocellata	Malleefowl	Unlikely – Optimal or sub optimal habitat does not occur within the Study Area.	V, Mi
Merops ornatus	Rainbow Bee-eater	Known -recorded within the Study Area.	Mi, Mar
Myiagra cyanoleuca	Satin Flycatcher	Unlikely - due to lack of optimal habitat.	Mi, Mar
Polytelis swainsonii	Superb Parrot	Known - Recorded throughout the Study Area and breeding is known to occur.	V
Rhipidura rufifons	Rufous Fantail	Unlikely - due to lack of optimal habitat.	Mi,
Rostratula australis	Australian Painted Snipe	Unlikely – Optimal habitat does not occur within the Study Area.	V, Mi,
Fish			
Maccullochella peelii peelii	Murray Cod, Cod, Goodoo	Unlikely – No optimal or sub optimal habitat present.	V
Macquaria australasica	Macquarie Perch	Unlikely - No optimal or sub optimal habitat present.	E
Mammals			
Nyctophilus corbeni	Eastern Long-eared Bat	Unlikely – No optimal habitat exists.	V
Petrogale penicillata	Brush-tailed Rock-wallaby	Unlikely – optimal habitat does not occur.	V
Phascolarctos cinereus	Koala	Potential – sub optimal habitat does occur	V
*CE=Critically Endangered; E = Endangered; V = Vulnerable; Mi=Migratory; Ma=Marine			

7.3 *SIGNIFICANT IMPACT ASSESSMENT*

Significant Impact Assessments was undertaken for all species and communities identified in *Table 7.2* that are known, likely or have the potential to occur in the Study Area. The assessments were undertaken in accordance with:

- *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DEWHA 2009a); and
- *Significant Impact Guidelines for the critically endangered Golden Sun Moth (Synemon plana): EPBC Act Policy Statement 3.12* (DEWHA 2009b).

The Significant Impact Assessments are provided in full in *Annex J.* The following sub-sections provide a summary of the outcomes of the Significant Impact Assessments under the relevant headings.

7.3.1 Threatened Ecological Communities

Box-Gum Grassy Woodland and Derived Grassland occurs in the Study Area along Tangmangaroo Rd and extends along the road to the north and south of the Study Area. An overhead transmission line is proposed in this area. The area of Box-Gum Grassy Woodland within the Study Area comprises 2.27 ha and the area that is likely to be impacted is 0.26 ha.

An assessment against the significant impact criteria for critically endangered ecological communities (DEWHA 2009) was undertaken and is provided in *Annex J.* The proposed action is likely to have a significant impact on Box-Gum Grassy Woodland and Derived Native Grassland as it will reduce the extent of a critically endangered ecological community and increase fragmentation.

7.3.2 Threatened Flora

A Significant Impact Assessment was undertaken for five Endangered flora species and four Vulnerable flora species identified as Known, Likely or Potential to occur within the Study Area. Only one of these species, Yass Daisy (*Ammobium craspedioides*) has been recorded in the Study Area and is discussed further below.

A population of Yass Daisy comprising over 200 individuals was recorded approximately 750 m to the west of the Study Area in the Mt Buffalo Cluster (refer *Figure 5.3*). The population occurs outside the Study Area and will not be affected by the Project. An important population of Yass Daisy has not been recorded in the Study Area. Areas comprising the species' woodland habitat will be avoided and therefore, will not be impacted by the Project. The species also occurs in derived native grassland and it is possible that areas of potential grassland habitat will be affected by the Project. An assessment against the significant impact criteria for vulnerable flora species (DEWHA 2009a) was undertaken for the Yass Daisy and is provided in *Annex J.* The assessment against the significant impact criteria concluded that the Project would not result in a significant impact to an important population of the Yass Daisy.

The Project is not expected to result in significant impacts to any of the EBPC Act listed flora species assessed in *Annex J.*

7.3.3 Threatened Fauna

The Significant Impact Assessment considered the potential impacts of one Critically Endangered Species, one Endangered Species and four Vulnerable species listed under the EPBC Act, based on the Likelihood of Occurrence

Assessment in Section *7.2.3*. A summary of the assessment outcomes is provided below, with the full results presented in *Annex J.*

Golden Sun Moth

Infrastructure associated with the Project is proposed in areas where GSM were recorded and in areas of suitable habitat for the species. This includes WTGs, access tracks, overhead transmission lines and a substation. Through the iterative design process, areas of known and potential habitat have been avoided as much as possible. *Table 7.3* shows the area of habitat in the Study Area and Development Footprint.

Table 7.3 Areas of Golden Sun Moth Habitat

Area in Study Area (ha)	Total Area in Development Footprint (ha)	Permanent Impact Area (ha)	Temporary Impact Area (ha)
810.2	100.87	82.48	18.39

Areas are based on the areas of Apple Box – Yellow Box Grassy Woodland - Mod_Good-TSC-DNG, Apple Box – Yellow Box Grassy Woodland - Low and an outlier area of habitat comprising Red Stringybark Open Forest – Low

The Project does not involve clearing of habitat on a broad scale, rather, it comprises clearing of small areas and narrow linear areas. Many of the access roads are proposed along existing farm access tracks and there are areas comprising exotic pasture or weeds in which infrastructure can be placed.

Despite this, some areas of GSM habitat will be affected, given that the potential habitat for the GSM is widespread in the Study Area (100.88 ha) and access roads for the Project will be wider than existing farm tracks. However, as the development footprint is linear and narrow and the turbine and substation areas are small on a landscape scale, the overall development footprint both during construction and operation would only require clearing of a small area in comparison to the area of GSM habitat available in the Study Area (approximately 12%). The completed infrastructure would not be at a scale that would impose a barrier to GSM movements.

GSM occur in grasslands and therefore, in areas that experience little shade. As such, the potential impacts of increased shade in GSM habitat caused by turbine towers has been considered. The potential impacts of shading are based on observed habitat characteristics of the species and have not undergone scientific experimentation and therefore, they are unconfirmed. Potential impacts include:

- changes to male and female behaviour during the flying season;
- changes to soil moisture and temperature, resulting in a change in species at a site; and

- cooler and moister soil conditions impacting the survival and growth of larvae.

These potential impacts have been associated with developments such as multi-storey carparks, which would create shading over a large area on a permanent basis (pers. comm. A Rowell and T O'Sullivan 2013). The wind turbines would create discrete narrow areas of shading that are not large enough or of a permanent nature (taking into account the movement of the sun) to create changes to soil moisture and temperature. The greatest shading impact would be the area around the base of the turbines, which will experience the largest area of shading for the longest periods of time. This area would already be disturbed for the turbine base. In terms of behaviour during the flying season, the extent of habitat in the Study Area is large and therefore, adult GSM would be able to avoid shaded areas (pers. comm. A Rowell and T O'Sullivan 2013).

The proposed action would result in removal of 100.88 ha of GSM habitat (82.48 ha permanent loss and 18.4 ha disturbed and rehabilitated after construction), which comprises 12% of the total area of habitat available in the Study Area. An assessment against the significant impact thresholds for the GSM in the Significant Impact Guidelines for the critically endangered Golden Sun Moth (DEWHA 2009b) was undertaken and is provided in *Annex J*. As greater than 0.5 ha of GSM habitat will be cleared, the proposed action meets both of the impact thresholds for habitat loss (refer *Annex J*). As such, the proposed action will have a significant impact on the GSM.

Swift Parrot

The Swift Parrot is endemic to south-eastern Australia. It breeds only in Tasmania, and migrates to mainland Australia in autumn. This species prefers profuse flowering Box Ironbark Woodlands in NSW for foraging habitat. No preferred foraging habitat has been identified within the Study Area. This species was not recorded during field surveys. The Study Area does not form part of the annual migratory route for this species (OEH 2012 c).

The Project is not anticipated to reduce the area of occupancy of the Swift Parrot. The Project will not be fragmenting an existing important population as none has been identified within the Study Area. The Study Area would provide at best sub optimal foraging opportunities for the Swift Parrot. The proposed action will not result in the introduction of an invasive species to the habitat of the Swift Parrot. The Locality already comprises a highly fragmented landscape that is susceptible to the establishment of invasive species.

The risk of collision is listed as a potential impact for this species. However, modelling of the cumulative collision risk impact to Swift Parrots was carried out in 2005 (Smales 2005a). The results show that the cumulative impacts of collision with turbines on the overall population of Swift Parrots, for all

current and presently proposed wind farms (at 2005) within the species' range, are very small (approximately one parrot every 10 years).

It has been concluded from the Significant Impact Assessment (see *Annex J*) carried out for this species that the proposed action is unlikely to have a significant impact on the Swift Parrot.

Striped Legless Lizard

The Striped Legless Lizard is found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. . It is also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Approximately 380.53 ha of secondary or sub optimal habitat for this species have been identified within the Study Area. The project would result in the removal of approximately 52.5 ha or 13% of what would be considered secondary habitat for this species.

Surveys were undertaken in areas of the most suitable habitat and this species was not recorded during the field surveys. No important populations of this species have been identified within the Study Area. The Project would not reduce the area of occupancy of the Striped Legless Lizard in the Study Area. No habitat that is currently occupied by this species will be removed as part of the proposed action. The project would not be fragmenting an existing important population. The Study Area does not provide habitat that is critical to the survival of the Striped Legless Lizard. Some areas of habitat available to the Striped Legless lizard would be modified or destroyed. It has been concluded from the Significant Impact Assessment (see *Annex J*) carried out on this species that the proposed action is unlikely to have a significant impact on the Striped Legless Lizard.

Pink-Tailed Worm Lizard

The Pink-tailed Worm-lizard inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass. Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. The closest record of this species is approximately 23 km north-west of the Study Area, and the Study Area is within the known distribution for this species. The species has not been recorded during targeted surveys, despite those being undertaken in accordance with the Survey Guidelines for Australia's Threatened Reptiles (DSEWPC 2011d) where optimal or sub optimal habitat was identified, during this study.

No important populations have been identified for this species within the Study Area. Approximately 380.53 ha of secondary grassland dominated by native grasses have been identified within the Study Area. A small portion of this (approximately 52.5 ha, or 13 %) contains potential habitat for the Pink-tailed Worm Lizard, however, this habitat is sub optimal due to the scattered nature of areas of small rocks and the intensive grazing that has occurred in

these areas. The construction of the wind farm would result in the loss or modification of a small portion of habitat suitable for this species.

The Project would not reduce the area of occupancy of the Pink-tailed Worm-lizard. The project would not be fragmenting an existing important population. The Study Area does not provide habitat that is critical to the survival of the Pink-tailed Worm-lizard. The Project involves the construction of access roads and the erection of wind turbine towers. The proposed action will not result in the introduction of an invasive species to the habitat of the Pink-tailed Worm-lizard. It has been concluded from the Significant Impact Assessment (see *Annex J*) carried out on this species that the proposed action is unlikely to have a significant impact on the Pink-tailed Worm-lizard.

Superb Parrot

The Superb Parrot mainly inhabits forest and woodlands dominated by eucalypts, especially River Red Gums and box eucalypts such as Yellow Box or Grey Box. The species also seasonally occurs in box-pine (*Callitris*) and Boree (*Acacia pendula*) woodlands (DSEWPC 2012). The Superb Parrot is dependent on aggregations of large hollow bearing trees and nests between September and December in hollow limbs or holes in the trunk of large eucalypts, mainly near water. In the inland slopes, most nests are in large Blakely's Red Gums, with many nest trees either dead or suffering from dieback. Much of the breeding habitat in the South-west Slopes is on private land. Superb Parrots are rarely observed on the inland slopes during winter, with the few birds seen usually being breeding pairs. The Study Locality is within known breeding area for this species (DSEWPC 2012).

The primary impact to Superb Parrots associated with the Project is that of injury or death of individual Superb Parrots due to collision with turbines and potential loss of breeding habitat through the removal of hollow bearing trees. The bird utilization surveys gathered data related to the flight activity of birds and this data has been used to assess the potential impacts to the species. The data obtained indicates that the species rarely flies within the height range of the proposed turbines (above 25 m).

The Project has been designed to avoid areas of woodland and paddock trees and therefore, is not likely to affect breeding habitat or cause fragmentation of habitat. Of the 449 mapped hollow bearing trees it is likely 15 will be removed as part of the proposed action. This constitutes approximately 3.4% of the total number of hollow bearing trees available to the Superb Parrot within 500 m of a proposed turbine location.

This species has been observed during the BUS flying at a height that is below rotor height; however one individual was recorded at RSA height. A collision risk model was run (*Section 6.3.3*) and it concluded that this species unlikely to collide with a turbine. Generally the observed flight patterns for this species were decisive and directional to foraging areas or to a paddock tree when startled.

This species appears to utilise the Study Area on a seasonal basis that coincides with cropping practices and the breeding season. Foraging areas are widespread across the Locality and it is anticipated only 3.4 % of potential breeding habitat within 500 m of a proposed turbine will be impacted. Thus it is unlikely the proposed action will impact on the species, affect foraging or breeding habitat to the extent that the species is likely to decline. The results of the Significant Impact Assessment (see *Annex J)* completed for this species found that the proposed action would not significantly impact on the Superb Parrot.

Koala

In NSW, the Koala inhabits a range of forest and woodland communities, including coastal forests, woodlands on the tablelands and western slopes, and woodland communities along watercourses. The primary feed trees in the Central and Southern Tablelands are the Ribbon Gum Eucalytus viminalis and the River Red Gum Eucalyptus camaldulensis with 18 secondary feed tree species including White Box, Yellow Box, Bundy (*Eucalyptus nortonii*) , Blakely's Red Gum, and Apple Box. There are two Stringybark supplementary species, including Red Stringybark and Yellow Stringybark (*Eucalyptus muelleriana*) (OEH 2008).

The Koala has not been recorded within the Study Area and the results of habitat assessments indicate that this species has the potential to utilise the Study Area. Under the Significant Impact Guidelines an important Koala population has not been identified within the Study Area. This species was not recorded during field surveys. Secondary and supplementary habitat for this species does exist within the Study Area. The Project would not reduce the area of occupancy of the Koala. This species has not been recorded within the Study Area.

No habitat that is currently occupied by this species will be removed as part of the proposed action; approximately 8.2% of secondary and supplementary habitat would be removed as part of the proposal. No areas of optimal habitat would be removed as part of the proposed action and there is unlikely to be a disruption to the breeding cycle of this species as a result of the proposed action. It has been concluded from the Significant Impact Assessment (see *Annex J*) carried out on this species that the proposed action is unlikely to have a significant impact on the Koala.

7.3.4 Migratory Species

Five Migratory species were identified as Known, Likely or Potential to occur within the Study Area based on the Likelihood of Occurrence Assessment in *Section 7.2.3*. A Significant Impact Assessment was undertaken for these species which is presented in *Annex J*.

Potential impacts to migratory species associated with the development of wind farms include:

- loss or degradation of flora and fauna habitat due to direct impacts such as clearing for turbine locations and access roads, and indirect impacts to bird species such as habitat avoidance; and
- injury or death of birds due to collision with turbines.

Extensive fauna surveys have been undertaken in the Study Area, as outlined within the earlier chapters of this report. It is unlikely that the Study Area provides an area of 'important habitat' for any migratory species, as described in the *Matters of National Environmental Significance Significant Impact Guidelines 1.1*. Therefore the Project is not expected to substantially modify, destroy or isolate an area of important habitat for a migratory species, or result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.

It is also considered unlikely that the Project will seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. Therefore the project is not anticipated to result in significant impact to migratory species as described under the *Matters of National Environmental Significance Significant Impact Guidelines 1.1.*

7.4 MEASURES TO AVOID OR REDUCE IMPACTS

The key approach to the management of impacts to Matters of NES for the proposed project relates to the layout design and the iterative process used to avoid impacts to ecological values where possible. The Project layout design has adopted avoidance and management measures in response to information gathered during the ecological field surveys, particularly in relation to threatened species and ecological communities listed under the EPBC Act. This approach has enabled WPCWP to avoid impacts wherever feasible, and to manage associated impacts such as habitat fragmentation and edge effects.

Management and mitigation measures will be implemented during both construction and operation of the proposed project to manage environmental impacts, which will incorporate specific measures for the GSM and Box-Gum Grassy Woodland and Derived Native Grassland CEEC. These measures will be supported by a number of management plans to be developed for the construction and operational phases of the Project. Details of avoidance, mitigation and offset measures are provided in *Chapter 6.*

7.5 MATTERS OF NES CONCLUSION

After detailed assessment of the significance of the proposed works, the assessments concluded that the proposed works will have a significant impact on the Golden Sun Moth and Box Gum Grassy Woodland and Derived Native

Grassland. A range of avoidance measures have been incorporated into the design of the Project and mitigation measures will be implemented to reduce the impacts to the threatened species and community.

The proponent proposes to develop an offset strategy to account for the residual impacts of the proposed action, which is being developed in consultation with OEH. The proponent intends to developed the offset package in accordance with the EPBC Act Environmental Offsets Policy, through a mechanism to be approved by DSEWPC during the EPBC Act assessment by preliminary documentation.

8 CONCLUSIONS

This ecological impact assessment has identified the ecological features of the Bango Wind Farm site and assessed the potential impacts to threatened species and ecological communities listed under the TSC Act, as well as Matters of NES listed under the EPBC Act.

Five vegetation communities were recorded in the Study Area, including two BVTs that occur in varying condition. The remaining vegetation communities largely comprise exotic species and do not meet the description of any BVTs. The majority of the Apple Box – Yellow Box Grassy Woodland meets the description for the Box-Gum Woodland EEC listing under the TSC Act and a small proportion also meets the description for the Box-Gum Grassy Woodlands and Derived Native Grasslands CEEC listing under the EPBC Act.

A total of 127 flora species were recorded in the Study Area. Nine threatened flora species listed under the EPBC Act and / or the TSC Act were considered likely to, or have the potential to, occur in the Study Area. Of these, none were recorded in the Study Area, however, one was recorded in the Locality.

A total of four fauna habitat types were recorded in the Study Area including native woodlands, native grasslands, exotic grasslands and aquatic habitats. Within these habitat types, a variety of fauna habitat resources were identified, including hollow bearing trees, paddock trees, tussock grasslands, disused mines, farms dams and creek lines.

A total of 152 fauna species were recorded in the Study Area. Thirty two threatened fauna species were considered likely to, or have the potential to, occur in the Study Area. This includes one invertebrate, one frog, three reptiles, 23 birds and four mammals. Of these, a total of 15 were recorded within the Study Area including one invertebrate, ten birds and three mammals. One migratory species listed under the EPBC Act was recorded in the Study Area.

The proposed wind farm has the potential to impact on a number of threatened species and ecological communities through direct and indirect impacts during the construction and operational phases. This includes Box-Gum Woodland, the Golden Sun Moth, Superb Parrot, Eastern Bent-wing Bat and Yellow-bellied Sheathtail Bat. Seven part tests were undertaken for these species and a number of other species that were considered likely or having the potential to occur in the Study Area. A total of 40 seven part tests were undertaken, including 39 for threatened species and one for an endangered ecological community. The seven part tests concluded that the Project is unlikely to have a significant impact on any of the threatened species.

Careful consideration has been given to minimisation of impacts, including avoidance, mitigation and offsetting measures. Avoidance of impacts has been applied through modifications to the wind farm layout. A range of general and species specific mitigation measures will be implemented to minimise impacts to native flora and fauna during both the construction and operation phases. An offset strategy will be developed to minimise residual impacts as much as possible and meet the 'improve or maintain' principle. This includes an offset strategy that was prepared using the BBAM.

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Annex A

Personnel Details and Qualifications

Table xx

Ecologist	Organisation	Involvement	Years' Experience	Qualifications
Adam Greenhalgh	ERM	Field survey and report preparation	Adam has undertaken ecological assessments specialising in fauna since 2007.	Bachelor of Applied Science (Environmental Resources Management) Southern Cross University Diploma in Applied Science (Biological Techniques) TAFE, Ultimo
Alison Rowell	Subcontractor	Field survey and specialist report preparation	Alison Rowell is a self-employed consultant, with 29 years' experience in surveys and studies of flora and fauna, specialising in identification, monitoring and management of threatened native species and pest species. Most of her recent work has been in woodlands and grasslands in south-eastern NSW and the ACT.	Bachelor of Science (Hons I), Australian National University, Canberra, 1974.
Bronwen Bowskill	WPCWP	PEI report preparation	Bronwen Bowskill has over 15 years' experience in the environmental industry, including over eight years as an ecologist and GIS consultant.	M. Engineering Science (GIS), University of New South Wales, 2004 Bushland Regeneration Certificate II 5806 (with distinction), TAFE, 2000 B. Natural Resources (Hons), University of New England, 1998
Chris Sanderson	ERM	Field survey	Chris has 4 years' experience in the ecological consulting industry.	Bachelor of Science (Ecology), University of Queensland, Australia, 2004 Bachelor of Information Technology (Honours), University of Queensland,

Ecologist	Organisation	Involvement	Years' Experience	Qualifications
				Australia, 2002
David Dique	ERM	Report technical review	David is a Principal Ecologist that has held state government and private consultancy roles for almost 20 years. From an academic and research background, David has a detailed understanding of principles that underpin biodiversity research, survey and assessment, management and conservation.	Doctor of Philosophy: University of Queensland, Brisbane Qld, 2004 Bachelor of Natural Resources (Hons 1): University of New England, Armidale NSW, 1995
Erin Lowe	ERM	Field survey and report preparation	Erin has 3 years' experience in environmental consulting.	Bachelor of Science (Sustainable Resource Management), University of Newcastle, 2009 Bachelor of Natural History Illustration, University of Newcastle, 2009 Planning for Bushfire Prone Areas Short Course, University of Technology Sydney, 2012
Evelyn Craigie	ERM	Field survey and report preparation	Evelyn has 8 years' experience in the ecological consulting industry. She has undertaken work in a wide variety of ecological habitats across Australia.	Master of Environmental Management, University of NSW, Australia, 2004 Bachelor of Science (Zoology), University of NSW, Australia, 2000
Hannah Matthew	ERM	Field survey	Hannah has over 10 years' experience in the fields of ecology and natural resource management, working on both public and private lands; in urban, rural and remote	Bachelor of Applied Science (Ecotourism, majoring in biology and ecology), with Distinction, Charles Sturt University, Albury 2001

Ecologist	Organisation	Involvement	Years' Experience	Qualifications
			settings.	Diploma Spatial Information Services (ongoing): National Environment Centre, (TAFE NSW)
Jasmin Lightbody	ERM	Field survey and report preparation	Jasmin has 1 year experience in environmental consulting.	Bachelor of Environmental Management Sustainable Development, University of Queensland, 2011.
Joshua Morris	ERM	Field survey and report preparation	Josh has 3 years' experience in environmental consulting.	Bachelor of Science (Ecology and Conservation Biology) Griffith University 2009
Katherine Taske	ERM	Report technical review and revisions	Katherine is an ecologist with over nine years' experience as an environmental consultant. Throughout her career Katherine has gained knowledge and experience in the assessment and management of both terrestrial and aquatic environments across Queensland, New South Wales, Tasmania and Western Australia.	Bachelor Environmental Science (Ecology), University of Queensland, Brisbane Qld AUSRIVAS Accreditation, University of Canberra, ACT
Mark Branson	ERM	Report technical review	Mark has eight years' experience in threatened species survey, habitat assessment, impact assessment, biodiversity offsetting, and environmental management projects.	Master of Science (Honours) Ecology, Macquarie University, Sydney Australia 2006 Postgraduate Certificate in Research Preparation, Macquarie University Sydney Australia 2004 Bachelor of Science (Biology) Macquarie University, Sydney Australia 2003

Ecologist	Organisation	Involvement	Years' Experience	Qualifications
Matthew Flower	ERM	Field survey	Matt has worked as an ecological consultant since 2006 based in Darwin (Northern Territory, Australia) and Newcastle (New South Wales, Australia) with a focus mostly on flora and vegetation surveys and impact assessment.	Bachelor of Environmental Science (2003) (Macquarie University) Postgraduate Certificate of Research Preparation (2004) (Macquarie University) First Class Honours Degree of Master of Science (2007) (Macquarie University)
Narawan Williams	Subcontractor	Microchiropteran bat data analysis	Narawan has 17 years' experience in environmental consulting.	Certificate II in Conservation and Land Management (Natural Area Restoration) RTD 20102 Belmont NSW 2005 6414 Statement of Attainment in Conservation and Land Management for Produce maps for land management purpose. Code 3550D Belmont NSW 2006
Stephanie Brookes	ERM	Field Survey	Stephanie has 2 Years' experience in environmental consulting.	Bachelor of Science (Majoring in Biology, specializing in Environmental Science) University of Auckland, New Zealand 2009.
Steven De Luzuriaga	ERM	Field Survey	Steven has 3 Years' experience in environmental consulting.	Master of Marine Science and Management, Southern Cross University (National Marine Science Centre), Coffs Harbour 2011. Bachelor of Environmental Science (Majoring in Coastal Management), Southern Cross University, Lismore

Ecologist	Organisation	Involvement	Years' Experience	Qualifications
				2009.
Tom O'Sullivan	Subcontractor	Field survey and specialist report preparation	Tom has over 17 years' experience in environmental consulting.	Masters of wildlife Management (incomplete) - Macquarie University Bachelor of Science (Majors in zoology and physical geography) – University of New England Certificate Environmental Management TAFE NSW
Tom Schmidt	ERM	Field Survey	Tom has 3 Years' experience in environmental consulting.	Bachelor of Environmental Science and Management, University of Newcastle

Annex B

Director General's Requirements, Environmental Assessment Requirements And OEH Letter

Director-General's Requirements

Section 75F of the *Environmental Planning and Assessment Act 1979*

Project	Construction and operation of a new wind farm and associated infrastructure. The project is proposed to comprise upwards of 100 wind turbines (MP 11_0039).
Site	Approximately 20km north of Yass and 20km south-east of Boorowa within the Yass Valley, Boorowa and Upper Lachlan Shire Local Government areas.
Proponent	Bango Wind Farm Pty Ltd
Date of Issue	31 March 2011
Date of Expiration	31 March 2013
General Requirements	The Environmental Assessment (EA) must include: • an **executive summary**; • a **detailed description** of the project (both the wind farm and associated infrastructure) including: → construction, operation and decommissioning details; → the location and dimensions of all project components including the wind turbines (including map coordinates in latitude/longitude and maximum AHD heights) and the proposed external cladding materials, wind monitoring/ or met masts, underground/ overhead cabling between turbines, electrical substation and transmission line linking the wind farm to the grid, temporary concrete batching plant(s), construction compounds, access roads/road upgrades (including internal access tracks) and obstacle lighting; → a timeline identifying the proposed construction and operation of the project components including staging, their envisaged lifespan and arrangements for decommissioning; → supporting maps/plans clearly identifying existing environmental features (e.g. watercourses, vegetation), infrastructure and landuse (including nearby residences and approved residential developments or subdivisions, if any) and the location/ siting of the project including associated infrastructure in the context of this existing environment; and → resourcing requirements (including, but not limited to, water supply and gravel). • consideration of any **relevant statutory provisions** including the consistency of the project with the objects of the *Environmental Planning and Assessment Act 1979* (i.e. Clause 5 of the Act) and any relevant development control plans; • an **assessment of the key issues** outlined below, during construction, operation and decommissioning (as relevant). The Environmental Assessment must assess the worst case as well as representative impact for all key issues and also consider cumulative impacts from surrounding approved or proposed wind farms or power plants (Rugby, Rye Park, Yass, Dalton power plant), as relevant; • demonstration that the wind farm will be capable of meeting relevant Building Code of Australia (BCA) standards and other **relevant codes** / manufacturers' specifications for the construction of wind farms; • a **draft Statement of Commitments** detailing measures for environmental mitigation, management and monitoring for the project; • a **conclusion justifying the project** taking into consideration the environmental, social and economic impacts of the project; the suitability of the site; and the public interest; and • **certification by the author** of the EA that the information contained in the Assessment is neither false nor misleading.
Key Assessment Requirements	The EA must include assessment of the following key issues for both the wind farm and transmission line: • **Strategic Justification** - the EA must: → include a strategic assessment of the need, scale, scope and location for the project in relation to predicted electricity demand, predicted transmission

constraints and the strategic direction of the region and the State in relation to electricity supply, demand and electricity generation technologies, and its role within the Commonwealth's Renewable Energy Target Scheme. The EA must clearly demonstrate that the existing transmission infrastructure has sufficient capacity to accommodate the project;

→ include a clear demonstration of quantified and substantiated greenhouse gas benefits, taking into consideration sources of electricity that could realistically be replaced and the extent of their replacement, with reference to the Department of Environment, Climate Change and Water *NSW wind farm greenhouse gas savings tool* (http://www.environment.nsw.gov.au/climatechange/greenhousegassavingstool.htm):

→ include an analysis of the suitability of the project with respect to potential land use conflicts with existing and future surrounding land uses (including rural residential development, building entitlements and subdivision potential, land of significant scenic or visual value, land of high agricultural value, mineral resources (i.e. with particular reference to the exploration licences 6274, 6590, 6873, 7412 and 7427 that exist over the site), forestry, conservation areas and Crown land), taking into account local and strategic landuse objectives and the potential for social and economic impacts on the local community. The analysis of site suitability shall consider any Environmentally Sensitive Area Mapping held by Boorowa Shire, Yass Valley Shire and the Upper Lachlan Shire Councils; and

→ describe the alternatives considered (location and/or design) for all project components, and provide justification for the preferred project demonstrating its benefits on a local and strategic scale and how it achieves stated objectives and any measures to offset residual impacts (for example community enhancement programmes). Options for sharing transmission infrastructure with nearby wind farms should be discussed.

- **Visual Impacts** - the EA must:

→ provide a comprehensive assessment of the landscape character and values and any scenic or significant vistas of the area potentially affected by the project taking into account cumulative impacts from surrounding approved or operational wind farms in the locality, including an assessment of the significance of landscape values and character in a local and regional context. This should describe community and stakeholder values of the local and regional visual amenity and quality, and perceptions of the project based on surveys and consultation;

→ assess the impact of shadow "flicker", blade "glint" and night lighting from the wind farm;

→ identify the zone of visual influence of the wind farm including consideration to night lighting (no less than 10 kilometres) and assess the visual impact of all project components on this landscape;

→ include an assessment of any cumulative visual impacts from transmission line infrastructure;

→ include photomontages of the project taken from potentially affected residences (including approved but not yet developed dwellings or subdivisions with residential rights), settlements and significant public view points, and provide a clear description of proposed visual amenity mitigation and management measures for both the wind farm and the transmission line. The photomontages must include representative views of turbine night lighting if proposed;

→ provide an assessment of the feasibility, effectiveness and reliability of proposed mitigation measures and any residual impacts after these measures have been implemented; and

→ include consideration of alternative transmission line pole designs to minimise visual impact.

- **Noise Impacts** - the EA must:

→ include a comprehensive noise assessment of all phases and components of

	the project taking into account cumulative impacts from surrounding approved or operational wind farms in the locality including: turbine operation, the operation of the electrical substation, corona and / or aeolian noise from the transmission line, construction noise (focusing on high noise-generating construction scenarios and works outside of standard construction hours), traffic noise during construction and operation, and vibration generating activities (including blasting) during construction and/ or operation. The assessment must identify noise/ vibration sensitive locations (including approved but not yet developed dwellings, baseline conditions based on monitoring results, the levels and character of noise (e.g. tonality, impulsiveness, low frequency etc) generated by noise sources, noise/ vibration criteria, modelling assumptions and worst case and representative noise/ vibration impacts; → in relation to wind turbine operation, determine the noise impacts under operating meteorological conditions (i.e. wind speeds from cut in to rated power), including impacts under meteorological conditions that exacerbate impacts (including varying atmospheric stability classes and the van den Berg effect for wind turbines). The probability of such occurrences must be quantified; → include monitoring to ensure that there is adequate wind speed/profile data and ambient background noise data that is representative for all sensitive receptors; → provide justification for the nominated average background noise level used in the assessment process, considering any significant difference between daytime and night time background noise levels at background noise levels higher than 30 dB(A); → identify any risks with respect to tonal, low frequency or infra-noise; → clearly outline the noise mitigation, monitoring and management measures that would be applied to the project. This must include an assessment of the feasibility, effectiveness and reliability of proposed measures and any residual impacts after these measures have been incorporated; → if any noise agreements with residents are proposed for areas where noise criteria cannot be met, provide sufficient information to enable a clear understanding of what has been agreed and what criteria have been used to frame any such agreements; and → include a contingency strategy that provides for additional noise attenuation should higher noise levels than those predicted result following commissioning and/or noise agreements with landowners not eventuate. The assessment must be undertaken consistent with the following guidelines: → Wind Turbines - the South Australian Environment Protection Authority's *Wind Farms - Environmental Noise Guidelines* (2003); → Substation – *NSW Industrial Noise Policy* (EPA, 2000); → Site Establishment and Construction – *Interim Construction Noise Guidelines* (DECC, 2009); → Traffic Noise – *Environmental Criteria for Road Traffic Noise* (NSW EPA, 1999); and → Vibration – *Assessing Vibration: A Technical Guideline* (DECC, 2006). • **Ecological Impacts** – the EA must include an ecological assessment considering terrestrial and aquatic ecosystems (as relevant), including groundwater dependent ecosystems, consistent with *Guidelines for Threatened Species Assessment* (DEC, 2005); The EA must: → identify threatened species, populations and communities listed under both State and Commonwealth legislation that have the potential to occur on site. In particular, the following must be addressed: box woodland, table basalt forest and natural temperature grassland communities, and crimson spider orchid, silky swainson-pea, Yass daisy, hoary sunray, small woodland birds, superb, turquoise & swift parrots, barking owl & powerful owl, raptors, squirrel glider, koala, spotted tailed quoll, bats and golden sun moth;

	→ map existing vegetation by vegetation/ community type and include details on existing site conditions, including whether the vegetation comprises a highly modified or over-cleared landscape and the types and quality of habitat resources available. Vegetation mapping should consider any Environmentally Sensitive Area Mapping held by Boorowa Shire Council, Yass Valley Shire and the Upper Lachlan Shire Council; → provide details of the survey methodology employed including survey effort and representativeness for each species targeted and clear justification for species that were discounted from requiring field surveys or further assessment; → demonstrate a design philosophy of impact avoidance on ecological values, and in particular, ecological values of high significance; → provide a worst case estimate of vegetation to be cleared (in hectares), including quantifying impacts (in hectares) by vegetation type and threatened species habitat (as relevant); → assess the significance of impacts to native vegetation, listed threatened species, populations and communities and their habitats with consideration to local and region-based ecological implications, including edge effects, habitat connectivity and distribution of species. The assessment must consider impacts to in-stream and riparian ecology from works close to waterways and/ or waterway crossings. In addition, impact of the project on birds and bats from blade strikes, low air pressure zones at the blade tips (barotrauma), and alteration to movement patterns resulting from the turbines must be assessed, including demonstration of how the project has been sited to avoid and/ or minimise such impacts; → include details of how flora and fauna impacts would be managed during construction and operation including adaptive management, rehabilitation/ regeneration measures and maintenance protocols; → demonstrate how the project (with the incorporation of all proposed measures to avoid, mitigate and/ or offset impacts) achieves a biodiversity outcome consistent with "maintain or improve" principles. Sufficient details must be provided to demonstrate the availability of viable and achievable options to offset the impacts of the project and to secure these measures in perpetuity; and → address the risk of weed spread and identify mitigation measures. • **Heritage Impacts** – the EA must include an assessment of impacts on Aboriginal and historic heritage. The EA must: → include sufficient information to demonstrate the likely impacts of the project on Aboriginal heritage values/items (archaeological and cultural) and outline proposed mitigation measures (including consideration of the effectiveness and reliability of the measures) in accordance with the Draft *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC, 2005). The assessment must be undertaken by suitably qualified heritage consultants and demonstrate effective consultation with Aboriginal communities in determining and assessing impacts, developing options and selecting options and mitigation measures (including the final proposed measures); and → provide sufficient information to demonstrate the likely impacts of the project on historic heritage values (including heritage vistas) and, where impacts to State or local historic heritage items are proposed, outline proposed mitigation and management measures (including consideration of the effectiveness and reliability of the measures) generally consistent with the guidelines in the NSW Heritage Manual. Where impacts to State or local historic heritage items are proposed, a statement of heritage significance must be included. • **Traffic and Transport** – the EA must assess the construction and operational traffic impacts of the project including: → details of traffic volumes (both light and heavy vehicles) and transport routes during construction and operation; → assess the potential traffic impacts of the project on road network function

(including intersection level of service) and safety;

→ assess the capacity of the existing road network to accommodate the type and volume of traffic generated by the project (including over-dimensional traffic) during construction and operation, including full details of any required upgrades to roads, bridges, site access provisions (for safe access to the public road network) or other road features;

→ details of measures to mitigate and/or manage potential impacts, including construction traffic control, road dilapidation surveys and measures to control soil erosion and dust generated by traffic volumes;

→ details of access roads within the site including how these would connect to the existing public road network (i.e. site access) and ongoing operational maintenance requirements for on-site roads; and

→ consideration of relevant Council traffic/road policies.

- **Hazard/Risks**– the EA must include an assessment of the potential impacts on aviation safety, including the need for aviation hazard lighting, considering nearby aerodromes and aircraft landing areas, defined air traffic routes, aircraft operating heights, approach/departure procedures, radar interference, communication systems, and navigation aids. Aerodromes within 30km of the turbines should be identified and impacts on obstacle limitation surfaces addressed. In addition, the EA must assess the impact of the turbines on the safe and efficient aerial application of agricultural fertilisers and pesticides in the vicinity of the turbines and transmission line. Possible effects on telecommunications systems must be identified. Potential hazards and risks associated with electric and magnetic fields and bushfires/use of bushfire prone land must also be assessed.

- **Water Supply, Water Quality and Hydrology** – The EA must:
  → identify water demands, and determine whether an adequate and secure water supply is available for the project;
  → identify water sources (surface and groundwater), water disposal methods and water storage structures in the form of a water balance;
  → include the statutory (licensing) context of the water supply sources;
  → assess potential environmental impacts associated with the use of the identified water sources including impacts on groundwater and implications for existing licensed users/basic landholder rights;
  → assess the potential to intercept groundwater, including predicted dewatering volumes, zone of drawdown and associated impact, water quality and disposal methods;
  → where the project involves crossing or works close to waterways, identify likely impacts to the waterways, how the waterways are proposed to be crossed and be designed in accordance with the NSW Office of Water Guidelines for Controlled Activities (August 2010);
  → describe the measures to minimise hydrological, water quality, aquatic and riparian impacts; and
  → identify how works within steep gradient land or highly erosive soil types will be managed during construction and operation.

- **Waste –** The EA must identify, quantify and classify the likely waste streams to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.

- **General Environmental Risk Analysis** – notwithstanding the above key assessment requirements, the EA must include an environmental risk analysis to identify potential environmental impacts associated with the project, proposed mitigation measures and potentially significant residual environmental impacts after the application of proposed mitigation measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of the additional key environmental impact(s) must be included in the EA.

Consultation Requirements	The Proponent must undertake a consultation programme as part of the environmental assessment process, including consultation with, but not necessarily limited to, the following parties: • Boorowa Shire Council; • Yass Valley Shire; • Upper Lachlan Shire Council; • Department of Environment, Climate Change and Water; • NSW Office of Water; • Industry and Investment NSW; • NSW Roads and Traffic Authority; • NSW Rural Fire Service; • Land and Property Management Authority; • Lachlan Catchment Management Authority; • Commonwealth Department of Defence; • Civil Aviation Safety Authority; • Airservices Australia; • Aerial Agricultural Society of Australia; • relevant service providers; • relevant minerals stakeholders (including exploration and mining title holders); and • the local community and landowners (including "associated" and "non-associated" properties). The consultation process shall include measures for disseminating information to increase awareness of the project as well as methods for actively engaging stakeholders on issues that would be of interest/concern to them. The EA must: → demonstrate effective consultation with stakeholders, and that the level of consultation with each stakeholder is commensurate with their degree of interest/concern or likely impact; → clearly describe the consultation process undertaken for each stakeholder/group including details of the dates of consultation and copies of any information disseminated as part of the consultation process (subject to confidentiality); and → describe the issues raised during consultation and how and where these have been addressed in the EA.

Relevant Guidelines - For Reference

General

Wind Energy Facilities draft Environmental Impact Assessment Guidelines (Planning NSW, June 2002)

Draft EIS Guideline "Network Electricity Systems and Related Facilities" (Planning NSW, February, 2002)

Best Practice Guidelines for Implementation of Wind Energy Projects in Australia (Auswind, 2006)

Visual

Wind Farms and Landscape Values: National Assessment Framework (Australian Wind Energy Association and Australian Council of National Trust, June 2007).

Ecology

Cumulative Risk for Threatened and Migratory Species (Commonwealth Department of Environment and Heritage, March 2006).

Wind Farms and Birds: Interim Standards for Risk Assessment, (Auswind, July 2005).

Assessing the Impacts on Birds – Protocols and Data Set Standards (Australian Wind Energy Association).

Threatened Biodiversity Survey and Assessment – Guidelines for Developments and Activities (Working Document) (DEC, 2004).

Aviation Hazard

Advisory Circular 139-18(0) Obstacle Marking and Lighting of Wind Farms (Civil Aviation Safety Authority, July 2007). Note: this advisory is currently withdrawn however a replacement has to date not been issued.

Windfarm Policy (Aerial Agricultural Association of Australia, December 2009)

Powerlines Policy (Aerial Agricultural Association of Australia, December 2009)

Information Sheet – Airport Related Development (AirServices Australia)

Water Quality

National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000).

The NSW State Groundwater Quality Protection Policy (DLWC, 1998).

The NSW State Groundwater Dependent Ecosystems Policy (DLWC, 2002).

NSW Office of Water Guidelines for Controlled Activities (August 2010)):

- → Watercourse Crossings;
- → Instream Works;
- → Laying Pipes and Cables in Watercourses;
- → Outlet Structures; and
- → Riparian Corridors.

Managing Urban Stormwater: Soils and Construction, Volume 1, 4th edition (Landcom, 2004).

Managing Urban Stormwater: Soils and Construction, Volume 2C Unsealed roads (DECC).

NSW GOVERNMENT | Planning & Infrastructure

Office of the Director General

Contact: Toby Philp
Phone: (02) 9228-6343
Fax: (02) 9228-6455
Email: toby.philp@planning.nsw.gov.au

Our ref.: MP11_0039

Mr Edward Mounsey
Head of Development
Wind Prospect CWP Pty Ltd
45 Hunter Street
Newcastle NSW 2300

Dear Mr Mounsey

Subject: Supplementary Director-General's Requirements for Bango Wind Farm MP11_0039

I refer to the Director-General's requirements which were issued for the above project on 31 March 2011.

These requirements specify that the community must be consulted during the preparation of the Environmental Assessment and relevant issues must be addressed in the document.

It is clear from submissions being received by the Department that many members of the community are not satisfied with the level and nature of consultation being undertaken by proponents during the preparation of wind farm environmental assessment documents.

I wish to emphasise the importance of effective and genuine community consultation and the need for proposals to proactively respond to the community's concerns.

