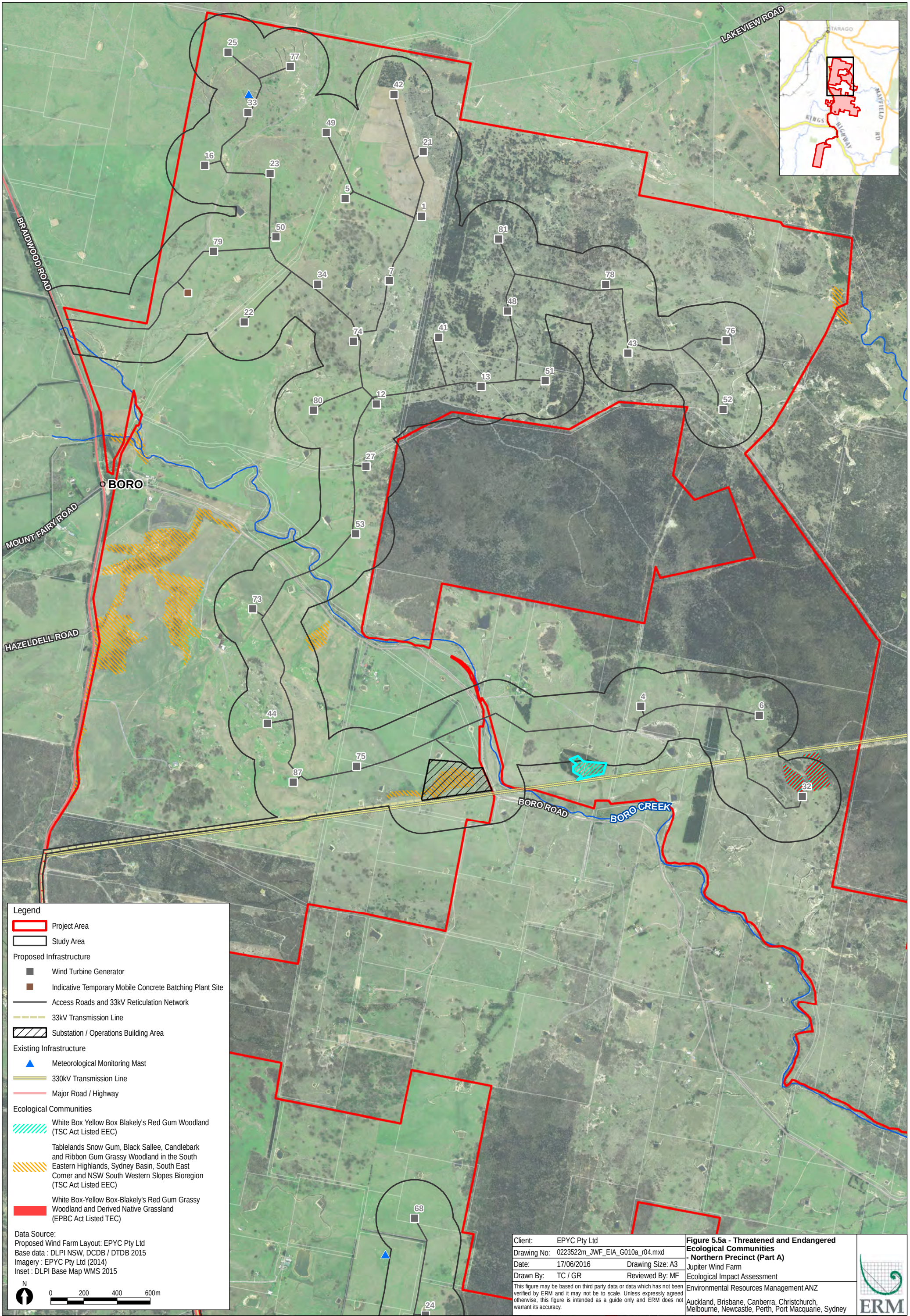




Legend

Project Area

Study Area

Proposed Infrastructure

- Wind Turbine Generator
- Indicative Temporary Mobile Concrete Batching Plant Site
- Access Roads and 33kV Reticulation Network
- 33kV Transmission Line
- Substation / Operations Building Area

Existing Infrastructure

- ▲ Meteorological Monitoring Mast
- 330kV Transmission Line
- Major Road / Highway

Ecological Communities

- White Box Yellow Box Blakely's Red Gum Woodland (TSC Act Listed EEC)
- Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion (TSC Act Listed EEC)
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act Listed TEC)