Accordingly, under section 75F(3) of the *Environmental Planning and Assessment Act*, I am issuing supplementary requirements which must be addressed in the preparation of your Environmental Assessment. These requirements are:

1. a comprehensive, detailed and genuine community consultation and engagement process must be undertaken. This process must ensure that the community is both informed of the proposal and is actively engaged in issues of concern to them, and is given ample opportunity to provide its views on the proposal. Sufficient information must be provided to the community so that it has a good understanding of what is being proposed and of the impacts. There should be a particular focus on those non wind farm associated community members who live in proximity to the site;

2. the Environmental Assessment must clearly document and provide details and evidence of the consultation process and who was consulted with;

3. all issues raised during the consultation process must be clearly identified and tabulated in the Environmental Assessment; and

4. the Environmental Assessment must state how the identified issues have been addressed, and how they have informed the proposal as presented in the

Environmental Assessment. In particular, the Environmental Assessment must state how the community's issues have been responded to.

I wish to emphasise that the Department will review compliance with these, and other, requirements during its adequacy review of the Environmental Assessment. If it does not adequately respond to these requirements it will not be accepted as adequate for public exhibition.

Your contact officer for this proposal, Toby Philp, can be contacted on (02) 9228-6343 or via email at toby.philp@planning.nsw.gov.au. Please mark all correspondence regarding the proposal to the attention of the contact officer.

Yours sincerely,

SHaddad

Sam Haddad
Director-General
16/9/2011

NSW GOVERNMENT | Environment, Climate Change & Water

Your reference:
Our reference: DOC11/12820 FIL11/258
Contact: Alison McLeod, (02) 6229 7002

The Manager- Water and Energy
Infrastructure Projects
Department of Planning
GPO Box 39
SYDNEY NSW 2001

30 March 2011

Dear Mr Osborne,

RE: Bango Wind Farm- Recommended Environmental Assessment Requirements

Issued pursuant to Section 75F Environmental Planning and Assessment Act 1979

I refer to your request for the Department of Environment, Climate Change and Water's (DECCW)[1] requirements for the environmental assessment (EA) for the above proposal received by DECCW on 9 March 2011.

DECCW has considered the details of the project as provided by DoP and has identified the information it requires to assess the project (see **Attachment 1**). The proponent should ensure that the EA is sufficiently comprehensive to enable DECCW to determine the extent of the impact(s) of the proposal.

The key issues requiring assessment for this project are summarised below:

1. Impacts of the project on biodiversity, native vegetation and threatened species and their habitat.
2. Impacts of the project on Aboriginal cultural heritage values.
3. The environmental impacts of the project.
4. Actions that will be taken to avoid or mitigate impacts or compensate for unavoidable impacts identified in 1-3 above.

In carrying out the assessment, the proponent should refer to the relevant guidelines as listed in **Attachment 2** and any relevant industry codes of practice and best practice management guidelines. DECCW request any field surveys for threatened species that have potential to occur

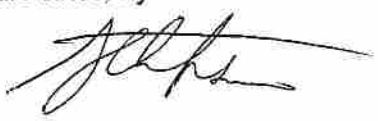
[1] Staff of DECCW perform the functions of the National Parks and Wildlife Service and the Environment Protection Authority

PO Box 622, Queanbeyan NSW 2620
11 Farrer Place, Queanbeyan NSW
Tel: (02) 6229 7002 Fax: (02) 6229 7006
ABN 30 841 387 271
www.environment.nsw.gov.au

on site, are conducted in accordance with the methodologies listed in **Attachment 3.** Any variation to this specific survey methodology must be supported by DECCW.

DECCW requests 3 hard copies of the EA for assessment. These documents should be lodged at DECCW's South East Regional Office, 11 Farrer Place, Queanbeyan NSW 2620. Please also send an electronic copy to our regional mailbox. If you have any queries regarding this matter please contact Alison McLeod on 6229 7002.

Yours sincerely



JULIAN THOMPSON
Unit Head – South East Region
Environment Protection and Regulation Group

Attachment 1

DECCW's Recommended Environmental Assessment Requirements (EARs)

Bango Wind Farm

TABLE OF CONTENTS

1 Environmental impacts of the project

1. Impacts related to the following environmental issues need to be assessed, quantified and reported on:
   - Aboriginal cultural heritage
   - Air Issues
   - Biodiversity
   - Noise and vibration
   - Waste including hazardous materials and radiation
   - Water and Soils
     - Soils - general
     - Water quality

   Environmental assessments (EAs) should address the specific requirements outlined under each heading below and assess impacts in accordance with the relevant guidelines mentioned. A full list of guidelines is at **Attachment 2.**

2 Aboriginal cultural heritage

The EA report should contain:

1. A description of the Aboriginal objects and declared Aboriginal places located within the area of the proposed development.

2. A description of the cultural heritage values, including the significance of the Aboriginal objects and declared Aboriginal places, that exist across the whole area that will be affected by the proposed development, and the significance of these values for the Aboriginal people who have a cultural association with the land.

3. A description of how the requirements for consultation with Aboriginal people as specified in clause 80C of the National Parks and Wildlife Regulation 2009 have been met.

4. The views of those Aboriginal people regarding the likely impact of the proposed development on their cultural heritage. If any submissions have been received as a part of the consultation requirements, then the report must include a copy of each submission and your response.

5. A description of the actual or likely harm posed to the Aboriginal objects or declared Aboriginal places from the proposed activity, with reference to the cultural heritage values identified.

6. A description of any practical measures that may be taken to protect and conserve those Aboriginal objects or declared Aboriginal places.

7. A description of any practical measures that may be taken to avoid or mitigate any actual or likely harm, alternatives to harm or, if this is not possible, to manage (minimise) harm.

8. A specific Statement of Commitment that the proponent will complete an Aboriginal Site Impact Recording Form and submit it to the Aboriginal Heritage

Information Management System (AHIMS) Registrar, for each AHIMS site that is harmed through the proposed development.

In addressing these requirements, the proponent must refer to the following documents:

a) *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (Department of Planning, 2005). These guidelines identify the factors to be considered in Aboriginal cultural heritage assessments for development proposals under Part 3A of the EP&A Act.

b) *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010) - http://www.environment.nsw.gov.au/licences/consultation.htm. This document further explains the consultation requirements that are set out in clause 80C of the National Parks and Wildlife Regulation 2009. The process set out in this document must be followed and documented in the Environmental Assessment Report.

c) *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010) - http://www.environment.nsw.gov.au/licences/archinvestigations.htm. The process described in this Code should be followed and documented where the assessment of Aboriginal cultural heritage requires an archaeological investigation to be undertaken.

Notes:

1. An Aboriginal Site Impact Recording Form (http://www.environment.nsw.gov.au/licences/DECCAHIMSSiteRecordingForm.htm) must be completed and submitted to the Aboriginal Heritage Information Management System (AHIMS) Registrar, for each AHIMS site that is harmed through archaeological investigations required or permitted through these environmental assessment requirements.

2. Under section 89A of the *National Parks and Wildlife Act* 1974, it is an offence for a person not to notify DECCW of the location of any Aboriginal object the person becomes aware of, not already recorded on the Aboriginal Heritage Information Management System (AHIMS). An AHIMS Site Recording Form should be completed and submitted to the AHIMS Registrar (http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm), for each Aboriginal site found during investigations.

3 Air issues

3.1 Air quality

Dust will be the main issue associated with air quality for the project corridor. The EA should include an air quality impact assessment (AQIA). The AQIA should:

1. Assess the risk associated with potential dust emissions for the construction stage of the proposal. Assessment of risk relates to environmental harm, risk to human heath and amenity.

2. Describe the receiving environment in detail. The proposal must be contextualised within the receiving environment (local, regional and inter-regional as appropriate). The description must include but need not be limited to:
    a. meteorology and climate;
    b. topography;
    c. surrounding land-use; receptors; and
    d. ambient air quality.

3. Detail emission control techniques/practices that will be employed by the proposal. The EA should describe in detail the measures proposed to mitigate the impacts and the extent to which the mitigation measures are likely to be effective in achieving the relevant environmental outcomes. A Cost Benefit Analysis on different mitigation measures/ technologies that have been investigated should also be included.

4. During the construction and operational phase of the project, impacts on amenity due to dust will need to be effectively managed.

4 Noise and vibration

In relation to noise, the following matters should be addressed (where relevant) as part of the Environmental Assessment.

DECCW supports the SA EPA Wind Farm Noise Guidelines (February 2003) and recommends that the SA Guideline (and criteria) be adopted as the sole basis for noise assessment of wind energy proposals in NSW. Use of other guidelines may be acceptable, provided compliance with these guidelines is also demonstrated. **The following information is designed to provide additional assistance, however it is the responsibility of the proponent to ensure that the assessment conforms with the aforementioned guideline.**

The EA must include a full assessment of how noise from this proposal will impact the surrounding environment and include information on the following:

- Identify all noise sources from the development (including both construction and operation phases). Detail all potentially noisy activities including ancillary activities such as transport of goods and raw materials at the construction stage, and maintenance of the wind turbine generators (WTG's) during operation stage;
- Identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, and other premises. This should include any residences on the property on which the WTG's are proposed (See also section 2.3 of the SA EPA Wind Farm Noise Guidelines February 2003);
- Typically the noise assessment should include a map of the locality showing any identified noise sensitive locations in relation to the site;
- Identify the land use zoning of the site and the immediate vicinity and the potentially affected areas.

1.1 Describe baseline conditions

- Determine the existing background noise levels for the identified noise sensitive residential receivers in accordance with the SA EPA Wind Farm Noise Guidelines (February 2003). The noise monitoring should comprise a minimum of 2000 measurement intervals (or the equivalent of two weeks worth of data), excluding any data adversely affected by the effects of wind and rain.
- Quantify winds that impinge on the microphone during noise monitoring. This is normally carried out at a height of 1200 to 1500mm above the ground.
- Prevailing wind speeds and directions shall be measured in accordance with the SA EPA Wind Farm Noise Guidelines (February 2003).

The noise impact assessment report should provide details of all monitoring of existing ambient noise levels including:

- Details of equipment used for the measurements;
- A description of the monitoring sites and where the equipment was positioned including photographs;

- A statement justifying the choice of monitoring site, including the procedure used to choose the site, having regards to the requirements of the SA EPA Wind Farm Noise Guidelines (February 2003);
- A description of the ambient noise environment including dominant and background noise sources at the assessment sites;
- The final L_{A90} values, based on the SA EPA's regression analysis method, for each integer wind speed from cut in to rated power;
- Graphs showing background noise at the receiver v's wind speed at the windfarm ,
- A record of periods of affected data (due to rain and/or excessive wind at the measurement location) methods used to exclude invalid data and a statement indicating that the data conforms to the SA EPA Wind Farm Noise Guidelines (February 2003) requirements;
- A statement qualifying the effectiveness of the microphone windshield protection for the range of wind speeds under consideration in the noise assessment.

1.2 Assess environmental impacts

Determine the noise criteria for the site. For each identified potentially affected receiver, this should include:

- Determination of the background noise levels for the range of integer wind speeds from cut in up to rated power;
- Determination of the noise criteria applicable to each assessment location based on the $L_{Aeq,10}$, adjusted for tonality, should not exceed 35dB(A) or the background noise (L_{A90}) by more than 5dB(A), whichever is the greater, at all relevant receivers for each integer wind speeds from cut in to rated power of the WTG.

Determine expected noise level and noise character (eg: tonality, impulsiveness, vibration, etc) likely to be generated from noise sources during:

- site establishment;
- construction;
- operational phases;
- transport including traffic noise generated by the proposal, where appropriate; and
- Other services (such as maintenance).

The noise impact assessment report should include noise source data for each wind turbine generator (WTG) source in 1/3 octave band centre frequencies including methods or references used to determine noise source levels. This data should address all proposed operating modes for the WTG's.

Determine the noise & vibration levels to be received at all locations identified as relevant receivers under the SA EPA Wind Farm Noise Guidelines (February 2003) for each integer wind speed from cut in speed to the speed of rated power. Potential impacts should be determined for the operating meteorological conditions (including wind speeds from cut in to rated power). Predicted noise levels from site establishment and construction phases should be assessed following the guidelines in the EPA, Environmental Noise Control Manual.

The proponent's assessment of the potential noise impacts shall include consideration of low frequency noise including infrasound.

The noise impact assessment report should include:

- A plan showing the location of each noise source (WTG and ancilliary equipment as relevant) for each prediction scenario as applicable;
- A list of the number and type of noise sources used in each prediction scenario to simulate all potential significant operating conditions on the site;
- Any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography, buildings or barriers, etc;
- Methods used to predict noise impacts including identification of the noise model used. The model used shall be supported with sufficient justification to demonstrate that the model has been proven to accurately predict noise from WTG under Australian conditions. Calibration of the model against existing wind farm operations is preferable, however other calibration methods may be considered on a case by case basis. An estimation of the models accuracy is essential;
- The predicted noise impacts from the operation scenario under the operating meteorological conditions (ie wind speeds from cut in to rated power) as well as calm conditions such as during maintenance periods where appropriate;
- Noise contours for the key prediction scenarios should be derived.

Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional mitigation measures to meet the criteria.

The noise impact assessment report should include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation.

Where blasting is intended at the site establishment or construction stage, the following details of the blast design should be included in the noise assessment:

- bench height, burden spacing, spacing burden ratio;
- blast hole diameter, inclination and spacing;
- type of explosive, maximum instantaneous charge, initiation, blast block size, blast frequency.

The noise impact assessment should include contingency measures or safeguards that provide for additional noise attenuation measures that are feasible and reasonable (and committed to by the proponent) should higher noise levels than those predicted result following commissioning of the WTG.

1.3 Compliance Assessment

The noise impact assessment shall identify, and commit to, the compliance assessment requirements presented in the SA EPA Wind Farm Noise Guidelines (February 2003) and the measures to be employed in the wind farm development to ensure that, if approved, a compliance assessment satisfying these requirements can be undertaken.

The construction and operation of the WTG will increase noise and vibration levels at sensitive receivers. The proposal must be designed, constructed, operated and maintained so that there are no adverse impacts from noise (including traffic noise).

Road transport to and from the project corridor has the potential to increase disturbance at residential properties along private or public haulage routes. To assess the extent of the impact, the noise impact assessment should identify the transport route(s) to be used, the hours of operation, anticipated traffic movements, and expected increase in noise levels. The publication *Environmental Criteria for Road Traffic Noise* (EPA, 1999) describes the methods generally applied by the DECC to determine noise planning levels for road traffic noise in locations of varying sensitivity.

The methodology, data and assumptions used to assess the impact of road haulage on residential properties must be fully documented and justified. Where disturbance due to road transport is likely to exceed the recommended criteria, the EA must describe the measures proposed to mitigate the impacts and the extent to which the measures are likely to be effective in achieving the relevant criteria.

5. Waste, chemicals and hazardous materials and radiation

5.1 General waste – any proposal

The EA should:

6. Include a detailed plan for in-situ classification of waste material, including the sampling locations and sampling regime that will be employed to classify the waste, particularly with regards to the identification of contamination hotspots.

6. Identify, characterise and classify all waste that will be generated onsite through excavation, demolition or construction activities, including proposed quantities of the waste.
Note: All waste must be classified in accordance with *DECCW's Waste Classification Guidelines.*

6. Identify, characterise and classify all waste that is proposed to be disposed of to an offsite location, including proposed quantities of the waste and the disposal locations for the waste. This includes waste that is intended for re-use or recycling.
Note: All waste must be classified in accordance with *DECCW's Classification Guidelines*.

6. Include a commitment to retaining all sampling and classification results for the life of the project to demonstrate compliance with *DECCW's Waste Classification Guidelines*.

6. Provide details of how waste will be handled and managed onsite to minimise pollution, including:

   a) Stockpile location and management
      - Labelling of stockpiles for identification, ensuring that all waste is clearly identified and stockpiled separately from other types of material (especially the separation of any contaminated and non-contaminated waste).
      - Proposed height limits for all waste to reduce the potential for dust and odour.
      - Procedures for minimising the movement of waste around the site and double handling.
      - Measures to minimise leaching from stockpiles into the surrounding environment, such as sediment fencing, geofabric liners etc.

   b) Erosion, sediment and leachate control including measures to be implemented to minimise erosion, leachate and sediment mobilisation at the site during works. The EA should show the location of each measure to be implemented. The Proponent should consider measures such as:
      - Sediment traps
      - Diversion banks
      - Sediment fences
      - Bunds (earth, hay, mulch)
      - Geofabric liners

- Other control measures as appropriate

The Proponent should also provide details of:

- how leachate from stockpiled waste material will be kept separate from stormwater runoff;
- treatment of leachate through a wastewater treatment plant (if applicable); and
- any proposed transport and disposal of leachate off-site.

6. Provide details of how the waste will be handled and managed during transport to a lawful facility. If the waste possesses hazardous characteristics, the Proponent must provide details of how the waste will be treated or immobilised to render it suitable for transport and disposal.

7. Include details of all procedures and protocols to be implemented to ensure that any waste leaving the site is transported and disposed of lawfully and does not pose a risk to human health or the environment.

8. Include a statement demonstrating that the Proponent is aware of DECCW's requirements with respect to notification and tracking of waste.

9. Include a statement demonstrating that the Proponent is aware of the relevant legislative requirements for disposal of the waste, including any relevant Resource Recovery Exemptions, as gazetted by DECCW from time to time.

10. Outline contingency plans for any event that affects operations at the site that may result in environmental harm, including: excessive stockpiling of waste, volume of leachate generated exceeds the storage capacity available on-site etc.

6. Water and soils

6.1 Soil issues - general

The EA should include:

1. An assessment of potential impacts on soil and land resources should be undertaken, being guided by *Soil and Landscape Issues in Environmental Impact Assessment* (DLWC 2000). The nature and extent of any significant impacts should be identified. Particular attention should be given to:
   a. Soil erosion and sediment transport - in accordance with *Managing urban stormwater: soils and construction,* vol. 1 (Landcom 2004) and vol. 2 (A. Installation of services; B Waste landfills; C. Unsealed roads; D. Main Roads; E. Mines and quarries) (DECC 2008).
   b. Mass movement (landslides) – in accordance with *Landslide risk management* guidelines presented in Australian Geomechanics Society (2007).
   c. Urban and regional salinity – guidance given in the Local Government Salinity Initiative booklets which includes *Site Investigations for Urban Salinity* (DLWC, 2002).

2. A description of the mitigation and management options that will be used to prevent, control, abate or minimise identified soil and land resource impacts

associated with the project. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

3. Where required, add any specific assessment requirements relevant to the project.

6.2 Water

Describe Proposal

1. The EA should provide details of the project that are essential for predicting and assessing impacts to waters including the quantity and physio-chemical properties of all potential water pollutants and the risks posed to the environment and human health.

2. Demonstrate that all practical options to avoid discharge have been implemented and environmental impact minimised where discharge is necessary.

3. Where relevant include a water balance for the development including water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options.

Background Conditions

4. Describe existing surface and groundwater quality. An assessment needs to be undertaken for any water resource likely to be affected by the proposal.

5. State the Water Quality Objectives for the receiving waters relevant to the proposal. These refer to the community's agreed environmental values and human uses endorsed by the NSW Government as goals for ambient waters (http://www.environment.nsw.gov.au/ieo/index.htm). Where groundwater may be impacted the assessment should identify appropriate groundwater environmental values.

6. State the indicators and associated trigger values or criteria for the identified environmental values. This information should be sourced from the ANZECC (2000) Guidelines for Fresh and Marine Water Quality (http://www.mincos.gov.au/publications/australian_and_new_zealand_guidelines_for_fresh_and_marine_water_quality).

7. State any locally specific objectives, criteria or targets which have been endorsed by the NSW Government.

Impact Assessment

8. Describe the nature and degree of impact that any proposed discharges will have on the receiving environment.

9. Assess impacts against the relevant ambient water quality outcomes. Demonstrate how the proposal will be designed and operated to:
    - protect the Water Quality Objectives for receiving waters where they are currently being achieved; and

- contribute towards achievement of the Water Quality Objectives over time where they are not currently being achieved.

10. Describe how stormwater will be managed both during and after construction.

7. Biodiversity

Biodiversity impacts can be assessed using **either** the BioBanking Assessment Methodology (scenario 1) or a detailed biodiversity assessment (scenario 2). The requirements for each of these approaches are detailed below.

The BioBanking Assessment Methodology can be used **either** to obtain a BioBanking statement, or to assess impacts of a proposal and to determine required offsets without obtaining a statement. In the latter instances, if the required credits are not available for offsetting, appropriate alternative options may be developed in consultation with DECCW officers and in accordance with DECCW policy.

Scenario 1 - Where a proposal is assessed using the BioBanking Assessment Methodology (BBAM):

1. Where a BioBanking Statement is being sought under Part 7A of the *Threatened Species Conservation* Act 1995 (TSC Act), the assessment must be undertaken by an accredited BioBanking assessor (as specified under Section 142B (1)(c) of the TSC Act 1995) and done in accordance with the *BioBanking Assessment Methodology and Credit Calculator Operational Manual* (DECCW, 2008). To qualify for a BioBanking Statement a proposal must meet the improve or maintain standard.

1a. The EA should include a specific Statement of Commitments that reflects all requirements of the BioBanking Statement including the number of credits required and any DG approved variations to impact on Red Flags.

2. Where the BioBanking Assessment Methodology is being used to assess impacts of a proposal and to determine required offsets, and a BioBanking Statement is not being obtained, the EA should contain a detailed biodiversity assessment and all components of the assessment must be undertaken in accordance with the *BioBanking Assessment Methodology and Credit Calculator Operational Manual* (DECCW, 2008).

2a. The EA should include a specific Statement of Commitments which:
- is informed by the outcomes of the proposed BioBanking assessment offset package;
- sets out the ecosystem and species credits required by the BioBanking Assessment Methodology and how these ecosystem and/or species credits will be secured and obtained;
- if the ecosystem or species credits cannot be obtained, provides appropriate alternative options to offset expected impacts, noting that an appropriate alternative option may be developed in consultation with DECCW officers and in accordance with DECCW policy;
- demonstrates how all options have been explored to avoid red flag areas;
- includes all relevant 'BioBanking files (e.g. *.xml output files), data sheets and documentation (including maps, aerial photographs, GIS shape files, other

remote sensing imagery etc.) to ensure DECCW can conduct an appropriate review of the assessment.

3. Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby DECCW estate reserved under the *National Parks and Wildlife Act 1974* or any marine and estuarine protected areas under the *Fisheries Management Act 1994* or the *Marine Parks Act 1997* should be considered. Please refer to the *Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water* (DECCW, 2010).

4. With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the assessment should identify and assess any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.

Scenario 2 - Where a proposal is assessed outside the BioBanking Assessment Methodology:

5. The EA should include a detailed biodiversity assessment, including assessment of impacts on threatened biodiversity, native vegetation and habitat. This assessment should address the matters included in the following sections.

5. A field survey of the site should be conducted and documented in accordance with Attachment 3, Appendix 1 and relevant guidelines, including;

- the *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna -Amphibians* (DECCW, 2009)
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004), and
- Threatened species survey and assessment guideline information on www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm.

If a proposed survey methodology is likely to vary significantly from the above methods, the proponent should discuss the proposed methodology with DECCW prior to undertaking the EA, to determine whether DECCW considers that it is appropriate.

Recent (less than five years old) surveys and assessments may be used. However, previous surveys should not be used if they have:

- been undertaken in seasons, weather conditions or following extensive disturbance events when the subject species are unlikely to be detected or present, or
- utilised methodologies, survey sampling intensities, timeframes or baits that are not the most appropriate for detecting the target subject species,

Unless these differences can be clearly demonstrated to have had an insignificant impact upon the outcomes of the surveys. If a previous survey is used, any additional species listed under the TSC Act since the previous survey took place, must be surveyed for.

Determining the list of potential threatened species for the site must be done in accordance with the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004) and the *Guidelines for Threatened Species Assessment* (Department of Planning, July 2005). The DECCW Threatened Species website http://www.environment.nsw.gov.au/threatenedspecies/ and the *Atlas of NSW Wildlife* database must be the primary information sources for the list of threatened species present. The BioBanking Threatened Species Database, the Vegetation Types databases (available on DECCW website at http://www.environment.nsw.gov.au/biobanking/biobankingtspd.htm and http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm, respectively) and other data sources (e.g. PlantNET, Online Zoological Collections of Australian Museums (http://www.ozcam.org/), previous or nearby surveys etc.) may also be used to compile the list.

5. The EA should contain the following information as a minimum:

a. The requirements set out in the *Guidelines for Threatened Species Assessment* (Department of Planning, July 2005).
b. Description and geo-referenced mapping of study area (and spatial data files), e.g. overlays on topographic maps, satellite images and /or aerial photos, including details of map datum, projection and zone, all survey locations, vegetation communities (including classification and methodology used to classify), key habitat features and reported locations of threatened species, populations and ecological communities present in the subject site and study area.
c. Description of survey methodologies used, including timing, location and weather conditions.
d. Details, including qualifications and experience of all staff undertaking the surveys, mapping and assessment of impacts as part of the EA.
e. Identification of national and state listed threatened biota known or likely to occur in the study area and their conservation status.
f. Description of the likely impacts of the proposal on biodiversity and wildlife corridors, including direct and indirect and construction and operation impacts. Wherever possible, quantify these impacts such as the amount of each vegetation community or species habitat to be cleared or impacted, or any fragmentation of a wildlife corridor.
g. Identification of the avoidance, mitigation and management measures that will be put in place as part of the proposal to avoid or minimise impacts, including details about alternative options considered and how long term management arrangements will be guaranteed.
h. Description of the residual impacts of the proposal. If the proposal cannot adequately avoid or mitigate impacts on biodiversity, then a biodiversity offset package is expected (see the requirements for this at point 6 below).
i. Provision of specific Statement of Commitments relating to biodiversity.

5. An assessment of the significance of direct and indirect impacts of the proposal must be undertaken for threatened biodiversity known or considered likely to occur in the study area based on the presence of suitable habitat. This assessment must take into account:

a. the factors identified in s.5A of the EP&A Act, and
b. the guidance provided by *The Threatened Species Assessment Guideline – The Assessment of Significance (DECCW, 2007)* which is available at: http://www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf

5. Where an offsets package is proposed by a proponent for impacts to biodiversity (and a BioBanking Statement has not been sought) this package should:

a) Meet DECCW's *Principles for the use of biodiversity offsets in NSW*, which are available at: www.environment.nsw.gov.au/biocertification/offsets.htm.
b) Identify the conservation mechanisms to be used to ensure the long term protection and management of the offset sites.
c) Include an appropriate Management Plan (such as vegetation or habitat) that has been developed as a key amelioration measure to ensure any proposed compensatory offsets, retained habitat enhancement features within the development footprint and/or impact mitigation measures (including proposed rehabilitation and/or monitoring programs) are appropriately managed and funded.

5. Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby DECCW estate reserved under the *National Parks and Wildlife Act 1974* or any marine and estuarine protected areas under the *Fisheries Management Act 1994* or the *Marine Parks Act 1997* should be considered. Refer to the *Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water* (DECC, 2010).

5. With regard to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the assessment should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.

Impacts of the project on threatened species and their habitat

The project area may support Endangered Ecological Communities and Threatened Species as listed in the TSC Act. Development will need to avoid EEC and provide an appropriate buffer and asset protection zone. The EA must describe what actions will be undertaken to avoid or mitigate impacts caused by the development on all threatened species described on the site. Threatened species that could potentially occur onsite and should be considered include;

- White Box, Yellow Box, Blakely's Red Gum Woodland (Also listed under the Commonwealth *Environment Protection & Biodiversity Conservation Act* 1999);
- Tableland Basalt Forest in the Sydney Basin and South East Highlands Bioregions;
- Natural Temperate Grasslands of the Southern Tablelands of NSW and the ACT (listed under the Commonwealth *Environment Protection & Biodiversity Conservation Act* 1999);
- Crimson Spider Orchid *Caladenia concolor*;
- Silky Swainson-pea *Swainsona sericea*;
- Yass Daisy *Ammobium craspedioides*;
- Hoary Sunray *Leucochrysum albicans* var. *tricolor*;
- Small woodland birds;
- Superb, Turquoise and Swift Parrots;
- Barking Owl and Powerful Owl;
- Raptors: Little Eagle, Square-tailed Kite and Spotted Harrier
- Squirrel Glider *Petaurus norfolcensis*;
- Koala *Phascolarctos cinereus*;

- Spotted-tailed Quoll *Dasyurus maculatus*;
- Bats; and
- Golden Sun Moth *Synemon plana*.

See Attachment 3 for a more comprehensive list of relevant threatened species and associated assessment requirements to be assessed for this project. However DECCW advise that the species in attachment b and those listed above is not exhaustive and there may be potential for a number of other threatened species to occur at the site. It is unlikely the subject site or adjoining areas have been covered by reliable survey and therefore the potential for species to occur must be acknowledged though habitat types rather than database records.

Other Vegetation Clearing

The EA should clearly outline the extent to which the development footprint will impact on areas of native vegetation. Offsetting biodiversity and habitat loss would be required as identified in the threatened species guidelines. There are formulas associated with the "maintain and improve" principle of the Government's vegetation reforms that DECCW considers should apply.

Attachment 2 – Guidance Material

Title	Web address
Relevant Legislation	
Commonwealth Environment Protection and Biodiversity Conservation Act 1999	http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/
Contaminated Land Management Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+140+1997+cd+0+N
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N
National Parks and Wildlife Act 1974	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N
Protection of the Environment Operations Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
Threatened Species Conservation Act 1995	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+101+1995+cd+0+N
Water Management Act 2000	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2000+cd+0+N
Aboriginal Cultural Heritage	
Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (2005)	Available from DoP.
Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010)	http://www.environment.nsw.gov.au/licences/consultation.htm
Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010)	http://www.environment.nsw.gov.au/licences/archinvestigations.htm
Aboriginal Site Impact Recording Form	http://www.environment.nsw.gov.au/licences/DECCAHIMSSiteRecordingForm.htm
Aboriginal Heritage Information Management System (AHIMS) Registrar	http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm
Air Issues	
Air Quality	
Approved methods for modelling and assessment of air pollutants in NSW (2005)	http://www.environment.nsw.gov.au/resources/air/ammodelling05361.pdf
Biodiversity	
BioBanking Assessment Methodology (DECC, 2008)	http://www.environment.nsw.gov.au/resources/biobanking/08385bbassessmethod.pdf
BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECCW, 2008)	http://www.environment.nsw.gov.au/biobanking/operationalmanual.htm
Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna -Amphibians	http://www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf

Title	Web address
(DECCW, 2009)	
Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft (DEC, 2004)	http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf
Guidelines for Threatened Species Assessment (Department of Planning, July 2005)	Draft available from DoP
DECCW Threatened Species website	http://www.environment.nsw.gov.au/threatenedspecies/
Atlas of NSW Wildlife	http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp
BioBanking Threatened Species Database	http://www.environment.nsw.gov.au/biobanking/biobankingtspd.htm
Vegetation Types databases	http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm
PlantNET	http://plantnet.rbgsyd.nsw.gov.au/
Online Zoological Collections of Australian Museums	http://www.ozcam.org/
Threatened Species Assessment Guideline - The Assessment of Significance (DECCW, 2007)	http://www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf
Principles for the use of biodiversity offsets in NSW	http://www.environment.nsw.gov.au/biocertification/offsets.htm
Noise and Vibration	
Interim Construction Noise Guideline (DECC, 2009)	http://www.environment.nsw.gov.au/noise/constructnoise.htm
Industrial Noise Policy Application Notes	http://www.environment.nsw.gov.au/noise/traffic.htm
Environmental Criteria for Road Traffic Noise (EPA, 1999)	http://www.environment.nsw.gov.au/noise/traffic.htm
Waste, Chemicals and Hazardous Materials and Radiation	
Waste	
Waste Classification Guidelines (DECC, 2008)	http://www.environment.nsw.gov.au/waste/envguidlns/index.htm
Water and Soils	
Contaminated Sites Assessment and Remediation	
Managing land contamination: Planning Guidelines – SEPP 55 Remediation of Land	http://www.planning.nsw.gov.au/DevelopmentAssessments/RegisterofDevelopmentAssessmentGuidelines/tabid/207/language/en-US/Default.aspx
Guidelines for Consultants Reporting on Contaminated Sites (EPA, 2000)	http://www.environment.nsw.gov.au/resources/clm/97104consultantsglines.pdf
Soils – general	
Soil and Landscape Issues in Environmental Impact Assessment (DLWC 2000)	http://www.dnr.nsw.gov.au/care/soil/soil_pubs/pdfs/tech_rep_34_new.pdf
Managing urban stormwater: soils and construction, vol. 1 (Landcom 2004) and	Vol 1 - Available for purchase at http://www.landcom.com.au/whats-new/publications-reports/the-

Title	Web address
vol. 2 (A. Installation of services; B Waste landfills; C. Unsealed roads; D. Main Roads; E. Mines and quarries) (DECC 2008)	blue-book.aspx Vol 2 - http://www.environment.nsw.gov.au/stormwater/publications.htm
Water	
Water Quality Objectives	http://www.environment.nsw.gov.au/ieo/index.htm
ANZECC (2000) Guidelines for Fresh and Marine Water Quality	http://www.mincos.gov.au/publications/australian_and_new_zealand_guidelines_for_fresh_and_marine_water_quality
Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones	http://deccnet/water/resources/AWQGuidance7.pdf
Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)	http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf

Attachment 3

EVALUATION OF IMPACTS ON THREATENED SPECIES for BANGO WIND FARM

For the purposes of the Biodiversity Impact Assessment, the species listed in Table 1 are to be addressed as *subject species*:

Table 1. List of *subject species*.

SPECIES	SCIENTIFIC NAME	STATUS
FAUNA		
Regent Honeyeater	*Anthochaera phrygia*	Critically Endangered
Booroolong Frog	*Litoria booroolongensis*	Endangered
Swift Parrot	*Lathamus discolor*	Endangered
Golden Sun Moth	*Synemon plana*	Endangered
Brown Treecreeper	*Climacteris picumnus victoriae*	Endangered
Diamond Firetail	*Stagonopleura guttata*	Vulnerable
Hooded Robin	*Melanodryas cucullata cucullata*	Vulnerable
Speckled Warbler	*Pyrrholaemus sagittatus*	Vulnerable
Grey-crowned Babbler	*Pomatostomus temporalis temporalis*	Vulnerable
Little Lorikeet	*Glossopsitta pusilla*	Vulnerable
Black-chinned Honeyeater	*Melithreptus gularis gularis*	Vulnerable
Turquoise Parrot	*Neophema pulchella*	Vulnerable
Varied Sittella	*Daphoenositta chrysoptera*	Vulnerable
Scarlet Robin	*Petroica boodang*	Vulnerable
Flame Robin	*Petroica phoenicea*	Vulnerable
White-fronted Chat	*Pyrrholaemus saggitatus*	Vulnerable
Painted Honeyeater	*Grantiella picta*	Vulnerable
Little Eagle	*Hieraaetus morphnoides*	Vulnerable
Spotted Harrier	*Circus assimilis*	Vulnerable
Square-tailed Kite	*Lophoictinia isura*	Vulnerable
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Vulnerable
Glossy Black-cockatoo	*Calyptorhynchus lathami*	Vulnerable
Superb Parrot	*Polytelis swainsoni*	Vulnerable
Barking Owl	*Ninox connivens*	Vulnerable
Powerful Owl	*Ninox strenua*	Vulnerable
Squirrel Glider	*Petaurus norfolcensis*	Vulnerable
Koala	*Phascolarctos cinereus*	Vulnerable
Eastern Pygmy Possum	*Cercartetus nanus*	Vulnerable
Spotted-tailed Quoll	*Dasyurus maculatus*	Vulnerable
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	Vulnerable
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	Vulnerable
Yellow Bellied Sheathtail-bat	*Saccolaimus flaviventris*	Vulnerable
Greater Broad-nosed bat	*Scoteanax rueppellii*	Vulnerable
Greater Long-eared Bat	*Nyctophilus timoriensis*	Vulnerable

SPECIES	SCIENTIFIC NAME	STATUS
FLORA		
Hoary Sunray	*Leucochrysum albicans* var. *tricolor*	Endangered (EPBC)
Crimson Spider Orchid	*Caladenia concolor*	Endangered
Doubletail Buttercup	*Diuris aequalis*	Endangered
Silky Swainson-pea	*Swainsona sericea*	Vulnerable
Yass Daisy	*Ammobium craspedioides*	Vulnerable
ENDANGERED ECOLOGICAL COMMUNITIES		
White Box, Yellow Box, Blakely's Red Gum Woodland		
Tableland Basalt Forest in the Sydney Basin and South East Highlands Bioregions		

One of the roles of the Evaluation of impacts is to determine which species, populations or ecological communities may be utilising, or present, on a development site. The entities to be considered for inclusion in the list of subject species, populations and ecological communities are listed in Table 2. This list is not exhaustive and other entities may also need to be included for assessment on the basis of desktop and habitat analyses and the outcomes of fieldwork.

Table 2. List of other entities for consideration as *subject species, populations or ecological communities.*

SPECIES	SCIENTIFIC NAME	STATUS
FAUNA		
Australasian Bittern	*Botaurus poiciloptilus*	Endangered
Grassland Earless Dragon	*Tympanocryptis pinguicolla*	Endangered
Little Whip Snake	*Suta flagellum*	Vulnerable
Pink-tailed Worm-lizard	*Aprasia parapulchella*	Vulnerable
Striped Legless Lizard	*Delma impar*	Vulnerable
Rosenberg's Goanna	*Varanus rosenbergi*	Vulnerable
Painted Snipe	*Rostratula benghalensis australis*	
FLORA		
Dwarf Kerrawang	*Rulingia prostrate*	Endangered
Mountain Swainson Pea	*Swainsona recta*	Endangered
Tarengo Leek Orchid	*Prasophyllum petilum*	Endangered
Button Wrinklewort	*Rutidosis leptorrhynchoides*	Vulnerable
Aromatic Peppercress	*Lepidium hyssopifolium*	Vulnerable
Robertson's Gum	*Eucalyptus robertsonii* subsp *hemisphaerica*	Vulnerable
Black Gum	*Eucalyptus aggregate*	Vulnerable
ENDANGERED ECOLOGICAL COMMUNITIES		
***Natural Temperate Grassland of the Southern Tablelands* (NSW and ACT) (EPBC community)**		
Frost Hollow Grassy Woodland (preliminary listed)		

In determining whether the entities listed in Table 2, as well as other entities, should also be addressed as subject species, populations and ecological communities, consideration shall be given to the habitat types present within the study area, recent records of threatened species, populations or ecological communities in the locality and the known distributions of threatened species, populations and ecological communities. This analysis and its conclusion are to be documented in the Evaluation of Impacts.

Databases such as the DECCW Atlas of NSW Wildlife and BioNet, as well as databases held by the Australian Museum and Royal Botanic Gardens, should be consulted to assist in compiling the list of possible entities to be analysed. It should be noted that if the DECCW Atlas is the only database that is referred to, due to data exchange agreements, the data provided by DECCW will only include that for which DECCW is a custodian. In many cases, this may only be a small subset of the data available. Other databases must also be consulted to create a comprehensive list of entities for consideration as subject species, populations or ecological communities.

3.2 Identifying habitats

In describing the *study area*, consideration shall be given to the previous land uses and the effect of these land uses on the *study area*. Relevant historical events may include fire, clearing, logging, slashing, recreational use and agricultural activities.

A description of habitats including such components as the frequency of tree hollows, the presence of wetlands, the density of understorey vegetation, the composition of the ground cover, the soil type and the presence of heath and permanent or ephemeral swamps shall be given. The condition of these habitats within the *study area* shall be discussed, including the prevalence of introduced species. A description of the habitat requirements of threatened species, populations or ecological communities likely to occur in the *study area* shall be provided.

Any areas which may provide habitat connectivity between the *study area* and adjacent areas of likely habitat for *subject species, populations or ecological communities* shall be identified and described.

In defining the *study area*, consideration shall be given to possible *indirect impacts* of the proposed action on species/habitats in and surrounding the *subject site*. These could include impacts arising from altered fire and hydrology regimes, soil erosion or pollution, fencing, habitat fragmentation and disruption of wildlife movement corridors, edge effects, altered light and noise regimes, disturbance of roosting areas or other impacts due to increased use of the area by humans, and the impacts of increased levels of domestic and feral predators.