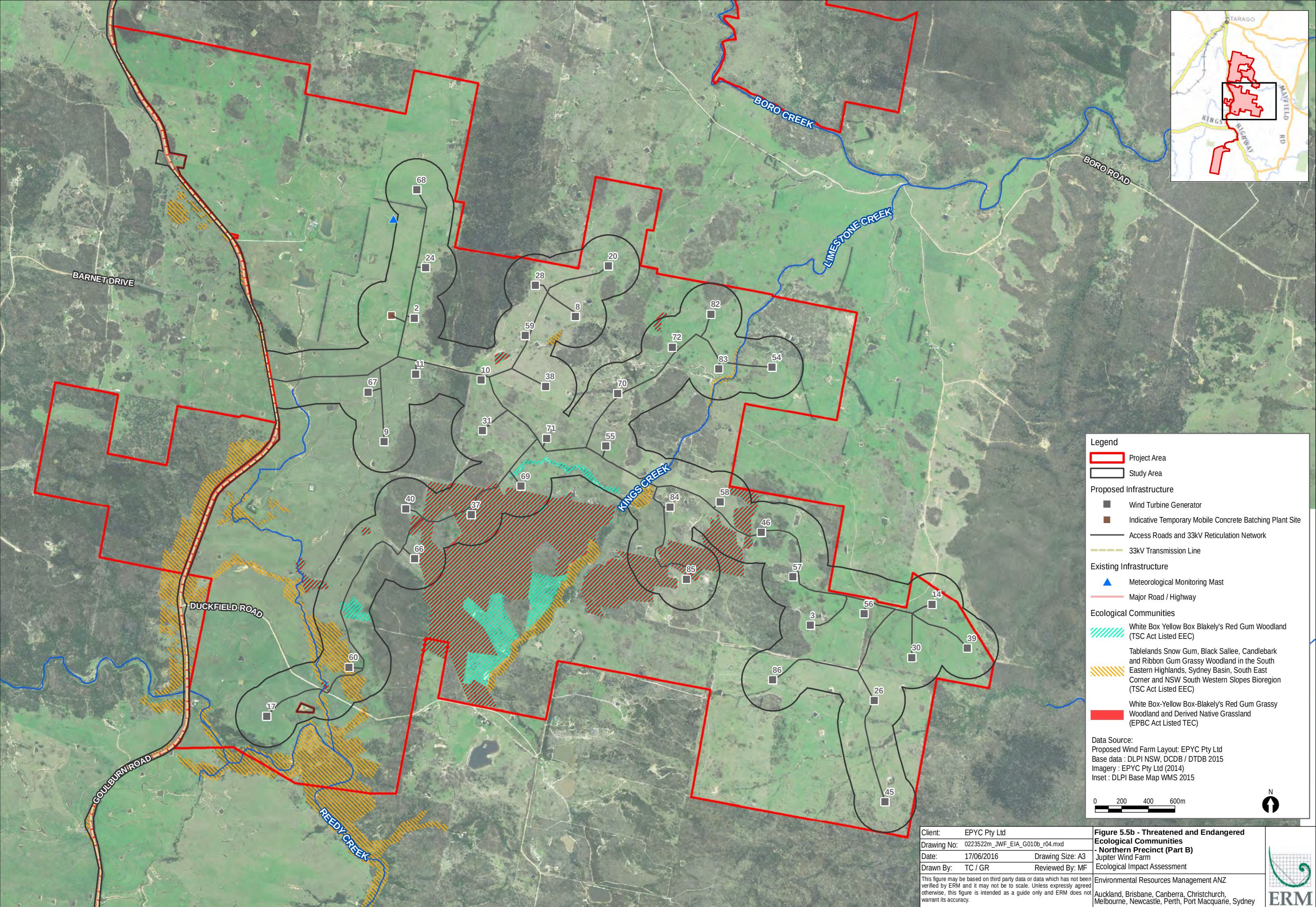
Data Source:
Proposed Wind Farm Layout: EPYC Pty Ltd
Base data : DLPI NSW, DCDB / DTDB 2015
Imagery : EPYC Pty Ltd (2014)
Inset : DLPI Base Map WMS 2015

N

0 200 400 600m

Client:	EPYC Pty Ltd		Figure 5.5a - Threatened and Endangered Ecological Communities - Northern Precinct (Part A) Jupiter Wind Farm Ecological Impact Assessment Environmental Resources Management ANZ Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney
Drawing No:	0223522m_JWF_EIA_G010a_r04.mxd		
Date:	17/06/2016	Drawing Size: A3	
Drawn By:	TC / GR	Reviewed By: MF	
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Legend

Project Area

Study Area

Proposed Infrastructure

Wind Turbine Generator

Indicative Temporary Mobile Concrete Batching Plant Site

Access Roads and 33kV Reticulation Network

33kV Transmission Line

Existing Infrastructure

Meteorological Monitoring Mast

Major Road / Highway

Ecological Communities

White Box Yellow Box Blakely's Red Gum Woodland (TSC Act Listed EEC)

Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion (TSC Act Listed EEC)

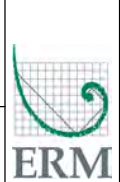
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act Listed TEC)

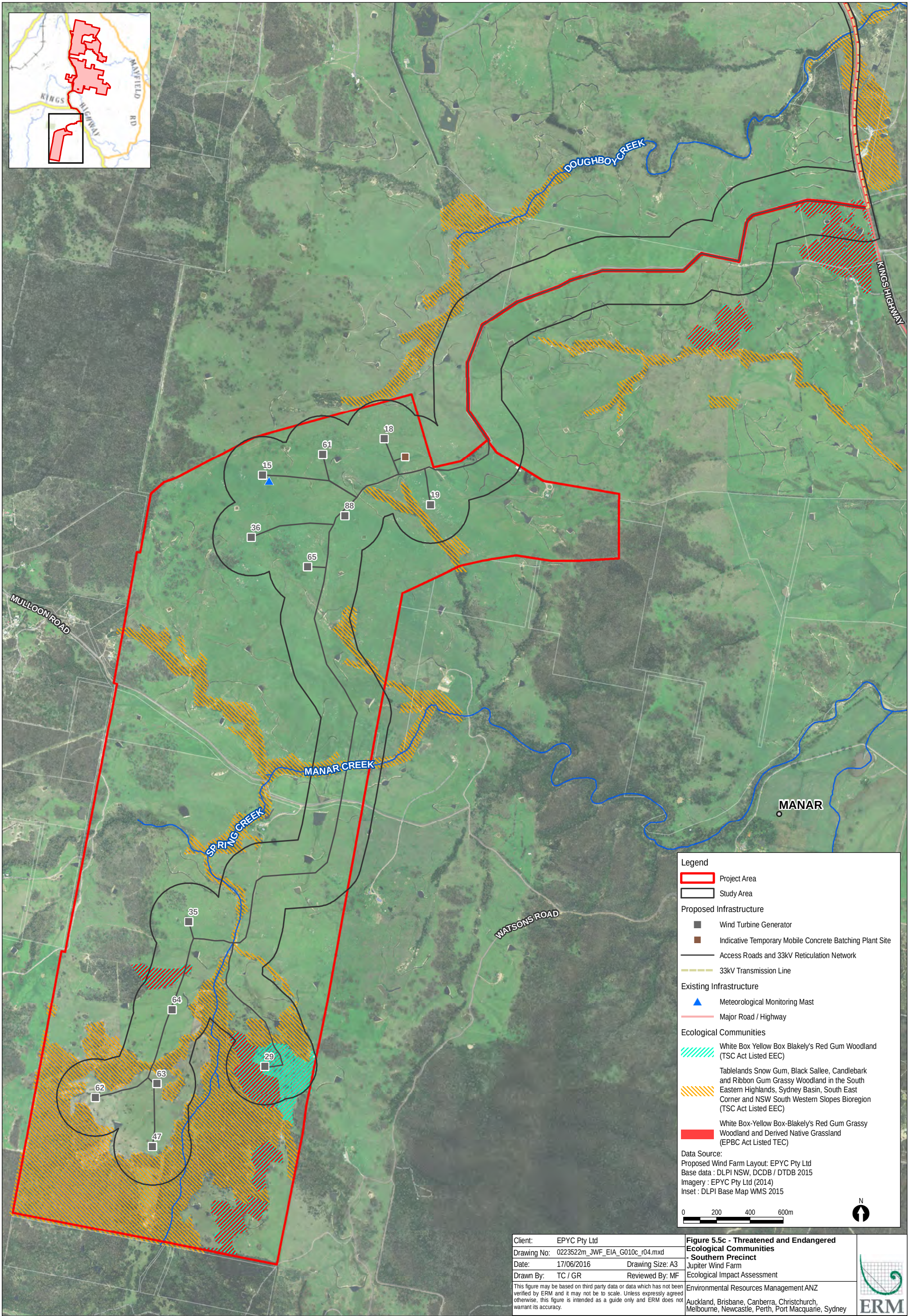
Data Source:
Proposed Wind Farm Layout: EPYC Pty Ltd
Base data : DLPI NSW, DCDB / DTDB 2015
Imagery : EPYC Pty Ltd (2014)
Inset : DLPI Base Map WMS 2015