Director General's Requirements for Environmental Assessment
Bango Wind Farm

Attachment 3, Appendix 1: Survey Requirements for Subject Species - DGRs for Bango Wind Farm

SPECIES	SURVEY REQUIREMENTS
Regent Honeyeater	The regional significance of the subject site for the Regent Honeyeater is unknown. There are potential breeding and foraging habitats on the subject site that should be surveyed using diurnal fixed-width transect or point-count surveys and call playback techniques, as the species responds to taped calls during the breeding season. Whilst surveys can be conducted at any time of the year, the optimal time is spring and summer during the breeding season.
Swift Parrot	This species is known to utilise the foraging resources and travel through the local area. There are foraging habitats on the subject site that should be surveyed using diurnal fixed-width transects and point-count surveys during Autumn - Winter.
Golden Sun Moth	Surveys of the *subject site* and *study area* shall be undertaken for this species. These surveys should target areas with higher than 40% *Austrodanthonia* in the groundcover. Areas of habitat should be hand-netted during known flight periods. The flight period for this species is short therefore surveys should be undertaken when other known populations in the area are flying. The consultant should discuss these periods with the DECCW prior to the survey being conducted. Surveys of the *locality* for habitat of the species shall be undertaken. These shall involve determining the extent of potentially suitable habitat from aerial photographs or other means, and ground-truthing selected sites to validate habitat suitability, condition and extent. The sites sampled shall be used to provide context to the habitat affected by the action proposed.
Brown Treecreeper, Diamond Firetail, Hooded Robin, Speckled Warbler, Grey-crowned Babbler, Little Lorikeet, Black-chinned Honeyeater, Turquoise Parrot and Varied Sittella.	Diurnal bird censuses shall be undertaken in the early morning and/or late afternoon within the *subject site* on three occasions each separated by a period of one week. Each census shall comprise observations for birds, including call recognition, for a period of 45 minutes at a minimum of three locations spread across the subject site. Surveys can be undertaken at any time of the year, but shall avoid high-wind and/or rainy days.
Scarlet Robin, Flame Robin	Diurnal bird censuses shall be undertaken in the early morning and/or late afternoon within the *subject site* on three occasions each separated by a period of one week. Each census shall comprise observations for birds, including call recognition, for a period of 45 minutes at a minimum of three locations spread across the subject site. Additional opportunistic bird census shall be employed across the *study area* and *locality* during the course of other surveys for the EA. Surveys should be concentrated on ridges, hills and foothills. Surveys should be between July to January however can be undertaken at any time of the year, but shall avoid high-wind and/or rainy days.
Gang Gang Cockatoo / Glossy Black-cockatoo / Superb Parrot	Undertake diurnal bird surveys across the study area and nesting assessments using a combination of stag-watching and listening for calls of the birds returning to nests in the late afternoon during the known breeding season of each species, to ascertain the locations of any nest sites in the study area. These surveys should target hollow-bearing trees with hollows of suitable size (>10cm

SPECIES	SURVEY REQUIREMENTS
	diameter) for the species that are to be removed for the proposal or which lie within 50m of areas to be disturbed by the proposal. Estimate the availability, condition and security of potential breeding habitat for the species in the locality by ground-truthing existing vegetation mapping datasets.
Superb Parrot	The subject site is a known breeding site for the Superb Parrot. It also provides important foraging and shelter habitat to this species. Surveys shall focus on identifying how the species is utilising these habitats across the site on a temporal basis, with regard to seasonally fluctuating food resources such as grain and oilseed crops. Particular attention should be given to the potential impacts on this species where wind turbine generators are positioned between suitable patches of habitat. The potential impact of turbines on this species over a local population shall also be assessed. Surveys should consider habitat beyond the subject site and how this habitat will influence Superb Parrot movements. The survey and assessment shall aim to map flight paths across the subject site taking into consideration the variation in seasonal foraging habitat within locality, which includes both natural/wild resources and planted crops. Foraging sites, both known and potential (e.g. known cropping paddocks) must be spatially mapped. Diurnal bird censuses shall be undertaken in the early morning and/or late afternoon within the *subject site* using a combination of opportunistic random searching, and 5-10 min fixed point surveys. The fixed point surveys should be selected using a stratified random design that focuses on sites where Superb Parrot are likely to be observed either flying, foraging, roosting or nesting. A suggested maximum distance between fixed point survey locations is 1 km. Both opportunistic and fixed point surveys for the Superb Parrot must be conducted over three separate survey periods, each separated by a period of one week. Each census shall comprise observations for birds. Surveys should not be restricted to the footprint, but should also cover areas between and adjacent footprint areas where Superb Parrot habitat and flight paths are likely to occur. Target survey will be undertaken during the breeding season (Sept – Jan) to identify nesting sites. Observed nest sites and potential nest sites (trees with hollows 12 cm diameter or greater or with a DBH greater than x cm (suggest 50 cm)) will be recorded and mapped to provide context in relation to the proposed development footprint.
Barking Owl and Powerful Owl	Nocturnal call playback (1 site per 100 ha) with an initial listening period of 10 min then play the call of each subject species separated by at least a 2 min listening period, then finish with a 10 minute listening period. Identify and map all hollow-bearing trees (potential nest trees) on the subject site and estimate the availability of hollow-bearing trees in the locality. The number of nocturnal call playback surveys should be consistent with *DEC 2004, Draft Threatened Biodiversity Survey & Assessment Guidelines for Developments and Activities.*
Squirrel Glider	The consultant needs to determine the distribution and abundance of the species on the subject site and its status in the region. Squirrel Gliders may occur across a wide variety of forest and woodland vegetation types. Live-trapping in trees is the preferred survey method for detecting Squirrel Gliders. Traps

SPECIES	SURVEY REQUIREMENTS
	should be either large Elliott box traps or wire mesh 'bandicoot' traps (200 mm wide x 170 mm tall x 500 mm long; Figure 2) (manufactured by R.E. Walters Pty. Ltd., Sunshine, VIC). Live-trapping is a preferred sampling technique as it allows for unequivocal identification of animals. This is particularly important as the Squirrel Glider is very similar in appearance to the smaller Sugar Glider, *Petaurus breviceps*. Identification via hair analysis is also known to be problematic between these two species, therefore ct hair tube surveys may be used to complement live trapping however it will not negate the need for live trapping. Bait should consist of a mixture of peanut butter, honey and rolled oats. A honey and water solution may be sprayed above and below the trap entrance. The number of traps set at a site will vary according to the extent of suitable habitat, the area over which possible den sites are present, and the scale of the proposed clearing or activity. Traps should ideally be positioned horizontally in low tree branches. Traps must be attached to trees and spaced approximately 50-100 m apart in a transect or grid layout, as the habitat allows. Traps must be set for a minimum period of 4 consecutive nights. On each day traps should be set at dusk and checked the following morning. Elliott trapping intensity should comply, at a minimum, with the *DEC 2004, Draft Threatened Biodiversity Survey & Assessment Guidelines for Developments and Activities*, available on DECCW public website. If the species is present, given the rarity of the species in the region, any proposed development must avoid direct impacts on the species in the first instance, minimise any unavoidable or indirect impacts, and then set up processes which establish long-term conservation of the species on-site. DECCW supports the use of cameras as a trade off survey intensity, however the lower intensity Elliott trapping should comply with the *DEC 2004, Draft Threatened Biodiversity Survey & Assessment Guidelines for Developments and Activities*.
Koala	It is noted that a Koala has been recorded on the subject site. Given the rarity of this species in the area it will be necessary for all areas that are actively used by the species to be identified. The most appropriate technique for doing this is the method known as the "Regularised Grid-Based Spot Assessment Technique" (RGBSAT) developed by Dr Stephen Phillips of Biolink Pty Ltd. DECCW now utilises this technique where it is necessary to obtain detailed activity data on low-density Koala populations in southern NSW. For further information on its application refer to the *Koala surveys in the coastal forests of the Bermagui–Mumbulla area: 2007–09 – An interim report* available on the DECCW web site at www.environment.nsw.gov.au The proponent is invited to engage with the DECCW prior to a full assessment of this species to clarify survey effort and the RGBSAT methodology. In conjunction with activity assessments the consultant is required to map potential Koala habitat in the study area. The Environment Assessment should consider detail outlined in State Environment Planning Policy (SEPP) 44.
Spotted-tailed Quoll	DECCW supports the use of remote digital infrared cameras as a suitable survey methodology for this species. Poor quality cameras are unfavourable. High quality cameras

SPECIES	SURVEY REQUIREMENTS
	with similar operating capacity of Reconyx or Moultrie brands are preferred as they are known to be more effective in detecting this species. Cameras must be installed in the most suitable habitats, drainage lines should be targeted. Cameras should be fixed to a tree or rock, elevated off the ground focusing on the bait station. Bait "chicken" should be placed in a secure housing approximately 1-1.5m from the camera and fixed 2-3cm off the ground to help species identification, especially in smaller mammals. Vegetation should be trimmed in an arc around the camera up to 1-2m to avoid interference. Camera should be installed for a minimum of 4 weeks. Cameras surveys can be undertaken during any time of the year, however failing detection, surveys will be required between March – September.
Eastern False Pipistrelle, Eastern Bentwing-bat, Greater Broad-nosed bat, Yellow-bellied Sheathtail-bat and Greater long-eared Bat.	Surveys using Anabat recorders and stag watching should aim to identify the number and location of roost sites for the subject bats and identify important foraging habitat in the study area and the locality. If required, the DECCW can provide further advice on bat survey techniques to acquire this information. Surveys of the subject site, study area and locality shall be undertaken for hollow-bearing trees. This shall involve intensive searches for hollow-bearing trees in the subject site and study area. Representative sampling of the locality for hollow-bearing trees shall involve the use of transects in selected locations and the gathering of data in conjunction with ground-truthing for endangered ecological communities. The number of hollow-bearing trees recorded shall be used to provide context to the potential breeding habitat affected by the action proposed.
Grassland Earless Dragon *Tympanocryptis pinguicolla*	Spider-tubes should be used to survey areas of suitable habitat, being natural temperate grassland or nearby secondary grassland, with a preference to lower, open areas dominated by wallaby grasses. Survey season should be for 10 weeks from February to April with tubes checked twice a week. Density of tubes should approximate 2/ha and be placed within transects of 10 tubes per transect spaced ten metres apart. Tubes should be left at least 2 weeks and no longer than one month prior to checking. In areas where grass is dense, grass around the tubes should be whipper-snipped for a radius of 1 metre around each tube to facilitate location and use by dragons. All spiders found in tubes should be removed at least 10 metres to reduce chance of re-colonisation.
Pink-tailed Worm-lizard and Little Whip Snake	Surveys of the *subject site* and *study area* shall be undertaken for this species. All rocky slopes should be systematically surveyed. This shall involve rock rolling and searching under logs and debris. Surveys shall be undertaken between mid-August and the end of October preferably after rain. Daily temperatures shall not exceed 25^{0}C during the survey period. Rocks, logs and debris shall be replaced carefully to sustain habitat integrity. Surveys of the *locality* for habitat of the species shall be undertaken. These shall involve determining the extent of potentially suitable habitat from aerial photographs or other means, and ground-truthing selected sites to validate habitat suitability, condition and extent. The sites sampled shall be used to provide context to the habitat affected by the action proposed.
Striped Legless Lizard *Delma impar*	Pitfall trapping for *Delma impar* should be undertaken for 6 weeks, starting in early to mid November and extending through to mid/late December. Pitfall traps or funnel traps should be placed in suitable habitat being natural temperate grassland or nearby secondary

SPECIES	SURVEY REQUIREMENTS
	grassland, with a preference for denser Kangaroo grass *Themeda australis* or other grassland, including Phalaris. Traps should be positioned in cross-shaped arrays of 5 traps each, 10 metres apart, with a trap at the centre and drift fencing extending 5 metres past the outside traps. Traps must be checked daily. In addition, roof tiles should be placed within likely habitat for at least 4 months prior to checking. Checking of tiles should be undertaken at least fortnightly throughout spring and early summer.
ENDANGERED ECOLOGICAL COMMUNITIES	**SURVEY REQUIREMENTS**
Yellow Box White Box Blakely's Red Gum Woodlands, Natural Temperate Grasslands and Tableland Basalt Forest.	Surveys shall identify the extent and condition of this ecological community in the *subject site*, *study area* and *locality*. This shall involve the use of vegetation surveys in the *subject site* and the *study area*. The use of existing datasets held by DECCW in combination with ground-truthing of selected sites within areas mapped by DECCW as the ecological community is recommended for surveys of the *locality*. The sites sampled shall be used to provide context to the ecological community affected by the action proposed. Surveys can be undertaken at any time of the year under varied seasonal conditions.
FLORA	**SURVEY REQUIREMENTS**
Silky Swainson Pea (*Swainsona sericea*), Mountain Swainson Pea (*Swainsona recta*), Tarengo Leek Orchid (*Prasophyllum petilum*), Crimson Spider Orchid (*Caladenia concolor*), and Yass Daisy (*Ammobium crespedioides*).	Systematic surveys using evenly spaced transects located about 10 m apart through all areas of woodland/grassland must be undertaken. Survey should be undertaken during the flowering periods; Silky Swainson Pea – September to December Mountain Swainson Pea and Tarengo Leek Orchid – October Crimson Spider Orchid – late August – September Yass Daisy – Spring, but also recognisable several months before hand and after flowering by its foliage Where possible, flowering should be confirmed at the nearest known site prior to surveys being undertaken. DECCW should be consulted to known population and seasons, and appropriate survey methods.

NSW GOVERNMENT | Office of Environment & Heritage

Your reference :
Our reference :
Contact : Matt Cameron, 02 6022 0605

Senior Development Manager
Wind Prospect CWP Pty Ltd
PO Box 1708
NEWCASTLE NSW 2300

Attention: Adrian Maddocks

Dear Mr Maddocks

RE: Bango Wind Farm – Updated Advice

I refer to the joint inspection of parts of the proposed Bango Wind Farm on the 14—15 June 2012 by Wind Prospects CWP Pty Ltd (Wind Prospects) and the Office of Environment and Heritage (OEH). As agreed, this inspection has provided OEH with an opportunity to highlight potential constraints to the project, as well as update previous advice on environmental impact assessment requirements.

Environmental Assessment

The EA should include a detailed biodiversity assessment. As part of this assessment, surveys must be undertaken for all threatened species, populations or ecological communities (hereafter, threatened species) that may be directly or indirectly impacted by the proposal. The habitats of threatened species must be mapped, with vegetation condition and habitat quality assessed. Advice on updated survey requirements is provided at Attachment 1.

Impacts on threatened species must be assessed, including impacts related to the following: habitat loss and degradation, fragmentation, disturbance caused by construction activities, interaction with turbines, fauna avoiding areas supporting turbines and associated infrastructure, increased numbers of pest plants and animals, and the intensification of landuse that may occur as a result of the development. The impact on non-threatened sensitive fauna (birds and bats) from blade strike, barotrauma, and alteration to movement patterns must also be considered.

The EA must consider the contribution made by the proposal to the cumulative impacts arising from the construction of multiple wind farms in the region on threatened and other sensitive species. This assessment of cumulative impacts must consider, though is not necessarily limited to, impacts upon Superb Parrots, soaring raptors, and bats.

The EA must detail the way that impacts have been avoided or mitigated. These measures include, but are not limited to, avoiding areas having significant ecological values, locating turbines such that the potential for sensitive species to encounter them is reduced, and taking

PO Box 622, Queanbeyan NSW 2620
11 Farrer Place, Queanbeyan NSW
Tel: (02) 6229 7002 Fax: (02) 6229 7006
ABN 30 841 387 271
www.environment.nsw.gov.au

measures that will reduce the attractiveness of turbines to sensitive species. Constraints identified in the recent site inspection are detailed in Attachment 1.

Offsets

We understand that the Biobanking Assessment Methodology (BAM) will be used to calculate the offset required to ensure that the proposal achieves biodiversity outcomes consistent with "maintain or improve" principles. To avoid duplication, you should ensure that data collected as part of the EA meets the requirements for the application of the biobanking methodology. We note Wind Prospects preferred option is for offsets to be located within the area where the impact will occur.

During the inspection, Wind Prospects raised the possibility of an area of Box-Gum Woodland currently part of the Commonwealth Government's Environmental Stewardship Program being used as an offset site. The BAM makes provision for lands subject to existing conservation obligations to be used as biobanking sites. The number of credits generated by such sites is reduced depending on the management actions currently required to be implemented and the duration of the existing conservation agreement (see link below). Wind Prospects and the landowner would need to satisfy themselves as to the views of the Commonwealth in relation to such a proposal.

http://www.environment.nsw.gov.au/resources/biobanking/2010187Biobankadditionality.pdf

Monitoring

There is a need to develop a monitoring program that will enable the impacts of the wind farm during construction, post-construction, and operation to be determined. This will require the collection of baseline data prior to construction commencing, as well as the establishment of suitable control sites. Early consideration of this issue may allow data collected as part of the EA to contribute to this long-term monitoring program. OEH strongly recommends that wind farm operators in the region cooperate to develop a program that will provide meaningful data on the impacts of wind generation on biodiversity.

If you have any further enquiries about this matter please contact Matt Cameron by telephoning 02 6022 0605.

Yours sincerely

Sandra Jones 19/7/12

DR SANDIE JONES
Acting Manager Landscape and Aboriginal heritage Protection
Conservation and Regulation Division
Office of Environment and Heritage

Attachments:

1. Bango Wind Farm – Updated Survey Requirements
2. Bango Wind Farm - Constraints

Attachment 1

Bango Wind Farm – Updated Survey Requirements

The survey requirements detailed in Attachment 1 of Appendix 3 of the then Department of Environment, Climate Change and Water advice to the Department of Planning (30 March 2011) generally remain appropriate. Changes to this advice are detailed below.

Superb Parrots

Superb Parrot nest surveys should be undertaken within 500-m of proposed turbines, with all potential nest trees monitored for evidence of use by nesting Superb Parrots. Monitoring of potential nest sites should occur on at least two occasions (separated by approximately 30-days) during the breeding season, with known nests used to get the timing right. Nest surveys should also be undertaken in the wider local area in order to assist in the possible identification of flight paths and allow for the relative importance of nests impacted by the development to be determined.

Targeted searches for Superb Parrots must be undertaken throughout the local area during the breeding season, with the objective of identifying foraging areas and flight paths. These surveys should be timed to coincide with periods when birds are undertaking these activities. A focus of these surveys should be identifying foraging habitat or flight paths that may be negatively impacted by the development, or which may bring birds into contact with proposed infrastructure. These targeted searches should be undertaken at least twice during the breeding season (separated by approximately 30-days) to allow for changes in the use of habitat over time.

Foraging areas and flight paths are likely to vary between years, depending on the availability and spatial distribution of food resources (natural and exotic). Superb Parrot habitat in the local area, including potential habitat (e.g., paddocks that may be cropped in subsequent years), must be mapped. The will allow for a more complete assessment of the impacts, particularly with regard to potential movement pathways.

Woodland Birds

Woodland bird surveys should be undertaken across the study area, which should be stratified and sampled systematically. The study area should include areas of habitat within 500-m of turbines or other infrastructure, plus contiguous habitat outside these areas. Area searches are likely to be the most effective method for detecting threatened woodland birds. Search effort should be adequate to characterise the use of habitats by target species. Surveys should be timed for when detection rates are likely to be higher (early in the breeding season), and are best undertaken in the early morning (sunrise to four hours after sunrise) on clear, still days. If surveys are undertaken outside optimal periods, survey effort should be increased. Surveys must be repeated at least twice (total of three survey periods), with survey periods separated by one week.

Diurnal Birds of Prey

Little Eagle and Wedge-tailed Eagles surveys should be undertaken, with the aim of identifying the number and spatial distribution of territories within 5km of the development site. Birds are most likely to be located when soaring or perched in prominent locations, with higher detection rates likely early in the breeding season. Areas within 500-m of turbines or other infrastructure should be searched for the presence of active or inactive eagle nests.

Attachment 2

Bango Wind Farm – Constraints

Note: The following comments are limited to sites that were inspected. Comments may be able to be extrapolated to other sites with similar characteristics. The Environmental Assessment (EA) may identify additional constraints. Recommendations made above in relation to the relocation of turbines and access roads are readily identifiable measures capable of reducing the potential impact of the development ahead of the Environmental Assessment. Location numbers refer to the properties visited during the site inspection.

Location 1

Turbine 60 (GDA94 671289, 6169942) is located in good condition hilltop woodland, providing potential habitat for a range of threatened species. While not inspected, Turbines 71 and 53 are situated nearby in what appears to be similar habitat. The access roads for these turbines, while sited to minimise disturbance to woody vegetation, will result in the loss of woodland and grassland habitat. The main access road will fragment the remnant, isolating vegetation currently surrounding the trig station. OEH recommends these turbines be moved and the access road be rerouted around the remnant.

Location 2

Turbine 70 (663973, 6171445) is situated adjacent to a cropping paddock on a gentle rise supporting remnant Box-Gum Woodland. This type of site provides a relatively high risk to Superb Parrots, with the surrounding area providing foraging and nesting habitat. As part of the assessment, OEH considers there is a need for all potential nest trees within the vicinity of turbines to be monitored for evidence of use by nesting Superb Parrots (see Attachment 1).

Turbines 92, 84, 104 (664032, 6173096) are situated at the confluence of the headwaters of a number of drainage lines, which may be used as movement pathways by Superb Parrots and other woodland birds. The access road in this area parallels and then crosses a vegetated road reserve, which may have importance as a movement pathway. We note there is a Superb Parrot record adjacent to this road reserve to the east of the project site. As previously advised, it is critical that Superb Parrot flight paths are identified as part of the assessment process. Identification of flight paths must have regard to yearly variation in the location of nesting areas and food sources (e.g., due to rotational cropping, variability in flowering intensity of key natural foods).

Turbine 76 (664706, 6172741) sits within an area of large old trees, predominantly Red Stringybark, with a grassy understorey. Just to the north is a relatively intact block of vegetation supporting mature trees with abundant hollows. Overall, this site forms part of a larger remnant that extends to the north and east, and makes a significant contribution to connectivity in the local area. A group of six Diamond Firetails was recorded from this remnant (665052, 6171762) during the site inspection. OEH recommends that Turbine 76 be moved from its current location, and if an access road is still required in this area it be rerouted.

Location 3

Six turbines (e.g., Turbine 103 - 663143, 6172262) are proposed for an area of Box-Gum Woodland that is currently part of the Commonwealth Government's Environmental Stewardship Program. This good quality remnant has records for Hooded Robins and Diamond Firetails. The Superb Parrot has been recorded from the property. The Golden Sun-moth has been recorded nearby, and good habitat exists for this species on site. An inactive Wedge-tailed Eagle nest was located during the site inspection (662810, 6172431).

The compatibility of a wind farm with the ecological values of the Environmental Stewardship site needs to be given careful consideration. The dispersed placement of turbines means that potential impacts will be widespread. The proposed layout also makes it difficult to significantly reduce potential impacts by eliminating or shifting individual turbines. A wind farm at this location would require approval under the EPBC Act.

Location 4

A group of turbines is proposed within or adjacent to native vegetation that forms part of a large remnant comprised mostly of Crown Land (e.g., Turbine 30 – 671175, 617442). Areas of grassland should be considered part of this remnant. Proposed access roads cross the southern part of this remnant at multiple locations. OEH recommends that turbines located within the centre of this remnant be removed (e.g., Turbines 27, 30, 35). Access roads should be sited so as to avoid this remnant.

A number of old mine workings were associated with the wooded rise on which Turbine 50 (671254, 6175214) is proposed to be located (part of the remnant mentioned in the preceding paragraph). These sites need to be assessed and recorded. I also note that a quartz flake was located at this site. While the context suggests this flake is unlikely to be an Aboriginal object, this flake and the site should be assessed by an archaeologist. The abandoned mine that was inspected (671794, 6174073) further down slope may provide habitat for Eastern Bent-wing Bats, and should be monitored for their presence at the appropriate time of year.

Annex C

Flora and Fauna Lists

C.1 SPECIES LIST

Table C.1 Fauna species identified during field surveys.

Scientific Name	Common Name	EPBC Status	TSC Status
Amphibians			
Crinia parinsignifera	Beeping Froglet	-	-
Crinia signifera	Common Eastern Froglet	-	-
Limnodynastes dumerilii	Eastern Pobblebonk	-	-
Limnodynastes peronii	Striped Marsh Frog	-	-
Limnodynastes tasmaniensis	Spotted Grass Frog	-	-
Litoria peronii	Peron's Tree Frog	-	-
Uperoleia laevigata	Smooth Toadlet	-	-
Birds			
Acanthiza apicalis	Inland Thornbill	-	-
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	-	-
Acanthiza lineata	Striated Thornbill	-	-
Acanthiza nana	Yellow Thornbill	-	-
Acanthiza pusilla	Brown Thornbill	-	-
Acanthiza reguloides	Buff-rumped Thornbill	-	-
Acanthorhynchus tenuirostris	Eastern Spinebill	-	-
Accipiter cirrocephalus	Collared Sparrohawk	-	-
Accipiter fasciatus	Brown Goshawk	-	-
Anas gracilis	Grey Teal	-	-
Anas superciliosa	Pacific Black Duck	-	-
Anthochaera carunculata	Red Wattlebird	-	-
Anthus novaeseelandiae	Australasian Pipit	-	-
Aphelocephala leucopsis	Southern Whiteface	-	-
Aquila audax	Wedge-tailed Eagle	-	-
Ardea pacifica	White-necked Heron	-	-
Artamus cyanopterus	Dusky Woodswallow	-	-
Artamus superciliosus	White-browed Woodswallow	-	-
Aythya australis	Hardhead	-	-
Cacatua galerita	Sulphur-crested Cockatoo	-	-
Cacatua sanguinea	Little Corella	-	-
Cacomantis flabelliformis	Fan-tailed Cuckoo	-	-
Cacomantis pallidus	Pallid Cuckoo	-	-
Calyptorhynchus funereus	Yellow-tailed Black-cockatoo	-	-
Chalcites lucidus	Shining Bronze-Cuckoo	-	-
Chenonetta jubata	Australian Wood Duck	-	-
Chthonicola sagittata	Speckled Warbler	-	V
Cincloramphus cruralis	Brown Songlark	-	-
Cincloramphus mathewsi	Rufous Songlark	-	-
Circus assimilis	Spotted Harrier	-	V
Climacteris picumnus victoriae	Brown Tree-creeper	-	V

Scientific Name	Common Name	EPBC Status	TSC Status
Colluricincla harmonica	Grey Shrike-thrush	-	-
Coracina novaehollandiae	Black-faced Cuckoo-shrike	-	-
Corcorax melanorhamphos	White-winged Chough	-	-
Cormobates leucophaea	White-throated Treecreeper	-	-
Corvus coronoides	Australasian Raven	-	-
Corvus mellori	Little Raven	-	-
Coturnix pectoralis	Stubble Quail	-	-
Cracticus tibicen	Australian Magpie	-	-
Cracticus torquatus	Grey Butcherbird	-	-
Cygnus atratus	Black Swan	-	-
Dacelo novaeguineae	Laughing Kookaburra	-	-
Daphoenositta chrysoptera	Varied Sitella	-	V
Dicaeum hirundinaceum	Mistletoebird	-	-
Egretta novaehollandiae	White-faced Heron	-	-
Elanus axillaris	Black-shouldered Kite	-	-
Eolophus roseicapillus	Galah	-	-
Eurystomus orientalis	Dollarbird	-	-
Falco berigora	Brown Falcon	-	-
Falco cenchroides	Nankeen Kestrel	-	-
Falcunculus frontatus	Crested Shrike-tit	-	-
Fulica atra	Eurasian Coot	-	-
Gerygone albogularis	White-throated Gerygone	-	-
Gerygone fusca	Western Gerygone	-	-
Grallina cyanoleuca	Magpie-lark	-	-
Haliastur sphenurus	Whistling Kite	-	-
Hirundo neoxena	Welcome Swallow	-	-
Lalage sueurii	White-winged Triller	-	-
Lichenostomus fuscus	Fuscous Honeyeater	-	-
Lichenostomus leucotis	White-eared Honeyeater	-	-
Lichenostomus pencillatus	White-plumed Honeyeater	-	-
Malurus cyaneus	Superb Fairy-wren	-	-
Malurus lamberti	Variegated Fairy-wren	-	-
Manorina melanocephala	Noisy Miner	-	-
Melithreptus brevirostris	Brown-headed Honeyeater	-	-
Merops ornatus	Rainbow Bee-eater	Mi	-
Microcarbo melanoleucos	Little Pied Cormorant	-	-
Myiagra inquieta	Restless Flycatcher	-	-
Myiagra rubecula	Leaden Flycatcher	-	-
Neochmia temporalis	Red-browed Finch	-	-
Ninox novaeseelandiae	Southern Boobook	-	-
Ocyphaps lophotes	Crested Pigeon	-	-
Pachycephala rufiventris	Rufous Whistler	-	-
Pardalotus punctatus	Spotted Pardalote	-	-
Pardalotus striatus	Striated Pardalote	-	-
Petrochelidon ariel	Fairy Martin	-	-

Scientific Name	Common Name	EPBC Status	TSC Status
Petrochelidon nigricans	Tree Martin	-	-
Petroica boodang	Scarlet Robin	-	V
Petroica goodenovii	Red-capped Robin	-	-
Phalacrocorax varius	Pied Cormorant	-	-
Phaps chalcoptera	Common Bronzewing	-	-
Philemon citreogularis	Little Friarbird	-	-
Philemon corniculatus	Noisy Friarbird	-	-
Platycercus elegans	Crimson Rosella	-	-
Platycercus eximius	Eastern Rosella	-	-
Podargus strigoides	Tawny Frogmouth	-	-
Polytelis swainsonii	Superb Parrot	V	V
Pomatostomus temporalis temporalis	Grey-crowed Babbler	-	V
Psephotus haematonotus	Red-rumped Parrot	-	-
Rhipidura albiscapa	Grey Fantail	-	-
Rhipidura leucophrys	Willie Wagtail	-	-
Sericornis frontalis	White-browed Scrubwren	-	-
Smicrornis brevirostris	Weebill	-	-
Stagonopleura guttata	Diamond Firetail	-	V
Strepera graculina	Pied Currawong	-	-
Tachybaptus novaehollandiae	Australasian Grebe	-	-
Tadorna tadornoides	Australian Shelduck	-	-
Threskiornis spinicollis	Straw-necked Ibis	-	-
Todiramphus sanctus	Sacred Kingfisher	-	-
Turnix varius	Painted Button-quail	-	-
Tyto javanica	Barn Owl	-	-
Vanellus miles	Masked Lapwing	-	-
Bats			
Austronomus australis (syn. *Tadarida australis)*	White-striped Freetail Bat	-	-
Chalinolobus gouldii	Gould's Wattled Bat	-	-
Chalinolobus morio	Chocolate Wattled Bat	-	-
Miniopterus schreibersii oceanensis	Eeastern bentwing Bat	-	V
Mormopterus sp	Freetail Bat	-	-
Mormopterus sp 2	Eastern Freetail Bat	-	-
Mormopterus sp 4	Southern Freetail Bat	-	-
Nyctophilus geoffroyii	Lesser Long-eared Bat	-	-
Nyctophilus sp	Long Eared Bat	-	-
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	-	V -
Vespadelus darlingtoni	Large Forest Bat	-	-
Vespadelus regulus	Southern Forest Bat	-	-
Vespadelus vulturnus	Little Forest Bat	-	-
Insects			
Synemon plana	Golden Sun Moth	CE	E

Scientific Name	Common Name	EPBC Status	TSC Status
Mammals			
Antechinus flavipes	Yellow-footed Antechinus	-	-
Macropus giganteus	Eastern Grey Kangaroo	-	-
Macropus robustus	Common Wallaroo	-	-
Macropus rufogriseus	Red-necked Wallaby	-	-
Petaurus norfolcensis	Squirrell Glider	-	V
Pseudocheirus peregrinus	Common Ringtail Possum	-	-
Tachyglossus aculeatus	Short-beaked Echidna	-	-
Trichosurus vulpecula	Common Brushtail Possum	-	-
Wallabia bicolor	Swamp Wallaby	-	-
Reptiles			
Carlia tetradactyla	Southern Rainbow skink	-	-
Ctenotus taeniolatus	Copper-tailed Skink	-	-
Delma inornata	Patternless Delma	-	-
Egernia cunninghami	Cunningham's Skink	-	-
Lampropholis delicata	Dark-flecked Garden Sunskink	-	-
Morethia boulengeri	South eastern Morethia Skink	-	-
Pogona barbata	Eastern Bearded Dragon	-	-
Pseudechis porphyriacus	Red-bellied Black Snake	-	-
Pseudonaja textilis	Eastern Brown Snake	-	-
Tiliqua rugosa	Shingleback	-	-
Tiliqua scincoides	Blue Tongue Skink	-	-
Varanus varius	Lace Monitor	-	-
Introduced Species			
*Carduelis carduelis**	European Goldfinch	-	-
*Lepus capensis**	Brown Hare	-	-
*Lepus europaeus**	European Hare	-	-
*Oryctolagus cuniculus**	Rabbit	-	-
*Passer domesticus**	House Sparrow	-	-
*Sturnus vulgaris**	Common Starling	-	-
*Turdus merula**	Common Blackbird	-	-
*Vulpes vulpes**	Fox	-	-

Status: V – Vulnerable, E – Endangered, CE – Critically Endangered.

Table C.2 Flora species identified during field surveys.

Scientific Name	Common Name	EPBC Status	TSC Status
Acacia dealbata	Silver Wattle	-	-
Acacia genistifolia	Early Wattle	-	-
Acacia gunii	Ploughshare Wattle	-	-
Acacia implexa	Hickory Wattle	-	-
Acaena ovina		-	-
Ammobium craspedioides	Yass Daisy	V	V
Amyema miquellii	Box Mistletoe	-	-

Scientific Name	Common Name	EPBC Status	TSC Status
Amyema pendulum subsp. pendulum		-	-
Aristida behriana	Bunch Wiregrass	-	-
Aristida ramosa	Purple Wiregrass	-	-
Arthropodium minus		-	-
Asperula conferta	Common Woodruff	-	-
Austrostipa bigeniculata		-	-
Austrostipa scabra		-	-
Brachyloma daphnoides	Daphne Heath	-	-
Brachyscome aculeata		-	-
Burchardia umbellata	Milkmaids	-	-
Caladenia carnea	Pink Finger orchid	-	-
Caladenia carnea var. carnea	Pink Fingers	-	-
Caladenia gracilis	Musky Caladenia	-	-
Calytrix tetragonia	Common Fringe-myrtle	-	-
Carex apressa	Tall Sedge	-	-
Cassinia arcuata	Sifton Bush	-	-
Cassinia laevis	Cough Bush	-	-
Cassinia longifolia		-	-
Cheilanthes sieberi	Mulga Fern	-	-
Chrysocephalum apiculatum	Common Everlasting	-	-
Chrysocephalum semipapposum	Clustered Everlasting	-	-
Convolvulus erubescens	Blushing Bindweed	-	-
Craspedia variabilis		-	-
Daucus glochidiatus	Native Carrot	-	-
Daviesia leptophylla	Slender Bitter Pea	-	-
Desmodium varians	Slender Tick Trefoil	-	-
Dichelachne micrantha	Shorthair Plumegrass	-	-
Dichondra repens	Kidney Weed	-	-
Dillwynia sericea	Showy Parrot Pea	-	-
Diuris sulphurea	Tiger Orchid	-	-
Drosera peltata	Pale Sundew	-	-
Elymus scaber	Wheatgrass	-	-
Eucalyptus albens	White Box	-	-
Eucalyptus blakelyi	Blakely's Red Gum	-	-
Eucalyptus bridgesiana	Apple Box	-	-
Eucalyptus goniocalyx	Long-Leaved Box	-	-
Eucalyptus macrorhyncha	Red Stringybark	-	-
Eucalyptus melliodora	Yellow Box	-	-
Eucalyptus polyanthemos	Red Box	-	-
Eucalyptus rossii	Scribbly Gum	-	-
Glossodia major	Waxlip Orchid	-	-
Glycine clandestina	Twining Glycine	-	-
Gonocarpus tetragynus	Common Raspwort	-	-
Goodenia hederacea	Forest Goodenia	-	-
Goodenia sp.		-	-

Scientific Name	Common Name	EPBC Status	TSC Status
Hakea decurrens		-	-
Haloragis heterophylla	Rough Raspwort	-	-
Hibbertia obtusifolia	Hoary Guinea Flower	-	-
Hydrocotyle laxiflora	Stinking Pennywort	-	-
Hypericum gramineum	Small St. Johns Wort	-	-
Juncus bufonius	Toad Rush	-	-
Leptorhyncos squamatus subsp. alpinus	Scaly Buttons	-	-
Lomandra filiformis subsp. coriacea		-	-
Lomandra filiformis subsp. filiformis	Wattle Mat-rush	-	-
Lomandra sp.		-	-
Luzula densiflora		-	-
Melichrus urceolatus	Urn Heath	-	-
Microlaena stipoides	Weeping Grass	-	-
Microtis parviflora	Slender Onion Orchid	-	-
Oxalis perennans		-	-
Phyllanthus hirtellus	Thyme Spurge	-	-
Poa sieberiana	Snowgrass	-	-
Pratia pedunculata	Matted Pratia	-	-
Pterostylis aciculiformis	-	-	-
Pterostylis cycnocephala	Swan Greenhood	-	-
Pultenaea foliolosa	Small-leaf Bush Pea	-	-
Pultenaea procumbens	Heathy Bush-pea	-	-
Ranunculus lappaceus	Common Buttercup	-	-
Rytidosperma monticola		-	-
Rytidosperma pallidum	Redanther Wallaby Grass	-	-
Rytidosperma setaceum	Smallflower Wallaby Grass	-	-
Schoenus latelaminatus	Medusa Bog Sedge	-	-
Solanum cinereum	Narrawa Burr	-	-
Solenogyne dominii	Smooth Solenogyne	-	-
Stackhousia monogyna	Creamy Candles	-	-
Stellaria pungens	Prickly Starwort	-	-
Stylidium graminifolium	Grass Trigger-plant	-	-
Stypandra glauca	Nodding Blue-lily	-	-
Thelymitra pauciflora	Slender Sun Orchid	-	-
Thelymitra rubra	Salmon Sun Orchid	-	-
Thysanotus patersonii	Twining Fringe-lily	-	-
Triptilodiscus pygmaeus	Austral Sunray	-	-
Utricularia dichotoma	Fairy Aprons	-	-
Velleia paradoxa	Spur Velleia	-	-
Viola betonicifolia	Native Violet	-	-
Vittadinia cuneata	Fuzzweed	-	-
Vittadinia gracilis	Woolly New Holland Daisy	-	-
Wahlenbergia communis	Blue Bell	-	-
Wahlenbergia stricta	Tall Bluebell	-	-
Wurmbea dioica	Early Nancy	-	-

Scientific Name	Common Name	EPBC Status	TSC Status
Introduced Species			
*Acetosella vulgaris**	Sorrel	-	-
*Aira sp.**		-	-
*Arctotheca calendula**	Capeweed	-	-
*Avena barbata**	Bearded Oats	-	-
*Briza maxima**	Quaking Grass	-	-
*Briza minor**	Shivery Grass	-	-
*Bromus diandrus**	Great Brome	-	-
*Bromus molliformis**	Soft Brome	-	-
*Centaurium erythraea**	Common Centaury	-	-
*Cynosurus echinatus**	Rough Dog's Tail	-	-
*Dactylis glomerata**	Cocksfoot	-	-
*Echium plantagineum**	Paterson's Curse	-	-
*Gamochaeta sp.**	Cudweed	-	-
*Holcus lanatus**	Yorkshire Fog	-	-
*Hordeum sp.**	Barley Grasses	-	-
*Hypochaeris radicata**	Catsear	-	-
*Leontedon taraxacoides**	Lesser Hawkbit	-	-
*Linaria pelisseriana**	Pelisser's Toadflax	-	-
*Lolium sp. **	Rye grass	-	-
*Marrubium vulgare**	White Horehound	-	-
*Onopordum acanthium**	Scotch Thistle	-	-
*Orobanche minor**		-	-
*Parentucellia latifolia**	Common Bartsia	-	-
*Petrorhagia nanteuilii**		-	-
*Phalaris sp.**	Canary Grass	-	-
*Plantago varia**	Plantain	-	-
*Poa annua**	Winter Grass	-	-
*Rosa rubiginosa**	Sweet Briar	-	-
*Trifolium sp.**	Clover	-	-
*Vulpia myuros**	Rat's Tail Fescue	-	-

Status: V – Vulnerable, E – Endangered.

Annex D

BUS Results

BUS No.	BUS Location	BUS Site Type	No. Completed	Latitude	Longitude	Nov	Dec	Jan	Feb
1	BUS Taffs	Impact	8	-34.51173697	148.754926	x	x		
2	BUS Hopefield	Impact	3	-34.50393802	148.770893	x	x		
3	BUS Willow	Impact	4	-34.58040898	148.8503		x	x	
4	BUS Wargeila	Reference	4	-34.54258497	148.913348		x	x	x
5	BUS Taree	Impact	5	-34.55521096	148.868092	x	x		
6	BUS Taree 2	Impact	3	-34.56253298	148.869767	x	x		
7	BUS Pines	Impact	6	-34.57356004	148.795331	x	x		
8	BUS Yambacoona	Impact	4	-34.56116304	148.825919	x	x		
9	BUS Glanmire	Reference	1	-34.59781702	148.760122	x			
10	BUS Springvale	Impact	4	-34.52489404	148.808316	x	x		x
11	Springvale property	Impact	2	-34.53078099	148.80936		x		
12	BUS Mt Buffalo	Impact	2	-34.59493901	148.869556	x	x		
13	BUS Loyde Davis	Impact	3	-34.639658	148.86625		x		x
14	Hopefield Lane	Impact	4	-34.49182701	148.776349		x		x
15	Hopefield Lane/Boorowa Rd	Impact	4	-34.45495402	148.785135		x	x	x
16	Harry's Creek Rd/Boorowa Rd	Reference	4	-34.48519299	148.813922		x	x	x
17	The Pines Property	Impact	3	-34.57391703	148.786294		x	x	
18	Mt Buffalo Access Gate	Impact	3	-34.60480903	148.896139		x	x	x
19	Lavestock Rd. Montalta Gate	Reference	4	-34.641029	148.851271		x	x	x
20	The Pines Access	Reference	5	-34.60232204	148.805244		x	x	

Annex E

Likelihood Of Occurance Assessment

Consideration of Subject Species

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Plants				
Yass Daisy *Ammobium craspedioides* TSC Act - V EPBC Act - V	The Yass Daisy is found in moist or dry forest communities, Box-Gum Woodland and secondary grassland derived from clearing of these communities. It grows in association with a large range of eucalypts (*Eucalyptus blakelyi, E. bridgesiana, E. dives, E. goniocalyx, E. macrorhyncha, E. mannifera, E. melliodora, E. polyanthemos, E. rubida*) (OEH 2012).	There are seven records of the species within a 10 km buffer of the Study Area, (PMST, NSW Wildlife Atlas, Atlas of Living Australia). Recorded during recent field surveys in the Locality and optimal habitat occurs in the Study Area.	Likely	Yes
Crimson Spider Orchid *Caladenia concolor* TSC Act - E EPBC - E	Occurs in regrowth woodland on granite ridge country that has retained a high diversity of plant species, including other orchids. The dominant trees are Blakely's Red Gum (*Eucalyptus blakelyi*), Red Stringybark (*E. macrorhyncha*), Red Box (*E. polyanthemos*) and White Box (*E. albens*); the diverse understorey includes Silver Wattle (*Acacia dealbata*), Hop Bitter-pea (*Daviesia latifolia*), Common Beard-heath (*Leucopogon virgatus*), Spreading Flax-lily (*Dianella revoluta*) and Poa Tussock (*Poa sieberiana*) (OEH 2012).	No records have been identified within 10 km of the Study Area. - Suitable habitat present in woodlands with an undisturbed understory. Areas of suitable habitat were surveyed during the flowering season for the species, in accordance with the flowering season at reference sites. The species was not recorded during these surveys.	Potential	Yes
Doubletail Buttercup *Diuris aequalis* TSC Act - E EPBC - V	Occurs in forest, low open woodland with grassy understorey and secondary grassland on the higher parts of the Southern and Central Tablelands (especially on the Great Dividing Range) (OEH 2012).	No records have been identified within 10 km of the Study Area. - Suitable habitat present in woodlands with an undisturbed understory and secondary grassland. Areas of suitable habitat were surveyed during the flowering season for the species. Was not recorded during recent field surveys.	Potential	Yes

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Hoary Sunray *Leucochrysum albicans var. tricolor* EPBC Act - E	The Hoary Sunray occurs in a wide variety of grassland, woodland and forest habitats, generally on relatively heavy soils. Plants can be found in natural or semi-natural vegetation and grazed or ungrazed habitat. Bare ground is required for germination (DSEWPC 2012).	No records have been identified within 10 km of the Study Area. The species was identified as potentially occurring in the PMST. suitable habitat present in woodlands with an undisturbed understory and secondary grassland. Areas of suitable habitat were surveyed during the flowering season for the species. Was not recorded during recent field surveys.	Potential	Yes
Silky Swainson-pea *Swainsona sericea* TSC Act - V	The species is found in Natural Temperate Grassland and Snow Gum *Eucalyptus pauciflora* Woodland on the Monaro, and in Box-Gum Woodland in the Southern Tablelands and South West Slopes. Silky Swainson-pea is sometimes found in association with cypress-pines (*Callitris* spp) (OEH 2012).	This species was recorded within the Locality. This species was not recorded within the recent field surveys.	Potential - sub-optimal habitat exists within the Study Area	Yes
Invertebrates				

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Golden Sun Moth *Synemon plana* TSC Act - E EPBC Act - CE	The species occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which the groundlayer is dominated by wallaby grasses (*Austrodanthonia* spp). The bare ground between the tussocks (inter-tussock spaces) is thought to be an important microhabitat feature for the Golden Sun Moth, as it is typically these areas on which the females are observed displaying to attract males. Habitat may contain several wallaby grass species, which are typically associated with other grasses particularly spear-grasses (*Austrostipa* spp.) or Kangaroo Grass (*Themeda australis*) (OEH 2012). Sites supporting Golden Sun Moth populations have generally been subject to light grazing. A number of populations occur in paddocks alongside where sheep and cattle graze. These sites have not undergone extensive pasture improvement or fertiliser usage and contain areas of primary Wallaby Grass cover. Based on recent observations at two ACT sites there is a possibility that Golden Sun Moth larvae feed on Chilean Needle Grass (*Nassella neesiana*) and Redleg Grass (*Bothriochloa macra*) (DSEWPC 2012).	A large number of records exist for this species within the Locality of the Study Area (PMST, ALA). This species has also been previously recorded within the Study Area and was recorded at numerous locations within the Study Area during recent field surveys.	Known	Yes

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Amphibians				
Booroolong Frog *Litoria booroolongensis* TSC Act - E EPBC Act - E	Lives along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins. Shelter under rocks or amongst vegetation near the ground on the stream edge. Sometimes bask in the sun on exposed rocks near flowing water during summer (OEH 2012).	No records within 10 km of the Study Area. Identified in PMST. Was not been recorded during field surveys.	Unlikely - due to the lack of swamps, Lignum/Typha and River Red Gum swamps or billabongs along floodplains and river valleys throughout the Study Area.	No
Growling Grass Frog *Litoria raniformis* TSC Act - V EPBC Act - E	Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat (OEH 2012). Has not been recorded during recent field surveys.	No records have been identified within 10 km of the study area. Identified in PMST. Has not been recorded during recent field surveys.	Unlikely - due to the ephemeral nature of the creeks and streams throughout the Study Area.	No
Birds				
Spotted Harrier *Circus assimilis* TSC Act - V	Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Preys on terrestrial mammals, birds and reptiles, occasionally insects and carrion (OEH 2012).	Has been recorded in the Atlas of Australian Birds, within 60 km of the site. The species was recorded during field surveys.	Known	Yes

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Brown Treecreeper *Climacteris picumnus victoriae* TSC Act - V	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Eucalyptus camaldulensis*) Hollows in standing dead or live trees and tree stumps are essential for nesting (OEH 2012).	Six Atlas of Living Australia records of this within 10 km of the Study Area. The species is also recorded in the area in the Atlas of Australian Birds This species was recorded during recent field surveys.	Known	Yes
Varied Sittella *Daphoenositta chrysoptera* TSC Act - V	Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland (OEH 2012).	Two Atlas of Living Australia records of this species exist within 10 km of the Study Area (1978, 1981). The species is also recorded in the area in the Atlas of Australian Birds.	Known	Yes
Regent Honeyeater *Anthochaera phrygia* TSC Act - CE EPBC Act - E	Mainly found on the inland slopes of south east Australia in dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak which support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Key eucalypt species include Mugga Ironbark (*Eucalyptus sideroxylon*), Yellow Box *(E. melliodora*), Blakely's Red Gum (*E. blakelyi*), White Box (*E. albens*) and Swamp Mahogany (*E. robusta*). Also utilises: Western Grey Box (E. macrocarpa), Grey Gum (*E. punctata*), Red Box (*E. polyanthemos*), Grey Box (*E. moluccana*), Swamp Mahogany (*E. robusta*), Narrow-leaved Ironbark (*E. crebra*), E. caleyi, Spotted Gum (*Corymbia maculata*), McKie's Stringybark (*E. mckieana*), Red Stringybark (*E. macrorhyncha*), Silver-top Stringybark (*E. laevopinea*) and Rough-barked Apple (*Angophora floribunda*). A shrubby understorey is an	Recorded in the Atlas of Australian Birds, within approximately 60 km of the site. The species was not recorded during field surveys.	Likely	Yes

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
	important source of insects and nesting material (OEH 2012b).			
Gang-gang Cockatoo *Callocephalon fimbriatum* TSC Act - V	In summer, it is generally found in high altitude tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. The species moves to lower altitudes in winter, preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. The species favours old growth attributes for nesting and roosting (OEH 2012).	Recorded in the Atlas of Australian Birds, within approximately 60 km of the site. The species was not recorded during field surveys.	Potential - suitable winter habitat exists in road reserves and on some properties.	Yes
Glossy Black-cockatoo Calyptorhynchus lathami TSC Act - V	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of She-oak species, particularly black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata)* occur. Feeds almost exclusively on the seeds of these species, shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites (OEH 2012).	The species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. The species was not recorded during field surveys.	Potential - the Study Area does not contain stands of She-oak, species may fly over the Study Area.	Yes
White-fronted Chat *Epthianura albifrons* TSC Act - V	Gregarious species, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground. Nests are usually built about 23 cm above the ground (but have been found up to 2.5 m above the ground) (OEH 2012).	Two records of the species exist within 10 km of the Study Area (1978, 1894) (Atlas of Living Australia , Atlas of Australian Birds).	Potential - farm dams and small creeks within the Study Area may provide sub-optimal habitat for the species.	Yes

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Little Lorikeet *Glossopsitta pusilla* TSC Act - V	NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs (OEH 2012). Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Nests in Eucalypt hollows in proximity to feeding areas if possible (OEH 2012).	The species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. The species was not recorded during field surveys.	Potential - suitable habitat exists within the Study Area.	Yes
Painted Honeyeater *Grantiella picta* TSC Act - V	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Insects and nectar from mistletoe or eucalypts are occasionally eaten (OEH 2012).	The species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. The species was not recorded during field surveys.	Potential – suitable habitat exists within the Study Area.	Yes
Little Eagle *Hieraaetus morphnoides* TSC Act - V	The Little Eagle is found throughout the Australian mainland. The species occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch (OEH 2012).	The Atlas of Living Australia holds two records for this species within within 10 km of the Study Area from 1978 and 1981. Resorded during field surveys.	Known	Yes
Swift Parrot *Lathamus discolor* TSC Act - E EPBC Act - E	The Swift Parrot is endemic to south eastern Australia. It breeds only in Tasmania, and migrates to mainland Australia in autumn (Higgins 1999; Swift Parrot Recovery Team 2001, cited in DSEWPC 2012). White Box-Yellow Box-Blakely's Red Gum EEC woodland on the New South Wales tablelands and western slopes is utilised for foraging by this species (DSE, 2005; DEC NSW 2005, cited in DSEWPC 2012).	The species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. The species was not recorded during field surveys.	Potential –habitat is restricted to some of the woodland areas.	Yes

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Square-tailed Kite *Lophoictinia isura* TSC Act - V	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Associated vegetation includes variously mixed woodlands of *Eucalyptus piperita, E. goniocalyx, E. dalrympleana, E. dives, E. mannifera and E. rossii* (OEH 2012).	No records have been identified within 10 km of the Study Area.	Potential - species may fly over the Study Area.	Yes
Hooded Robin *Melanodryas cucullata cucullatta* TSC Act - V	This species prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season (OEH 2012).	The species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. The species was not recorded during field surveys (Atlas of Australian Birds).	Potential - some small areas of structurally diverse habitats with a native understorey occur in roadside reserves.	Yes
Black-chinned Honeyeater *Melithreptus gularis gularis* TSC Act - V	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum *(E. blakelyi*) and Forest Red Gum *(E. tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees. Nectar is taken from flowers, and honeydew is gleaned from foliage (OEH 2012)	The species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. The species was not recorded during field surveys (Atlas of Australian Birds).	Likely - E. *melliodora* and *E. blakelyi* woodland exists within the Study Area.	Yes

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Turquoise Parrot *Neophema pulchella* TSC Act - V	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Nests in tree hollows, logs or posts, from August to December (OEH 2012).	No records have been identified within 10 km of the Study Area.	Potential – woodland in roadside reserves and remnant patches may provide suitable habitat.	Yes
Barking Owl *Ninox connivens* TSC Act - V	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. Requires very large permanent territories in most habitats due to sparse prey densities (OEH 2012).	The species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. The species was not recorded during field surveys (Atlas of Australian Birds).	Potential - roadside reserves and remnant patches within farmland may provide suitable habitat.	Yes
Powerful Owl *Ninox strenua* TSC Act - V	Within NSW, this species is widely distributed throughout the eastern forests from the coast inland to the tablelands with scattered, historical records from the western slopes and plains. Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Generally requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. Nests in large tree hollows (at least 0.5 m deep), in large eucalypts (DBH of 80-240 cm) that are at least 150 years old (OEH 2012b).	No records have been identified within 10 km of the Study Area. Not recorded during targeted surveys.	Potential – species may fly over the Study Area.	Yes

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Scarlet Robin *Petroica boodang* TSC Act - V	In NSW, the Scarlet Robin occurs from the coast to the inland slopes. The Scarlet Robin lives in dry eucalypt forests and woodlands, usually with an open grassy understorey with few scattered shrubs. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber, which are important for foraging (OEH 2012).	This species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. One record exists in the Atlas of Living Australia for this species from 1978 within 9 km of the Study Area. This species was recorded at a number of locations within the Study Area during recent field surveys.	Known	Yes
Flame Robin *Petroica phoenicea* TSC Act - V	The Flame Robin breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes, with a ground layer dominated by native grasses. In winter, the bird moves to inland slopes and plains, where it occurs in dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees. The species is occasionally found in temperate rainforest, herbfields, heathlands, shrublands and sedgelands. The species prefers clearings or areas with open understoreys (OEH 2012).	This species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. Three records exist in the Atlas of Living Australia for this species within 9 km of the Study Area, two from 1978 and one from 1981. This species was not within the Study Area during recent field surveys.	Likely - recorded within the Locality and some areas of optimal habitat exists within the Study Area.	Yes

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Superb Parrot *Polytelis swainsonii* TSC Act -V EPBC Act - V	In NSW the Superb Parrot mostly occurs west of the Great Divide, where it mainly inhabits the Riverina. Its range extends north to around Narrabri and Wee Waa in the North west Plain Region. They mainly inhabit forests and woodlands dominated by eucalypts, especially River Red Gums and box eucalypts such as Yellow Box or Grey Box. The species also seasonally occurs in box-pine (Callitris) and Boree (Acacia pendula) woodlands (DSEWPC 2012). The Superb Parrot is dependent on aggregations of large hollow bearing trees and nests between September and December in hollow limbs or holes in the trunk of large eucalypts, mainly near water. In the inland slopes, most nests are in large Blakely's Red Gums, with many nest trees either dead or suffering from dieback. The entrance to the nesting cavity ranges from 5–13 m above the ground for nest trees on the inland slopes. Birds nest deep within the tree hollow, sometimes even at ground level (DSEWPC 2012).	This species has been previously recorded within the Study Area from a number of sources and a large number of records exist for the Locality (PMST, ALA, AAB, NSW Wildlife Atlas). This species was recorded during the recent field surveys.	Known – recorded throughout the Study Area and breeding is known to occur.	Yes
Grey-crowned Babbler *Pomatostomus temporalis temporalis* TSC Act - V	The species inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Flight is laborious so birds prefer to hop to the top of a tree and glide down to the next one. Birds are generally unable to cross large open areas. Territories range from one to fifty hectares and are usually around 10 ha (OEH 2012).	This species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. This species was recorded within the Study Area during field surveys.	Known	Yes

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Speckled Warbler *Pyrrholaemus sagittatus* TSC Act - V	Lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy large, relatively undisturbed remnants are required for the species to persist in an area. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding.	Two records of Speckled Warbler exist in the locality - one approximately 2.5 km to the west of the site from 1981, and one approximately 2.5 km to the east of the footprint from 1978. This species was recorded during recent field surveys.	Known	Yes
Diamond Firetail *Stagonopleura guttata* TSC Act - V	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum (*Eucalyptus pauciflora*) Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Has been recorded in some towns and near farm houses (OEH 2012).	This species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. Three previous records exist within the Locality of the Study Area, two from 1978 and one from 1981. This species was recorded within the Study Area during recent field surveys.	Known	Yes

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Mammals				
Koala *Phascolarctos cinereus* TSC Act - V EPBC Act - V	In NSW, the Koala inhabits a range of forest and woodland communities, including coastal forests, woodlands on the tablelands and western slopes, and woodland communities along watercourses. The primary feed trees in the Central and Southern Tablelands are the Ribbon Gum (*Eucalytus viminalis*) and the River Red Gum (*Eucalyptus camaldulensis*) with 18 secondary feed tree species including White Box (*Eucalyptus albens*), Yellow Box (*Eucalyptus melliodora*), Bundy (*Eucalyptus nortonii*), Blakely's Red Gum (*Eucalyptus blakelyi*), and Apple-topped Box (*Eucalyptus bridgesiana*). There are two Stringybark supplementary species, including Red Stringybark (*Eucalyptus macrorhyncha*) and Yellow stringybark (*Eucalyptus muelleriana*) (OEH 2012).	There are two records of this species within five kilometres of the Study Area. One is approximately three kilometres from a 500 meter buffer around proposed turbine locations and was recorded in 1970, the other is from approximately 1.5 kilometres from a five hundred metre bufferfrom a proposed turbine and was recorded in 1997 (OEH 2012). Feed trees exist within the site although these are paddock trees or amongst patchy vegetation. There have been no recent sightings and no evidence of Koala has been recorded during field surveys within areas of potential habitat. Has not been recorded during recent field surveys.	Potential – suitable habitat does occur, however, is sub-optimal.	Yes
Eastern Pygmy Possum *Cercartetus nanus* TSC Act - V	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north eastern NSW where they are most frequently encountered in rainforest. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (*Pseudocheirus peregrinus*) dreys or thickets of vegetation, (eg. grass-tree skirts). Tree hollows are favoured for nesting, but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks (OEH 2012).	No records have been identified within 10 km of the Study Area.	Unlikely no suitable habitat exists.	No

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Spotted-tailed Quoll *Dasyurus maculatus* TSC Act -V EPBC Act - E	Found on the east coast of NSW and is recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites (OEH 2012).	No records have been identified within 10 km of the Study Area.	Unlikely - woodland is highly fragmented.	No
Eastern False Pipistrelle *Falsistrellus tasmaniensis* TSC Act - V	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibernates in winter. Females are pregnant in late spring to early summer (OEH 2012).	No records have been identified within 10 km of the Study Area.	Unlikely - few areas have trees taller than 20 m.	No
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis* TSC Act - V	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave with specific temperature and humidity regimes that is used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about 300 km range of maternity caves. The species hunts in forested areas, catching moths and other flying insects above the tree tops (OEH 2012).	No records have been identified within 10 km of the Study Area. recorded during field surveys,	Known	Yes
Greater Long-eared Bat *Nyctophilus corbeni* TSC Act - V EPBC Act - V	Inhabits a variety of vegetation types, including mallee, buloke (*Allocasuarina leuhmanni*) and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark (OEH 2012). This species prefers lower altitudes	No records have been identified within 20 km of the Study Area. Identified as potentially occurring in the PMST.	Unlikely	No

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Yellow Bellied Sheathtail-bat *Saccolaimus flaviventris* TSC Act - V	In the most southerly part of its range - most of Victoria, south western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn (OEH 2012). Roosts in tree hollows and buildings, and in treeless areas they are known to utilise mammal burrows. Forages for insects in most habitats across its very wide range, and flies high and fast over the forest canopy, but lower in more open country. Seasonal movements are unknown but there is speculation about a migration to southern Australia in late summer and autumn (OEH 2012).	No previous records exist for this species within the Locality. This species was recorded during the recent field surveys.	Known -	Yes
Greater Broad-nosed bat *Scoteanax rueppellii* TSC Act - V	The species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. The species' direct flight is suited to open woodland. Although this species usually roosts in tree hollows, it has also been found in buildings (OEH 2012).	No recorded within within the Study Locality. Nearest record being east of Gunning approx. 60km to the east. Not recorded during field surveys.	Unlikely	No
Squirrel Glider *Petaurus norfolcensis* TSC Act - V	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Require abundant tree hollows for refuge and nest sites.	No previous records exist for this species within the Locality. This species was recorded during the recent field surveys.	Known	Yes

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Ecological Communities				
White Box, Yellow Box, Blakely's Red Gum Woodland / White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland TSC Act - E EPBC Act - CE	Characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum. The trees may occur as pure stands, mixtures of the three species or in mixtures with other trees, including wattles. Commonly co-occurring eucalypts include Apple Box (*E. bridgesiana*), Red Box (*E. polyanthemos*), Candlebark *(E. rubida*), Snow Gum (*E. pauciflora*), Argyle Apple (*E. cinerea*), Brittle Gum *(E. mannifera*), Red Stringybark (E. macrorhyncha), Grey Box (*E. microcarpa*), Cabbage Gum (*E. amplifolia*) and others. The understorey in intact sites is characterised by native grasses and a high diversity of herbs; the most commonly encountered include Kangaroo Grass (*Themeda australis*), Poa Tussock (*Poa sieberiana*), wallaby grasses (*Austrodanthoni*a spp.), spear-grasses (*Austrostipa* spp.), Common Everlasting (Chrysocephalum apiculatum), Scrambled Eggs (*Goodenia pinnatifida*), Small St John's Wort (*Hypericum gramineum*), Narrow-leafed New Holland Daisy (*Vittadinia muelleri*) and blue-bells (*Wahlenbergia* spp.). Shrubs are generally sparse or absent, though they may be locally common. Remnants generally occur on fertile lower parts of the landscape where resources such as water and nutrients are abundant. Disturbed remnants are considered to form part of the community, including where the vegetation would respond to assisted natural regeneration (OEH 2012).	Mapped and recorded in the Study Area	Known – scattered patches occur in the Study Area.	Yes

Common Name / Species Name / Status	Habitat Requirements	Previous Records	Likelihood of Occurrence	Assessment of Significance Undertaken?
Tableland Basalt Forest in the Sydney Basin and South East Highlands Bioregions TSC Act - E	Tableland Basalt Forest typically occurs on loam or clay soils associated with basalt or, less commonly, alluvium, fine-grained sedimentary rocks, granites and similar substrates that produce relatively fertile soils. The species composition of Tableland Basalt Forest varies with average annual rainfall. On basalt or plutonic substrates east of Mittagong and Moss Vale, at the eastern edge of its distribution where average rainfall exceeds 1000-1100 mm per year, the community is replaced by Robertson Basalt Tall Open-forest and Mount Gibraltar Forest. Its distribution spans altitudes from approximately 600 m to 900 m above sea level, usually on undulating or hilly terrain. Mean annual rainfall varies from approximately 750 mm up to 1100 mm across the distribution of the community (OEH 2012)	Not mapped or recorded in the Study Area	Unlikely – suitable habitat does not occur	No

Status: CE = Critically Endangered, E = Endangered, V = Vulnerable

Annex F

Assessment of Significance Under Section 5A EP&A Act

F.1 ASSESSMENTS OF SIGNIFICANCE

The following assessment is based on the Assessment of Significance (seven part test) in accordance with Section 5A of the EP&A Act. These factors allow a determination of whether there is likely to be a significant effect on threatened species, populations or ecological communities as listed under the *Threatened Species Conservation Act 1995* (TSC Act), or their habitats for those species and ecological communities which have been recorded or are likely to occur in the Study Area. Threatened species and ecological communities assessed here have been selected for inclusion following the process outlined in *Section 4.10*.

F.1.1 Endangered Ecological Communities

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland EEC is characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum. The understorey at intact sites is characterised by native grasses and a high diversity of herbs. Shrubs are generally sparse or absent, though they may be locally common. Remnants generally occur on fertile lower parts of the landscape where resources such as water and nutrients are abundant. Disturbed remnants form part of the community, referred to as derived native grasslands, including where the vegetation would respond to assisted natural regeneration (DEC 2002).

White Box – Yellow Box – Blakely's Red Gum Woodland (Box Gum Woodland) is scattered through the Study Area on lower slopes and in valleys.

(a)	*in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*
	Not applicable.
(b)	*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*
	Not applicable.
(c)	*in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
	A total of 380.54 ha of Box Gum Woodland occurs in the Study Area, including 67.54 ha of woodland and 313 ha of derived native grassland (DNG). A total of 52.5 ha of Box Gum Woodland occurs within the Development Footprint and will be removed as part of the Project, including 3.34 ha of woodland and 49.16 ha of DNG. Of this, 0.51 ha of woodland and 6.47 ha of DNG is part of the temporary construction footprint and will be rehabilitated upon completion of construction. Thus, the residual area of Box Gum Woodland that will be removed comprises 2.83 ha of woodland and 42.69 ha of DNG. The Project will reduce the extent of Box-Gum Woodland in the Study Area. The majority of the Box-Gum Woodland that would be removed comprises DNG dominated by Speargrasses and Wallaby Grasses, with

	few native herbs. Areas of Box-Gum Woodland in better condition, with an intact canopy and groundcover occur in the Study Area and 95% of these will be retained. The ecological field surveys have informed the design of the Project resulting in adjustments to the Development Footprint to avoid areas of intact Box-Gum Woodland. A number of mitigation measures will be implemented during both the construction and operation phases to further reduce the impacts of the Project. The removal of Box-Gum Woodland would not have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
	The Project may result in indirect impacts to areas of Box-Gum Woodland adjacent or nearby the Development Footprint. This includes the operation of edge effects, whereby a vegetation community's susceptibility to factors such as weed invasion and erosion are increased due to its increased exposure to surrounding disturbed environments. The vegetation community becomes less resilient and able to undergo natural regeneration. This may modify the composition of the ecological community. Areas of Box-Gum Woodland in better condition, with an intact canopy and groundcover occur in the Study Area and 95% of these will be retained. The ecological field surveys have informed the design of the Project resulting in adjustments to the Development Footprint to avoid areas of intact Box-Gum Woodland. A number of mitigation measures will be implemented during both the construction and operation phases to minimise the impacts of the Project. The removal of Box-Gum Woodland would not adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
(d)	*in relation to the habitat of a threatened species, population or ecological community:*
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
	A total of 380.54 ha of Box Gum Woodland occurs in the Study Area, including 67.54 ha of woodland and 313 ha of derived native grassland (DNG). A total of 52.5 ha of Box Gum Woodland occurs within the Development Footprint and will be removed as part of the Project, including 3.34 ha of woodland and 49.16 ha of DNG. Of this, 0.51 ha of woodland and 6.47 ha of DNG is part of the temporary construction footprint and will be rehabilitated upon completion of construction. Thus, the residual area of Box Gum Woodland that will be removed comprises 2.83 ha of woodland and 42.69 ha of DNG.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
	The Box-Gum Woodland in the Study Area is already highly fragmented, comprising patches in farm paddocks and narrow linear corridors along roadsides. The greatest impact in terms of fragmentation will be in the area comprising a narrow roadside corridor of intact Box-Gum Woodland along Tangmangaroo Road. Overhead transmission lines are proposed in this area, which would result in fragmentation of this area of Box-Gum Woodland. The transmission line would be approximately 60 m wide. The nature of the easement would allow for retention of the groundcover and low shrub cover which would provide for connectivity of some of the

	community strata and is unlikely to present a barrier for dispersal of genetic material.
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,
	Given the currently highly fragmented and degraded state of this ecological community across its distribution, all areas of Box-Gum Grassy Woodland which meet the minimum condition criteria should be considered important to the survival of this ecological community in the locality and on a broader scale. However, the areas of DNG occur in paddocks that are used for grazing. Therefore, it is unlikely that these areas will have the opportunity to undergo regeneration. Of the Box-Gum Woodland to be removed, the most important area comprises the woodland areas. A small proportion of this will be removed, comprising approximately 5% of its extent in the Study Area. As the majority of the intact Box-Gum Woodland will be retained in the Study Area, the long term survival of the ecological community is not likely to be affected by the removal of habitat.
(e)	*whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*
	At the time of writing, critical habitat for this EEC had not been listed under Part 3 of the TSC Act.
(f)	*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*
	No recovery or threat abatement plans have been prepared for Box-Gum Woodland under the NSW TSC Act. However, a draft national recovery plan has been prepared for White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (DECCW 2010). The overall objective of the recovery plan is to promote the recovery and prevent the extinction of this ecological community. The specific objective to be achieved within the life-span of the recovery plan is to minimise the risk of extinction of the ecological community through: • achieving no net loss in the extent and condition of the ecological community throughout its geographic distribution; • increasing protection of sites in good condition; • increasing landscape functionality of the ecological community through management and restoration of degraded sites; • increasing transitional areas around remnants and linkages between remnants; and • bringing about enduring changes in participating land manager attitudes and behaviours towards environmental protection and sustainable land management practices to increase extent, integrity and function of Box-Gum Grassy Woodland. The proposed action is considered to contravene certain objectives of the draft national recovery plan, mostly in regards to net loss to the extent of the EEC. The turbine and track layout has largely been designed to avoid woodland areas where this community has been identified however, a small proportion of woodland areas will be removed. The extent of this removal has been reduced through the iterative design process, with infrastructure being moved away from areas of intact Box-Gum Woodland and areas protected under an Environmental Stewardship Program.

(g)	*whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*
	The proposed action constitutes, is part of, or is likely to result in the operation of, or increase the impact of the following key threatening processes (KTPs) as listed in schedule 3 of the TSC Act: • clearing of native vegetation; • invasion of native plant communities by exotic perennial grasses; and • loss of hollow bearing trees. Areas of Box-Gum Woodland in good condition, with an intact canopy and groundcover occur scattered through the Study Area and 95% of these will be retained. The ecological field surveys have informed the design of the Project resulting in adjustments to the Development Footprint to avoid areas of intact Box-Gum Woodland as much as possible. A number of mitigation measures will be implemented during both the construction and operation phases to minimise the impacts of clearing. The TSC act also refers to disturbed habitat from clearing permitting the establishment and spread of exotic species which may displace native species. The invasion of the community by exotic perennial grasses constitutes a threat to the EEC. Schedule 3 of the TSC Act lists this KTP as a specific threat to White Box - Yellow Box - Blakelys Red Gum Woodland specifically in regards to Coolatai grass (*Hyparrhenia hirta*) invasion. This exotic species was not identified during any surveys within the Study Area however the clearing of this community means the remaining areas are more likely to be subject to increased weed incursion, including the invasion of perennial grasses. Fifteen hollow bearing trees will be removed as part of the proposed action. These hollows provide potential habitat for threatened species. The layout of the proposed action has been designed to avoid hollow bearing trees as much as possible, in accordance with the results of extensive surveys for hollow bearing trees.
	Conclusion
	Box-Gum Woodland occurs throughout the Study Area in varying conditions. The Project will involve clearing of a small area of intact woodland and larger areas of DNG. This will reduce the extent of the EEC, however, as the majority of the intact Box-Gum Woodland will be retained in the Study Area, the Project is unlikely to have a significant impact on the EEC.

F.1.2 Flora

Yass Daisy (*Ammobium craspedioides*) – V – TSC Act

Crimson Spider Orchid (*Caladenia concolor*) – E – TSC Act

Buttercup Doubletail (*Diuris aequalis*) – E – TSC Act

Silky Swainson Pea (*Swainsona sericea*) – V – TSC Act

Robertsons Gum (*Eucalyptus robertsonii*) – V – TSC Act

Aromatic Peppercress (*Lepidium hyssopifolium*) – E – TSC Act

Tarengo Leek Orchid (*Prasophyllum petilum*) – E – TSC Act

Mountain Swainson Pea (*Swainsona recta*) – E – TSC Act

Black Gum (*Eucalyptus aggregata*) – E – TSC Act

Button Wrinklewort (*Rutidosis leptorrhyncoides*) – E – TSC Act

Seven part tests for the ten threatened plants are included together in this table, however, where differences in habitat preference and potential impacts occur, these are outlined separately.

Yass Daisy

The Yass Daisy is listed as vulnerable under the TSC Act. It is found from near Crookwell to near Wagga Wagga, with most populations occurring in the Yass region. It occurs in moist or dry forest communities, Box-Gum Woodland and secondary grassland derived from clearing of these communities. Some populations persist in grazed areas. The Yass Daisy grows in association with a large range of Eucalypts (*Eucalyptus blakelyi, E. bridgesiana, E. dives, E. goniocalyx, E. macrorhyncha, E. mannifera, E. melliodora, E. polyanthemos, E. rubida*) (OEH 2012c).

It is considered likely to occur in the Study Area as it was recorded in the Locality during ERM's field surveys and there are seven database records in the Locality. Optimal habitat occurs in the Study Area.

Crimson Spider Orchid

The Crimson Spider Orchid is listed as endangered under the TSC Act. The current NSW Scientific Committee listing incorporates two populations which have each been described as separate species by D.L. Jones. One of these populations comprises a few hundred plants on private property near Bethungra and the other of about 100 plants occurs in Burrinjuck Nature Reserve. The other occurrences of the Crimson Spider Orchid in NSW are in the Nail Can Hill Crown Reserve near Albury and from a small Crown land site north-west of Wagga Wagga. The species also occurs in Victoria (OEH 2012c).

The species inhabits regrowth woodland on granite ridge country that has retained a high diversity of plant species, including other orchids. It occurs in woodland areas where the dominant associated trees are Blakely's Red Gum (*Eucalyptus blakelyi*), Red Stringybark (*E. macrorhyncha*), Red Box (*E. polyanthemos*) and White Box (*E. albens*). The understorey includes Silver Wattle (*Acacia dealbata*), Hop Bitter-pea (*Daviesia latifolia*), Common Beard-heath (*Leucopogon virgatus*), Spreading Flax-lily (*Dianella revoluta*) and Poa Tussock (*Poa sieberiana*) (OEH 2012c).

This species is deciduous, producing a leaf during autumn or winter and after flowering in spring survives the dry summer and early autumn as a dormant tuber. Flowering does not take place every year for reasons that are not fully understood, though each plant probably lives for a considerable number of years (OEH 2012c).

The species was not recorded in the Study Area during recent field surveys and there are no database records in the Locality. However, it has the potential to occur in the Study Area as there are some areas of optimal habitat.

Buttercup Doubletail

The Buttercup Doubletail is listed as endangered under the TSC Act. The species has been recorded in Kanangra-Boyd National Park, Gurnang State Forest, towards Wombeyan Caves, the Taralga - Goulburn area, and the ranges between Braidwood, Tarago and Bungendore.

The Buttercup Doubletail has been recorded in forest, low open woodland with a grassy understorey and secondary grassland on the higher parts of the Southern and Central Tablelands. Its leaves die back each year and resprout just before flowering. Populations tend to contain few, scattered individuals; despite extensive surveys, only about 200 plants in total, from 20 populations are known (OEH 2012c).

The species was not recorded in the Study Area during recent field surveys and there are no database records in the Locality. However, it has the potential to occur in the Study Area as there are some areas of optimal habitat.

Silky Swainson Pea

The Silky Swainson Pea is listed as vulnerable under the TSC Act. The species has been recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. The species is found in Box-Gum Woodland in the Southern Tablelands (OEH 2012c).

The species was not recorded in the Study Area during recent field surveys, however, database records show it has been recorded in the Locality. It has the potential to occur in the Study Area as there are some areas of optimal habitat.

Robertsons Gum

Robertsons Gum is listed as vulnerable under the TSC Act. The species is known only from the central tablelands of NSW, at small disjunct localities from north of Orange to Burraga. The species is locally frequent in grassy or dry sclerophyll woodland or forest, on lighter soils and often on granite. It is usually found in closed grassy woodlands in locally sheltered sites. Habitats include quartzite ridges, upper slopes and a slight rise of shallow clay over volcanics. Associated vegetation includes variously mixed woodlands of *Eucalyptus piperita, E. goniocalyx, E. dalrympleana, E. dives, E. mannifera and E. rossii*. Populations are usually highly localised, with trees recorded as frequent in populations (OEH 2012c).

The species was not recorded in the Study Area during recent field surveys and there are no database records in the Locality. However, it has the potential to occur in the Study Area as there are some areas of optimal habitat.

Aromatic Peppercress

The Aromatic Peppercress is listed as endangered under the TSC Act. In NSW, there is a small population near Bathurst, one population at Bungendore and one near Crookwell. The species occurs in a variety of habitats including woodland with a grassy understorey and grassland. It appears to respond to disturbance, having appeared after soil disturbance at one site. Its cryptic and non-descript nature (appearing like several weed species) makes it hard to detect (OEH 2012c).

The species was not recorded in the Study Area during recent field surveys and there are no database records in the Locality. However, it has the potential to occur in the Study Area as there are some areas of optimal habitat.

Tarengo Leek Orchid

The Tarengo Leek Orchid is listed as endangered under the TSC Act. Natural populations are known from a total of four sites in NSW: at Boorowa, Captains Flat, Ilford and Delegate. The species grows in open sites within Natural Temperate Grassland at the Boorowa and Delegate sites. Also grows in grassy woodland in association with River Tussock (*Poa labillardieri*), Black Gum (*Eucalyptus aggregata*) and tea-trees (*Leptospermum* spp.) at Captains Flat and within the grassy groundlayer dominated by Kangaroo Grass under Box-Gum Woodland at Ilford. The species is apparently highly susceptible to grazing, being retained only at little-grazed travelling stock reserves (Boorowa & Delegate) and in cemeteries (Captains Flat, Ilford and Hall). Population density at the Boorowa site is higher in the open grassland dominated by wallaby grasses (*Austrodanthonia* spp.), compared to that within the denser stands of Kangaroo Grass (*Themeda australis*). Plants retreat into subterranean tubers after fruiting, so are not visible above-ground (OEH 2012c).

The species was not recorded in the Study Area during recent field surveys. There are five records within 10 – 20 km of the Study Area. It has the potential to occur in the Study Area as there are some areas of sub-optimal habitat.

Mountain Swainson Pea

The Mountain Swainson Pea is listed as endangered under the TSC Act. Populations occur in the Queanbeyan and Wellington-Mudgee areas. Over 80% of the southern population grows on a railway easement. Before European settlement, the Small Purple-pea occurred in the grassy understorey of woodlands and open-forests dominated by Blakely's Red Gum Yellow Box, Candlebark Gum and Long-leaf Box. It grows in association with understorey dominants that include Kangaroo Grass, Poa tussocks and Speargrasses (OEH 2012c).

The species was not recorded in the Study Area during recent field surveys and there are no database records in the Locality. However, it has the potential to occur in the Study Area as there are some areas of optimal habitat.

Button Wrinklewort

The Button Wrinklewort is listed as endangered under the TSC Act. The species occurs in Box-Gum Woodland, secondary grassland derived from Box-Gum Woodland or in Natural Temperate Grassland; and often in the ecotone between the two communities. The species is apparently susceptible to grazing, being retained in only a small number of populations on roadsides, rail reserves and other un-grazed or very lightly grazed sites (OEH 2012c).

The species was not recorded in the Study Area during recent field surveys and there are no database records in the Locality. However, it has the potential to occur in the Study Area as there are some areas of optimal habitat.

(a)	*in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*
	The proposed action will result in vegetation removal, including 8.62 ha of woodland and 49.16 ha of DNG. Should a population or individuals of the threatened plant species occur in the Development Footprint, they would be removed as part of the proposed action. The Project comprises small and narrow linear elements spread across a wide area and as such, the resulting permanent cleared areas are unlikely to affect seed dispersal or vegetative reproduction in plants that are retained in the vicinity of the Development Footprint. The proposed action is unlikely to have an adverse effect on the life cycle of the threatened plant species such that viable local populations are likely to be placed at risk of extinction.
(b)	*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*
	Not applicable.
(c)	*in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
	Not applicable.
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
	Not applicable.
(d)	*in relation to the habitat of a threatened species, population or ecological community:*
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
	The Yass Daisy, Doubletail Buttercup and Aromatic Peppercress inhabit areas of woodland, open forest and DNG. A total of 57.78 ha of this habitat will be removed as part of the proposed action. The Crimson Spider Orchid inhabits woodland on granite ridge country that has retained a high diversity of plant species. A total of 5.28 ha of this habitat would be removed as part of the proposed action. The Silky Swainson Pea and Mountain Swainson Pea inhabit areas of Box-Gum Woodland. A total of 2.83 ha of this habitat would be remved as part of the proposed action. Robertson's Gum inhabits dry sclerophyll woodland or forest on lighter soils, often on granite. A total of 5.28 ha of this habitat would be removed as part of the proposed action.

The Tarengo Leek Orchid occurs in Natural Temperate Grassland. The species may inhabit areas of DNG. A total of 49.16 ha of DNG will be removed as part of the proposed action. However, the species is highly susceptible to grazing and much of the DNG in the Study Area is grazed.

The Button Wrinklewort occurs in Box-Gum Woodland and its associated DNG. A total of 45.52 ha of this habitat type will be removed as part of the proposed action.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The habitat for threatened plants is already highly fragmented in the Study Area, comprising patches of native vegetation interspersed among paddocks of improved exotic pasture and cropping. The Project comprises small and narrow linear elements spread across a wide area and as such, the resulting permanent cleared areas are unlikely to affect seed dispersal or vegetative reproduction in plants that are retained in the vicinity of the Development Footprint.

The greatest impact in terms of fragmentation will be in the area comprising a narrow roadside corridor of intact Box-Gum Woodland along Tangmangaroo Road. Overhead transmission lines are proposed in this area, which would result in fragmentation of this area of Box-Gum Woodland. The transmission line would be approximately 60 m wide. The nature of the easement would allow for retention of the groundcover and low shrub cover which would provide for connectivity of some of the community strata and is unlikely to present a barrier for dispersal of genetic material. The remaining areas of infrastructure have been sited in areas that are already cleared of woodland, or close to the edges of woodland patches and thus, would not lead to fragmentation or isolation.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,

The majority of the habitat to be removed comprises DNG, which does not comprise optimal habitat for the threatened plants, although some have been recorded in similar habitats. The area of DNG to be removed comprises approximately 16% of the DNG in the Study Area.

Areas of Box-Gum Woodland and Red Stringybark Open Forest in good condition comprise important habitat, particularly as these areas are highly fragmented in the Study Area. These areas have largely been avoided by the proposed action, with approximately 95% of their total occurrence in the Study Area being retained.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

At the time of writing, critical habitat had not been listed for any of the threatened plants under Part 3 of the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Recovery Plans have been prepared under the TSC Act for the Crimson Spider Orchid and Tarengo Leek Orchid. National Recovery Plans have been prepared for the Crimson Spider Orchid and Aromatic Peppercress.

Crimson Spider Orchid

The overall objective of the Draft Recovery Plan for the Crimson Spider Orchid is to achieve viable populations in the wild as a basis for downlisting the species from endangered to vulnerable. The specific objectives of the plan are to:

- determine the extent and severity of threatening processes and eliminate or minimise the impact as necessary;
- collect additional information on the occurrence of the species and regularly monitor all populations to detect population trends, anticipate potential threats and facilitate early management intervention;
- increase the population of Crimson Spider Orchids;
- describe the two new species of Caladenia occurring at Bethungra and Burrinjuck and nominate them for listing under the TSC Act;
- establish the Crimson Spider Orchid and Bethungra Spider Orchid in cultivation;
- investigate the biology and ecology of the three Spider Orchid species to obtain the detailed knowledge necessary to make informed and effective management decisions;
- provide for the long term conservation and management of the population of Crimson Spider Orchid and the Burrinjuck Spider Orchid; and
- inform and involve the community in the conservation of the Crimson Spider Orchid, the Bethungra Spider Orchid and the Burrinjuck Spider Orchid.

The Crimson Spider Orchid is included in the National Recovery Plan for Twenty Five Threatened Orchid Taxa of Victoria, South Australia and NSW. The objectives of this plan are to:

- acquire accurate information for conservation status assessments;
- identify key biological functions;
- identify important, common and potential habitat;
- ensure that all existing populations and their habitat are protected and managed appropriately;
- increase the size of populations in the wild;
- determine the growth rates and viability of populations;
- establish populations in cultivation;
- establish cultivated plants in the wild;
- builda network of goverement and non-government organisations and individuals; and
- cooperate in bioregional policy implementation and manage recovery plan implementation.

The objectives from both plans relate to actions to be undertaken by OEH and DSEWPC to facilitate research and increase knowledge regarding the species. The proposed action does not contravene these objectives.

Tarengo Leek Orchid

The overall objective of the National Recovery Plan for the Tarengo Leek Orchid is to maintain or enhance the populations of Tarengo Leek Orchid at the five known sites, by controlling threatening processes and improving conditions for growth and recruitment. The recovery actions are specifically related to the five known populations. As the known populaitons do not occur in the Study Area, these actions are not applicable to the proposed action.

Aromatic Peppercress

The overall objective of the National Recovery Plan for the Aromatic Peppercress is to minimise the probability of extinction in the wild and to increase the probability of populations becoming sef sustaining in the long term. The specific objectives are to:

- determine distribution, abundance and population structure;
- determine habitat requirements;
- determine and manage threats to populations;
- protect habitat on private and public land;
- identify key biological and ecological functions;
- determine growth rates and viability of populations;
- establish a population in cultivation;
- establish new populations in the wild; and
- build community support for conservation.

The objectives from this plan relate to actions to be undertaken by DSEWPC to facilitate research and increase knowledge regarding the species. There is also a strong focus on managing the known populations, which do not occur in the vicinity of the Study Area. The proposed action does not contravene these objectives.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed action constitutes, is part of, or is likely to result in the operation of, or increase the impact of one key threatening process (KTPs) as listed in schedule 3 of the TSC Act: clearing of native vegetation.

Areas of woodland and open forest in good condition, with an intact canopy and groundcover occur scattered through the Study Area and 95% of these will be retained. The Project layout has been designed to avoid areas of woodland as much as possible and the ecological field surveys have informed the design. This has resulted in adjustments to the Development Footprint to avoid areas of intact woodland and open forest as much as possible. A number of mitigation measures will be implemented during both the construction and operation phases to minimise the impacts of clearing.

Conclusion

The threatened plants were not recorded in the Study Area during field surveys, however, potential habitat for all ten threatened plants occurs. Areas of potential habitat will be removed or modified as part of the Project, the majority of which comprises grassland habitat. Areas of similar habitat occur throughout the Study Area and Locality and the removal of this habitat is unlikely to significantly impact these species. As the Development Footprint is narrow and linear, it is unlikely to affect fragmentation, seed dispersal and vegetative reproduction to the extent that it will significantly impact these species, should they occur in the Development Footprint.

F.1.3 Invertebrates

Golden Sun Moth (*Synemon plana*) – E – TSC Act

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Golden Sun Moth

The species occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which the groundlayer is dominated by wallaby grasses (*Austrodanthonia* spp). Grasslands dominated by wallaby grasses are typically low and open. The bare ground between the tussocks (inter-tussock spaces) is thought to be an important microhabitat feature for the Golden Sun Moth, as it is typically these areas on which the females are observed displaying to attract males. Habitat may contain several wallaby grass species, which are typically associated with other grasses particularly spear-grasses (*Austrostipa* spp.) or Kangaroo Grass (*Themeda australis*) (OEH 2012).

Sites supporting Golden Sun Moth populations have generally been subject to light grazing. A number of populations occur in paddocks alongside where sheep and cattle graze. These sites have not undergone extensive pasture improvement or fertiliser usage and contain areas of primary Wallaby Grass cover. Based on recent observations at two ACT sites there is a possibility that Golden Sun Moth larvae feed on Chilean Needle Grass (*Nassella neesiana*) and Redleg Grass (*Bothriochloa macra*) (DSEWPC 2012).

A large number of records exist for this species within the Study Locality. This species has also been previously recorded within the Study Area and was recorded at numerous locations within during intensive targeted field surveys. Areas of optimal habitat have also been identified through the survey period. A total of 103 male GSM and one female GSM were recorded at 22 sites during the survey period. The highest number of GSM observed at a given site was 23 individuals, with the majority of sites having 10 or fewer.

The proposal would involve the construction of a wind farm and its associated infrastructure such as access tracks building and crane pads, power lines both aerial and underground. The dominate impact of the proposal to the Golden Sun Moth would be habitat loss and fragmentation. Based on the infrastructure layout, which is considered to be a worst case scenario in terms of extent, 82.48 ha of GSM habitat will be removed from a total of 810.2 ha within the Study Area, (with an additional 18.4 ha disturbed and rehabilitated after construction).

A GSM Management Plan will be developed and implemented to identify species and habitat specific measures such that the condition and extent of remaining habitat can be managed. Management will include measures such as movement through and disturbance to mapped GSM habitat will be minimised during the flying period, from November to January, if possible areas of habitat will be delineated by barrier tape (or similar) to clearly demarcate these areas and limit risk of vehicles traversing through habitat accidently all vehicle movements will be contained to roads and tracks where possible. With the proposed mitigation measures put into place it is unlikely that the proposed action would impact the life cycle of the Golden Sun Moth such that viable local populations of these species will be placed at risk of extinction.