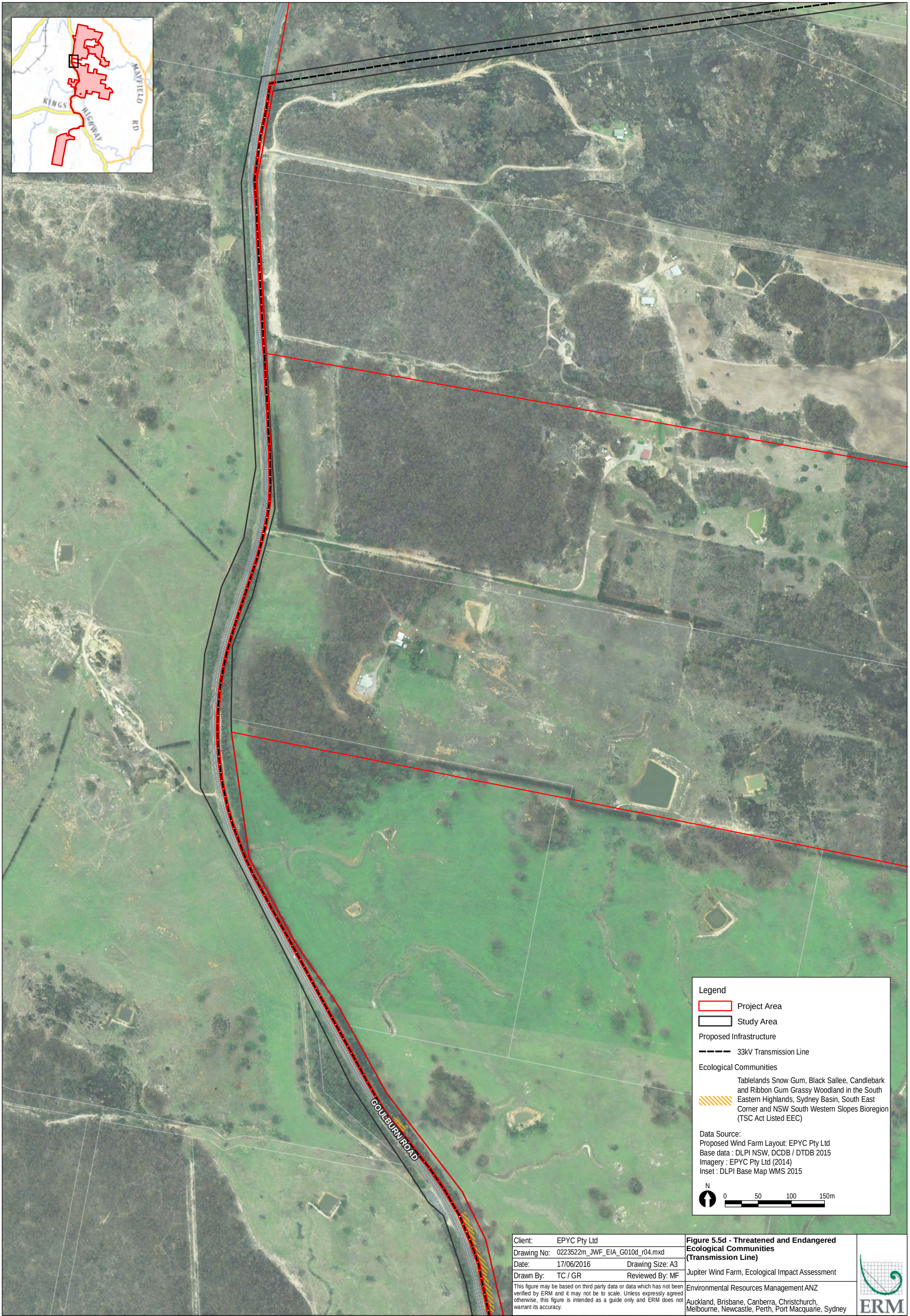
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Client:	EPYC Pty Ltd		Figure 5.5b - Threatened and Endangered Ecological Communities - Northern Precinct (Part B) Jupiter Wind Farm Ecological Impact Assessment Environmental Resources Management ANZ Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney
Drawing No:	0223522m_JWF_EIA_G010b_r04.mxd		
Date:	17/06/2016	Drawing Size: A3	
Drawn By:	TC / GR	Reviewed By: MF	
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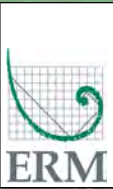
Client:	EPYC Pty Ltd
Drawing No:	0223522m_JWF_EIA_G010d_r04.mxd
Date:	17/06/2016
Drawn By:	TC / GR
Reviewed By:	MF
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.	