(b)	*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*
	Not applicable.
(c)	*in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
	Not applicable.
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
	Not applicable.
(d)	*in relation to the habitat of a threatened species, population or ecological community:*
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
	Up to 82.48 ha of GSM habitat will be removed with an additional 18.4 ha disturbed and rehabilitated after construction.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
	Fragmentation of Golden Sun Moth habitat associated with the proposed action is likely to be limited to the widening of existing tracks, corridors for transmission lines and clearing for crane pads and turbines. The habitat within the Study Area is already fragmented to a degree. The implementation of a GSM Management Plan will target specific measures such that the condition and extent of remaining habitat can be managed, thus minimising the impacts of fragmentation on this species.
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,
	The Golden Sun Moth habitat within Study Area is important to the survival of a local population of this species. The low numbers of moths observed during the targeted surveys however may indicate that the areas of habitat are sub prime or have been affected by land management processes.
(e)	*whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*
	No critical habitat for Golden Sun Moth is listed under Part 3 of the TSC Act.
(f)	*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*
	No recovery or threat abatement plans exist for the Golden Sun Moth under the NSW TSC Act.

(g)	*whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. The proposed action may clear native vegetation that provides potential habitat for this species. The key threatening process of clearing of native vegetation will result from the proposal.

The Golden Sun Moth is threatened by invasion of exotic pasture species and Kangaroo Grass (*Themeda australis*) in grassland habitat and also high fire frequency. Implementation of management measures such as weed management and fire management measures to minimise fire risk and spread from infrastructure would be implemented to reduce operation of these key threatening processes.

Conclusion

This species was recorded during field surveys in native grassland areas throughout the Study Area. The proposal would result in the removal of a small portion of habitat but could result in the fragmentation of existing habitat. To mitigate these impacts a Flora and Fauna Management Plan would be implemented outlining measures to minimise disturbance to mapped GSM habitat, to conduct works outside of the flying period and delineating habitat by barrier tape to limit the risk of vehicles traversing through habitat accidently. The preservation of key sites would further mitigate any impacts to this species. With the mitigation measures implemented it is unlikely that the proposal would result in a significant impact on the Golden Sun Moth.

F.1.4 Reptiles

Pink-Tailed Worm-lizard (*Aprasia parapulchella*) – V - TSC Act

Rosenberg's Goanna (*Varanus rosenbergi*) – V – TSC Act

Striped Legless Lizard (*Delma impar*) – V – TSC Act

(a)	in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Pink-tailed Worm-lizard

This species inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. This species was not recorded during targeted field surveys. This species has not been recorded within the Study Locality. Some areas of sub optimal habitat have been identified within the Study Area in some of the upper slope areas. Approximately 380.53 ha of secondary or sub optimal habitat for this species have been identified within the Study Area.

Rosenberg's Goanna

Rosenberg's Goanna is found in heath, open forest and woodland. Termite mounds are a critical habitat component and are used for nesting. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens. The species required large areas of habitat. This species

	was not recorded during field surveys. This species has not been recorded within the Study Locality. Suitable habitat is that sub prime has been identified within some of the intact woodland areas. These areas however are largely fragmented. Approximately 1,180.34 ha of woodland and open woodland habitat for this species have been identified within the Study Area Striped Legless Lizard This species is found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass (*Themeda australis*), spear-grasses (*Austrostipa* spp.) and poa tussocks (*Poa* spp.), and occasionally wallaby grasses (*Austrodanthonia* spp.). This species was not recorded during targeted field surveys. This species has not been recorded within the Study Locality. Approximately 313 ha of secondary or sub optimal habitat for this species have been identified within the Study Area. The proposal would involve the construction of a wind farm and its associated infrastructue such as access tracks builing and crane pads, power lines both aireal and underground. The predominate impact to the Pink-tailed Worm-lizard, Striped Legless Lizard, and Rosenberg's Goanna would be habitat removal or modification. Approximately 49.16 ha or 13.6 % of a total of approximately 313 ha of potential habitat for the Pink-tailed Worm-lizard, and Striped Legless Lizard, may be removed or modified as part of the project. Approximately 8.62 ha or 5.2 % of potential habitat for the Rosenberg's Goanna may be removed or modified as part of the project. To mitigate any potential impacts areas of potential habitat for these species will be marked prior to the commencement of works and all vehicles/equipment will be restricted to designated tracks located outside of these areas, so as to prevent accidental disturbance to this species. Where possible infrastructure including power poles will be positioned, where possible to avoid areas of potential habitat. Where direct impacts could occur, a pre-clearance survey by an ecologist of all disturbance areas will be undertaken and any individuals found will be relocated to nearby shelter. The pre-clearance strategy will be undertaken in accordance with the EMP. With the adoption of the appropriate mitigation measures such as pre-clearance surveys, habitat avoidance, and disturbance minimisation within building areas it is unlikely that the proposal would adversely affect the lifecycles of the Pink-tailed Worm-lizard, Striped Legless Lizard, and Rosenberg's Goanna such that a viable local population would be placed at extinction.
(b)	in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,
	Not applicable.
(c)	in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
	Not applicable.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Up to approximately 49.16 ha of Woodland and derived native grassland, which is considered the most suitable habitat for the Pink-tailed Worm-lizard, Striped Legless Lizard, in the Study Area, will be impacted as a result of the proposed action. Approximately 42.69 ha of this is expected to be permanently removed (for widening of access tracks) while a much larger proportion of this may be modified (for transmission line easement) though is likely to still provide suitable habitat for this species. The habitat in the Study Area is not considered critical to the survival of the species.

Up to approximately 8.62 ha of Woodland habitat most suitable to the Rosenberg's Goanna will be impacted as a result of the proposed action. Approximately 6.58 ha of this are expected to be permanently removed (for widening of access tracks).

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Fragmentation of grassland and associated grassy woodland habitat associated with the proposed action is likely to be limited to the widening of existing tracks, corridors for transmission lines and clearing for crane pads and turbines. The habitat within the Study Area is already fragmented to a degree; only minimal further fragmentation will result from the proposed action. The level of fragmentation resulting from the proposed action is considered unlikely to isolate populations of the threatened reptile species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,

None of the areas identified as suitable habitat for these species within the Study Area would be considered areas of habitat important to the long term survival of any of these species. The level of fragmentation and habitat loss is not expected to threaten the long-term survival of local populations of the threatened reptiles and it is therefore not considered that the habitat to be impacted is critical to the survival of these species in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat within the Study Area for any of the threatened reptiles is listed under Part 3 of the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A national recovery plan has been prepared for the Striped Legless Lizard (Smith and Robertson 1999). The objectives of the plan are:

- establish and maintain national forums for the discussion and organisation of the conservation of *D. impar* across its natural distribution;
- determine the distribution of potential *D. impar* habitat;
- determine the current distribution and abundance of *D. impar* in Victoria, New South Wales, the Australian Capital Territory and South Australia;

- establish a series of reserves and other managed areas such that viable populations are maintained across the known distribution of the species;
- determine the habitat use and ecological requirements of *D. impar*;
- identify the nature and extent of the threatening processes affecting *D. impar*;
- undertake a program of research and monitoring to provide a basis for adaptive management of *D. impar*;
- increase community awareness and involve the community in aspects of the recovery program;
- assess the need for salvage and translocation, determine their feasibilities,
- develop protocols and undertake a trial translocation if appropriate; and
- Ensure that captive populations are used to support education and research elements of the Recovery Plan.

The proposed action is not considered to contravene any of the objectives of the recovery plan.

A National Recovery Plan for the Pink-tailed Legless Lizard/Worm Lizard has been prepared (Osborne et al 1995). The objectives of this plan are to:

- keep domestic dogs and cats indoors at night;
- undertake feral animal control;
- apply fire regimes that maintain structure and floristic diversity (e.g. patch burning);
- search for the species in suitable habitat in areas that are proposed for development or management actions, and mark sites onto maps or plans;
- do not collect bush rock or remove rocks for pasture management purposes;
- do not destroy habitat and surrounding areas by ploughing;
- do not allow heavy, prolonged grazing on habitat;
- do not plant trees and shrubs into habitat;
- control invasions of weeds and pasture species (but be wary of the impact of herbicide use in habitat); where possible use methods that directly target weeds, such as spot spraying and hand removal;
- protect natural grassland remnants within the known distribution of the
- species;
- ensure remnant populations remain connected or linked to each other. In cases where remnants have lost connective links, re-establish links by re-vegetating sites to act as stepping stones for dispersal; and
- mark sites and potential habitat onto maps used for planning hazard reduction burns.

The proposed action incorporating mitigation measures is unlikely to contravene these objectives or interfere substantially with the recovery of the Pink-tailed Legless Lizard.

There is no recovery plan, national or state for the Rosenberg's Goanna.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. Three are relevant to the Pink-tailed Worm-lizard, Striped Legless Lizard, and Rosenberg's Goanna;:

- bush rock removal – removing potential shelter and/or basking sites;
- clearing of native vegetation; and
- Removal of dead wood and dead trees.

	With the adoption of mitigation measures including avoiding and/or minimising clearance of native vegetation, weed management, inspection of rocks within the disturbance areas, re-location of rocks disturbed by establishment of the development footprint, it is not expected that the proposed activity will result in a significant increases of these key threatening processes.
	Conclusion
	None of these species were recorded during field surveys, however, the Study Area may provide potential habitat for these species. Potential impacts to these reptiles include removal of habitat. A portion of woodland habitat that is preferred habitat for Rosenberg's Goanna would be removed as part of the project. This is unlikely to increases the levels of fragmentation within the Study Area as it is already highly fragmented. The project has avoided impacts on large tracts of woodland by the relocation of turbines and infrastructure to minimise impacts on woodland and associated grasslands. Furthermore, the demarcation of key habitat areas for the Striped Legless Lizard and Pink-tailed Worm-lizard would ensure these habitats be preserved and improved. Through the implementation of mitigation measures to avoid disturbance to areas of key habitat for these species, it is unlikely that the Project would have a significant impact on these species.

F.1.5 Birds

Brown Treecreeper *(Climacteris picumnus)* – V – TSC Act

Hooded Robin *(Melanodryas cucullata cucullata)* – V – TSC Act

Speckled Warbler *(Chthonicola sagittata)* – V – TSC Act

Grey-crowned Babbler *(Pomatostomus temporalis temporalis)* – V – TSC Act

Scarlet Robin *(Petroica boodang)* – V – TSC Act

Flame Robin *(Petroica phoenicea)* – V – TSC Act

Diamond Firetail *(Stagonopleura guttata)* – V – TSC Act

Varied Sittella *(Daphoenositta chrysoptera)* – V – TSC Act

Painted Honeyeater (*Grantiella picta) – V – TSC A*

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Brown Treecreeper

This species can be found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species. this species was recorded during field surveys at a number of different locations throughout the Study Area.

Hooded Robin

The species prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. This species has been recorded within the Study Locality. This species has not been recorded during field surveys however potential habitat has been identified within the woodland areas of the Study Area.

Speckled Warbler

This species lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy Large, relatively undisturbed remnants are required for the species to persist in an area. This species was recorded within the Study Area during the field surveys.

Grey-crowned Babbler

The Grey-crowned Babbler inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Birds are generally unable to cross large open areas. Territories range from one to fifty hectares and are usually around 10 ha (OEH 2012). This species was recorded in the Study Area during field surveys.

Scarlet Robin

The Scarlet Robin lives in dry eucalypt forests and woodlands, usually with an open grassy understorey with few scattered shrubs. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber, which are important for foraging (OEH 2012). This species was recorded within the Study Area during the field surveys at four different locations.

Flame Robin

The Flame Robin breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes, with a ground layer dominated by native grasses. This species was not recorded during field surveys. This species has been recorded within the Study Locality. Sub optimal habitat has been identified within the Study Area in the form of open woodlands.

Diamond Firetail

The Diamond Firetail is found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and insects. This species was recorded at four different locations within the Study Area in mostly roadside vegetation.

Varied Sittella

The Varied Sittella inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland (OEH 2012). This species was recorded at three different locations during the field surveys.

Painted Honeyeater

Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Insects and nectar from mistletoe or eucalypts are occasionally eaten (OEH 2012). The species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. The species was not recorded during field surveys.

The proposal would involve the construction of a wind farm and its associated infrastructure such as access tracks building and crane pads, power lines both aerial and underground. The predominate impact to the woodland bird species would be habitat removal, and habitat alienation. The total amount of woodland habitat to be removed is approximately 8.62 ha of a total of 166.78 ha within the Study Area. Of this amount 2.04 ha will be temporarily removed as part of construction compounds and temporary infrastructure leaving 6.58 ha of woodland that would be permanently removed. Large areas of woodland would remain unimpacted within the Study Area.

The proposal aims to avoid clearance of large remnants of woodland habitat thus there is a reduced likelihood of removal of breeding habitat and disruption of nesting. Pre-clearance inspections for nests and implementation of management measures as appropriate may further limit any likely disturbance of nesting.

The impact of habitat alienation on woodland birds is yet to be understood. To monitor and quantify this impact post construction and operation surveys should be carried out in those areas potentially affected. The proposed action is considered unlikely to impact the life cycle of threatened woodland bird species such that viable local populations of these species will be placed at risk of extinction.

(b)	*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

Not applicable.

(c)	*in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
	Not applicable.
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
	Not applicable.
(d)	*in relation to the habitat of a threatened species, population or ecological community:*
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
	Up to 8.62 ha of woodland habitat is likely to be removed as a result of the proposed action. This represents approximately 5.1 % of the estimated occurrence of potential habitat for this species within the Study Area. Approximately 15 hollow bearing trees will be removed, approximately 3.4 % of the hollow bearing trees mapped within 500 m of turbine infrastructure.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
	Fragmentation of woodland habitat associated with the proposed action is likely to be limited to the widening of existing tracks, corridors for transmission lines and clearing for crane pads and turbines. The habitat within the Study Area is already fragmented to a degree; the removal of 8.62 ha of woodland habitat is unlikely to increase the incidence of fragmentation within the Study Area.
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,
	The importance of the habitats to be removed as part of the proposal to the threatened woodland birds is unlikely to crucial to the survival of a local viable population. The level of fragmentation and habitat loss associated with the construction of access tracks and associated infrastructure is not expected to threaten the long-term survival of local populations of threatened woodland birds. The removal of hollow bearing trees is likely to take place in open paddock areas although it is anticipated that some would be removed as part of vegetation removal. The habitat to be impacted by the proposed action is not considered to be critical to the long-term survival of these species in the locality.
(e)	*whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*
	No critical habitat has been identified within the Study Area for any of the threatened woodland bird species is listed under Part 3 of the TSC Act.
(f)	*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*
	No recovery plans have been prepared for any of the threatened woodland bird species.
(g)	*whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*
	There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. Three are relevant to the threatened woodland bird species: • clearing of native vegetation; • removal of dead wood and dead trees; and • loss of hollow-bearing trees. A number of avoidance and mitigation measures will be adopted to minimise these processes including avoiding and/or minimising clearance of native vegetation, avoiding or minimising removal of dead trees and hollow-bearing trees where possible.

The project would involve the removal of approximately 15 hollow bearing trees from predominately paddock areas. Where dead wood, dead trees and fallen hollow-bearing trees would be relocated into adjoining areas.

Conclusion

The proposal would not significantly impact on the Brown Treecreeper, Diamond Firetail, Varied Sittella Flame Robin, Scarlet Robin, Grey-crowned Babbler, Speckled Warbler or Hooded Robin. Habitat loss for these species would constitute removal of a small amount of woodland and forest. Hollow-bearing trees and fallen timber would be retained where possible to mitigate impacts. Furthermore, habitat loss would be offset by preserving and improving large areas of woodland that are in moderate to good condition.

Regent Honeyeater *(Anthochaera phrygia)* – E – TSC Act

Swift Parrot *(Lathamus discolor)* – E – TSC Act

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Regent Honeyeater

Mainly found on the inland slopes of south-east Australia in dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak which support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Key eucalypt species include Mugga Ironbark (*Eucalyptus sideroxylon*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*), White Box (*E. albens*) and Swamp Mahogany (*E. robusta*). Also utilises: Western Grey Box (*E. macrocarpa*), Grey Gum (*E. punctata*), Red Box (*E. polyanthemos*), Grey Box *(E. moluccana*), Narrow-leaved Ironbark (*E. crebra*), *E. caleyi*, Spotted Gum (*Corymbia maculata*), McKie's Stringybark (*E. mckieana*), Red Stringybark (*E. macrorhyncha*), Silver-top Stringybark (*E. laevopinea*) and Rough-barked Apple (*Angophora floribunda*). Nectar and fruit from the mistletoes *Amyema miquelii, A. pendula* and *A. cambagei* are also eaten during the breeding season. The species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. The species was not recorded during field surveys. This species is likely to use the Study Area as optimal habitat occurs.

Swift Parrot

The Swift Parrot is endemic to south-eastern Australia. It breeds only in Tasmania, and migrates to mainland Australia in autumn (Higgins 1999; Swift Parrot Recovery Team 2001, cited in DSEWPC 2012). White Box-Yellow Box-Blakely's Red Gum EEC woodland on the New South Wales tablelands and western slopes is utilised for foraging by this species (DSE, 2005; DEC NSW 2005, cited in DSEWPC 2012). No records have been identified for this species within 10 km of the Study Area. This species was not recorded during field surveys. Potential foraging habitat is restricted to some of the woodland areas.

The proposal would involve the construction of a wind farm and its associated infrastructure such as access tracks building and crane pads, power lines both aerial and underground. The dominate impact to the Regent Honeyeater and the Swift Parrot would be habitat removal, and potential blade strike.

The total amount of woodland habitat to be removed is approximately 8.62 ha of a total of 166.78 ha within the Study Area. Of this amount 2.04 ha will be temporarily removed as part of construction compounds and temporary infrastructure leaving 6.58 ha of woodland that would be permanently removed. Large areas of woodland would remain unimpacted within the Study Area.

Due to the nomadic nature of the Regent Honeyeater it is likely to fly at RSA height during longer movements. If the species is drawn to the Study Area by suitable foraging resources there is a potential for rotor collisions to result in the death of individuals. The

Regent Honeyeater is only likely to visit the Study Area irregularly and in small numbers; a very short period of time would be spent by each individual at RSA height thus the likelihood of rotor collision is therefore considered to be low.

Due to the migratory/nomadic nature of the Swift Parrot individual birds are likely to fly at RSA height during longer migratory movements and while travelling longer distances between patches of suitable foraging habitat. If the species is drawn to the Study Area by suitable foraging resources there is a potential for rotor collisions to result in the death of individuals. This risk of collision has been modelled by Smales (2005a) as very low (between 0.08 and 0.13 birds per year) across the species' range. The risk of collision is likely to be increased during adverse weather conditions when visibility is reduced. The Swift Parrot is only likely to visit the Study Area irregularly. While in the Study Area the Swift Parrot is likely to move between flowering trees at or below tree height and therefore below the RSA height (35 to 120m above the ground). The likelihood of rotor collision is therefore considered to be low.

The proposed action is considered unlikely to impact the life cycle of the Regent Honeyeater or Swift Parrot such that a viable local population of this species will be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Up to 8.62 ha of woodland habitat is likely to be removed as a result of the proposed action. This represents approximately 5.1 % of the estimated occurrence of potential habitat for this species within the Study Area.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Fragmentation of woodland habitat associated with the proposed action is likely to be limited to the widening of existing tracks, corridors for transmission lines and clearing for crane pads and turbines. The habitat within the Study Area is already fragmented to a degree; the removal of 8.62 ha of woodland habitat is unlikely to increase the incidence of fragmentation within the Study Area.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,

The importance of the habitats to be removed as part of the proposal to the Regent Honeyeater and Swift Parrot is unlikely to crucial to the survival of a local viable population. The level of fragmentation and habitat loss associated with the construction of access tracks and associated infrastructure is not expected to threaten the long-term survival of local populations of either of these species. The habitat to be impacted by the proposed action is not considered to be critical to the long-term survival of these species in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat has been identified within the Study Area for any of the threatened woodland bird species is listed under Part 3 of the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There are national recovery plans for both the Swift Parrot and the Regent Honeyeater.

Regent Honeyeater

The objectives, criteria and actions proposed in the recovery plan for this species are based on a thorough review of the biological and ecological information available at the time of writing. However, it is emphasised that our knowledge of the habitat requirements of the Regent Honeyeater, and of seasonal or drought-induced movements, is still deficient, and that the adequacy of these actions will need to be reassessed as new information becomes available.

Long-term objectives [to be achieved within two decades] include:

- To ensure that the species persists in the wild.
- To achieve a down-listing from nationally endangered to vulnerable by stabilising the population and securing habitat extent and quality in the main areas of occupancy.
- Achieve increasing reporting rates (5%) in areas previously used regularly, e.g. Munghorn Gap, Bendigo, north-east Melbourne, Eildon area.

Swift Parrot

The plan considers the conservation requirements of the species across its range, identifies the actions to be taken to ensure its long-term viability in nature and the parties who will undertake these actions. This species is mainly threatened by loss and alteration of habitat from forestry activities including firewood harvesting, clearing for residential, agricultural and industrial developments, attrition of old growth trees in the agricultural landscape, suppression of forest regeneration, and frequent fire. The species is also threatened by the effects of climate change, food and nest source competition, flight collision hazards, psittacine beak and feather disease, and illegal capture and trade.

The overall objective of this plan is to prevent further population decline of the Swift Parrot and to achieve a demonstrable sustained improvement in the quality and quantity of Swift Parrot habitat to increase carrying capacity. These objectives will be achieved by implementing recovery actions for each of the following specific recovery objectives:

- Objective 1: To identify and prioritise habitats and sites used by the species across its range, on all land tenures.

- Objective 2: To implement management strategies to protect and improve habitats and sites on all land tenures
- Objective 3: To monitor and manage the incidence of collisions, competition and Beak and Feather Disease (BFD).
- Objective 4: To monitor population trends and distribution throughout the range.

The proposed actions have taken into account the management of areas of habitat and the impacts have been reduced as much as possible through the application of the mitigation hierarchy. Therefore, the proposed action is not inconsistent with the objectives of the above recovery plans.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. One are relevant to the Regent Honeyeater and the Swift Parrot:

- clearing of native vegetation;

A number of avoidance and mitigation measures will be adopted to minimise this process including avoiding and/or minimising the clearing of large tracts of native vegetation will minimise the impact of this process and associated reduction in foraging resource.

Conclusion

The Project is unlikely to have a significant impact on the Regent Honeyeater or the Swift Parrot. The project would result in the removal of a small portion of the total habitat available to these species. The resources available within the Study Area would be regarded as sub optimal and this is shown by the lack of records of these species within the Locality. The Study Area does not represent an area of optimal breeding habitat for either of these species as both of these species have well known breeding areas. The presence of either of these species within the Study Area would be regarded as a stopover and would generally be in small numbers. Therefore the collision risk with a turbine rotor to these species would be considered very low.

Little Lorikeet *(Glossopsitta pusilla)* – V - TSC Act

Black-chinned Honeyeater *(Melithreptus gularis)* – V - TSC Act

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Little Lorikeet

The Little Lorikeet forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Roosts in treetops, often distant from feeding areas, and nests in Eucalypt hollows in proximity to feeding areas if possible (OEH 2012). The species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. The species was not recorded during field surveys. Suitable habitat for this species exists within the Study Area.

Black-chinned Honeyeater

Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees. Nectar is taken from flowers, and honeydew is gleaned from foliage (OEH 2012). The species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. The species was not recorded during field surveys. Suitable habitat for this species exists within the Study Area.

The proposal would involve the construction of a wind farm and its associated infrastructure such as access tracks building and crane pads, power lines both aerial and underground. The dominate impacts to the Little Lorikeet and the Black-chinned Honeyeater would be habitat removal, and potential blade strike.

The total amount of woodland habitat to be removed is approximately 8.62 ha of a total of 166.78 ha within the Study Area. Of this amount 2.04 ha will be temporarily removed as part of construction compounds and temporary infrastructure leaving 6.58 ha of woodland that would be permanently removed. Large areas of woodland would remain unimpacted within the Study Area.

Both species may occasionally fly at RSA height. These species would not regularly fly at RSA height the risk of a significant number of rotor collision deaths is considered low. It is therefore considered unlikely that rotor collisions would have a significant impact on these species. The proposed action is unlikely to impact the life cycle of the Little Lorikeet and Black-chinned Honeyeater such that viable local populations of these species will be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Up to 8.62 ha of woodland habitat is likely to be removed as a result of the proposed action. This represents approximately 5.1 % of the estimated occurrence of potential habitat for this species within the Study Area. A further 15 hollow bearing trees would be removed this is approximately 3.4 % of the total hollow bearing trees mapped within the Study Area.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Fragmentation of woodland habitat associated with the proposed action is likely to be limited to the widening of existing tracks, corridors for transmission lines and clearing for crane pads and turbines. The habitat within the Study Area is already fragmented to a degree; the removal of 8.62 ha of woodland habitat is unlikely to increase the incidence of fragmentation within the Study Area.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,

The importance of the habitats to be removed as part of the proposal to the Little Lorikeet and the Black-chinned Honeyeater is unlikely to crucial to the survival of a local viable population. The level of fragmentation and habitat loss associated with the construction of access tracks and associated infrastructure is not expected to threaten the long-term survival of local populations of either of these species. The habitat to be impacted by the proposed action is not considered to be critical to the long-term survival of these species in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat has been identified within the Study Area for any of the threatened woodland bird species is listed under Part 3 of the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Little Lorikeet or Black-chinned Honeyeater under the NSW TSC Act.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. Three are relevant to the Little Lorikeet and Black-chinned Honeyeater:

- clearing of native vegetation;
- removal of dead wood and dead trees; and
- loss of hollow-bearing trees.

A number of avoidance and mitigation measures will be adopted to minimise these processes including avoiding clearance of native vegetation in large tracts, avoiding or minimising removal of dead wood, dead trees and hollow-bearing trees where possible. This has largely been achieved through avoidance of forested/woodland habitat and avoidance of Box-Gum woodland and riparian habitats associated with lower slopes and plains.

Conclusion

The proposal would not significantly impact on the Little Lorikeet or Black-chinned Honeyeater. Habitat loss for these species would constitute removal of a small amount of woodland and forest. Hollow-bearing trees and fallen timber would be retained where possible to mitigate impacts. As these species are very mobile, the impact of habitat fragmentation would not significantly impact these species. Furthermore, habitat loss would be offset by preserving and improving large areas of woodland that are in moderate to good condition.

Turquoise Parrot *(Neophema pulchella)* – V – TSC Act

Gang-gang Cockatoo *(Callocephalon fimbriatum)* – V – TSC Act

(a)	*in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

Turquoise Parrot

Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Usually seen in pairs or small, possibly family, groups and have also been reported in flocks of up to thirty individuals. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Nests in tree hollows, logs or posts, from August to December (OEH 2012). No records have been identified within 10 km of the Study Area. This species was not recorded during field surveys. Woodland in roadside reserves and remnant patches may provide suitable habitat.

Gang-gang Cockatoo

The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales. In summer, it is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. The species moves to lower altitudes in winter, preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. The species favours old growth attributes for nesting and roosting (OEH 2012). The species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. The species was not recorded during field surveys. Suitable winter habitat exists in road reserves and on some properties.

The proposal would involve the construction of a wind farm and its associated infrastructure such as access tracks building and crane pads, power lines both aerial and underground. The dominate impact to the Turquoise Parrot and the Gang-gang Cockatoo would be habitat removal, and potential blade strike.

The total amount of woodland habitat to be removed is approximately 8.62 ha of a total of 166.78 ha within the Study Area. Of this amount 2.04 ha will be temporarily removed as part of construction compounds and temporary infrastructure leaving 6.58 ha of woodland that would be permanently removed. Large areas of woodland would remain unimpacted within the Study Area. 15 hollow bearing trees would be removed this is approximately 3.4 % of the total hollow bearing trees mapped within the Study Area.

The Turquoise Parrot and Gang-gang Cockatoo may fly at RSA height while travelling between patches of suitable foraging habitat. If the species is drawn to the Study Area by suitable foraging resources there is a potential for rotor collisions to result in the death of individuals. The Turquoise Parrot spends most of its time foraging on the ground; only a very short period of time would be spent by each individual at RSA height the likelihood of rotor collision is therefore considered to be low. The Gang-gang Cockatoo spends the majority of its foraging time in trees and when traversing open area between patches of trees would remain at canopy height thus rarely fly at RSA height. Therefore the likelihood of rotor collision is considered to be low for the Gang-gang Cockatoo.

The proposed action is considered unlikely to impact the life cycle of the Turquoise Parrot and Gang-gang Cockatoo such that a viable local population of this species will be placed at risk of extinction.

(b)	*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*
	Not applicable.
(c)	*in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
	Not applicable.
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
	Not applicable.
(d)	*in relation to the habitat of a threatened species, population or ecological community:*
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
	Up to 8.62 ha of woodland habitat is likely to be removed as a result of the proposed action. This represents approximately 5.1 % of the estimated occurrence of potential habitat for this species within the Study Area. 15 hollow bearing trees would be removed this is approximately 3.4 % of the total hollow bearing trees mapped within the Study Area.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
	Fragmentation of woodland habitat associated with the proposed action is likely to be limited to the widening of existing tracks, corridors for transmission lines and clearing for crane pads and turbines. The habitat within the Study Area is already fragmented to a degree; the removal of 8.62 ha of woodland habitat is unlikely to increase the incidence of fragmentation within the Study Area.
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,
	The importance of the habitats to be removed as part of the proposal to the Turquoise Parrot and Gang-gang Cockatoo is unlikely to crucial to the survival of a local viable population. The level of fragmentation and habitat loss associated with the construction of access tracks and associated infrastructure is not expected to threaten the long-term survival of local populations of either of these species. The habitat to be impacted by the proposed action is not considered to be critical to the long-term survival of these species in the locality.
(e)	*whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*
	No critical habitat has been identified within the Study Area for the Turquoise Parrot or the Gang-gang Cockatoo is listed under Part 3 of the TSC Act.

(f)	*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*

There is no recovery plan for the Turquoise Parrot or the Gang-gang Cockatoo under the NSW TSC Act.

(g)	*whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. Two are relevant to the Regent Honeyeater and the Swift Parrot:

- clearing of native vegetation;
- loss of hollow bearing trees.

A number of avoidance and mitigation measures will be adopted to minimise these processes including avoiding clearance of native vegetation in large tracts, avoiding or minimising removal hollow-bearing trees where possible. This has largely been achieved through avoidance of forested/woodland habitat remnants within road corridors of the Study Area and avoidance of Box-Gum woodland and riparian habitats associated with lower slopes and plains.

Conclusion

The proposal would not significantly impact on the Turquoise Parrot or Gang-gang Cockatoo. Habitat loss for these species would constitute removal of a small amount of woodland and forest. Hollow-bearing trees and fallen timber would be retained where possible to mitigate impacts. The Study Area does not constitute as known breeding habitat for either of these species and as such no known breeding habitat would be removed or modified. These species both have foraging habitats that rely on terrestrial resources. As these species move from resource to resource they are unlikely to fly at RSA height and would therefore be at little risk of collision with a wind turbine. Both of these species are very mobile thus the impact of habitat fragmentation would not significantly impact these species. Furthermore, habitat loss would be offset by preserving and improving large areas of woodland that are in moderate to good condition.

White-fronted Chat *(Epthianura albifrons)* – V – TSC Act

(a)	*in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

White-Fronted Chat

The White-fronted Chat is a gregarious species, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground (OEH 2012). Two records of the species exist within the Study Locality. The Study Area may provide sub optimal habitat for this species.

The proposal would involve the construction of a wind farm and its associated infrastructure such as access tracks building and crane pads, power lines both aerial and underground. The proposed action is likely to impact on potential breeding and foraging habitat for the White-fronted Chat.

The total amount of native grassland habitats for the species associated with grassland derived from Box-Gum Woodland to be removed is approximately 49.16 ha of a total of 313 ha within the Study Area. Of this amount 6.47 ha will be temporarily removed as part of construction compounds and temporary infrastructure leaving 42.69 ha of

grassland derived from Box-Gum Woodland that would be permanently removed. Large areas of grassland derived from Box-Gum Woodland would remain unimpacted within the Study Area.

The White-fronted Chat is not considered to be at risk of rotor collision impacts as this species moves at a height that is generally below RSA. The proposed action is considered unlikely to impact the life cycle of the White-fronted Chat such that the viable local population will be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The total amount of native grassland habitats for the species associated with Natural Temperate Grassland and grassland derived from Box-Gum Woodland to be removed is approximately 49.16 ha of a total of 313 ha or 15 % within the Study Area. Of this amount 6.47 ha will be temporarily removed as part of construction compounds and temporary infrastructure leaving 42.69 ha of grassland derived from Box-Gum Woodland that would be permanently removed.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Fragmentation of woodland habitat associated with the proposed action is likely to be limited to the widening of existing tracks, corridors for transmission lines and clearing for crane pads and turbines. Fragmentation of habitat for the White-fronted Chat is unlikely to impact on the White-fronted Chat as this species is very mobile.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,

The importance of the habitats to be removed as part of the proposal is not expected to threaten the long-term survival of local populations of the White-fronted Chat and the habitats are therefore not considered to be critical to the long-term survival of the species in the locality.

(e)	*whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*
	No critical habitat has been identified within the Study Area for White-fronted Chat is listed under Part 3 of the TSC Act.
(f)	*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*
	There is no recovery plan for the White-fronted Chat under the NSW TSC Act.
(g)	*whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*
	There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. The proposed action is considered to be the operation of two KTPs relevant to the threatened White-fronted Chat: • Clearing of native vegetation; and • Removal of dead wood and dead trees. A number of avoidance and mitigation measures will be adopted to minimise these processes including avoiding and/or minimising clearance of native vegetation, avoiding or minimising removal of dead trees where possible. Where possible (in agreement with local landowners) dead wood, dead trees and fallen hollow-bearing trees would be relocated into adjoining areas.
	Conclusion
	The Project is unlikely to have a significant impact on the Whit-fronted Chat. The project would involve the removal of a small amount of habitat that is available to the White-fronted Chat within the Study Area. To offset potential impacts to this species mitigation measures will be adopted to minimise the impacts of vegetation removal. Habitat loss would be offset by preserving and improving large areas of woodland that are in moderate to good condition.

Superb Parrot *(Polytelis swainsonii)* – V – TSC Act

(a)	*in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*
	Superb Parrot This species mainly inhabits forest and woodlands dominated by eucalypts, especially River Red Gums and box eucalypts such as Yellow Box or Grey Box. The species also seasonally occurs in box-pine (*Callitris*) and Boree (*Acacia pendula*) woodlands (DSEWPC 2012). The Superb Parrot is dependent on aggregations of large hollow bearing trees and nests between September and December in hollow limbs or holes in the trunk of large eucalypts, mainly near water. In the inland slopes, most nests are in large Blakely's Red Gums, with many nest trees either dead or suffering from dieback. The entrance to the nesting cavity ranges from 5–13 m above the ground for nest trees on the inland slopes. Birds nest deep within the tree hollow, sometimes even at ground level. The same nest hollows are used in successive years, although it is not known if it is always by the same pair. Occasionally a different hollow in the same tree is used, and nest trees may continue to be used even after the tree has died (DSEWPC 2012). Much of the breeding habitat in the South-west Slopes is on private land. Superb Parrots are rarely observed

on the inland slopes during winter, with the few birds seen usually being breeding pairs. Most of the breeding population from the inland slopes appears to move to the eucalypt-pine woodlands on the plains of west-central and north-central New South Wales (DSEWPC 2012).

This species has been previously recorded within the Study Area from a number of sources and a large number of records exist from within the locality. Extensive targeted survey for the species has been undertaken since July 2012 and into early 2013. Surveys have included identification of suitable nest hollows within 500 m of all proposed turbines, bird census surveys and bird utilisation surveys in which the flying height and direction are recorded at numerous sites across the Study Area. The species has been recorded at 15 locations and a total of 148 individuals across the Study Area in woodland areas, in stands of planted trees, foraging in native grassland, pasture and cropping paddocks.

The primary impacts to Superb Parrots associated with the project are that of injury or death of individual Superb Parrots due to collision with turbines, habitat loss and habitat alienation.

The bird utilization surveys gathered data related to the flight activity of birds and this data has been used to assess the potential impacts to the species. The data obtained showed the Superb Parrot was recorded 148 times from a total of eight different BUS sites. One Superb Parrot was recorded at RSA height during the surveys which is 0.7 % of the total number recorded. 147 or 99.3 % of the Superb Parrots recorded during the BUS were flying below RSA height.

The Project has been designed to avoid areas of woodland and paddock trees and therefore, is not likely to affect breeding habitat or cause fragmentation of habitat. This species is mostly associated with Box Gum Woodland but was observed foraging on cropped grain. Within the Study Area a total of 67.54 ha of Box Gum Woodland have been identified. As a result of the project approximately 3.34 ha or 4.49 %would be removed or modified. Of the 449 mapped hollow bearing trees it is likely 15 will be removed as part of the proposed action. This constitutes approximately 3.4 % of the total number of hollow bearing trees available to the Superb Parrot within 500 m of a proposed turbine location.

The BUS data combined with a collision risk model analysis concluded that this species was rarely recorded flying at RSA height and when it was recorded the collision risk model predicted that 0.0055 birds are at risk for the month of November. Furthermore this species appears to utilise the Study Area on a seasonal basis that coincides with cropping practices and the breeding season. Foraging areas are widespread across the Locality and although it is anticipated 3.4 % of potential breeding habitat within 500 m of a proposed turbine will be impacted this would make up a small proportion of the habitat available throughout the Study Locality.

The proposed action is considered unlikely to impact the life cycle of the Superb Parrot such that a viable local population of this species will be placed at risk of extinction.

(b) *in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

Not applicable.

(c) *in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable.

	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
	Not applicable.
(d)	*in relation to the habitat of a threatened species, population or ecological community:*
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
	As a result of the project approximately 3.34 ha or 4.49 %of Box Gum Woodland habitat would be removed or modified within the Study Area. Of the 449 mapped hollow bearing trees it is likely 15 will be removed as part of the proposed action. This constitutes approximately 3.4 % of the total number of hollow bearing trees available to the Superb Parrot within 500 m of a proposed turbine location.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
	Fragmentation of woodland habitat associated with the proposed action is likely to be limited to the widening of existing tracks, corridors for transmission lines and clearing for crane pads and turbines. The habitat within the Study Area is already fragmented to a degree; the removal of 3.34 ha of woodland habitat is unlikely to increase the incidence of fragmentation within the Study Area. The highly mobile nature of this species further decreases the impact of fragmentation.
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,
	The importance of the habitats to be removed as part of the proposal to the Superb Parrot is unlikely to be crucial to the survival of a local viable population. The level of fragmentation and habitat loss associated with the construction of access tracks and associated infrastructure is not expected to threaten the long-term survival of local populations of either of these species. The habitat to be impacted by the proposed action is not considered to be critical to the long-term survival of these species in the locality.
(e)	*whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*
	No critical habitat has been identified within the Study Area for any of the threatened woodland bird species is listed under Part 3 of the TSC Act.
(f)	*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*
	The Recovery Plan for the Superb Parrot: Polytelis swainsonii was developed in 2011 by the Victorian Department of Sustainability and Environment (DSE). This plan is largely focussed on increasing knowledge and awareness of the species and its habitat, particularly nesting habitat. It also focusses on protecting nesting habitat. The proposed action will remove a small portion of potential nesting habitat for the species and as such, will not interfere substantially with the recovery of the species. The proposed action is not considered to contravene any of the objectives of the recovery plan and is considered to have contributed to increasing the knowledge of the species ecological requirements.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. Three are relevant to the Superb Parrot:

- clearing of native vegetation;
- removal of dead wood and dead trees; and
- loss of hollow-bearing trees.

A number of avoidance and mitigation measures will be adopted to minimise these processes including avoiding clearance of native vegetation in large tracts, avoiding or minimising removal of dead wood, dead trees and hollow-bearing trees where possible. This has largely been achieved through avoidance of forested/woodland habitat and avoidance of Box-Gum woodland and riparian habitats associated with lower slopes and plains.

Conclusion

The Project would result in the removal of a small portion of foraging and breeding habitat for this species. Field surveys recorded this species throughout the Study Area, thus showing that the resources within the Study Area are important for the survival of this species. This species was recorded once flying at RSA height during BUS's which took place over the species breeding season. The Superb Parrot was observed mostly flying at below RSA height, thus is generally unlikely to be at risk of a collision with a turbine. Habitat removal would be very minor in comparison to the resources available to these species. The project would impact on potential breeding habitat, however, it would be generally regarded to be below a threshold which would be considered as a significant impact. It is concluded that the project would not result in a significant impact to the Superb Parrot, however, this species is considered to be a local key species and would be monitored as part of a bird and bat monitoring program.

Square-tailed Kite *(Lophoictinia isura)* – V – TSC Act

Little Eagle *(Hieraaetus morphnoides)* – V – TSC Act

Spotted Harrier *(Circus assimilis)* – V – TSC Act

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Square-tailed Kite

The Square-tailed Kite is found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Associated vegetation includes variously mixed woodlands of *Eucalyptus piperita, E. goniocalyx, E. dalrympleana, E. dives, E. mannifera* and *E. rossii* (OEH 2012). This species has not been recorded within the Study Locality. This species was not recorded during field surveys. This species has a wide range however may potentially fly over the Study Area and utilise the area as part of its foraging range.

Little Eagle

The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. The species occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch (OEH 2012). Records for this species extend from Crookwell to the east of the Study Locality to Yass in the south, to west of Harden to the west (OEH 2012). This species was recorded during field surveys.

Spotted Harrier

The Spotted Harrier occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. The species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site. This species was recorded during field surveys.

The proposal would involve the construction of a wind farm and its associated infrastructure such as access tracks building and crane pads, power lines both aerial and underground. The impacts to the Square-tailed Kite Little Eagle and the Spotted Harrier include loss of foraging or breeding habitat and potential injury or mortality from bladestrike.

The proposal would remove approximately 8.62 ha of potential breeding habitat for the Little Eagle and the Spotted Harrier (woodland, forest), the Square-tailed Kite is unlikely to breed locally (most breeding records for this species are along the coast). This would reduce the amount of large trees within this area for nesting potentially by 5.1 % from a total area of 166.78 ha avalable. Turbines in or near breeding areas, could affect juvenile survival rates due to potential blade strike or disturbance. However, no active nests for threatened raptors were detected during surveys. To mitigate any potential impact to breeding pairs it is recommended that as a precautionary measure where mature/tall trees are to be removed a pre-clearance inspection for nesting sites would be undertaken in the final design stage of the project to avoid these critical habitat features. Turbines will be located away from forest remnants where possible to further mitigate the possibility of blade strike.

The Square-tailed Kite and Little Eagle are likely to be at RSA height when in the Study Area and be at risk of rotor collisions. The Little Eagle was recorded once within the Study Area flying at RSA height. The Square-tailed Kite was not recorded however this species would be considered likely to flyover the Study Area. Both of these species prefer to hunt over woodlands. Where possible turbines have been placed away from the edges of woodland areas to minimise the possibility of blade strike for either of these species.