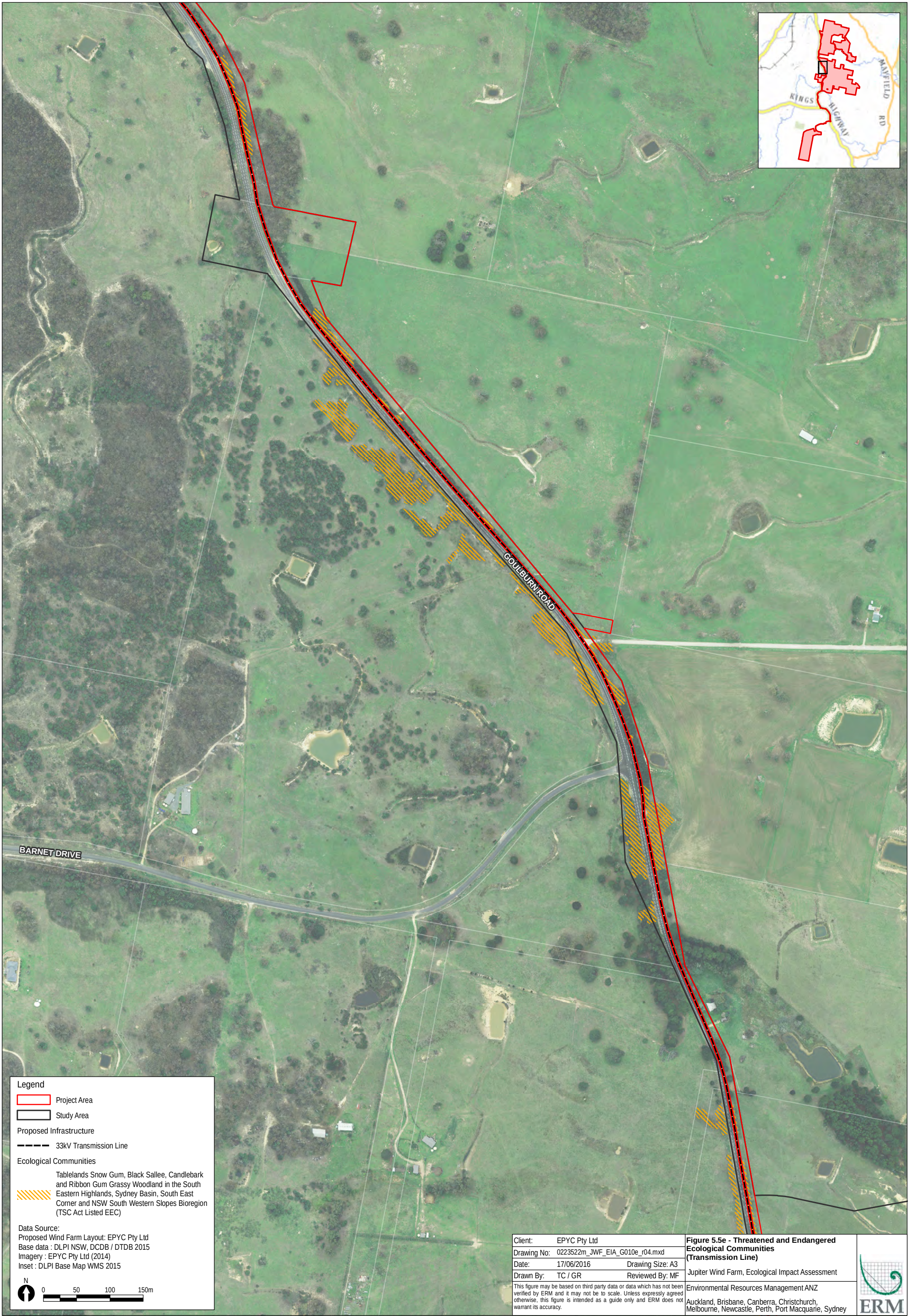
Figure 5.5d - Threatened and Endangered Ecological Communities (Transmission Line)

Jupiter Wind Farm, Ecological Impact Assessment

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney





Legend

Project Area

Study Area

Proposed Infrastructure

33kV Transmission Line

Ecological Communities

Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion (TSC Act Listed EEC)

Data Source:

Proposed Wind Farm Layout: EPYC Pty Ltd

Base data : DLPI NSW, DCDB / DTDB 2015

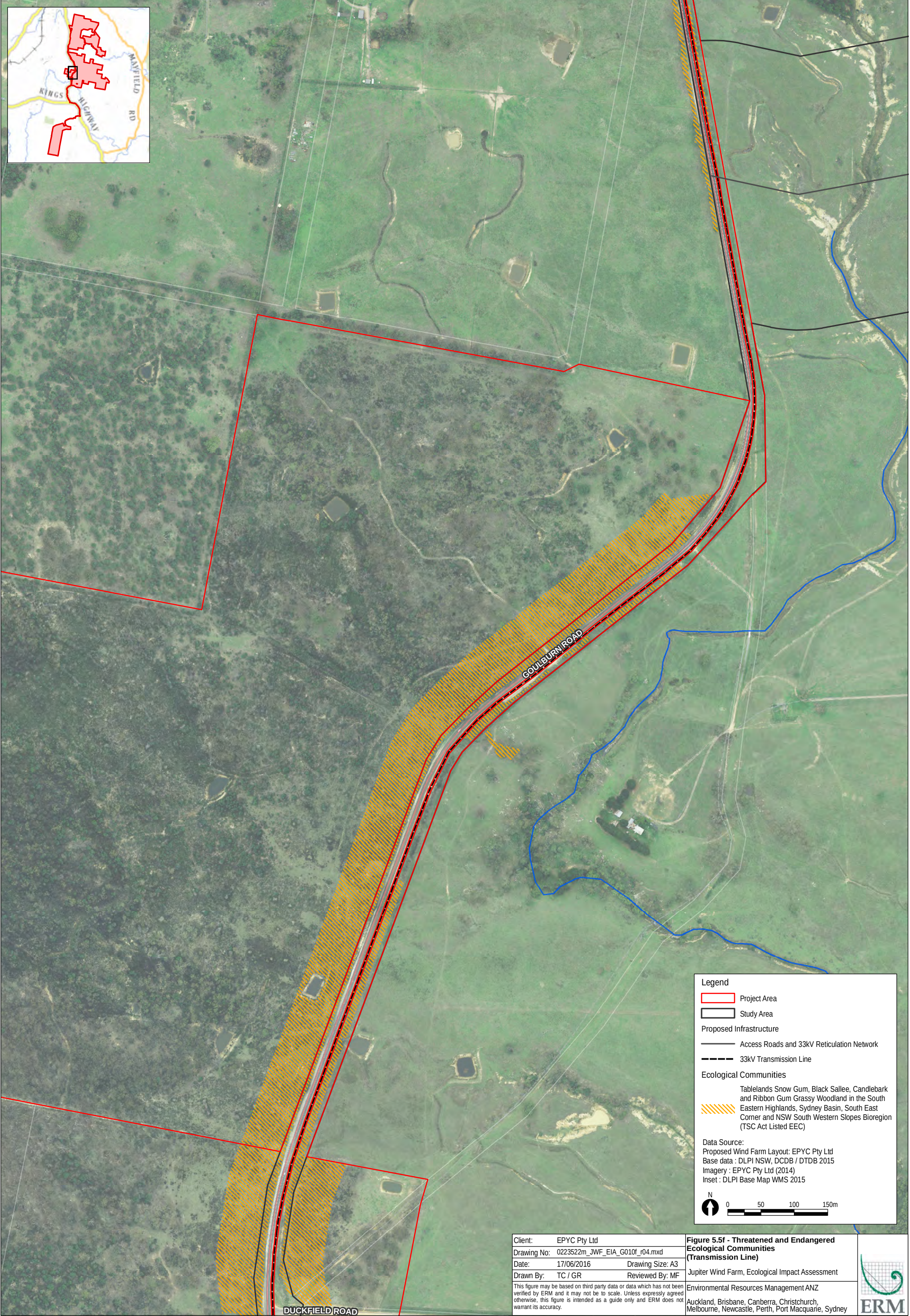
Imagery : EPYC Pty Ltd (2014)

Inset : DLPI Base Map WMS 2015

N

0 50 100 150m

Client:	EPYC Pty Ltd	Figure 5.5e - Threatened and Endangered Ecological Communities (Transmission Line) Jupiter Wind Farm, Ecological Impact Assessment Environmental Resources Management ANZ Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney	
Drawing No:	0223522m_JWF_EIA_G010e_r04.mxd		
Date:	17/06/2016		
Drawn By:	TC / GR		
	Reviewed By: MF		
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.			



Legend

Project Area

Study Area

Proposed Infrastructure

Access Roads and 33kV Reticulation Network

33kV Transmission Line

Ecological Communities

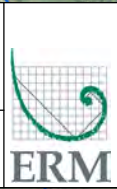
Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South East Corner and NSW South Western Slopes Bioregion (TSC Act Listed EEC)

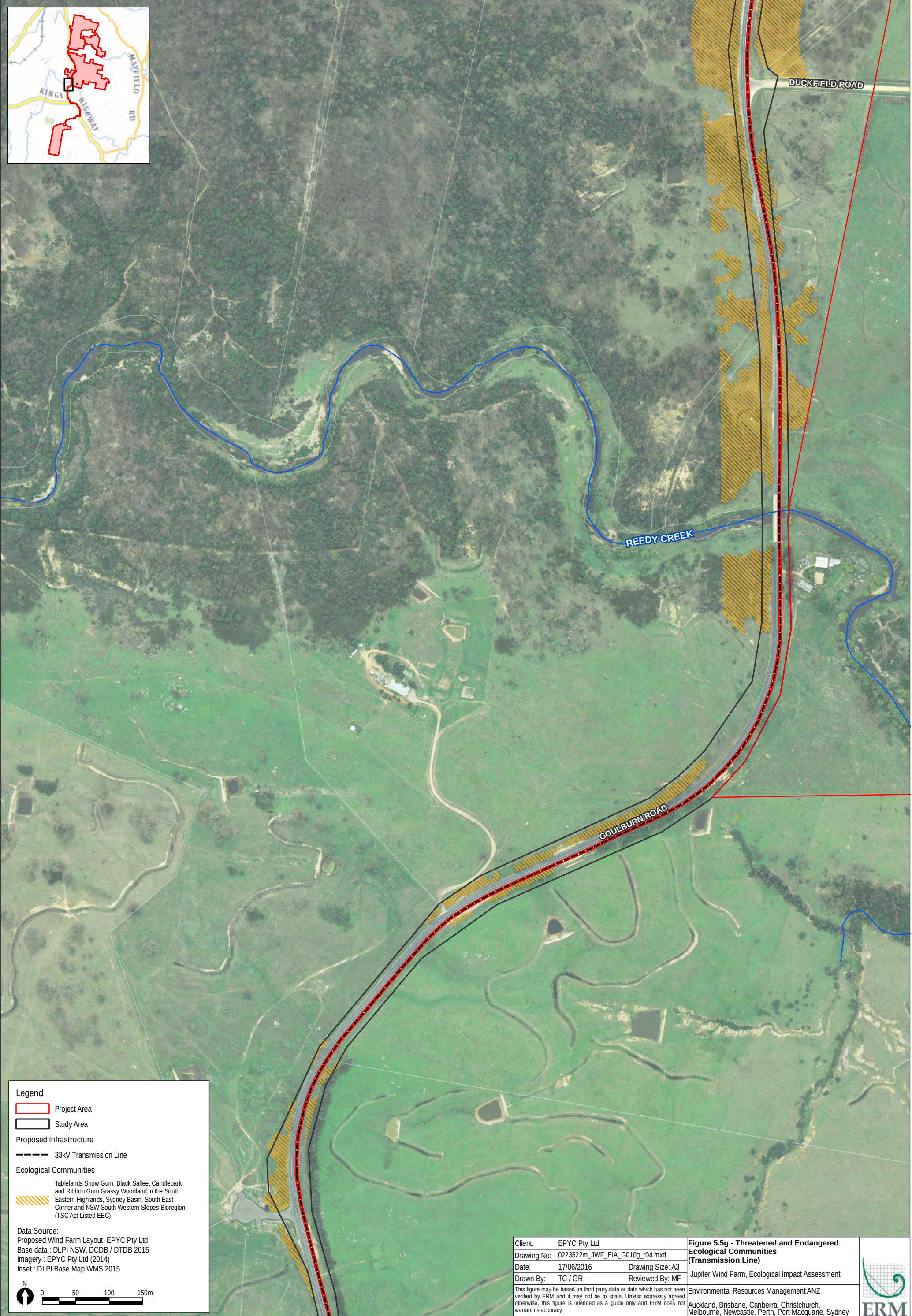
Data Source:
Proposed Wind Farm Layout: EPYC Pty Ltd
Base data : DLPI NSW, DCDB / DTDB 2015
Imagery : EPYC Pty Ltd (2014)
Inset : DLPI Base Map WMS 2015