The Spotted Harrier on the Pines property and is likely to be resident within the Study Area. The Spotted Harrier generally flys low over open grasslands and woodlands (Olsen 1995) and would rarely fly at RSA height, therefore would not be regularly at risk of rotor collision impacts. The Little Eagle was recorded at flying above RSA within the Study Area. The Little Eagle is an agile species that utilises its supreme manoeuvrability to catch prey whilst in flight (Olsen 1995). Furthermore studies conducted in Australia and overseas show that a number of raptor species have a rate of avoidance to wind farm turbines at 100 % (Meredith *et al.* 2002); The proposed action is considered unlikely to impact the life cycle of threatened raptor species such that viable local populations of these species will be placed at risk of extinction.

(b)	*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*

Not applicable.

(c)	*in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal would remove approximately 8.62 ha of potential breeding and foraging habitat for the Little Eagle the Spotted Harrier (woodland, forest), the Square-tailed Kite is unlikely to breed locally (most breeding records for this species are along the coast). This would reduce the amount of large trees available for nesting by 5.1 % from a total area of 166.78 ha available.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Fragmentation of woodland and forest habitat associated with the proposed action is likely to be limited to the widening of existing tracks, corridors for transmission lines and clearing for crane pads and turbines. Actual vegetation clearing would be very small in relation to the amount available locally of similar or better quality. While it is likely that Clusters of operational turbines would reduce the use of habitat within the vicinity, it seems unlikely that they would present a barrier to movement or cause isolation or fragmentation of habitat for these highly mobile species. In the case of Spotted Harrier, they are likely to forage lower than the RSA height, the Square-tailed Kite and Little Eagle may both soar higher than and within RSA height and raptors have been shown to be able to negotiate movements around turbines.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,

Habitat within the Study Area does not appear to be of high importance to any of the three raptor species. Active Raptor nests were not observed at the site. The closest record for these three raptors is over 10 km away. It is unlikely that these species rely on resources at the site given the lack of evidence of usage; however, the proposal site does contain habitat features of importance to the species. Farm dams, creeks and farmland/open habitats present foraging opportunities for these species and drought refuges. Forest and woodland provide nesting opportunities.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat for the Square-tailed Kite Little Eagle and the Spotted Harrier are listed under Part 3 of the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There are no current threat abatement or recovery plans for these species.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. Three of these is relevant to the proposal:

- Clearing of native vegetation (minor potential impact considering the pattern and extent with respect to these wide ranging species).
- Loss of dead wood and dead trees (may affect perching and hunting by raptors).
- Loss of hollow-bearing trees (may affect the abundance of raptors' prey species).

Measures to address these KTPs include minimising habitat loss by:

- Retaining hollow-bearing trees and stags where possible.
- Retaining fallen timber.
- Placing turbines, roads, circuits and crane hard-stand areas to avoid removal of native vegetation.

These avoidance and mitigation measures will be adopted to minimise this process within the Study Area.

Conclusion

Whilst the proposal would reduce vegetated habitat for nesting by 8.62 ha for these three raptors, much of the vegetation on the steep slopes and paddock trees throughout the site would be retained. Potential Little Eagle nesting habitat on the higher slopes is unlikely to be impacted as much of the taller trees in these locations would be retained. The Spotted Harrier is unlikely to be impacted by turbine collision as they generally fly below RSA height. The Square-tailed Kite and Little Eagle could be impacted by collision as they both forage in the sweep zone however, as raptors are known to avoid turbines, it is likely that mortality rates would be minimal. The Project would not significantly impact on the Square-tailed Kite or Spotted Harrier. It is unlikely that the proposal would significantly impact on the Little Eagle, however, this species is considered to be a key species and would be monitored as part of the bird and bat monitoring program.

Powerful Owl *(Ninox strenua)* – V – TSC Act

Barking Owl *(Ninox connivens)* – V – TSC Act

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Powerful Owl

The Powerful Owl is widely distributed throughout the eastern forests from the coast inland to the tablelands with scattered, historical records from the western slopes and plains. This species inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. Generally requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. This species was not recorded during field surveys. There are no records of this species in the Study Locality. Habitat does exist within the Study Area for both breeding and foraging and as this species has a large range the Study Area could be considered part of a Powerful Owls range.

Barking Owl

Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. This species was not recorded during targeted surveys. The species has been recorded in the Atlas of Australian Birds, within approximately 60 km of the site.

The proposal would involve the construction of a wind farm and its associated infrastructure such as access tracks building and crane pads, power lines both aerial and underground. The impacts to the Powerful Owl and the Barking Owl include loss of foraging or breeding habitat.

The proposal would remove approximately 6.58 ha of potential foraging habitat for the This would reduce the amount of large trees available for nesting by 3.9 % from a total area of 166.78 ha available. Potential breeding habitat will be affected by the removal of 15 hollow bearing trees of a recorded 485 from within the Study Area. Large areas of more suitable habitat along the remnant road corridors, adjoining the impact areas, exist within and beyond the Study Area, and breeding potential for these species is not expected to be significantly impacted.

The Powerful and Barking Owls may occasionally fly at RSA height when travelling between patches of suitable habitat however both species would not regularly fly at RSA height and be at risk of rotor collision impacts. It is unlikely that rotor collisions would have a significant impact on the owl species.

Through protection of large tracts of habitat in location of infrastructure potential impacts on breeding cycle of both owls (such as removal of potential roosting sites, reduction in habitat for prey species, disturbance of nesting behaviour) have been avoided. The proposed action is considered unlikely to impact the life cycle of threatened owl species such that viable local populations of these species will be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal would remove approximately 6.58 ha of potential breeding and foraging habitat for the Powerful Owl and the Barking Owl. This would reduce the amount of large trees available for nesting by 3.9 % from a total area of 166.78 ha available. Approximately 15 hollow bearing trees will be removed, approximately 3.4 % of the hollow bearing trees mapped within 500 m of turbine infrastructure.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Fragmentation of woodland and forest habitat associated with the proposed action is likely to be limited to the widening of existing tracks, corridors for transmission lines and clearing for crane pads and turbines. Actual vegetation clearing would be very small

in relation to the amount available locally of similar or better quality. While it is likely that Clusters of operational turbines would reduce the use of habitat within the vicinity, it seems unlikely that they would present a barrier to movement or cause isolation or fragmentation of habitat for these highly mobile species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,

Habitat within the Study Area does not appear to be of high importance to the Powerful Owl or the Barking Owl. No breeding pairs were observed during field surveys. It is unlikely that these species rely on resources at the site given the lack of evidence of usage, however, the proposal site does contain some habitat features of importance to the species. Farm dams, creeks and farmland/open habitats present foraging opportunities for these species and drought refuges. Forest and woodland remnants along road corridors may provide nesting opportunities.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat for any of the threatened owl species is listed under Part 3 of the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A draft recovery plan has been prepared for the Barking Owl (NPWS 2003) and the Powerful Owl is listed in the approved recovery plan for large forest owls (DEC 2006). The objectives of each plan are listed below:

Barking Owl:

- Specific Objective 1: Increase understanding of the biology, ecology and management of the Barking Owl;
- Specific Objective 2: Increase education and awareness of and involvement in the conservation of the Barking Owl and its habitat in NSW;
- Specific Objective 3: Undertake threat abatement and mitigation;
- Specific Objective 4: Gain efficiencies through links with other conservation plans and conservation groups; and
- Specific Objective 5: Provide organisational support.

Large Forest Owls (Powerful Owl):

- Objective 1: Assess the distribution and amount of high quality habitat for each owl species across public and private lands to get an estimate of the number and proportion of occupied territories of each species that are, and are not, protected;
- Objective 2: To monitor trends in population parameters (numbers, distribution, territory fidelity and breeding success) across the range of the three species and across different land tenures and disturbance histories;
- Objective 3: To assess the implementation and effectiveness of forest management prescriptions designed to mitigate the impact of timber harvesting operations on the three owl species and, (if necessary), to use this information to refine the prescriptions so that forestry activities on state forests are not resulting in adverse changes in species abundance and breeding success;
- Objective 4: Ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment processes;
- Objective 5: Minimise further loss and fragmentation of habitat by protection and more informed management of significant owl habitat (including protection of individual nest sites);

- Objective 6: To improve the recovery and management of the three large forest owls based on an improved understanding of key areas of their biology and ecology;
- Objective 7: To raise awareness of the conservation requirements of the three large forest owls amongst the broader community, to involve the community in owl conservation efforts and in so doing increase the information base about owl habitats and biology; and
- Objective 8: To coordinate the implementation of the recovery plan and continually seek to integrate actions in this plan with actions in other recovery plans or conservation initiatives.

The proposed action does not contravene any of the objectives or actions of the relevant recovery plans.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. Three of these are relevant to the proposal:

- Clearing of native vegetation (minor potential impact considering the pattern and extent with respect to these wide ranging species).
- Loss of dead wood and dead trees (may affect perching and hunting by raptors).
- Loss of hollow-bearing trees (may affect the abundance of raptors' prey species).

Measures to address these KTPs include minimising habitat loss by:

- Retaining hollow-bearing trees and stags where possible.
- Retaining fallen timber.
- Placing turbines, roads, circuits and crane hard-stand areas to avoid removal of native vegetation.

These avoidance and mitigation measures will be adopted to minimise this process within the Study Area.

Conclusion

The proposal would not significantly impact on the Powerful Owl or the Barking Owl provided mitigation measures are implemented. Habitat loss for these species is largely through loss of hollow-bearing trees and stags as breeding resources. Hollow-bearing trees and stags would be retained where possible to mitigate impacts. The project has been designed to avoid large tracts of remnant habitat. Furthermore, habitat loss would be offset by preserving and improving these large areas of woodland.

F.1.6 Bats

Eastern Bentwing-bat *(Miniopterus schreibersii oceanensis)* – V – TSC Act

Yellow Bellied Sheathtail-bat *(Saccolaimus flaviventris)* – V – TSC Act

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Eastern Bentwing-bat

The Eastern Bentwing-bat hunts in forested areas, catching moths and other flying insects above the tree tops. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. This species forms discrete populations centred on a maternity cave with specific temperature and humidity regimes that is used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about 300 km range of maternity caves. (OEH 2012). The nearest known maternity roost site is Wee Jasper, approximately 67 km to the south of the Study Area. This species was positively recorded at two different locations on the edge of woodland habitat within the Study Area during the field surveys. Two abandoned mines were investigated during the field surveys but there was no activity recorded at these locations.

Yellow Bellied Sheathtail-bat

The Yellow-bellied Sheathtail-bat forages for insects in most habitats across its very wide range, and flies high and fast over the forest canopy, but lower in more open country. This species roosts in tree hollows and buildings, and in treeless areas they are known to utilise mammal burrows. Seasonal movements are unknown but there is speculation about a migration to southern Australia in late summer and autumn (OEH 2012). The yellow Bellied Sheathtail-bat was positively recorded using Anabat units from two locations within the Study Area.

The proposal would involve the construction of a wind farm and its associated infrastructure such as access tracks building and crane pads, power lines both aerial and underground. The predominate impact to the Eastern Bentwing-bat and the Yellow Bellied Sheathtail-bat would be blade strike, roosting habitat for the Yellow Bellied Sheath Tail-bat and a small portion of foraging habitat loss for both species in the form of woodland to be removed. 15 hollow bearing trees would be removed this is approximately 3.4 % of the total hollow bearing trees mapped within the Study Area.

Both the Eastern Bentwing-bat and the Yellow Bellied Sheathtail-bat are considered to have the potential to fly at RSA height within the Study Area. Both of these species fly above the canopy of forest and woodland areas, but fly lower in open areas. The majority of the turbines have been cited to avoid woodland areas and as such have been placed in open areas. Canopy heights in the woodland areas on the hill tops in the vicinity of potential turbine locations are typically 10-15 m in total height. RSA height has been conservatively estimated at 20 – 150 m. It is likely that some bats would fly within RSA and as such collisions would occur however as both of these species were recorded very rarely within the Study Area it is unlikely that the Study Area represents an important roost or foraging site for either of these species.

It is therefore unlikely that a significant number of rotor collision deaths will occur as a result of the proposed action although it is acknowledged that some collision deaths may occur. The proposed action is unlikely to impact the life cycle of any of the threatened bat species such that viable local populations of these species will be placed at risk of extinction.

(b)	*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*
	Not applicable.
(c)	*in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
	Not applicable.
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
	Not applicable.
(d)	*in relation to the habitat of a threatened species, population or ecological community:*
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
	Up to 8.62 ha of woodland habitat is likely to be removed as a result of the proposed action. This represents approximately 5.1 % of the estimated occurrence of potential habitat for this species within the Study Area. Approximately 15 hollow bearing trees will be removed, approximately 3.4 % of the hollow bearing trees mapped within 500 m of turbine infrastructure.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
	Fragmentation of woodland habitat associated with the proposed action is likely to be limited to the widening of existing tracks, corridors for transmission lines and clearing for crane pads and turbines. The habitat within the Study Area is already fragmented to a degree; the removal of 8.62 ha of woodland habitat is unlikely to increase the incidence of fragmentation within the Study Area. The level of fragmentation resulting from the proposed action is considered unlikely to isolate populations of the bat species which are highly mobile.
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,
	The level of fragmentation and habitat loss is not expected to threaten the long-term survival of local populations of the Eastern Bentwing-bat and the Yellow Bellied Sheathtail-bat and it is therefore not considered that the habitat to be impacted is critical to the survival of these species in the locality.
(e)	*whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*
	No critical habitat for any of the threatened hollow-dependent bat species is listed under Part 3 of the TSC Act.

(f)	*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*

No recovery or threat abatement plans exist for the threatened hollow-dependent bat species under the NSW TSC Act.

(g)	*whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. Three are relevant to the Eastern Bentwing Bat and the Yellow bellied Sheathtail Bat;

- clearing of native vegetation;
- removal of dead wood and dead trees; and
- loss of hollow-bearing trees.

Avoidance and mitigation measures will be adopted to minimise these processes including avoiding clearance of native vegetation in large tracts, avoiding or minimising removal of dead wood, dead trees and hollow-bearing trees where possible. This has largely been achieved through avoidance of large tracts of forested/woodland habitat through the centre of the Study Area.

Conclusion

Whilst the proposal would reduce potential roosting habitat for the Yellow Bellied Sheathtail bat and foraging habitat for both of these bat species, the loss of habitat would be very small in comparison to the resources available in the greater Study Area. The Yellow-bellied Sheathtail Bat and Eastern Bentwing Bat could be impacted by turbine collision/barotrauma as they fly in the sweep zone. The Yellow-bellied Sheathtail Bat is likely to occur in low numbers and therefore unlikely to be impacted at a population level. Potential impacts to this species are not likely to be significant. Impacts to the Eastern Bentwing Bat would also be minor as this species was only recorded at two sites and not in great numbers. There is also no evidence to suggest this species utilises the site heavily for foraging from a known nearby maternity cave. It is therefore unlikely that the proposal would significantly impact on the Eastern Bentwing Bat, however, this species is considered to be a key species and would be monitored as part of the bird and bat monitoring program.

F.1.7 Mammals (excluding bats)

Koala *(Phascolarctos cinereus)* – V – TSC Act

(a)	*in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*

Koala

In NSW, the Koala inhabits a range of forest and woodland communities, including coastal forests, woodlands on the tablelands and western slopes, and woodland communities along watercourses. The primary feed trees in the Central and Southern Tablelands are the Ribbon Gum *Eucalyptus viminalis* and the River Red Gum *Eucalyptus camaldulensis* with 18 secondary feed tree species including White Box *Eucalyptus albens*, Yellow *Box Eucalyptus melliodora*, Bundy *Eucalyptus nortonii*, Blakely's Red Gum

Eucalyptus blakelyi, and Apple-topped Box *Eucalyptus bridgesiana*. There are two Stringybark supplementary species, including Red Stringybark *Eucalyptus macrorhyncha* and Yellow stringybark *Eucalyptus muelleriana* (OEH 2008).

Secondary and supplementary habitat for this species does exist within the Study Area. This species was not recorded within the Study Area during field surveys. There are two records of this species within five kilometres of the Study Area. One is approximately three kilometres from a proposed turbine location and was recorded in 1970, the other is from approximately 1.5 kilometres from a proposed turbine and was recorded in 1997 (OEH 2012).

The proposal would involve the construction of a wind farm and its associated infrastructure such as access tracks building and crane pads, power lines both aerial and underground. The impact to the Koala will be predominately secondary foraging habitat loss. The proposal will result in the removal of approximately 5.54 ha of moderate to good quality Box gum Woodland and Red Stringybark Open Forest of a total of 101.51 ha recorded within the Study Area. Larger tracts of habitat are found within existing road corridors along Tangmangoroo Road, Drews Road, Laverstock Road and Harrys Creek Road adjoining the impact areas have been avoided and will be retained within the Study Area. The foraging range of the Koala is not expected to be significantly impacted. The proposed action is unlikely to impact the life cycle of the Koala such that a viable local population of this species will be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal will result in the removal of approximately 5.54 ha of moderate to good quality Box gum Woodland and Red Stringybark Open Forest of a total of 101.51 ha recorded within the Study Area. This amounts to approximately 5.4 % of the total available secondary foraging resources available for the Koala and is a small portion of the habitat available outside of the Study Area.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Fragmentation of woodland and forest habitat associated with the proposed action is likely to be limited to the widening of existing tracks, corridors for transmission lines and clearing for crane pads and turbines. A portion of the identified habitat along Tangmangaroo Road will be fragmented by approximately 60 m due to an easement for infrastructure crossing the road in this location. The fragmentation in this location is

unlikely to impede the movement of animals north or south of this area. This area is predominately made up of secondary or sub optimal foraging habitat for this species and this species quite often traverses open areas as it moves through the landscape. The fragmentation of habitat is unlikely to impede the movements of the Koala in this area thus a population of this species is unlikely to suffer the effects of isolation.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,

The area of woodland that would be affected by fragmentation as part of the proposal does not represent an area of optimal habitat and animals are unlikely to be impeded by 60 m of easement. The level of fragmentation and habitat loss for the Koala in this location is not expected to threaten the long-term survival of a local population of the Koala. Therefore the habitat to be impacted by the proposed action is not considered to be critical to the long-term survival of this species in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat for the Koala is listed under Part 3 of the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

An approved recovery plan for the Koala has been prepared (DECC 2008). The objectives of the recovery plan are listed below:

- Objective 1: To conserve koalas in their existing habitat;
- Objective 2: To rehabilitate and restore koala habitat and populations;
- Objective 3: To develop a better understanding of the conservation biology of koalas;
- Objective 4: To ensure that the community has access to factual information about the distribution, conservation and management of koalas at a national, state and local scale;
- Objective 5: To manage captive, sick or injured koalas and orphaned wild koalas to ensure consistent and high standards of care;
- Objective 6: To manage over browsing to prevent both koala starvation and ecosystem damage in discrete patches of habitat; and
- Objective 7: To coordinate, promote the implementation, and monitor the effectiveness of the NSW Koala Recovery Plan across NSW.

The proposed action is not considered to contravene any of the objectives of the recovery plan for the Koala. The proposal meets Objective 1 to conserve Koalas in their existing habitat since the turbine, access road layout and ancillary infrastructure has avoided the forest patches where potential koala habitat was recorded.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. One of these is relevant to the Koala:

- clearing of native vegetation;

Avoidance and mitigation measures will be adopted to minimise this process including avoiding clearance of native vegetation in large tracts. This has largely been achieved through avoidance of large tracts of forested/woodland habitat through the centre of the Study Area.

Conclusion

The Project would result in the removal of a small portion of sub optimal habitat for the Koala. A small portion of this sub optimal habitat would be fragmented to make way for infrastructure. The Koala is a very mobile species and readily takes to the ground to

move through the landscape. The clearance of a small amount of sub optimal habitat is unlikely to fragment existing habitat or isolate an existing population of this species within the Study Area. Furthermore the adoption of mitigation measures to retain large tracts of woodland would further reduce any impacts to this species. The Project is unlikely to significantly impact on the Koala.

Squirrel Glider *(Petaurus norfolcensis)* – V – TSC Act

(a)	*in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,*
	Squirrel Glider This species inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range. Prefers mixed species stands with a shrub or Acacia midstorey. Requires abundant tree hollows for refuge and nest sites. This species was recorded whilst spotlighting in the Study Area during field surveys within a road corridor remnant. The proposal would involve the construction of a wind farm and its associated infrastructure such as access tracks building and crane pads, power lines both aerial and underground. The impact to the Squirrel Glider will be potential habitat loss. The proposal will result in the removal of approximately 0.26 ha of moderate to good quality Box gum Woodland of a total of 2.26 ha recorded within the Study Area. Larger areas of suitable habitat that consist of mainly existing road corridors along Tangmangoroo Road, Drews Road, Laverstock Road and Harrys Creek Road adjoining the impact areas have been avoided and will be retained within the Study Area. Approximately 15 hollow bearing trees will be removed, approximately 3.4 % of the hollow bearing trees mapped within 500 m of turbine infrastructure. Most of these are larger paddock trees and would not provide suitable breeding habitat for the Squirrel Glider. Therefore the breeding potential for this species is not expected to be significantly impacted. The proposed action is unlikely to impact the life cycle of the Squirrel Glider such that viable local populations of this species will be placed at risk of extinction.
(b)	*in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,*
	Not applicable.
(c)	*in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
	Not applicable.
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
	Not applicable.
(d)	*in relation to the habitat of a threatened species, population or ecological community:*
	(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
	The proposal will result in the removal of approximately 0.26 ha of moderate to good quality Box Gum Woodland of a total of 2.26 ha recorded within the Study Area. That is 11 % of the total amount of Box Gum Woodland recorded in the Study Area and is a small portion of the habitat available outside of the Study Area. Approximately 15 hollow bearing trees will be removed, approximately 3.4 % of the hollow bearing trees mapped within 500 m of turbine infrastructure.

	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
	Fragmentation of woodland and forest habitat associated with the proposed action is likely to be limited to the widening of existing tracks, corridors for transmission lines and clearing for crane pads and turbines. A portion of the identified habitat along Tangamangaroo Road will be fragmented by approximately 60 m due to an easement for infrastructure crossing the road in this location. The fragmentation in this location is likely to impede the movement of animals north or south of this area. This can be mitigated by retaining suitable trees at approximate 30 m spacings to allow animals to traverse this area.
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the Locality,
	The level of fragmentation and habitat loss for the Squirrel Glider in this location is not expected to threaten the long-term survival of a local population of the Squirrel Glider. Therefore the habitat to be impacted by the proposed action is not considered to be critical to the long-term survival of this species in the locality.
(e)	*whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*
	No critical habitat for the Squirrel Glider is listed under Part 3 of the TSC Act.
(f)	*whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*
	There is no recovery plan for the Squirrel Glider under the NSW TSC Act.
(g)	*whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*
	There are currently 37 key threatening processes listed under the Threatened Species Conservation Act 1995. Three are relevant to the Squirrel Glider: • clearing of native vegetation; • removal of dead wood and dead trees; and • loss of hollow-bearing trees. Avoidance and mitigation measures will be adopted to minimise these processes including avoiding clearance of native vegetation in large tracts, avoiding or minimising removal of dead wood, dead trees and hollow-bearing trees where possible. This has largely been achieved through avoidance of large tracts of forested/woodland habitat through the centre of the Study Area.
	Conclusion
	The Squirrel Glider was recorded during the field surveys. The greatest impact to this species would be habitat fragmentation. The hollow bearing trees to be removed would not constitute optimal breeding habitat for this species thus would be unlikely to significantly impact on the lifecycle of this species. The removal of a portion of habitat within the road corridor may increase the level of habitat fragmentation on this species by impeding movement through the road corridor. If mitigation measures such as the retention of as many large trees as possible in the area of impact are implemented, it is unlikely that the proposal would have a significant impact on the Squirrel Glider.

Annex G

Avian Collision Risk Model

G.1 COLLISION RISK MODEL

G.1.1 Calculating Bird Collision Risk

The Collision Risk Model (CRM) used in this assessment has been developed by Scottish National Heritage and is referred to as the Band Model (SNH 2012, Band 2000). This model provides a means of estimating collision risks and hence the potential bird mortality which may be caused by a wind farm.

Stage 1

The first stage is to determine the risk (probability) of a bird being hit by a turbine blade when making a transit through a rotor without any avoidance. The probability depends on the bird dimension (length and wingspan) and operational measures of the wind turbine including:

- Maximum chord width of rotor = 2m
- Pitch angle of rotor = 24 degrees
- Rotor diameter = 144 m
- Rotation period = 4.29 m/s

Collision risk was estimated for the identified species recorded within the Study Area. However, some bird species were not included in the assessment because all individuals recorded within the Study Area were below the rotor height during the surveys and thus the risk cannot be determined by the adopted calculations.

The predicted collision risk from the CRM therefore generated an average collision risk for each of the subject species of upwind flying direction and downwind flying direction. The tables below are taken from the Band Model for the calculation of collision risk for each of the subject species.

CALCULATION OF COLLISION RISK FOR SUPERB PARROT PASSING THROUGH ROTOR AREA

K: [1D or [3D] (0 or 1)	1		
NoBlades	3		
MaxChord	2	m	
Pitch (degrees)	24		
BirdLength	0.4	m	
Wingspan	0.15	m	
F: Flapping (0) or gliding (+1)	0		
Bird speed	15	m/sec	
RotorDiam	144	m	
RotationPeriod	4.29	sec	
Bird aspect ratioo: □	2.67		

Calculation of alpha and p(collision) as a function of radius

			Upwind:			Downwind:	
r/R	c/C	□	collide		contribution	collide	contribution
radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
0.025	0.575	5.69	7.30	0.34	0.00043	6.36	0.30	0.00037
0.075	0.575	1.90	2.86	0.13	0.00100	1.92	0.09	0.00067
0.125	0.702	1.14	2.43	0.11	0.00142	1.29	0.06	0.00075
0.175	0.860	0.81	2.38	0.11	0.00194	0.98	0.05	0.00080
0.225	0.994	0.63	2.36	0.11	0.00247	0.74	0.03	0.00078
0.275	0.947	0.52	2.06	0.10	0.00265	0.52	0.02	0.00067
0.325	0.899	0.44	1.85	0.09	0.00280	0.41	0.02	0.00062
0.375	0.851	0.38	1.68	0.08	0.00294	0.50	0.02	0.00088
0.425	0.804	0.33	1.55	0.07	0.00306	0.56	0.03	0.00111
0.475	0.756	0.30	1.43	0.07	0.00316	0.60	0.03	0.00133
0.525	0.708	0.27	1.33	0.06	0.00325	0.63	0.03	0.00153
0.575	0.660	0.25	1.24	0.06	0.00331	0.64	0.03	0.00171
0.625	0.613	0.23	1.15	0.05	0.00336	0.64	0.03	0.00188
0.675	0.565	0.21	1.08	0.05	0.00339	0.64	0.03	0.00202
0.725	0.517	0.20	1.01	0.05	0.00340	0.64	0.03	0.00215
0.775	0.470	0.18	0.94	0.04	0.00339	0.62	0.03	0.00226
0.825	0.422	0.17	0.88	0.04	0.00337	0.61	0.03	0.00235
0.875	0.374	0.16	0.82	0.04	0.00333	0.59	0.03	0.00242
0.925	0.327	0.15	0.76	0.04	0.00327	0.57	0.03	0.00247
0.975	0.279	0.15	0.70	0.03	0.00319	0.55	0.03	0.00251

Overall p(collision) = Upwind 5.5% Downwind 2.9%

Average 4.2%

CALCULATION OF COLLISION RISK FOR LITTLE EAGLE PASSING THROUGH ROTOR AREA

K: [1D or [3D] (0 or 1)	1		
NoBlades	3		
MaxChord	2	m	
Pitch (degrees)	24		
BirdLength	0.5	m	
Wingspan	1.2	m	
F: Flapping (0) or gliding (+1)	1		
Bird speed	18	m/sec	
RotorDiam	144	m	
RotationPeriod	4.29	sec	
Bird aspect ratioo: □	0.42		

Calculation of alpha and p(collision) as a function of radius

			Upwind:			Downwind:		
r/R	c/C	□	collide		contribution	collide		contribution
radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
0.025	0.575	6.83	12.86	0.50	0.00062	11.92	0.46	0.00058
0.075	0.575	2.28	4.60	0.18	0.00134	3.66	0.14	0.00107
0.125	0.702	1.37	3.36	0.13	0.00163	2.22	0.09	0.00108
0.175	0.860	0.98	2.98	0.12	0.00202	1.58	0.06	0.00107
0.225	0.994	0.76	2.77	0.11	0.00242	1.15	0.04	0.00100
0.275	0.947	0.62	2.32	0.09	0.00248	0.78	0.03	0.00083
0.325	0.899	0.53	2.00	0.08	0.00252	0.53	0.02	0.00067
0.375	0.851	0.46	1.75	0.07	0.00255	0.36	0.01	0.00053
0.425	0.804	0.40	1.74	0.07	0.00288	0.56	0.02	0.00093
0.475	0.756	0.36	1.61	0.06	0.00297	0.62	0.02	0.00114
0.525	0.708	0.33	1.50	0.06	0.00305	0.66	0.03	0.00134
0.575	0.660	0.30	1.40	0.05	0.00312	0.68	0.03	0.00152
0.625	0.613	0.27	1.30	0.05	0.00317	0.69	0.03	0.00168
0.675	0.565	0.25	1.22	0.05	0.00320	0.70	0.03	0.00183
0.725	0.517	0.24	1.14	0.04	0.00322	0.70	0.03	0.00197
0.775	0.470	0.22	1.07	0.04	0.00322	0.69	0.03	0.00209
0.825	0.422	0.21	1.00	0.04	0.00321	0.68	0.03	0.00219
0.875	0.374	0.20	0.94	0.04	0.00319	0.67	0.03	0.00228
0.925	0.327	0.18	0.88	0.03	0.00315	0.66	0.03	0.00236
0.975	0.279	0.18	0.82	0.03	0.00309	0.64	0.02	0.00242

Overall p(collision) = Upwind 5.3% Downwind 2.9%

Average 4.1%

CALCULATION OF COLLISION RISK FOR SPOTTED HARRIER PASSING THROUGH ROTOR AREA

K: [1D or [3D] (0 or 1)	1	
NoBlades	3	
MaxChord	2	m
Pitch (degrees)	24	
BirdLength	0.55	m
Wingspan	1.3	m
F: Flapping (0) or gliding (+1)	1	
Bird speed	18	m/sec
RotorDiam	144	m
RotationPeriod	4.29	sec
Bird aspect ratioo: □	0.42	

Calculation of alpha and p(collision) as a function of radius

			Upwind:			Downwind:	
r/R	c/C	□	collide		contribution	collide	contribution
radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
0.025	0.575	6.83	13.29	0.52	0.00065	12.36	0.48	0.00060
0.075	0.575	2.28	4.74	0.18	0.00138	3.81	0.15	0.00111
0.125	0.702	1.37	3.45	0.13	0.00168	2.31	0.09	0.00112
0.175	0.860	0.98	3.04	0.12	0.00207	1.64	0.06	0.00112
0.225	0.994	0.76	2.82	0.11	0.00246	1.20	0.05	0.00105
0.275	0.947	0.62	2.36	0.09	0.00252	0.82	0.03	0.00087
0.325	0.899	0.53	2.03	0.08	0.00256	0.57	0.02	0.00071
0.375	0.851	0.46	1.78	0.07	0.00259	0.39	0.02	0.00057
0.425	0.804	0.40	1.79	0.07	0.00296	0.61	0.02	0.00101
0.475	0.756	0.36	1.66	0.06	0.00307	0.67	0.03	0.00123
0.525	0.708	0.33	1.55	0.06	0.00315	0.71	0.03	0.00144
0.575	0.660	0.30	1.45	0.06	0.00323	0.73	0.03	0.00163
0.625	0.613	0.27	1.35	0.05	0.00329	0.74	0.03	0.00180
0.675	0.565	0.25	1.27	0.05	0.00333	0.75	0.03	0.00196
0.725	0.517	0.24	1.19	0.05	0.00336	0.75	0.03	0.00211
0.775	0.470	0.22	1.12	0.04	0.00338	0.74	0.03	0.00224
0.825	0.422	0.21	1.05	0.04	0.00337	0.73	0.03	0.00235
0.875	0.374	0.20	0.99	0.04	0.00336	0.72	0.03	0.00245
0.925	0.327	0.18	0.93	0.04	0.00333	0.71	0.03	0.00254
0.975	0.279	0.18	0.87	0.03	0.00328	0.69	0.03	0.00260

Overall p(collision) = Upwind 5.5% Downwind 3.1%

Average 4.3%

CALCULATION OF COLLISION RISK FOR WEDGE TAILED EAGLE PASSING THROUGH ROTOR AREA

K: [1D or [3D] (0 or 1)	1	
NoBlades	3	
MaxChord	2	m
Pitch (degrees)	24	
BirdLength	0.9	m
Wingspan	2.3	m
F: Flapping (0) or gliding (+1)	1	
Bird speed	15	m/sec
RotorDiam	144	m
RotationPeriod	4.29	sec
Bird aspect ratioo: □	0.39	

Calculation of alpha and p(collision) as a function of radius

			Upwind:			Downwind:	
r/R	c/C	□	collide		contribution	collide	contribution
radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
0.025	0.575	5.69	14.78	0.69	0.00086	13.84	0.65	0.00081
0.075	0.575	1.90	5.24	0.24	0.00183	4.30	0.20	0.00150
0.125	0.702	1.14	3.70	0.17	0.00215	2.55	0.12	0.00149
0.175	0.860	0.81	3.17	0.15	0.00258	1.77	0.08	0.00144
0.225	0.994	0.63	2.88	0.13	0.00302	1.27	0.06	0.00133
0.275	0.947	0.52	2.42	0.11	0.00311	0.88	0.04	0.00113
0.325	0.899	0.44	2.09	0.10	0.00317	0.65	0.03	0.00099
0.375	0.851	0.38	2.18	0.10	0.00382	1.00	0.05	0.00175
0.425	0.804	0.33	2.05	0.10	0.00405	1.06	0.05	0.00210
0.475	0.756	0.30	1.93	0.09	0.00427	1.10	0.05	0.00244
0.525	0.708	0.27	1.83	0.09	0.00447	1.13	0.05	0.00275
0.575	0.660	0.25	1.74	0.08	0.00465	1.14	0.05	0.00305
0.625	0.613	0.23	1.65	0.08	0.00482	1.14	0.05	0.00333
0.675	0.565	0.21	1.58	0.07	0.00496	1.14	0.05	0.00359
0.725	0.517	0.20	1.51	0.07	0.00509	1.14	0.05	0.00384
0.775	0.470	0.18	1.44	0.07	0.00520	1.12	0.05	0.00406
0.825	0.422	0.17	1.38	0.06	0.00529	1.11	0.05	0.00427
0.875	0.374	0.16	1.32	0.06	0.00537	1.09	0.05	0.00446
0.925	0.327	0.15	1.26	0.06	0.00542	1.07	0.05	0.00463
0.975	0.279	0.15	1.20	0.06	0.00546	1.05	0.05	0.00478

Overall p(collision) = Upwind 8.0% Downwind 5.4%

Average 6.7%

Stage 2

The second stage is to estimate the number of birds flying through rotors (ie number of bird at risk) per month. The Study Area measures approximately 41 km from top to bottom the number of birds at risk will be estimated for this area. This is to provide a more conservative approach by assuming all birds recorded in close proximity will pass through the Study Site. The flight risk window was first estimated by multiplying the width of the assessment area (ie 41 km) with the maximum height of the turbine (ie 192 m). The total rotor area as proportion to the flight risk window was then calculated by considering the total number of wind turbine (ie 122 for option 1) and the maximum radius of the rotor (ie 72 m).

The number of birds at risk in each month was then estimated calculating the number of birds observed flying at RSA height by the number of surveys undertaken for that month then this multiplied by four to give the number of birds per hour. The *birds at risk per day* was estimated by assuming the birds utilized the area for 10.5 hours per day for the duration of species that persisted in the Study Area. This was then multiplied by the number of days for that monthly to give an approximation of haow many birds would be at risk per month.

The number of birds passing through the rotor area was calculated by multiplying the amount of birds at risk per month by the proportion of the area risk window that was made up of the rotor area.

Finally, the number of bird collisions per year will be predicted by multiplying the risk (1st stage) with the number of birds at risk (2nd stage). This number, however, assumes the birds fly as if the wind turbine structures and rotors were not there and take no avoiding action (ie death). In reality most birds do take avoiding action and therefore the predicted number is usually adjusted by the avoidance factor. It is suggested that an avoidance rate of 95% is conservative enough for collision risk assessment. An avoidance rate of 99 % was also applied as this rate assumes that moist specdies would avoid collision 99 % of the time. Detailed calculations of the predictions were showed belowin Table I.0.

Table G.1 Superb Parrot Collision Risk Calculations

Band collision percent	4%						collisions per month			
Superb Parrot	no of birds	Birds within RSA	no of surveys	Birds at risk per survey hour	Birds at risk per day assuming 10.5 hrs daylight hours	birds at risk per month	birds passing through rotor area	no avoidence	95% avoidence	99% avoidance
November	98	1	23	0.173913043	1.826086957	54.7826087	13.82012895	0.55280516	0.0276403	0.005528
December	50	0	0	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0

Table G.2 Little Eagle Collision Risk Calculations

Band collision percent	4.1%						collisions per month			
Little Eagle	no of birds	Birds within RSA	no of surveys	Birds at risk per survey hour	Birds at risk per day assuming 10.5 hrs daylight hours	birds at risk per month	birds passing rotor area through	no avoidence	95% avoidence	99% avoidance
November	1	1	23	0.173913043	1.826086957	54.7826087	13.82012895	0.56662529	0.0283313	0.005666
December	0	0	0	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0

Table G.3 Spottet Harrier Collision Risk Calculations

Band collision percent	**4.3%**							**collisions per month**		
Spotted Harrier	no of birds	Birds within RSA	no of surveys	Birds at risk per survey hour	Birds at risk per day assuming 10.5 hrs daylight hours	birds at risk per month	birds passing rotor area through	no avoidence	95% avoidence	99% avoidance
November	0	0	0	0	0	0	0	0	0	0
December	1	1	29	0.137931034	1.448275862	44.89655172	11.32615166	0.48702452	0.0243512	0.00487
January	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0

Table G.3 Wedge Tailed Eagle Collision Risk Calculations

Band collision percent	**6.7%**							**collisions per month**		
Wedge-tailed Eagle	no of birds	Birds within RSA	no of surveys	Birds at risk per survey hour	Birds at risk per day assuming 10.5 hrs daylight hours	birds at risk per month	birds passing rotor area through	no avoidence	95% avoidence	99% avoidance
November	1	1	23	0.173913043	1.826086957	54.7826087	13.82012895	0.92594864	0.0462974	0.009259
December	2	2	29	0.275862069	2.896551724	89.79310345	3.591724138	0.24064552	0.0120323	0.002406
January	2	2	10	0.8	8.4	260.4	65.69167961	4.40134253	0.2200671	0.044013
February	2	2	14	0.571428571	6	168	42.38172878	2.83957583	0.1419788	0.028396

Annex H

BioBanking Report

Bango Wind Farm

BioBanking Assessment Report

Wind Prospect CWP Pty Ltd

May 2013

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FINAL REPORT

Wind Prospect

Bango Wind Farm
BioBanking Assessment Report

May 2013

Reference:
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Environmental Resources Management Australia
Level 2, Suite 3B, 40 Brisbane Avenue
Barton, ACT 2600
Telephone +61 2 6253 6888
Facsimile +61 2 6253 6889
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CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

1.1 BACKGROUND

This report presents the results of a BioBanking assessment that was undertaken to inform the biodiversity offsets required for the proposed Bango Wind Farm (the Project). The approach outlined in the Biodiversity Banking and Offsets Scheme (BioBanking) administered by the NSW Office of Environment and Heritage (OEH) has been adopted in this report in an effort to quantify and offset the potential biodiversity impacts associated with the Project.

1.1.1 *Biodiversity Banking and Offsets Scheme*

BioBanking was developed by the NSW Department of Environment and Climate Change (DECC), now OEH, and came into effect in 2008. BioBanking establishes an 'improve or maintain' test for biodiversity values through a specifically developed BioBanking Assessment Methodology (BBAM) and BioBanking Credit Calculator, which enables Accredited Assessors to calculate the offsets required for a Development Site and the credits available at a BioBank Site (the offset location).

There are two types of credits associated with BioBanking:

- **ecosystem credits:** can only be used to offset biodiversity impacts in the same ecological community, or in another community of the same formation that has an equal or greater percentage of land cleared and the same predicted threatened species; and

- **species credits:** can only be used to offset biodiversity impacts on the same threatened species (DECC 2009).

1.2 THE PROJECT

1.2.1 *Project Application Area*

The term "Project Application Area" (PAA) refers to the area in which the proponent (WPCWP) has applied to develop the Project. The PAA is located 20 km north of Yass in the Boorowa and Yass Local Government Areas (LGA). It is bound by parcels of land associated with the Development Footprint (see *Figure 1.1* within the Ecological Impact Assessment report).

1.2.2 Study Area

The "Study Area" is the area which has been assessed for ecological values related to the Project; defined as a buffer of 100 m radius around the Development Footprint (see *Figure 1.2* within the Ecological Impact Assessment report).

1.2.3 Development Footprint

The "Development Footprint" is the area in which physical disturbance is proposed for the development of the Project and includes the location of infrastructure including Wind Turbine Generators (WTGs), access tracks including passing bays and cuttings, overhead power lines including stanchions and their associated easements, underground electrical reticulation routes, electrical compounds (switching stations and substations), office facilities, laydown areas and weather masts. The Development Footprint area used in the BioBanking Assessment is based on the permanent Development Footprint and does not include areas of temporary disturbance. The Development Footprint is located wholly within the PAA.

1.2.4 Clusters

The Project comprises three clusters of WTGs which are geographically associated. The Mt Buffalo Cluster incorporates the east of the Project, the Kangiara Cluster incorporates the centre of the project, while the Langs Creek Cluster incorporates the north west of the Project (see ***Error! Reference source not found.***).

1.2.5 Locality

The term "Locality" is used to discuss the context of the Project within the broader landscape; defined as the area contained within a buffer of 10 km around the Study Area.

1.3 PURPOSE

The purpose of this report is to use the BioBanking assessment provision of the EP&A Act to provide a clear indication of the biodiversity offset requirements associated with the removal of vegetation as part of the Project.

1.4 ASSUMPTIONS

Where assumptions have been made in relation to specific sections of the Credit Calculator, these are detailed in the relevant sections of this report.

2 METHODS

2.1 DESKTOP REVIEW

An initial desktop review was undertaken to obtain the following information:

- the vegetation types that occur within the site;
- the placement of 1000 hectare (ha) and 100ha assessment circles;
- the number of plots/transects likely to be required; and
- threatened species that may occur within the site.

The desktop review included analysis of topographical maps, aerial photography, vegetation mapping, vegetation modelling and Geographic Information Systems (GIS) interpretations.

Vegetation mapping was undertaken in the field during a reconnaissance-style field trip to verify the vegetation types present and ground truth vegetation boundaries.

Data were collected during subsequent field surveys in accordance with the BBAM. Details of the survey effort undertaken for the project are provided in ERM (2013).