N

0 50 100 150m

Client:	EPYC Pty Ltd	Figure 5.5f - Threatened and Endangered Ecological Communities (Transmission Line)
Drawing No:	0223522m_JWF_EIA_G010f_r04.mxd	Jupiter Wind Farm, Ecological Impact Assessment
Date:	17/06/2016	Environmental Resources Management ANZ
Drawn By:	TC / GR	Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney
Reviewed By:	MF	
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.		





Legend

Project Area

Study Area

Proposed Infrastructure

33kV Transmission Line

Ecological Communities

Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion (TSC Act Listed EEC)

Data Source:
Proposed Wind Farm Layout: EPYC Pty Ltd
Base data : DLPI NSW, DCDB / DTDB 2015
Imagery : EPYC Pty Ltd (2014)
Inset : DLPI Base Map WMS 2015

N
0 50 100 150m

Client: EPYC Pty Ltd	Figure 5.5g - Threatened and Endangered Ecological Communities (Transmission Line) Jupiter Wind Farm, Ecological Impact Assessment Environmental Resources Management ANZ Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney	
Drawing No: 0223522m_JWF_EIA_G010g_r04.mxd		
Date: 17/06/2016 Drawing Size: A3		
Drawn By: TC / GR Reviewed By: MF		
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.		



Legend

Project Area

Study Area

Proposed Infrastructure

33kV Transmission Line

Ecological Communities

Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion (TSC Act Listed EEC)

Data Source:
Proposed Wind Farm Layout: EPYC Pty Ltd
Base data : DLPI NSW, DCDB / DTDB 2015
Imagery : EPYC Pty Ltd (2014)
Inset : DLPI Base Map WMS 2015

N

0 50 100 150m

Client:	EPYC Pty Ltd		Figure 5.5h - Threatened and Endangered Ecological Communities (Transmission Line) Jupiter Wind Farm, Ecological Impact Assessment Environmental Resources Management ANZ Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney
Drawing No:	0223522m_JWF_EIA_G010h_r04.mxd		
Date:	17/06/2016	Drawing Size: A3	
Drawn By:	TC / GR	Reviewed By: MF	
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.			





Legend

Project Area

Study Area

Proposed Infrastructure

33kV Transmission Line

Ecological Communities

Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion (TSC Act Listed EEC)

Data Source:

Proposed Wind Farm Layout: EPYC Pty Ltd

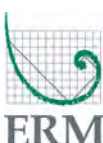
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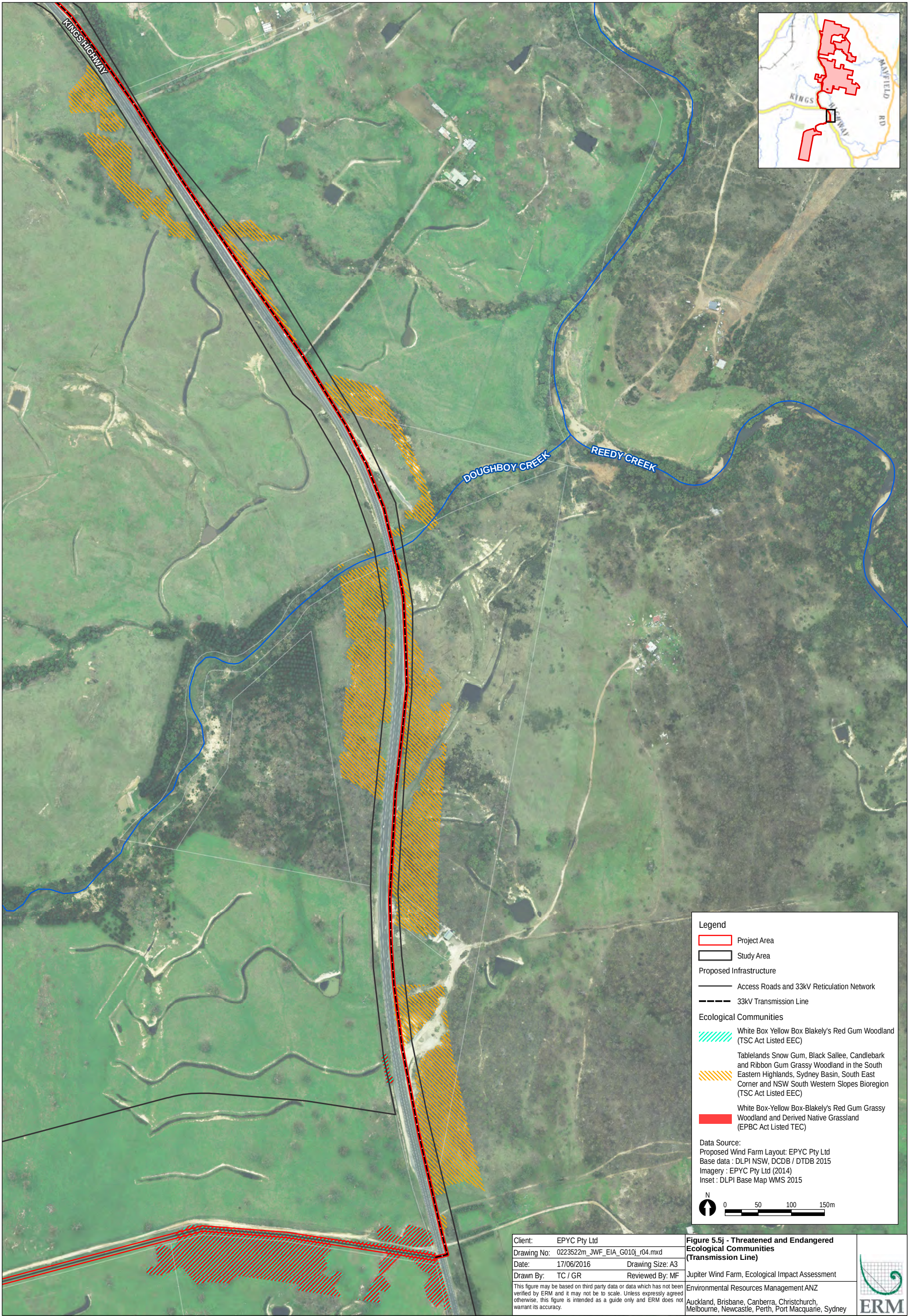
Imagery : EPYC Pty Ltd (2014)

Inset : DLPI Base Map WMS 2015

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0 50 100 150m

Client:	EPYC Pty Ltd		Figure 5.5i - Threatened and Endangered Ecological Communities (Transmission Line) Jupiter Wind Farm, Ecological Impact Assessment Environmental Resources Management ANZ Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney	
Drawing No:	0223522m_JWF_EIA_G010i_r04.mxd			
Date:	17/06/2016	Drawing Size: A3		
Drawn By:	TC / GR	Reviewed By: MF		
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.				



Legend

Project Area

Study Area

Proposed Infrastructure

Access Roads and 33kV Reticulation Network

33kV Transmission Line

Ecological Communities

White Box Yellow Box Blakely's Red Gum Woodland (TSC Act Listed EEC)

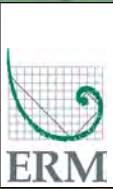
Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion (TSC Act Listed EEC)

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act Listed TEC)

Data Source:
Proposed Wind Farm Layout: EPYC Pty Ltd
Base data : DLPI NSW, DCDB / DTDB 2015
Imagery : EPYC Pty Ltd (2014)
Inset : DLPI Base Map WMS 2015

N
0 50 100 150m

Client:	EPYC Pty Ltd		Figure 5.5j - Threatened and Endangered Ecological Communities (Transmission Line) Jupiter Wind Farm, Ecological Impact Assessment Environmental Resources Management ANZ Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney
Drawing No:	0223522m_JWF_EIA_G010j_r04.mxd		
Date:	17/06/2016	Drawing Size: A3	
Drawn By:	TC / GR	Reviewed By: MF	
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.			



5.5

FLORA SPECIES

A total of 214 species were identified during the flora surveys of the Study Area, 161 (75.2%) of which were indigenous and 53 (24.8%) are introduced. A full list is provided in *Annex D*.

5.5.1

Threatened Flora

Field investigations identified two species of threatened flora, the Hoary Sunray (refer to *Photograph 5.1*) and the Buttercup Doubletail (refer to *Photograph 5.2*). Both threatened species were identified during the spring surveys in late October 2014. The location of records and associated known habitat for both species in the Study Area is shown in *Figure 5.6*.

The number of individuals of the Buttercup Doubletail was low where it was observed with only three identified.

The Hoary Sunray distribution was patchy within its area of occurrence however where it was observed it occurred in very high numbers with a count of 20 individuals within a BioBanking plot area (50 m x 20 m) and another point count of one patch of 113 individuals. Using the count from within the plot area, the density was estimated at 200 individuals per hectare for the area of occurrence.

Potential habitat for six other threatened flora species was identified (refer to *Table 5.7*) and is discussed further in *Chapters 6 and 7*.

Table 5.6 *Threatened Flora and Potential Threatened Flora Habitat Identified in the Study Area*