2.2 FIELD SURVEY

The field survey was undertaken in accordance with Appendix 2 of the *BioBanking Assessment Methodology and Credit Calculator Operational Manual* (DECC, 2009). This included undertaking a series of nested 20 x 50 m and 20 x 20 m plots (refer to *Figure 4.1* within the Ecological Impact Assessment report) in which the following attributes were recorded:

- GPS coordinates;
- native plant species richness (the number of native species that occur in a 20 m x 20 m plot);
- native over-storey cover (percent cover over a 50 m transect);
- native mid-storey cover (percent cover over a 50 m transect);
- native groundcover (grasses) (percent cover over a 50 m transect);
- native groundcover (shrubs) (percent cover over a 50 m transect);
- native groundcover (other) (percent cover over a 50 m transect);
- exotic plant cover (percent cover over a 50 m transect);

- number of trees with hollows (total number within a 50 m x 20 m plot);

- over-storey regeneration (the proportion of over-storey species that are regenerating across the entire vegetation zone; and

- total length of fallen logs (within a 50 m x 20 m plot).

The BioBanking Credit Calculator Version 2.0 was used to calculate the the credit profile of the development site in accordance with the Draft Operational Manual for Using the BioBanking Credit Calculator v2.0, the *BioBanking Assessment Methodology and Credit Calculator Operational Manual* (DECC 2009).

The number of plots/transects was determined by the area of each vegetation zone, as outlined in *Table 2.1*

Table 2.1 Minimum number of transects/plots required per zone area

Vegetation Zone Area (ha)	Minimum number of transects/plots
0 – 4	1 transect/plot per 2ha (or part thereof), or 1 transect/plot if vegetation is on low condition
>4 – 20	3 transects/plots or 2 transects/plots if vegetation is in low condition
>20 – 50	4 transects/plots or 3 transects/plots if vegetation is in low condition
>50 – 100	5 transects/plots or 3 transects/plots if vegetation is in low condition
>100 – 250	6 transects/plots or 4 transects/plots if vegetation is in low condition
>250 – 1000	7 transects/plots or 5 transects/plots if vegetation is in low condition
>1000	8 transects/plots or 5 transects/plots if vegetation is in low condition or in a homogenous landscape in the Western Division. More transects/plots may be needed if the condition of the vegetation is variable across the zone.

Source: page 26 of BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECC, 2009)

The field survey was undertaken in September and November 2012 and February 2013. The survey was undertaken in conjunction with extensive flora and fauna surveys that were undertaken for the Project. This included vegetation mapping and targeted surveys for threatened species.

2.3 *CREDIT CALCULATOR*

The BioBanking Credit Calculator Version 2.0 (BBCC) was used to calculate the credits for the Development Site. The calculations were undertaken in accordance with the *Draft Operational Manual for Using the BioBanking Credit Calculator v2.0* (OEH 2012a), the *BioBanking Assessment Methodology and Credit Calculator Operational Manual* (DECC 2009).

To ensure compliance with the BBAM, ERM consulted the OEH BioBanking team who provided advice on a recommended, simplified approach to apply to large scale assessments such as the Bango Wind Farm (Andrew Remnant email to ERM 9 November 2012). The aim of this method is to simplify the assessment process and involves combining threatened species sub-zones that have identical attributes:

- CMA sub region;
- percent native vegetation cover of the 1000ha and 100ha assessment circles;
- vegetation community;
- condition; and
- adjacent remnant area class size <5 ha, 5-25ha (including 25ha), >25-100ha (including 100ha) or >100ha.

2.4 *MODIFICATIONS TO THE METHODOLOGY*

The stepwise approach recommended by Andrew Remnant (OEH) is:

1. Create threatened species subzones as per guidance in the BioBanking Assessment Methodology and Operational Manual;
2. Group the percent native vegetation cover for each assessment circle into one the following four categories: <10%, 11-30%, 31-70% and 71-100%;
3. Each category is a new assessment circle (for the purpose of entering data into the Credit Calculator, i.e. between 1 and 4 circles); and
4. Amalgamate all threatened species subzones where the following values are identical: CMA sub region, percent native vegetation cover of the 1000ha and 100ha assessment circle, vegetation community, condition and adjacent remnant area class size <5 ha, 5-25ha (including 25ha), >25-100ha (including 100ha) or >100ha.

Details of data sources and assumptions are provided throughout the results chapters.

3 CONTEXTUAL INFORMATION

3.1 BIOBANKING ASSESSMENT DETAILS

Table 3.1 provides contextual information relevant to the BioBanking assessment.

Table 3.1 BioBanking Assessment Details

Component	Data
Proposal ID	0089/2012/0333D
Assessor Name/Accreditation Number	Evelyn Craigie/0089
Assessment Type	Development
Catchment	Lachlan
Sub-catchment	Upper Slopes
Mitchell Landscape	Boorowa Volcanics

3.2 BIOMETRIC VEGETATION TYPES

The BioBanking methodology uses specific vegetation types that were developed for each Catchment Management Authority (CMA) area. These Biometric Vegetation Types (BVTs) are stored in the NSW Vegetation Types Database (OEH 2012b). The BioMetric Vegetation Types that occur in the development footprint and, where applicable, their equivalent EECs are shown in *Table 3.2.*

Table 3.2 Biometric Vegetation Types in the Development Footprint

Biometric Code	Biometric Vegetation Type	Equivalent Endangered Ecological Community (listed under the TSC Act)
LA103	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	White Box Yellow Box Blakely's Red Gum Woodland
LA182	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion	-

4 RESULTS

4.1 ASSESSMENT CIRCLES

An assessment circle with a radius of 1784m (1000ha) is used to assess the impact of the proposal on the percent native vegetation cover and as a filter to identify threatened species that may occur on the site. A 100ha circle (564m radius) is used to assess the impact of the proposal on the surrounding vegetation cover at a more local scale (DECC 2009).

Initially eighteen 1000 ha and 100 ha assessment circles were used to cover the entire Development Footprint. Assessment circles are indicated on *Figure 4.1*. The percent native vegetation cover was estimated in each of the eighteen 1000 ha and 100 ha circles into one of three categories: <10%, 11-30% and 31-70% (none of the assessment circles had a percent native vegetation cover of > 70%). The circles and their vegetation zones (and associated Threatened Species Subzones) within the circles in each of the three categories were amalgamated.

4.2 CONNECTIVITY

The design of the wind farm has ensured that connectivity (according to the definition in the BioBanking Assessment Methodology (BBAM)) of vegetation will not be severed for the following reasons:

- 50 m x 100 m pads for wind turbines within woody vegetation are connected by access roads <15m wide;
- 40 m wide overhead powerline routes will not sever connectivity through woody vegetation (<100m) or grassland vegetation as the infrastructure is an overhead powerline and the ground layer will be largely left intact; and
- clearing will be limited to the pylon footprint and the trees underneath the powerlines.

Connectivity varies across the Development Footprint, however, it will not result in any connectivity classes to be crossed.

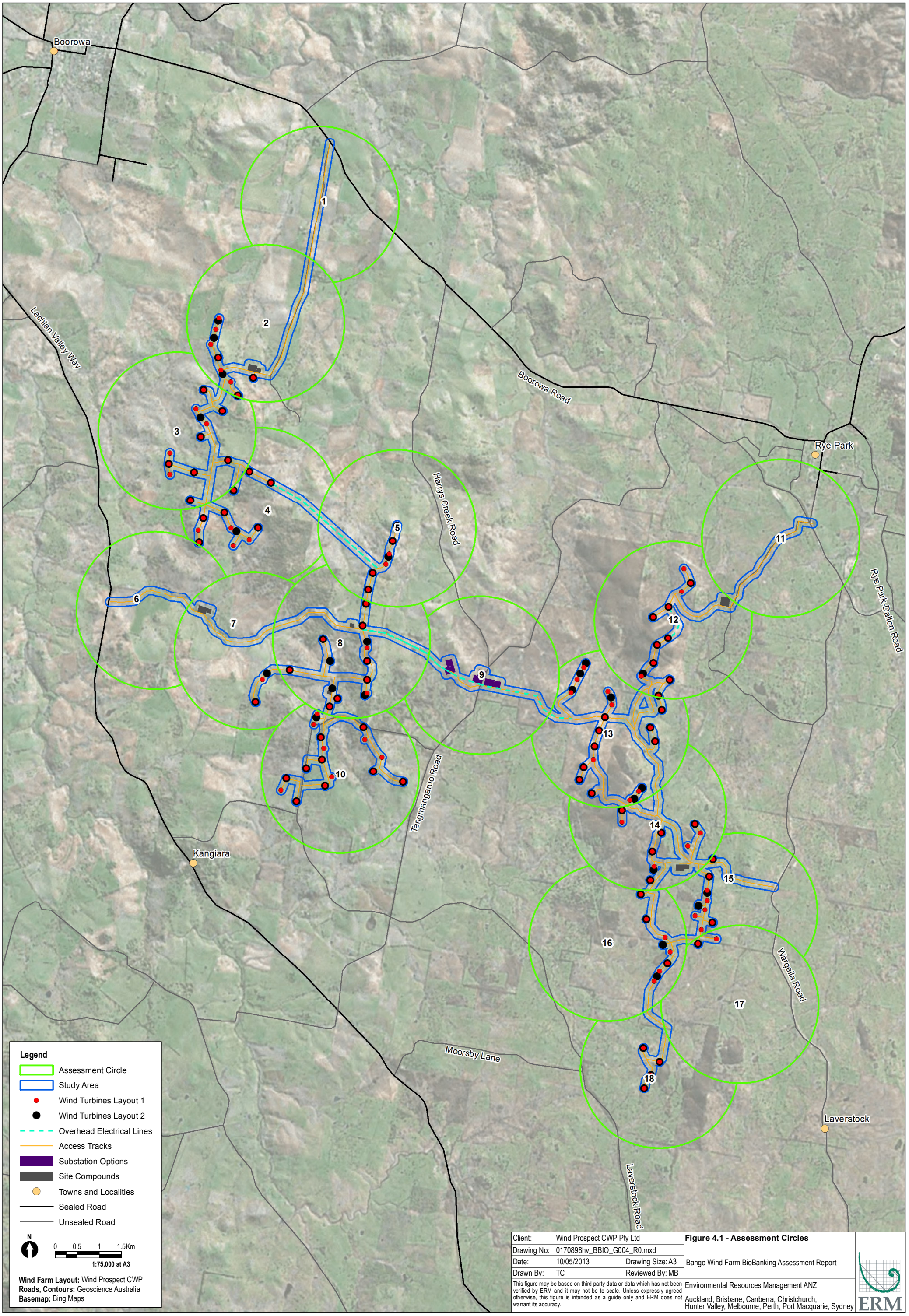

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Figure 4.1 - Assessment Circles

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4.3 VEGETATION ZONES

Vegetation zones are relatively homogenous areas of the same vegetation type and similar condition. Each vegetation zone should be a distinct vegetation type (according to the Vegetation Types Database) and similar broad condition state, i.e. moderate / good or low (DECC 2009). There are six vegetation zones across the site, as shown in *Table 4.1* and *Figure 4.2*.

GIS was used to identify the area of each vegetation zone in each of the eighteen 1000 ha assessment circles. These areas were combined where the assessment circle attributes were identical (as described in Section 2.2). Vegetation zones in each of the 18 assessment circles smaller than the minimum allowable size in the credit calculator (i.e. 0.25 ha) were added to the most similar vegetation type in the same original assessment circle number.

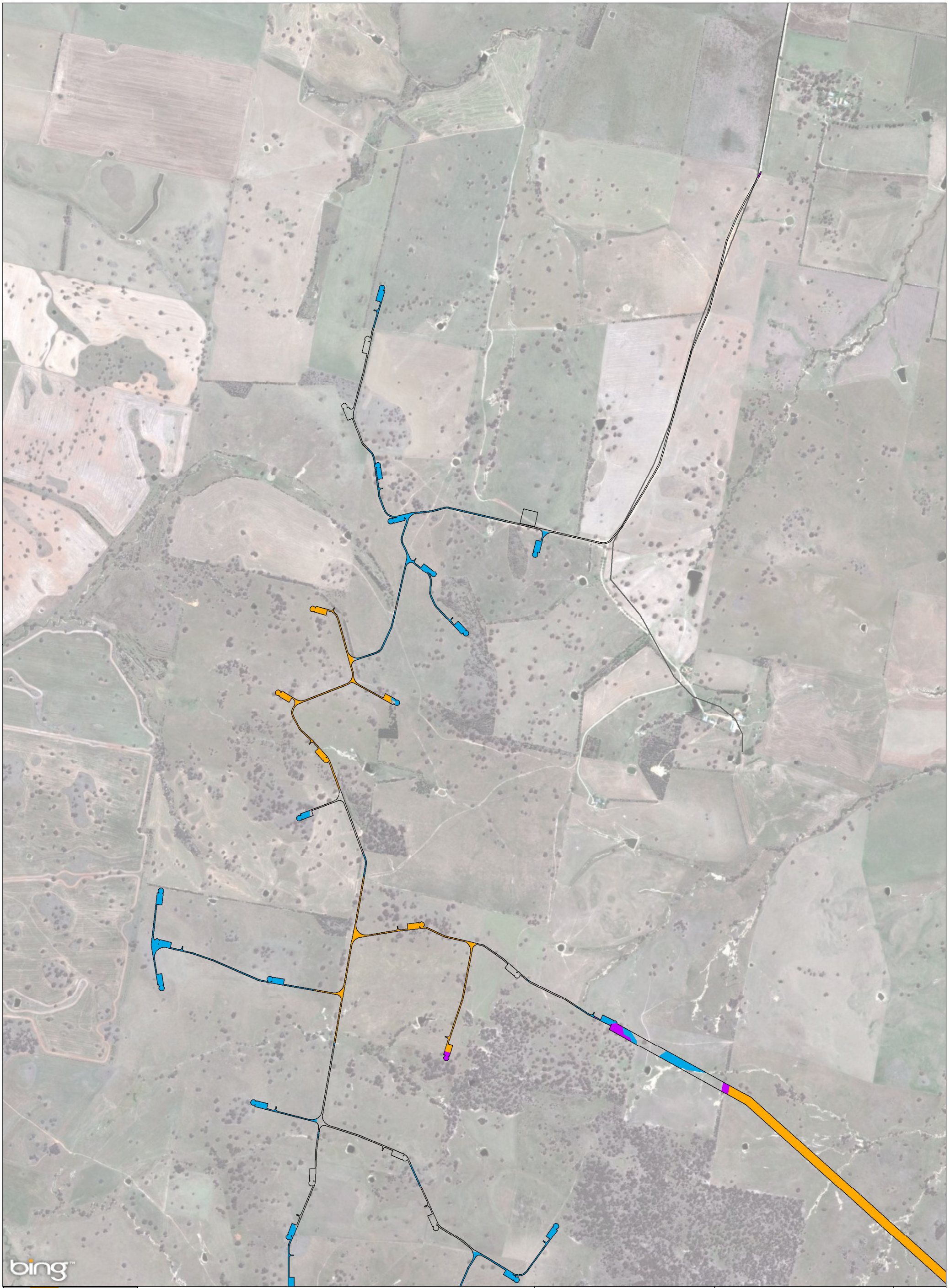
Table 4.1 Area of Each Vegetation Zone in the Study Area and Development Footprint

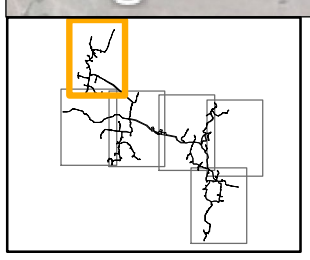
BVT	BVT Code	Vegetation Zone	Area in Study Area (ha)	Area in Development Footprint (ha)
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	LA103	LA103_Moderate/ Good_High ^	2.27	0.26
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	LA103	LA103_Moderate/ Good_Medium *	65.27	2.57
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	LA103	LA103_Moderate/ Good_Poor*	313.00	42.69
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	LA103	LA103_Low	469.57	38.11
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion	LA182	LA182_ Moderate/ Good	99.24	3.75
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion	LA182	LA182_ Low	238.72	17.39

^Critically Endangered Ecological Community under the EPBC Act

*Endangered Ecological Community under the TSC Act

DNG = Derived Native Grassland





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- LA103_Moderate/Good_Medium (EEC)
- LA103_Moderate/Good_Poor (EEC)
- LA103_Low
- LA182_Moderate/Good
- LA182_Low
- Permanent Development Footprint

Wind Farm Layout: Wind Prospect CWP
Roads: Geoscience Australia
Basemap: Bing Maps

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Figure 4.2a - Vegetation Zones

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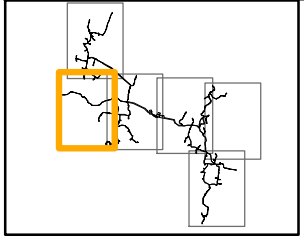

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- Permanent Development Footprint

Wind Farm Layout: Wind Prospect CWP
Roads: Geoscience Australia
Basemap: Bing Maps

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Figure 4.2b - Vegetation Zones

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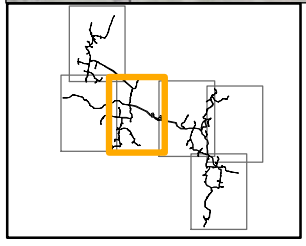

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- LA103_Low
- LA182_Moderate/Good
- LA182_Low
- Permanent Development Footprint

Wind Farm Layout: Wind Prospect CWP
Roads: Geoscience Australia
Basemap: Bing Maps

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Figure 4.2c - Vegetation Zones

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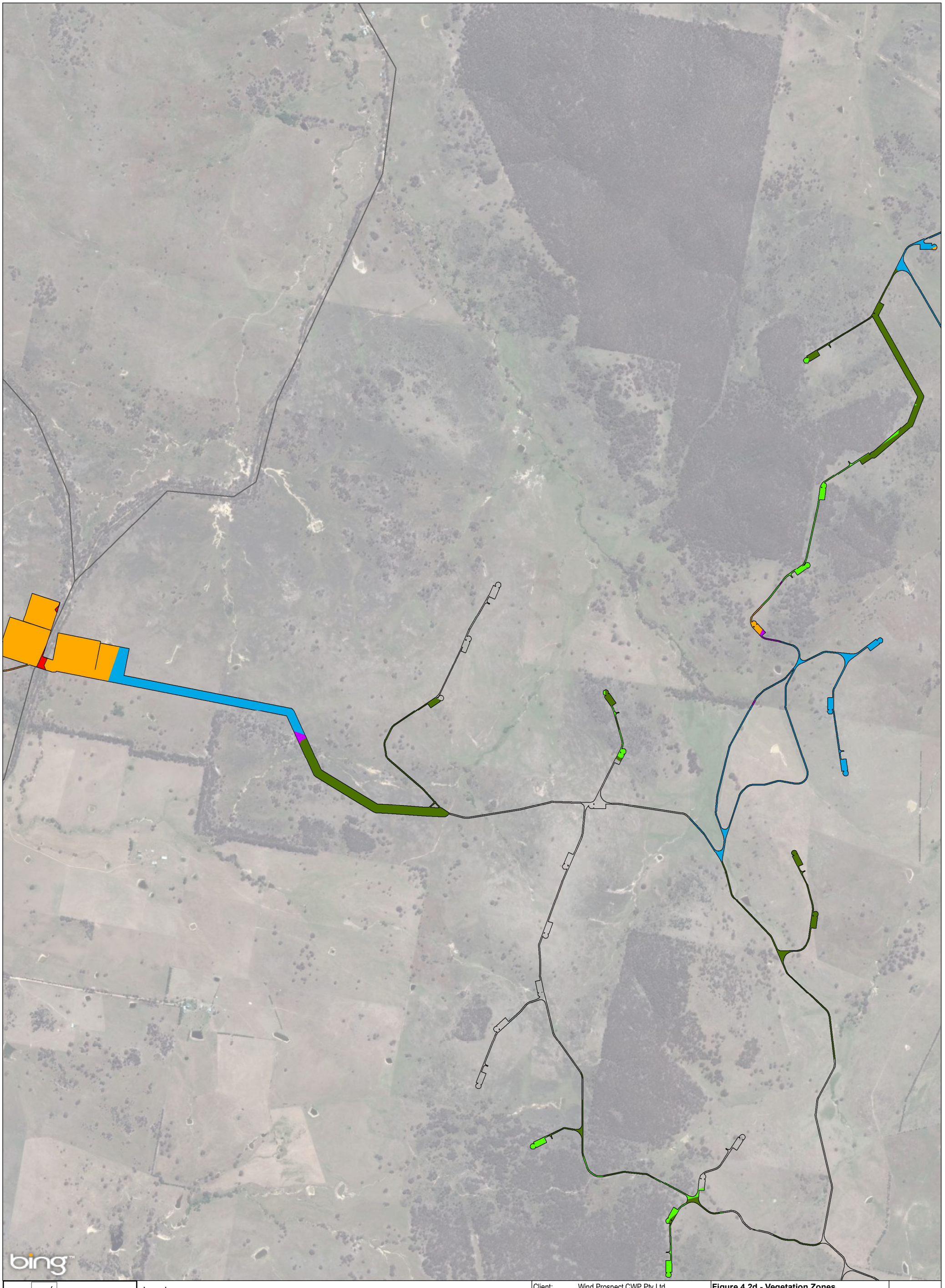

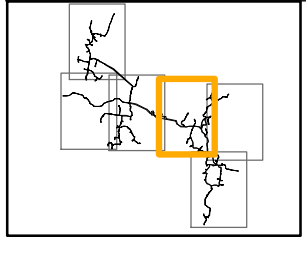

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- LA182_Moderate/Good
- LA182_Low
- Permanent Development Footprint

Wind Farm Layout: Wind Prospect CWP
Roads: Geoscience Australia
Basemap: Bing Maps

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Figure 4.2d - Vegetation Zones

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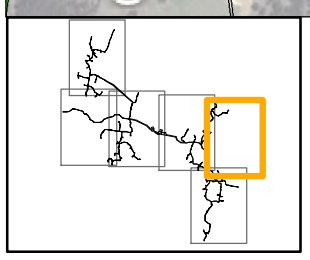

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- LA182_Low
- Permanent Development Footprint

Wind Farm Layout: Wind Prospect CWP
Roads: Geoscience Australia
Basemap: Bing Maps

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Figure 4.2e - Vegetation Zones

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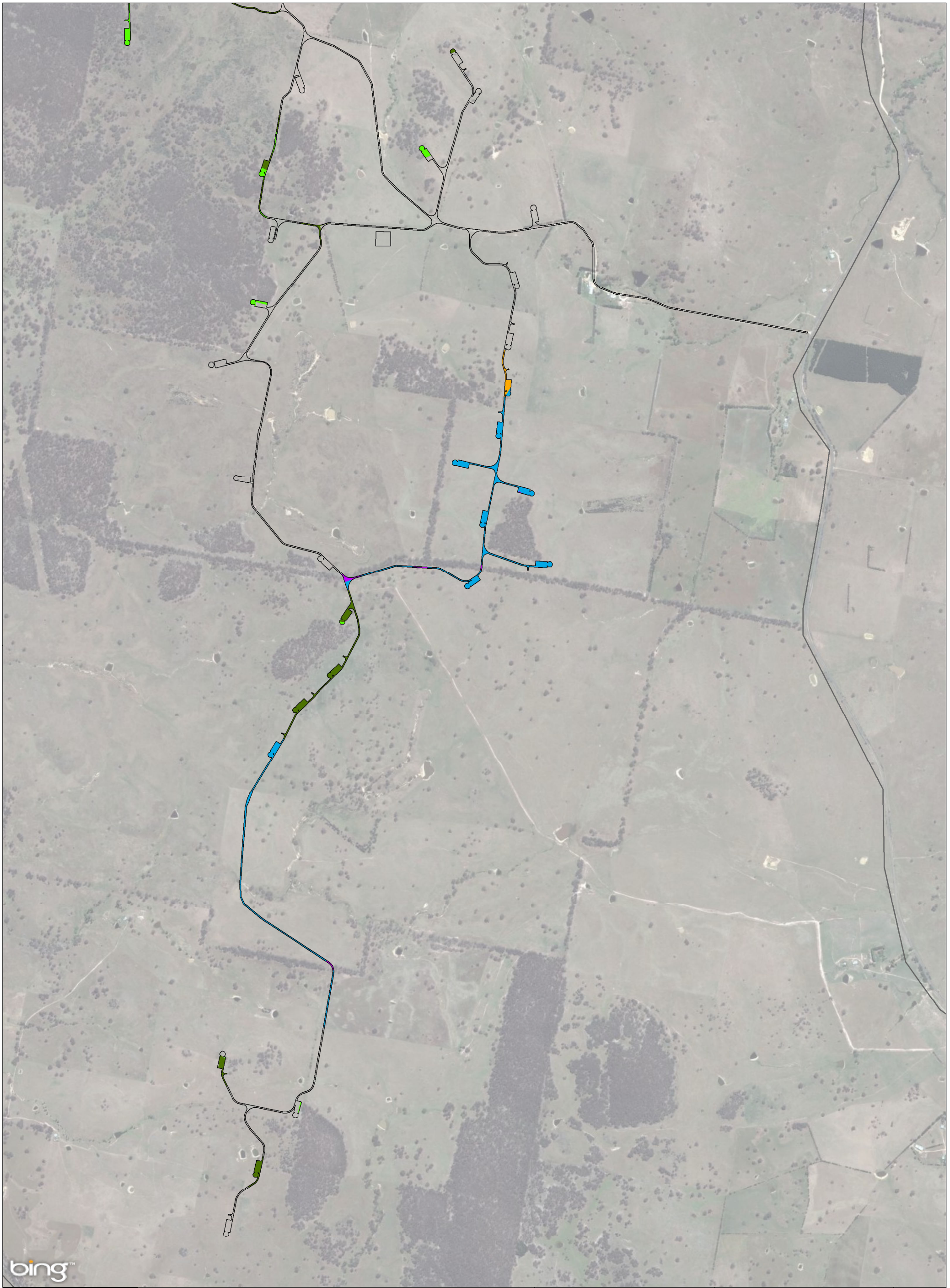

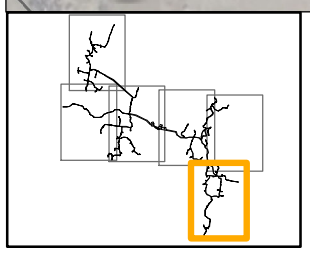

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- LA103_Low
- LA182_Moderate/Good
- LA182_Low
- Permanent Development Footprint

Wind Farm Layout: Wind Prospect CWP
Roads: Geoscience Australia
Basemap: Bing Maps

N

0 150 300 450m

1:17,500 at A3

Client:	Wind Prospect CWP Pty Ltd		
Drawing No:	0170898hv_BBIO_G005_R0.mxd		
Date:	10/05/2013	Drawing Size: A3	
Drawn By:	TC	Reviewed By: MB	

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 4.2f - Vegetation Zones

Bango Wind Farm BioBanking Assessment Report

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

4.4 PATCH SIZE/ADJACENT REMNANT AREA

GIS and aerial photographs were used to visually estimate the patch size and adjacent remnant area for each threatened species sub-zone.

4.5 THREATENED SPECIES SUBZONES

Threatened species sub-zones are derived from the vegetation zones for applying the initial five filters to predict which threatened species require assessment (DECC 2009). The filters are:

- CMA subregion area in which the Study Area occurs;
- vegetation type and vegetation condition;
- percent native vegetation cover in a 1000-ha assessment circle;
- adjacent remnant area (the area of moderate to good condition native vegetation of which the Study Area is a part, which is linked to the next area of native vegetation);
- patch size including low-condition (the area of native vegetation of which the Study Area is a part, which is linked to the next area of native vegetation).

Threatened species subzones were created for each vegetation zone in each of the three assessment circle groups. Where the adjacent remnant area differs for different patches within a vegetation zone, additional threatened species subzones were created.

4.6 GEOGRAPHIC AND HABITAT FEATURES

Geographic and habitat features that are present at the site can be selected from a list provided by the credit calculator. The selected features determine the threatened species that are likely to occur and therefore, require further assessment.

The following geographic and habitat features occur at the site:

- land within 250 m of termite mounds or rock outcrops;
- seasonally wet / boggy sites;
- land containing caves or similar structures;
- land south of Cowra in Upper Slopes CMA subregion;
- land containing a forb rich grassy groundlayer;

- land south and west of Young in Upper Slopes CMA subregion; and
- land within 100 m of stream or creek banks.

4.7 IDENTIFIED POPULATIONS

There are currently no identified populations associated with the BioBanking methodology (OEH 2012b). Therefore, information was not entered at this section of the calculator.

4.8 SITE SURVEY

ERM undertook flora and fauna field surveys from July 2012 to February 2013. Eleven threatened species were recorded in the Development Footprint during these surveys. This section provides discussion on how the identification of these species in the Development Footprint relates to the BBCC.

Species Predicted to Occur

Species that have a high likelihood of occurrence at a development or BioBank site are assessed in conjunction with general biodiversity values, based on the vegetation type present. These species are included in the ecosystem credits generated by the calculator. The likely impacts on these species are measured by the predicted change in site attributes that result from these actions and by the area of land that is impacted. As these species have a high likelihood of occurrence based on the attributes assigned to a threatened species subzone, threatened species surveys are not required (DECC, 2008). However these species can be marked as not occurring at a site if survey for these species does not identify them or suitable habitat.

A likelihood of occurrence assessment was undertaken as part of the EIA. The full list of threatened species that are predicted by the BBCC to occur at the site are shown in

Table 4.2. The final column indicates whether the species was retained in the BBCC based on field survey results and the outcome of the likelihood of occurrence assessment (ERM 2013).

Table 4.2 Species Predicted to Occur in the Study Area

Scientific Name	Common Name	Species Observed in Permanent Development Footprint (Y/N)	Potential to Occur in the Study Area (ERM 2013)
Burhinus grallarius	Bush Stone-curlew	N	N
Calyptorhynchus lathami	Glossy Black-cockatoo	N	Y
Cercartetus nanus	Eastern Pygmy-possum	N	N
Chalinolobus picatus	Little Pied Bat	N	N
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Y	Y
Dasyurus maculatus	Spotted-tailed Quoll	N	N
Glossopsitta pusilla	Little Lorikeet	N	Y
Grantiella picta	Painted Honeyeater	N	Y
Lathamus discolor	Swift Parrot	N	Y
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	N	Y
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Y	Y
Neophema pulchella	Turquoise Parrot	N	Y
Ninox connivens	Barking Owl	N	Y
Ninox strenua	Powerful Owl	N	Y
Petaurus norfolcensis	Squirrel Glider	Y	Y
Petroica boodang	Scarlet Robin	Y	Y
Petroica phoenicea	Flame Robin	N	Y
Phascolarctos cinereus	Koala	N	Y
Polytelis swainsonii	Superb Parrot	Y	Y
Pyrrholaemus saggitatus	Speckled Warbler	Y	Y
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Y	Y
Stagonopleura guttata	Diamond Firetail	Y	Y
Xanthomyza phrygia	Regent Honeyeater	N	Y

Source: BioBanking calculator and ERM (2013)

Species Requiring Targeted Survey

Species credits apply to threatened species that cannot be reliably predicted to occur in a vegetation type. Species credits can also apply to species that require protection of particular habitat elements, such as breeding habitat for a cave roosting bat.

The list of threatened species requiring targeted surveys is shown in *Table 4.3*. ERM undertook flora and fauna field surveys between July 2012 and February 2013. The timing of these surveys was appropriate for detection of all the species (in accordance with the survey time matrix provided by the BioBanking Credit Calculator).

Table 4.3 ***Species Requiring Targeted Survey***

Scientific Name	Common Name	Species Observed in Permanent Development Footprint (Y/N)
Ammobium craspedioides	Yass Daisy	N
Caladenia concolor	Crimson Spider Orchid	N
Callocephalon fimbriatum	Gang-gang Cockatoo	N
Circus assimilis	Spotted Harrier	Y
Goodenia macbarronii	Narrow Goodenia	N
Hieraaetus morphnoides	Little Eagle	Y
Litoria booroolongensis	Booroolong Frog	N
Lophoictinia isura	Square-tailed Kite	N
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	N
Phascogale tapoatafa	Brush-tailed Phascogale	N
Swainsona recta	Small Purple Pea	N
Varanus rosenbergi	Rosenberg's Goanna	N

Source: Biobanking Credit Calculator and ERM 2013

4.9 SITE VALUES

The credit calculator generates a decrease in site value score, based on the field data and type of development that is proposed. If the extent of development impact varies over a vegetation zone, this can be reflected by dividing the vegetation zone into different management zones. This has been done for this BioBanking assessment as the development will result in varying degrees of ecological impact dependant on the type of infrastructure.

For 11 of the Vegetation Zones, the development impact will result in clearing of all vegetation (refer *Table 4.4*). For Vegetation Zone 1, the development impact was reduced as this area occurs under an overhead transmission line and as such, the groundcover will not be completely cleared (refer *Table 4.4*). This was not applied to other areas that occur under overhead transmission lines as they were not able to be assigned to an appropriate threatened species subzone, due to the threatened species subzones being amalgamated.

Table 4.4 ***Change in Site Attributes***

Site Attribute	Change in Areas of Permanent Impact	Change in Areas under Overhead Powerline Easement
Native plant species	=0	-1
Native over-storey cover	=0	=0
Native mid-storey cover	=0	No change
Native ground cover (grasses)	=0	No change
Native ground cover (shrubs)	=0	No change
Native ground cover (other)	=0	No change
Exotic plant cover	=0	No change
Number of trees with hollows	=0	=0
Overstorey regeneration	=0	=0
Total length of fallen logs	=0	=0

The decrease in site value is the basis for determining the number of biodiversity credits that are required for a development site.

Plot Numbers

The minimum number of plots was achieved for each vegetation zone. A total of 28 plots were completed.

4.10 THREATENED SPECIES SURVEY RESULTS

One species was recorded in the Development Footprint that was not predicted by the calculator or identified as requiring targeted surveys: Golden Sun Moth. This species was added to this section of the calculator.

The Spotted Harrier and Little Eagle were listed as species requiring targeted survey. These species were observed in the Development Footprint and information regarding these species was added to this section of the calculator.

4.11 CREDIT REQUIREMENTS

The BioBanking credit calculator provides a credit report showing the ecosystem and species credits required to offset the development. The proposal requires 1827 ecosystem credits and 2240 species credits (required for Golden Sun Moth, Spotted Harrier and Little Eagle). The credit report outlines the vegetation types in CMA subregions where offsets can be sought. This report is included in *Annex H.2* and *Annex H.3.*

A discussion of the equivalent hectare conversions using the BioBanking Credit Converter is provided in *Section 6.8* within the Ecological Impact Assessment report.

REFERENCES

Department of Environment and Climate Change NSW (DECC) (2008) **BioBanking Assessment Methodology,** State of NSW and Department of Environment and Climate Change NSW, Sydney.

Office of Environment and Heritage NSW (OEH) (2008) **Biometric: Terrestrial Biodiversity Tool for the NSW Property Vegetation Planning System**, OEH, Sydney
http://www.environment.nsw.gov.au/projects/biometrictool.htm
Accessed 11/12/12

Department of Environment and Climate Change NSW (DECC) (2012a) **BioBanking Assessment Methodology and Credit Calculator Operational Manual**, State of NSW and Department of Environment and Climate Change NSW, Sydney.

ERM (2013). **Bango Wind Farm: Ecological Impact Assessment**. Report prepared by Environmental Resources Management Australia Pty Ltd for Wind Prospect CWP Pty Ltd.

Office of Environment and Heritage NSW (2012b) **Databases**, OEH, Sydney
http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm
Accessed 11/12/12

Office of Environment and Heritage NSW (2012b) **Draft Operational Manual for Using the BioBanking Credit Calculator v2.0**, OEH, Sydney.

BioBanking Credit Calculator

BioBanking credit report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 10/05/2013 Time: 2:20:52PM Tool version: 2.0

Development details

Proposal ID:	0089/2012/0333D
Proposal name:	Bango Wind Farm
Proposal address:	Lachlan Valley Way Boorowa NSW 2586
Proponent name:	Wind Prospect CWP Pty Ltd
Proponent address:	PO BOX 1708 Newcastle NSW 2300
Proponent phone:	02 4013 4640
Assessor name:	Evelyn Craigie
Assessor address:	Buidling C, 33 Saunders Street PYRMONT NSW 2009
Assessor phone:	8586 8719
Assessor accreditation:	0089

Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report
- ☐ Predicted threatened species not on site
  - Bush Stone-curlew — Burhinus grallarius
  - Eastern Pygmy-possum — Cercartetus nanus

- Little Pied Bat — Chalinolobus picatus
- Spotted-tailed Quoll — Dasyurus maculatus

☐ Change threatened species response to gain (Tg value)

Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	0.26	7	Yes
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	0.30	7	Yes
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	29.34	319	Yes
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	22.69	163	No
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	1.53	17	No
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	2.27	48	Yes
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	13.35	714	Yes
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	15.42	153	No
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	2.63	81	No
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	14.94	259	No
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	1.12	50	No
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	0.92	9	No
Total	104.77	1,827	

Credit profiles

1. Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103)

Number of ecosystem credits required	163
CMA sub-region	Upper Slopes - Lachlan
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	

Offset options - vegetation types	Offset options - CMA sub-regions

Snow Gum - Candle Bark grassland/woodland of the South Eastern Highlands, (LA205) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (LA219) Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103) Black Sallee - Tussock Grass open woodland of the South Eastern Highlands, (LA113) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (LA120) Blakely's Red Gum moist sedgey woodland on flats and drainage lines of the South Eastern Highlands and South Western Slopes, (LA121) Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (LA145) Riverine Inland Grey Box grassy woodland of the semi-arid (warm) climate zone (Benson 237), (LA194)	Orange - Lachlan South Olary Plain, MU Basin Sands - Lachlan Oberon - Lachlan Kanangra - Lachlan Murrumbateman - Lachlan Crookwell - Lachlan LA Plains - Lachlan Darling Depression (Part A) Nymagee-Rankins Springs - Lachlan Barnato Downs Upper Slopes - Lachlan Lower Slopes - Lachlan Darling Depression (Part B) LA - Lachlan

2. Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103)

Number of ecosystem credits required	7
CMA sub-region	Upper Slopes - Lachlan
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	**Offset options - CMA sub-regions**
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103) Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (CW102) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112) Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (CW138) White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, (CW215) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (CW216) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (LA219) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (LA120) Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson	Upper Slopes - Lachlan Orange - Lachlan Orange - Central West MU Fans Talbragar Valley Pilliga - Central West Pilliga (Part A) Pilliga (Part B) Upper Slopes - Murray Upper Slopes - Murrumbidgee Upper Slopes - Central West Lower Slopes - Murray Lower Slopes - Murrumbidgee Lower Slopes - Lachlan

201), (LA145) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (MR528) Grassy White Box woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (MR561) Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands, (MR648) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (MU523) Grassy White Box woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (MU551)	Liverpool Plains (Part A) Liverpool Plains (Part B)

3. Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103)

Number of ecosystem credits required	7
CMA sub-region	Upper Slopes - Lachlan
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	0-5 ha

Offset options - vegetation types	**Offset options - CMA sub-regions**
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103) Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (CW102) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112) Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (CW138) White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, (CW215) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (CW216) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (LA219) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (LA120) Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (LA145) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (MR528) Grassy White Box woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (MR561) Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands, (MR648) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South	Upper Slopes - Lachlan Orange - Lachlan Orange - Central West MU Fans Talbragar Valley Pilliga - Central West Pilliga (Part A) Pilliga (Part B) Upper Slopes - Murray Upper Slopes - Murrumbidgee Upper Slopes - Central West Lower Slopes - Murray Lower Slopes - Murrumbidgee Lower Slopes - Lachlan Liverpool Plains (Part A) Liverpool Plains (Part B)

Western Slopes Bioregion (Benson 277), (MU523) Grassy White Box woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (MU551)	

4. Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103)

Number of ecosystem credits required	319
CMA sub-region	Upper Slopes - Lachlan
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	25-100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103) Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (CW102) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112) Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (CW138) White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions, (CW215) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (CW216) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (LA219) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (LA120) Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (LA145) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (MR528) Grassy White Box woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (MR561) Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands, (MR648) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (MU523) Grassy White Box woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (MU551)	Upper Slopes - Lachlan Orange - Lachlan Orange - Central West MU Fans Talbragar Valley Pilliga - Central West Pilliga (Part A) Pilliga (Part B) Upper Slopes - Murray Upper Slopes - Murrumbidgee Upper Slopes - Central West Lower Slopes - Murray Lower Slopes - Murrumbidgee Lower Slopes - Lachlan Liverpool Plains (Part A) Liverpool Plains (Part B)

5. Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103)

Number of ecosystem credits required	153
CMA sub-region	Upper Slopes - Lachlan
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	

Offset options - vegetation types	Offset options - CMA sub-regions
Snow Gum - Candle Bark grassland/woodland of the South Eastern Highlands, (LA205) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (LA219) Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103) Black Sallee - Tussock Grass open woodland of the South Eastern Highlands, (LA113) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (LA120) Blakely's Red Gum moist sedgey woodland on flats and drainage lines of the South Eastern Highlands and South Western Slopes, (LA121) Fuzzy Box - Inland Grey Box on alluvial brown loam soils of the NSW South Western Slopes Bioregion and southern BBS Bioregion (Benson 201), (LA145) Riverine Inland Grey Box grassy woodland of the semi-arid (warm) climate zone (Benson 237), (LA194)	Orange - Lachlan South Olary Plain, MU Basin Sands - Lachlan Oberon - Lachlan Kanangra - Lachlan Murrumbateman - Lachlan Crookwell - Lachlan LA Plains - Lachlan Darling Depression (Part A) Nymagee-Rankins Springs - Lachlan Barnato Downs Upper Slopes - Lachlan Lower Slopes - Lachlan Darling Depression (Part B) LA - Lachlan

6. Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103)

Number of ecosystem credits required	48
CMA sub-region	Upper Slopes - Lachlan
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	0-5 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103) Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (CW102) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (CW216)	Upper Slopes - Lachlan MU Fans Pilliga - Central West Pilliga (Part B) Upper Slopes - Central West Liverpool Plains (Part A) Liverpool Plains (Part B)

7. Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103)

Number of ecosystem credits required	714
CMA sub-region	Upper Slopes - Lachlan
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	5-25 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (LA103) Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands, (CW102) Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (Benson 277), (CW112) White Box grassy woodland on well drained podsolic clay soils on hills in the NSW South Western Slopes Bioregion (Benson 266), (CW216)	Upper Slopes - Lachlan MU Fans Pilliga - Central West Pilliga (Part B) Upper Slopes - Central West Liverpool Plains (Part A) Liverpool Plains (Part B)

8. Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290), (LA182)

Number of ecosystem credits required	17
CMA sub-region	Upper Slopes - Lachlan
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	

Offset options - vegetation types	Offset options - CMA sub-regions
White Cypress Pine woodland on sandy loam soils on the plains of central NSW (wheatbelt) (Benson 70), (LA223) Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290), (LA182) Red Stringybark - White Box grassy open forest of the South Western Slopes, (LA183)	Orange - Lachlan South Olary Plain, MU Basin Sands - Lachlan Oberon - Lachlan Kanangra - Lachlan Murrumbateman - Lachlan Crookwell - Lachlan LA Plains - Lachlan Darling Depression (Part A) Nymagee-Rankins Springs - Lachlan Barnato Downs Upper Slopes - Lachlan Lower Slopes - Lachlan Darling Depression (Part B) LA - Lachlan

9. Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290), (LA182)

Number of ecosystem credits required	259
CMA sub-region	Upper Slopes - Lachlan
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	

Offset options - vegetation types	Offset options - CMA sub-regions
White Cypress Pine woodland on sandy loam soils on the plains of central NSW (wheatbelt) (Benson 70), (LA223) Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290), (LA182) Red Stringybark - White Box grassy open forest of the South Western Slopes, (LA183)	Orange - Lachlan South Olary Plain, MU Basin Sands - Lachlan Oberon - Lachlan Kanangra - Lachlan Murrumbateman - Lachlan Crookwell - Lachlan LA Plains - Lachlan Darling Depression (Part A) Nymagee-Rankins Springs - Lachlan Barnato Downs Upper Slopes - Lachlan Lower Slopes - Lachlan Darling Depression (Part B) LA - Lachlan

10. Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290), (LA182)

Number of ecosystem credits required	81
CMA sub-region	Upper Slopes - Lachlan
Minimum percent native vegetation cover class	11-30%
Minimum adjacent remnant area class	0-5 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290), (LA182) McKie's Stringybark - New England Blackbutt - Rough-barked Apple grassy open forest of the New England Tablelands, (BR155)	Upper Slopes - Lachlan Wollemi (Part A) Wollemi - Central West Capertee Hill End

	Bundarra Downs (Part A) Yengo - Hunter/Central Rivers Wyong Armidale Plateau Tingha Plateau Eastern Nandewars (Part B) Kerrabee - Central West Hunter Liverpool Range - Central West Pilliga - Central West Pilliga (Part B) Peel - Namoi Peel - Border Rivers/Gwydir Nandewar, Northern Complex Upper Slopes - Central West Lower Slopes - Murray Lower Slopes - Central West Bogan-Macquarie - Central West Liverpool Plains (Part A) Liverpool Plains (Part B) Stanthorpe Plateau

11. Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290), (LA182)

Number of ecosystem credits required	9
CMA sub-region	Upper Slopes - Lachlan
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	

Offset options - vegetation types	Offset options - CMA sub-regions
White Cypress Pine woodland on sandy loam soils on the plains of central NSW (wheatbelt) (Benson 70), (LA223) Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290), (LA182) Red Stringybark - White Box grassy open forest of the South Western Slopes, (LA183)	Orange - Lachlan South Olary Plain, MU Basin Sands - Lachlan Oberon - Lachlan Kanangra - Lachlan Murrumbateman - Lachlan Crookwell - Lachlan

	LA Plains - Lachlan Darling Depression (Part A) Nymagee-Rankins Springs - Lachlan Barnato Downs Upper Slopes - Lachlan Lower Slopes - Lachlan Darling Depression (Part B) LA - Lachlan

12. Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290), (LA182)

Number of ecosystem credits required	50
CMA sub-region	Upper Slopes - Lachlan
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	5-25 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290), (LA182) McKie's Stringybark - New England Blackbutt - Rough-barked Apple grassy open forest of the New England Tablelands, (BR155)	Upper Slopes - Lachlan Wollemi (Part A) Wollemi - Central West Capertee Hill End Yengo - Hunter/Central Rivers Wyong Armidale Plateau Tingha Plateau Eastern Nandewars (Part B) Kerrabee - Central West Hunter Liverpool Range - Central West Peel - Namoi Peel - Border Rivers/Gwydir Nandewar, Northern Complex Upper Slopes - Central West Stanthorpe Plateau

Species credits

Common name	Scientific name	Extent of impact	Number of species credits required
Little Eagle	Hieraaetus morphnoides	6.58	89
Spotted Harrier	Circus assimilis	6.58	89
Golden Sun Moth	Synemon plana	82.48	2,062

BioBanking Credit Calculator

Ecosystem credits

Proposal ID :	0089/2012/0333D
Proposal name :	Bango Wind Farm
Assessor name :	Evelyn Craigie
Assessor accreditation number :	0089
Tool version :	1.1
Report created :	10/05/2013 14:19

Assessment circle name	Landscape score	Vegetation zone name	Vegetation type name	Condition	Red flag status	Management zone name	Management zone area	Current site value	Future site value	Loss in site value	Credit required for bio diversity	Credit required for TS	TS with highest credit requirement	Average species loss	Species TG Value	Final credit requirement for management zone
AC1 <10	12.00	LA103_Moderate/Good_High	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	Moderate/Good_High	Yes	MZ1	0.26	55.56	11.28	44.28	4	7	Squirrel Glider	41.67	0.45	7
AC1 <10	12.00	LA103_Moderate/Good_Medium	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	Moderate/Good_Medium	Yes	MZ2	0.30	31.77	0.00	31.77	3	7	Superb Parrot	44.44	0.53	7
AC1 <10	12.00	LA103_Moderate/Good_Poor	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	Moderate/Good_Poor	Yes	MZ3	29.34	9.38	0.00	9.38	157	319	Superb Parrot	16.67	0.53	319
AC1 <10	12.00	LA103_Low	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	Low	No	MZ4	22.69	16.67	0.00	16.67	163	0		0.00	0.00	163
AC1 <10	12.00	LA182_Low	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	Low	No	MZ5	1.53	32.29	0.00	32.29	17	0		0.00	0.00	17
AC2 11-30	12.00	LA103_Moderate/Good_Medium	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	Moderate/Good_Medium	Yes	MZ6	2.27	26.56	0.00	26.56	22	48	Barking Owl	23.81	0.33	48
AC2 11-30	12.00	LA103_Moderate/Good_Poor	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	Moderate/Good_Poor	Yes	MZ7	13.35	54.69	0.00	54.69	223	714	Barking Owl	66.67	0.33	714
AC2 11-30	12.00	LA103_Low	Apple Box - Yellow Box dry grassy woodland of the South Eastern Highlands	Low	No	MZ8	15.42	27.60	0.00	27.60	153	0		0.00	0.00	153

Assessment circle name	Landscape score	Vegetation zone name	Vegetation type name	Condition	Red flag status	Management zone name	Management zone area	Current site value	Future site value	Loss in site value	Credit required for bio diversity	Credit required for TS	TS with highest credit requirement	Average species loss	Species TG Value	Final credit requirement for management zone
AC2 11-30	12.00	LA182_Moderate/Good	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	Moderate/Good	No	MZ9	2.63	46.35	0.00	46.35	38	81	Squirrel Glider	50.00	0.45	81
AC2 11-30	12.00	LA182_Low	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	Low	No	MZ10	14.94	57.29	0.00	57.29	259	0		0.00	0.00	259
AC3 31-70	12.00	LA182_Moderate/Good	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	Moderate/Good	No	MZ11	1.12	64.06	0.00	64.06	21	50	Squirrel Glider	75.00	0.45	50
AC3 31-70	12.00	LA182_Low	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest the NSW South Western Slopes Bioregion (Benson 290)	Low	No	MZ12	0.92	25.00	0.00	25.00	9	0		0.00	0.00	9

BioBanking Credit Calculator

Species credits

Proposal ID :	0089/2012/0333D
Proposal name :	Bango Wind Farm
Assessor name :	Evelyn Craigie
Assessor accreditation number :	0089
Tool version :	1.1
Report created :	10/05/2013 14:19

Scientific name	Common name	Species TG value	Identified population?	Can Id. popn. be offset?	Area / number of loss	Negligible loss	Red flag status	Number of credits
Synemon plana	Golden Sun Moth	0.40	No		82.48	9,999,999.00	No	2,062
Hieraaetus morphnoides	Little Eagle	0.74	No		6.58	9,999,999.00	No	89
Circus assimilis	Spotted Harrier	0.74	No		6.58	9,999,999.00	No	89

Annex I

PMST Report

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

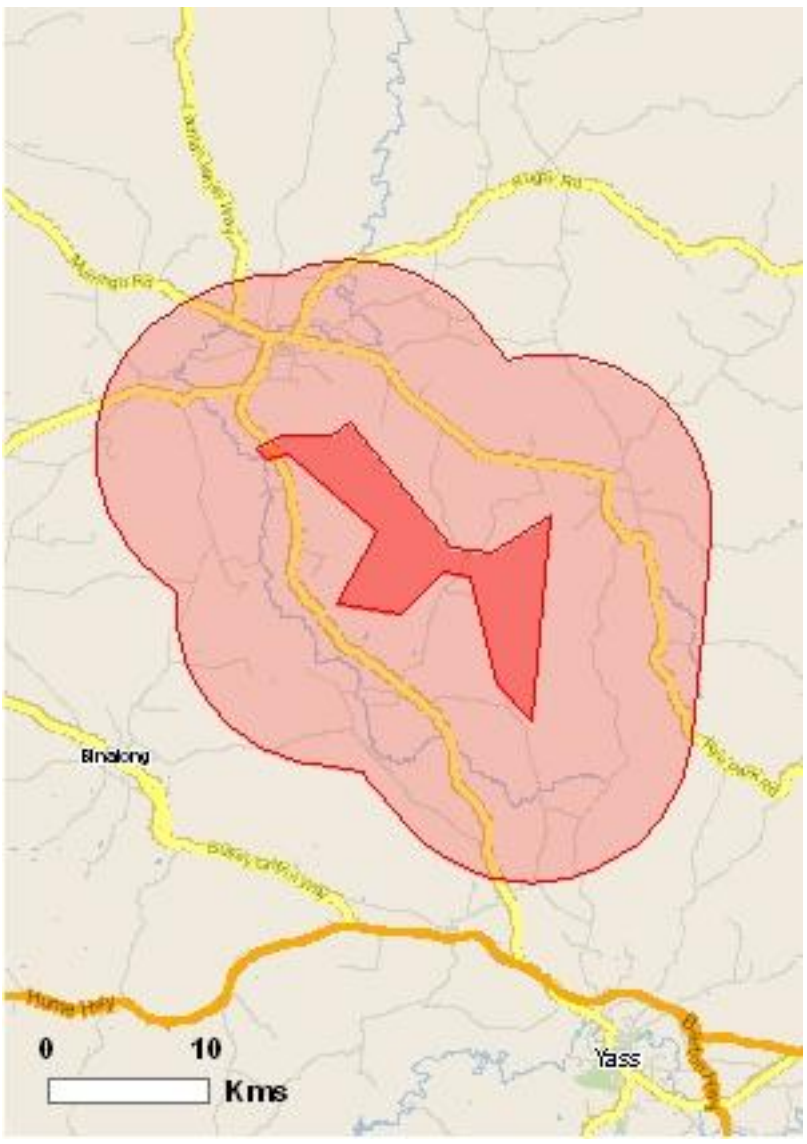
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

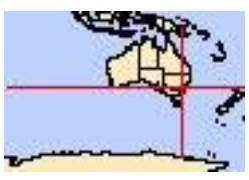
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 01/03/13 11:20:54



Coordinates

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	3
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	19
Listed Migratory Species:	11

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	10
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	11
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	11
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (RAMSAR) [Resource Information]

Name	Proximity
Banrock station wetland complex	Upstream from Ramsar
Coorong and lakes alexandrina and albert	Upstream from Ramsar
Riverland	Upstream from Ramsar

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community likely to occur within area
Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory	Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Breeding likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Vulnerable	Species or species habitat may occur within area
Fish		

Name	Status	Type of Presence
Maccullochella peelii		
Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Macquaria australasica		
Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Frogs		
Litoria booroolongensis		
Booroolong Frog [1844]	Endangered	Species or species habitat may occur within area
Litoria raniformis		
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog [1828]	Vulnerable	Species or species habitat may occur within area
Insects		
Synemon plana		
Golden Sun Moth [25234]	Critically Endangered	Species or species habitat known to occur within area
Mammals		
Nyctophilus corbeni		
South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Plants		
Ammobium craspedioides		
Yass Daisy [20758]	Vulnerable	Species or species habitat likely to occur within area
Leucochrysum albicans var. tricolor		
Hoary Sunray [56204]	Endangered	Species or species habitat likely to occur within area
Pelargonium sp. Striatellum (G.W.Carr 10345)		
Omeo Stork's-bill [84065]	Endangered	Species or species habitat may occur within area
Prasophyllum petilum		
Tarengo Leek Orchid [55144]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Aprasia parapulchella		
Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat likely to occur within area
Delma impar		
Striped Legless Lizard [1649]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Vulnerable*	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Telstra Corporation Limited

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Vulnerable*	Species or species habitat may occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Historic		
Clonoulty	NSW	Indicative Place
Glenara, Privy and Stables	NSW	Indicative Place
Kangiara Pre 1909 Village Area	NSW	Indicative Place
Kangiara, Post 1909 Village	NSW	Indicative Place
St John the Baptist Church Group	NSW	Indicative Place
St Patricks Church	NSW	Indicative Place
Tarengo	NSW	Indicative Place
Walla Walla Copper Mines	NSW	Indicative Place
Wallah Wallah Silver and Lead Mine and Smelter	NSW	Indicative Place
Boorowa Courthouse	NSW	Registered
Dendavilleigh	NSW	Registered

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Coordinates

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-34.49787 148.70967,-34.49073 148.72335,-34.49014 148.7519,-34.483 148.76202,-34.55379
148.81853

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of Sustainability, Environment, Water, Population and Communities
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Annex J

EPBC Act Significant Impact Assessment

J.1 SIGNIFICANT IMPACT ASSESSMENT

This section provides the Significant Impact Assessment for threatened species and ecological communities listed under the EPBC Act, following the Commonwealth *Significant Impact Assessment Guidelines 1.1* (DEWHA 2009). Species and ecological communities identified here have been selected for inclusion following the process outlined in *Chapter 7*. The threatened species and ecological communities assessed as likely to occur in the Study Area are shown in *Table C.1*. A Significant Impact Assessment is provided below for each of these species and ecological communities.

J.1.1 ENDANGERED ECOLOGICAL COMMUNITIES

The following table provides an assessment against the Significant Impact Guidelines for the Critically Endangered Ecological Community – Box Gum Grassy Woodland and Derived Grassland.

Critically Endangered Ecological Community - Significant impact criteria Box-Gum Grassy Woodland and Derived Grassland	
An action is likely to have a significant impact on a critically endangered ecological community if there is a real chance or possibility that it will:	
Reduce the extent of an ecological community	The extent of the Box-Gum Grassy Woodland and Derived Grassland will be reduced by 0.27 ha as a result of clearing for an overhead transmission line and its associated easement. This comprises 10% of the occurrence of Box-Gum Grassy Woodland patch that occurs along Tangmangaroo Road and 12% of the extent of Box-Gum Grassy Woodland and Derived Grassland in the Study Area.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	The Box-Gum Grassy Woodland and Derived Grassland within the Development Footprint occurs as part of a narrow linear corridor along both sides of Tangmangaroo Road. The proposed action would result in expansion of the existing gaps in the woodland corridor to 60 m. Therefore, the proposed action would increase fragmentation of the Box-Gum Grassy Woodland in this area.
Adversely affect habitat critical to the survival of an ecological community	The area of Box-Gum Grassy Woodland and Derived Grassland that would be impacted by the proposed action does not comprise habitat critical to the survival of the community. The habitat qualities that occur in the Development Footprint also occur in the remaining areas of Box-Gum Grassy Woodland and Derived Grassland, which would not be affected by the proposed action.
Modify or destroy abiotic (non-living) factors (such as water, nutrients or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	The proposed action involves clearing of vegetation and earthworks, however, this will not be at a scale that would result in modification or destruction of abiotic factors necessary for the survival of the community.

Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example of regular burning or flora or fauna harvesting	The species within the Development Footprint (0.27 ha) will be removed, however, this will not result in a change to the species composition of the overall occurrence of the ecological community in the Study Area or Locality.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: • *Assisting invasive species, that are harmful to the listed ecological community, to become established; or* • *Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community*	The occurrence of Box-Gum Grassy Woodland in the Study Area comprises a narrow linear corridor and therefore, is susceptible to invasive species. Mitigation measures will be implemented during the construction and operational phases to prevent invasive species becoming established and to prevent pollutants from entering the ecological community. Therefore, the quality and integrity of the Box-Gum Grassy Woodland would not be substantially reduced.
Interfere with the recovery of an ecological community	The proposed action would not interfere with the recovery of the ecological community. While the proposed action would result in clearing of 0.27 ha of Box-Gum Grassy Woodland, the area has not been identified in a recovery plan or as part of a Conservation Management Network. The proposed wind farm has been designed to avoid areas of the ecological community as much as possible and the 2.54 ha of remaining Box-Gum Grassy Woodland along Tangmangaroo Road would not be affected.
Conclusion: The extent of disturbance to Box-Gum Grassy Woodland and Derived Native Grassland has been reduced as much as possible through changes to the Project design. However, the proposed action will reduce the extent of the ecological community and increase fragmentation of the ecological community and as such, will result in a significant impact to the ecological community.	

J.1.2 FLORA

Endangered Flora

The following table provides an assessment against the Significant Impact Guidelines for Endangered Species for the flora species that are known, likely or have the potential to occur.

Endangered Species - Significant impact criteria
Woodland Species: Mountain Swainson Pea (*Swainsona recta*) Woodland and grassland species: Aromatic Peppercress (*Lepidium hyssopifolium*), Hoary Sunray (*Leucochrysum albicans* var. *tricolor*), Tarengo Leek Orchid (*Prasophyllum petilum*), Button Wrinklewort (*Rutidosis leptorrhyncoides*)
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

lead to a long-term decrease in the size of a population	Targeted surveys were undertaken during the flowering season for each endangered species identified in the referral. Where applicable, this coincided with the flowering times at reference sites. The species were not recorded in the Study Area during targeted surveys. Woodland species - The majority of woodland areas will not be disturbed as part of the proposed action. Therefore, it is unlikely the proposed action will lead to a long-term decrease in the size of a population. Woodland and grassland species - The majority of woodland areas will not be disturbed as part of the proposed action. Clearing in grassland areas will be restricted to a number of discrete areas for the turbines and substations, and narrow linear areas for the remaining infrastructure. As such, clearing in grassland areas will not be on a broad scale. Therefore, it is unlikely the proposed action will lead to a long-term decrease in the size of a population.
reduce the area of occupancy of the species	As the species were not recorded in the Study Area during targeted surveys, it is unlikely the proposed action will reduce the area of occupancy of the endangered species identified in the referral.
fragment an existing population into two or more populations	As the species were not recorded in the Study Area during targeted surveys, it is unlikely the proposed action will fragment an existing population of the endangered species identified in the referral into two or more populations.
adversely affect habitat critical to the survival of a species	Habitat critical to the survival of the endangered species identified in the referral does not occur in the Study Area.
disrupt the breeding cycle of a population	As the species were not recorded in the Study Area during targeted surveys, it is unlikely the proposed action will disrupt the breeding cycle of a population of the endangered species identified in the referral.
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The species were not recorded in the Study Area during targeted surveys. Woodland species - The majority of woodland areas will not be disturbed as part of the proposed action. Therefore, it is unlikely the proposed action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the endangered species identified in the referral are likely to decline. Woodland and grassland species - The majority of woodland areas will not be disturbed as part of the proposed action. Clearing in grassland areas will be restricted to a number of discrete areas for the turbines and substations, and narrow linear areas for the remaining infrastructure. As such, clearing in grassland areas will not be on a broad scale. Therefore, it is unlikely the proposed action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the endangered species identified in the referral are likely to decline.
result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat	Mitigation measures will be implemented during the construction and operational phases to prevent weed species becoming established in the vicinity of the Development Footprint.
introduce disease that may cause the species to decline	The proposed action would not introduce disease to the endangered plants' habitat. Mitigation measures will be implemented during the construction and operational phases to prevent introduction of soil borne plant pathogens to the area.

interfere with the recovery of the species	Woodland species - The majority of woodland areas will not be disturbed as part of the proposed action. The species identified in the referral have not been recorded in the Study Area. It is unlikely that proposed action would interfere with the recovery of these species. Woodland and grassland species - The majority of woodland areas will not be disturbed as part of the proposed action. Clearing in grassland areas will be restricted to a number of discrete areas for the turbines and substations, and narrow linear areas for the remaining infrastructure. As such, clearing in grassland areas will not be on a broad scale. The species have not been recorded in the Study Area. It is unlikely that proposed action would interfere with the recovery of these species.

J.1.3 VULNERABLE FLORA

The following table provides an assessment against the Significant Impact Guidelines for Vulnerable Species for the flora species that are known, likely or have the potential to occur in the Study Area.

Vulnerable Species - Significant impact criteria Woodland Species: Crimson Spider Orchid (*Caladenia concolor*) and Robertson's Gum (*Eucalyptus robertsonii* subsp. *hemisphaerica*) Woodland and grassland species: Yass Daisy (*Ammobium craspedioides*), Doubletail Buttercup (*Diuris aequalis*)	
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
lead to a long-term decrease in the size of an important population of a species	Yass Daisy - The important population of Yass Daisy that occurs in the Locality will not be affected by the proposed action as it occurs approximately 750 m from the nearest section of the Development Footprint. Field surveys were undertaken in areas of suitable habitat within the Study Area during the flowering season for the species. The species was not observed within the Study Area. Woodland and grassland species - Targeted surveys were undertaken during the flowering season for each of the vulnerable species identified in the referral. Where applicable, this coincided with the flowering times at reference sites. The species were not recorded in the Study Area during targeted surveys and as such, it is considered that important populations of the vulnerable species do not occur in the Study Area. Therefore, it is unlikely the proposed action will lead to a long-term decrease in the size of an important population of any of the vulnerable species listed above.
reduce the area of occupancy of an important population	Yass Daisy - The important population of Yass Daisy that occurs in the Locality would not be affected by the proposed action as it occurs approximately 750 m from the nearest section of the Development Footprint. Woodland and grassland species - It is considered that important populations of the vulnerable species listed above do not occur in the Study Area and therefore, it is unlikely the proposed action will reduce the area of occupancy of an important population of the vulnerable species listed above.

fragment an existing important population into two or more populations	Yass Daisy - The important population of Yass Daisy that occurs in the Locality would not be fragmented by the proposed action as works will not be undertaken in its vicinity. Woodland and grassland species - It is considered that important populations of the vulnerable species listed above do not occur in the Study Area and therefore, it is unlikely the proposed action will fragment an existing important population of the vulnerable species into two or more populations.
adversely affect habitat critical to the survival of a species	Yass Daisy - The habitat in which the population of Yass Daisy occurs is approximately 750 m from the nearest section of the Development Footprint and would not be affected by the proposed action. Woodland and grassland species - Habitat critical to the survival of the vulnerable species listed above does not occur in the Study Area.
disrupt the breeding cycle of an important population	Yass Daisy - The breeding cycle of the important population of Yass Daisy would not be affected by the proposed action as it occurs approximately 750 m from the nearest section of the Development Footprint. Woodland and grassland species - It is considered that important populations of the vulnerable species listed above do not occur in the Study Area and therefore, it is unlikely the proposed action will disrupt the breeding cycle of an important population.
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Yass Daisy - The habitat for the species would not be affected by the proposed action as it occurs approximately 750 m from the nearest section of the Development Footprint. Woodland species - The majority of woodland areas will not be disturbed as part of the proposed action. Therefore, it is unlikely the proposed action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the vulnerable species listed above are likely to decline. Woodland and grassland species - The majority of woodland areas will not be disturbed as part of the proposed action. Clearing in grassland areas will be restricted to a number of discrete areas for the turbines and substations, and narrow linear areas for the remaining infrastructure. As such, clearing in grassland areas will not be on a broad scale. Therefore, it is unlikely the proposed action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the vulnerable species listed above are likely to decline.
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Yass Daisy - The proposed action would not result in invasive species becoming established in the Yass Daisy habitat as the works would be undertaken 750 m away. Additionally, mitigation measures will be implemented during the construction and operational phases to prevent weed species becoming established in the vicinity of the Development Footprint. Woodland and grassland species - Mitigation measures will be implemented during the construction and operational phases to prevent weed species becoming established in the vicinity of the Development Footprint.
introduce disease that may cause the species to decline	Yass Daisy - The proposed action would not introduce disease to the Yass Daisy habitat. Mitigation measures will be implemented during the construction and operational phases to prevent introduction of soil borne plant pathogens to the area. Woodland and grassland species - Mitigation measures will be implemented during the construction and operational phases to prevent introduction of soil borne plant pathogens to the area.

interfere substantially with the recovery of the species	Yass Daisy - The proposed action will not impact upon the Yass Daisy population and therefore, would not interfere with the recovery of the species. Woodland species - The proposed action will largely avoid areas of woodland habitat. The species have not been recorded in the Study Area and it is unlikely that proposed action would interfere with the recovery of these species. Woodland and grassland species - The proposed action will largely avoid areas of woodland habitat. Small and narrow linear areas of grassland habitat will undergo clearing. However, as the species have not been recorded in the Study Area, it is unlikely that proposed action would interfere with the recovery of these species.

Conclusion: The proposed action would not have a significant impact on the important population of the Yass Daisy recorded in the Locality. The proposed action would not have a significant impact on important populations of the remaining vulnerable flora species listed above.

J.2 FAUNA SPECIES

J.2.1 Critically Endangered Fauna

The following table provides an assessment against the Significant Impact Guidelines for the Golden Sun Moth.

Significant Impact Thresholds for the Golden Sun Moth		
Ecological Element Affected	**Impact Threshold**	**Comment**
Large or contiguous habitat area (>10ha)	Habitat loss, degradation or fragmentation >0.5ha	GSM were observed both in areas of large or contiguous habitat and small or fragmented habitat. The proposed layout has been amended to account for GSM habitat locations as much as possible. The Project does not involve clearing of habitat on a broad scale; rather, it comprises clearing of small areas and narrow linear areas. The proposed action would result in removal of 51.94 ha of habitat for the GSM. This is greater than the impact threshold.
Small or fragmented habitat area (<10ha)	Any habitat loss, degradation or fragmentation	
Habitat connectivity	Fragmentation of a population through the introduction of a barrier to dispersal (e.g. breaks in habitat >200m)	The Project would not introduce a barrier to dispersal. The Project infrastructure would not create a break in habitat >200m).

Conclusion: The proposed action is likely to have a significant impact on the GSM as it meets both of the impact thresholds for habitat loss.

J.3 ENDANGERED FAUNA

The following table provides an assessment against the Significant Impact Guidelines for Endangered Species for the fauna species that are known, likely or have the potential to occur.

Endangered Species - Significant impact criteria	
Swift Parrot *Lathamus discolour*	
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
lead to a long-term decrease in the size of a population	This species was not recorded during field surveys. This species prefers profuse flowering box ironbark woodlands in NSW for foraging habitat. No preferred foraging habitat has been identified within the Study Area. If any individuals of this species were to pass through the Study Area it would be passing to move to an area of greater foraging habitat. Modelling of the cumulative collision risk impact to Swift Parrots was carried out in 2005 (Smales 2005a). Thirty five wind farms across the Swift Parrot's range were modelled. Results show that cumulative impacts of collision with turbines on the overall population of Swift Parrots, predicted by the modelling for all current and presently proposed wind farms within the species' range are very small, equating to approximately one parrot every 10 years. There will be no impact to this species habitat and therefore, the proposed action will not lead to a long term decrease in the size of population of this species.
reduce the area of occupancy of the species	The project would not reduce the area of occupancy of the Swift Parrot. Some foraging habitat may be removed; however, this comprises a small proportion of the habitat available in the Locality.
fragment an existing population into two or more populations	The project would not be fragmenting an existing important population as none has been identified within the Study Area. This species is highly mobile and the population migrates during the winter months to feed on winter flowering gums.
adversely affect habitat critical to the survival of a species	The Study Area would provide at best sub optimal foraging opportunities for the Swift Parrot. Some of the foraging habitat will be removed, however, foraging habitat for this species is widespread in the Locality and the area of habitat to be removed does not comprise habitat critical to the survival of the species.
disrupt the breeding cycle of a population	Breeding for this species takes place in Tasmania. No breeding sites have been located during the field surveys. Nesting habitat will not be removed as part of the proposed action and it is unlikely that it will disrupt the breeding cycle of an important population.
modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Study Area would provide the Swift Parrot with marginal foraging habitat. A small portion of this habitat will be removed, however, preferable foraging habitat is widespread in the Locality and as such, this is unlikely to cause the species to decline.
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposed action will not result in the introduction of an invasive species to the habitat of the Swift Parrot. The Locality already comprises a highly fragmented landscape that is susceptible to the establishment of invasive species. The proposed action will not increase this susceptibility and mitigation measures will be implemented to prevent introduction of invasive species.
introduce disease that may cause the species to decline	The proposed action will not result in the introduction of a disease being introduced that would impact on the Swift Parrot.

interfere with the recovery of the species	The *Recovery Plan for the Swift Parrot: Lathamus discolor* was developed in 2011 (Saunders et al 2011). This plan is largely focussed on increasing knowledge and awareness of the species and its habitat. Threats identified include the construction of wind energy turbines in south eastern Australia and these may have implications for the conservation of the Swift Parrot where they are poorly sited (Barrios and Rodriguez 2004). Swift Parrots tend to move within the height of trees in which they are feeding, although less frequent migration between sites may be higher. A study of the cumulative impacts of collision with turbines on the overall population of Swift Parrot was determined to be very small (Smales 2005a). Given the species has not been recorded within the Study Area The proposed action will not remove foraging habitat for the species and as such, will not interfere substantially with the recovery of the species.
Conclusion: The proposed action would not have a significant impact on the Swift Parrot.	

J.3.1 VULNERABLE FAUNA

The following table provides an assessment against the Significant Impact Guidelines for Vulnerable Species for the fauna species that are known, likely or have the potential to occur.

Vulnerable Species - Significant impact criteria	
Superb Parrot *Polytelis swainsonii* Koala *Phascolarctos cinereus* Striped Legless Lizard *Delma impar* Pink-tailed Worm-lizard *Aprasia parapulchella*,	
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
lead to a long-term decrease in the size of an important population of a species	Superb Parrot - Under the significant Impact Guidelines the Superb Parrot in the Locality is considered an important population. Field surveys indicate that there is considerable breeding habitat within the Study Area. Bird utilisation survey results indicate that the species rarely fly at or above the height of wind turbine blades. Normal flying height observed has been between 0 – 40 m and the tip of a rotor will be approximately 48 m above ground level. The Superb Parrot utilises woodland patches and corridors for movement and foraging throughout the Study Area. The project would involve the removal and / or modification of up to 8.62 ha of woodland area. The total area of woodland in the Study Area is approximately 166.79 ha. Thus, the project would result in a 4.9% reduction in the woodland area available in the Study Area for this species. It is not considered that this will lead to a long-term decrease in the size of the population of the Superb Parrot in the Study Area. During the operational phase of the proposed action, Superb Parrots may collide with the moving turbines or change their migratory paths. However, Superb Parrots generally move along wooded corridors when making local foraging movements, rarely crossing large areas of open ground (Baker-Gabb 2011) and it is likely that they move at a level within or just above the height of the trees in which they feed. Bird utilisation surveys recorded normal flying height for the Superb Parrot at between 0 – 40 m. The tip of a rotor will be approximately 48 m above ground level. Thus, they are unlikely to collide with turbines. During migration from breeding to non-breeding sites, the species follows wooded areas. Given the above it is unlikely that the proposed action would lead to lead to a

	long-term decrease in the size of an important population. Koala – no important populations for this species have been identified within the Study Area . This species was not recorded during field surveys. Approximately 166.79 ha of woodland area that constitutes both secondary and supplementary habitat occurs within the Study Area. The project would result in the removal and / or modification of approximately 8.62ha, or 4.9%, of secondary and supplementary habitat for the species. It is unlikely that this reduction in secondary and supplementary habitat would result in a long-term decrease in the size of an important population of the species. Given the arboreal nature and the rarity of this species within the Study Area and across the Locality it is unlikely that the proposed wind farm is likely to lead to a long term decrease of an important population of this species. Striped Legless Lizard - no important populations have been for this species have been identified within the Study Area. This species was not recorded during field surveys. The Striped Legless Lizard prefers natural temperate grasslands dominated by perennial tussock grasses. The species is also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. No areas of natural temperate grassland have been identified within the Study Area. An area of 380.53 ha of potential secondary habitat in the form of Box Gum Woodland and derived native grassland has been identified within the Study Area (NB only 0.27 ha of this vegetation comprises the TEC). The proposed action would result in the loss of approximately 52.48 ha or 13% of secondary habitat, the removal of this small portion of secondary habitat is unlikely to lead to a long term decrease of an important population if one exists of this species. Pink-tailed Worm-lizard - no important populations of this species have been identified within the Study Area. This species was not recorded during field surveys. The Pink-tailed Worm-lizard occurs in primary and secondary grassland, grassy woodland and woodland communities. Approximately 312.99 ha of secondary grassland has been identified within the Study Area. A small portion of this comprises suitable habitat for this species due to the presence of small rocks in this community. The proposed action would result in the loss or modification of a 49.16 ha of this vegetation community however, only a small portion of this comprises suitable habitat for the species. It is unlikely that this loss of habitat will lead to a long term decrease of an important population of the species.
reduce the area of occupancy of an important population	Superb Parrot - The project would not reduce the area of occupancy of the Superb Parrot. Nesting habitat will not be removed as part of the proposed action. Approximately 4.9% of Superb Parrot foraging habitat will be removed within the Study Area. This comprises a small proportion of the habitat available in the Locality. Koala – The project would reduce the area of potential occupancy of the Koala by approximately 8.62 ha, or 4.9%, of the total area of secondary and supplementary habitat. This species has not been recorded within the Study Area. Habitat for the Koala will not be removed as part of the proposed action. Striped Legless Lizard –The Striped Legless Lizard prefers natural temperate grasslands dominated by perennial tussock grasses. It is also found in secondary grassland near natural temperate grassland and occasionally in open Box-Gum Woodland. No areas of natural temperate grassland have been identified within the Study Area. An area of 380.53 ha of potential secondary habitat in the form of Box

	Gum Woodland and derived native grassland has been identified within the Study Area (only 0.27 ha of this comprises the TEC). The construction of the wind farm would result in the loss of approximately 52.48 ha, or 13%, of secondary habitat. This loss would not reduce the area of occupancy of the Striped Legless Lizard. This species has not been recorded within the Study Area. No habitat that is currently known to be occupied by this species will be removed as part of the proposed action. Pink-tailed Worm-lizard - Approximately 312.99 ha of secondary grassland habitat has been identified within the Study Area. A small portion of this comprises suitable habitat for this species due to the presence of small rocks in this community. The proposed action would result in the loss or modification of a small portion of habitat. The project would not reduce the area of occupancy of the Pink-tailed Worm-lizard. This species has not been recorded within the Study Area. No habitat that is currently known to be occupied by this species will be removed as part of the proposed action.
fragment an existing important population into two or more populations	Superb Parrot - The project would not be fragmenting an existing important population. The species nesting and sheltering habitat is already fragmented across the landscape and the proposed action would not increase this fragmentation. Foraging habitat will be modified as part of the proposed action, however, the species is highly mobile and foraging habitat is widespread across the Locality. Therefore, the removal of foraging habitat will not lead to fragmentation of an important population. Koala – The project would not be fragmenting an existing important population. No important populations of this species have been identified within the Study Area. Therefore, the proposed wind farm will not lead to fragmentation of an important population. Striped Legless Lizard – The project would not be fragmenting an existing important population. No important populations of this species have been identified within the Study Area. Therefore, the proposed wind farm will not lead to fragmentation of an important population. Pink-tailed Worm-lizard - The project would not be fragmenting an existing important population. No important populations of this species have been identified within the Study Area. Therefore, the proposed wind farm will not lead to fragmentation of an important population.
adversely affect habitat critical to the survival of a species	Superb Parrot - The Study Area provides nesting and foraging opportunities for the Superb Parrot. The Superb Parrot utilises woodland patches and corridors for movement and foraging throughout the Study Area. The project involves the removal and / or modification of up to 8.62 ha of woodland habitat. The total area of woodland in the Study Area is approximately 166.79 ha. Thus, the Project would result in a 4.9% reduction in the woodland area available in the Study Area for this species. Approximately 449 hollow bearing trees that would constitute potential nesting habitat have been identified within the Study Area. A maximum of 15, or 3.34%, will be removed as part of the proposed action. A total loss of 4.9% of potential foraging habitat and 3.34% of potential breeding habitat within the Study Area will be removed, however, foraging habitat and breeding habitat is widespread in the Locality and the area of habitat to be removed does not comprise habitat critical to the survival of the species. Koala – The Study Area does not provide habitat that is critical to the survival of the Koala. The habitat that exists within the Study Area is sub optimal and would be supplementary at best. Foraging

	habitat is widespread in the Locality and the area of habitat to be removed does not comprise habitat critical to the survival of the species. Striped Legless Lizard – The Study Area does not provide habitat that is critical to the survival of the Striped Legless Lizard. The habitat that exists within the Study Area is widespread throughout the Locality. The area of habitat to be removed does not comprise habitat critical to the survival of the species. Pink-tailed Worm-lizard - The Study Area does not provide habitat that is critical to the survival of the Pink-tailed Worm-lizard. The habitat that exists within the Study Area is widespread throughout the Locality. The area of habitat to be removed does not comprise habitat critical to the survival of the species.
disrupt the breeding cycle of an important population	Superb Parrot – Approximately 449 hollow bearing trees that constitute potential breeding habitat have been identified in the Study Area and within 500 m of proposed turbine locations. No breeding sites have been located during the field surveys. It has been identified that a maximum of 15 hollow bearing trees fall within the project footprint and are likely to be removed as part of the proposed action. This is approximately 3.34% of the total potential breeding area identified and it is unlikely that it will disrupt the breeding cycle of an important population. Koala – No important populations of the Koala have been identified within the Study Area. No breeding habitat for the Koala has been identified in the Study Area. The construction of the wind farm would increase traffic through the Study Area and the Locality; this however is unlikely to result in the disruption of the breeding cycle for an important population of the Koala. Striped Legless Lizard – No important populations of the Striped Legless Lizard have been identified within the Study Area. Breeding habitat for the Striped Legless Lizard has been identified in the Study Area. The construction of the wind farm would remove a small portion and introduce noise dust and vibrations into those areas of the Study Area. However given the large expanses of potential breeding habitat in the Study Area for this species this unlikely to result in the disruption of the breeding cycle for an important population of the Striped Legless Lizard. Pink-tailed Worm-lizard - No important populations of the Pink-tailed Worm-lizard have been identified within the Study Area. Breeding habitat for the Pink-tailed Worm-lizard has been identified in the Study Area. The construction of the wind farm would remove a small portion and introduce noise dust and vibrations into those areas of the Study Area. However given the large expanses of potential breeding habitat in the Study Area for this species this unlikely to result in the disruption of the breeding cycle for an important population of the Pink-tailed Worm-lizard.
modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Superb Parrot - The Study Area provides nesting and foraging habitat for the Superb Parrot. Approximately 15 hollow bearing tress, or 3.34% of the total recorded, will be removed as part of the proposed action. A further 4.9% of foraging habitat will be removed, however, foraging habitat is widespread in the Locality and as such, this is unlikely to cause the species to decline. Koala – The project involves the construction of access roads and the erection of wind turbine towers. No large areas of habitat available to the Koala would be modified, destroyed isolated or decreased such that the species is likely to decline. Striped Legless Lizard - The project involves the construction of access roads and the erection of wind turbine towers. Some areas of

	habitat available to the Striped Legless lizard would be modified or destroyed. These areas however would not be isolated and the overall availability of habitat to the Striped Legless Lizard would not decrease such that the species is likely to decline. Pink-tailed Worm-lizard - The project involves the construction of access roads and the erection of wind turbine towers. Some areas of habitat available to the Pink-tailed Worm-lizard would be modified or destroyed. These areas however would not be isolated and the overall availability of habitat to the Pink-tailed Worm-lizard would not decrease such that the species is likely to decline.
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Superb Parrot - The proposed action will not result in the introduction of an invasive species to the habitat of the Superb Parrot. The Locality already comprises a highly fragmented landscape that is susceptible to the establishment of invasive species. The proposed action will not increase this susceptibility and mitigation measures will be implemented to prevent introduction of invasive species. Koala – The proposed action will not result in the introduction of an invasive species to the habitat of the Koala. The Locality already comprises a highly fragmented landscape that is susceptible to the establishment of invasive species. The proposed action will not increase this susceptibility and mitigation measures will be implemented to prevent introduction of invasive species. Striped Legless Lizard – The proposed action will not result in the introduction of an invasive species to the habitat of the Striped Legless Lizard. The Locality already comprises a highly fragmented landscape that is susceptible to the establishment of invasive species. The proposed action will not increase this susceptibility and mitigation measures will be implemented to prevent introduction of invasive species. Pink-tailed Worm-lizard - The proposed action will not result in the introduction of an invasive species to the habitat of the Pink-tailed Worm-lizard. The Locality already comprises a highly fragmented landscape that is susceptible to the establishment of invasive species. The proposed action will not increase this susceptibility and mitigation measures will be implemented to prevent introduction of invasive species.
introduce disease that may cause the species to decline	The proposed action will not result in the introduction of a disease being introduced that would impact on the Superb Parrot, Koala, Striped Legless Lizard or Pink-tailed Worm-lizard.
interfere substantially with the recovery of the species	Superb Parrot - The *Recovery Plan for the Superb Parrot: Polytelis swainsonii* was developed in 2011 by the Victorian Department of Sustainability and Environment (DSE). This plan is largely focussed on increasing knowledge and awareness of the species and its habitat, particularly nesting habitat. It also focusses on protecting nesting habitat. The proposed action will not remove nesting habitat for the species and as such, will not interfere substantially with the recovery of the species. Koala – A national Koala Conservation and Management Strategy was released in 2009. The strategy aims to conserve koalas by retaining viable populations in the wild throughout their natural range. The proposed action is unlikely to interfere with a viable population or interfere with suitable habitat for a viable population. The proposed action is therefore unlikely to substantially interfere with the recovery of the Koala. Striped Legless Lizard – a national recovery plan for the Striped Legless lizard was produced in 1999 and notes it is important that viable populations or clusters of populations of this species are

	represented and maintained in reserves or appropriately managed sites across the known distribution of the species. The proposed action is unlikely to interfere with a known population of this species and as such will not interfere substantially with the recovery of the species. Pink-tailed Worm-lizard – a recovery plan for the Pink-tailed Worm-lizard was produced in 1995 and cites cultivation, livestock grazing and rock removal have contributed to habitat deterioration in much of its former range. The proposed action would involve the removal of some rock habitat in the Study Area. This would be very minor in the greater area that has been subject to significant grazing over a long period of time. It is unlikely that the proposed action would interfere substantially in the recovery of this species.

Conclusion: The proposed action would not have a significant impact on important populations of the vulnerable fauna species listed above.

J.4 MIGRATORY SPECIES

The following table provides an assessment against the Significant Impact Guidelines for migratory species that are known, likely or have the potential to occur.

Migratory Species - Significant impact criteria Cattle Egret *Ardea ibis* Latham's Snipe *Gallinago hardwickii* White-bellied Sea-eagle *Haliaeetus leucogaster* White-throated Needletail *Hirundapus caudacutus* Rainbow Bee-eater *Merops ornatus*	
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:	
substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	No areas of important habitat for any of the migratory species identified as being known to exist, or have the potential to exist, have been identified in the Study Area. The proposed action involves the construction and operation of a wind farm. This action is unlikely to modify destroy or isolate any habitat that is important to a migratory species.
result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or	The Study Area does not provide an area of important habitat for a migratory species. The proposed action will involve the construction and operation of a wind farm. All impacts on the environment will be mitigated or controlled through a series of operational and management plans. It is thus unlikely that the action would result in an invasive species becoming established in the Study Area.
seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	No ecologically significant proportions of a migratory species population have been identified in the Study Area. The action would involve the construction and operation of a wind farm. The citing of the wind farm has considered migratory flight patterns and as such none have been identified within the Study Area. It is thus considered unlikely that the Project will seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

Conclusion: The proposed action would not have a significant impact on the migratory species listed above.