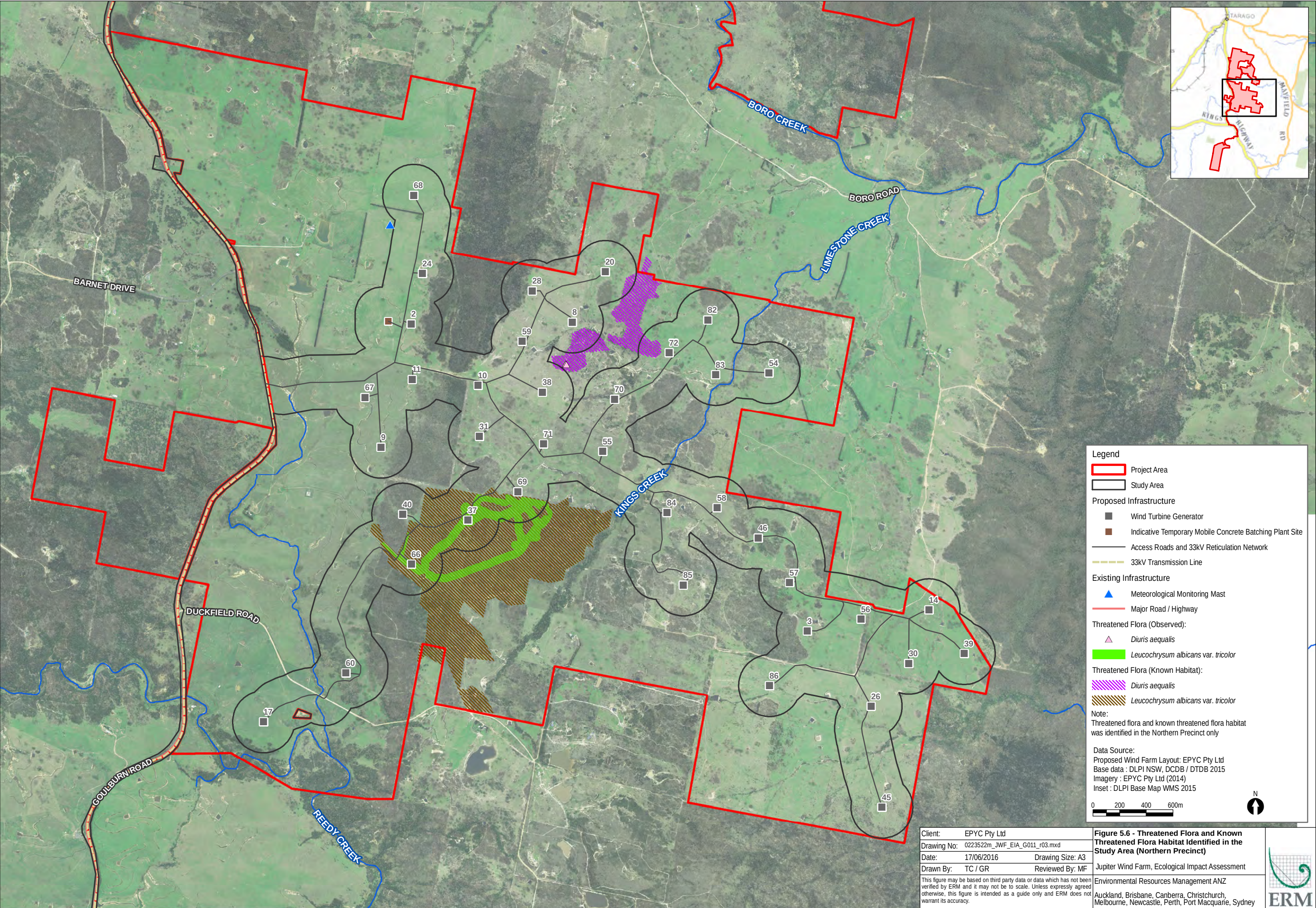
Common Name	Scientific Name	EPBC Act Status	TSC Act Status	Individuals Identified	Potential Habitat Identified
Few-seeded Bossiaea	<i>Bossiaea oligosperma</i>	V	V	-	X
Buttercup Doubletail	<i>Diuris aequalis</i>	V	E	X	X
Black Gum	<i>Eucalyptus aggregata</i>	-	V	-	X
Basalt Pepper-cress	<i>Lepidium hyssopifolium</i>	E	E	-	X
Hoary Sunray, Grassland Paper-daisy	<i>Leucochrysum albicans</i> subsp. <i>albicans</i> var. <i>tricolor</i>	E	-	X	X
Pale Pomaderris	<i>Pomaderris pallida</i>	V	V	-	X
Matted Bush-pea	<i>Pultenaea pedunculata</i>	-	E	-	X
Austral Toadflax	<i>Thesium australe</i>	V	V	-	X
E = Endangered, V = Vulnerable					

Photograph 5.1 *Hoary Sunray Growing in Access Road*



Photograph 5.2 *Buttercup Doubletail (Diuris aequalis)*





5.5.2

Introduced Flora

The *Noxious Weeds Act 1993* designates some introduced flora as ‘declared noxious weeds’. This declaration designates actions required by the landholder in managing these weeds. Field investigations identified 30 introduced flora species in the Study Area of which four are listed as Declared Noxious Weeds under the *Noxious Weeds Act 1993* in either the Goulburn-Mulwaree or former Palerang LGAs. These are shown in *Table 5.8*.

Table 5.7 *Declared Noxious Weeds Identified in the Study Area*

Common Name	Scientific Name	Declaration Class and LGA ¹	Location
African Boxthorn	<i>Lycium ferocissimum</i>	GM ² : Class 4 P ³ : Class 3	Along the Goulburn-Braidwood Road and Kings Highway road reserves.
Chilean Needle Grass	<i>Nassella neesiana</i>	GM ² : Class 4 P ³ : Class 4	Occasional occurrences in the paddocks of the northern part of the Study Area
Serrated Tussock	<i>Nassella trichotoma</i>	GM: Class 4 P: Class 4	Occasional occurrences in the paddocks of the northern part of the Study Area
Blackberry	<i>Rubus fruticosus</i> agg. spp. ⁴	GM: Class 4 P: Class 4	Occasional occurrences in woodland in the central and southern parts of the Study Area, and one dense infestation in a gully in the southern part of the Study Area.
Willow	<i>Salix</i> sp.	GM: Class 4 P: Class 4	On larger creeks mostly Reedy Creek in the centre of the Study Area

1. LGA = Local Government Area

2. GM = Goulburn-Mulwaree

3. P = former Palerang

4. agg. spp. = aggregate of species denoting a taxonomically complex group of taxa listed together.

Class 3 weeds are ‘regionally controlled weeds’ meaning: the plant must be fully, and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed (DPI 2015). Class 4 weeds are ‘locally controlled weeds’ meaning: the growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction (DPI 2015).

5.6

FAUNA HABITAT

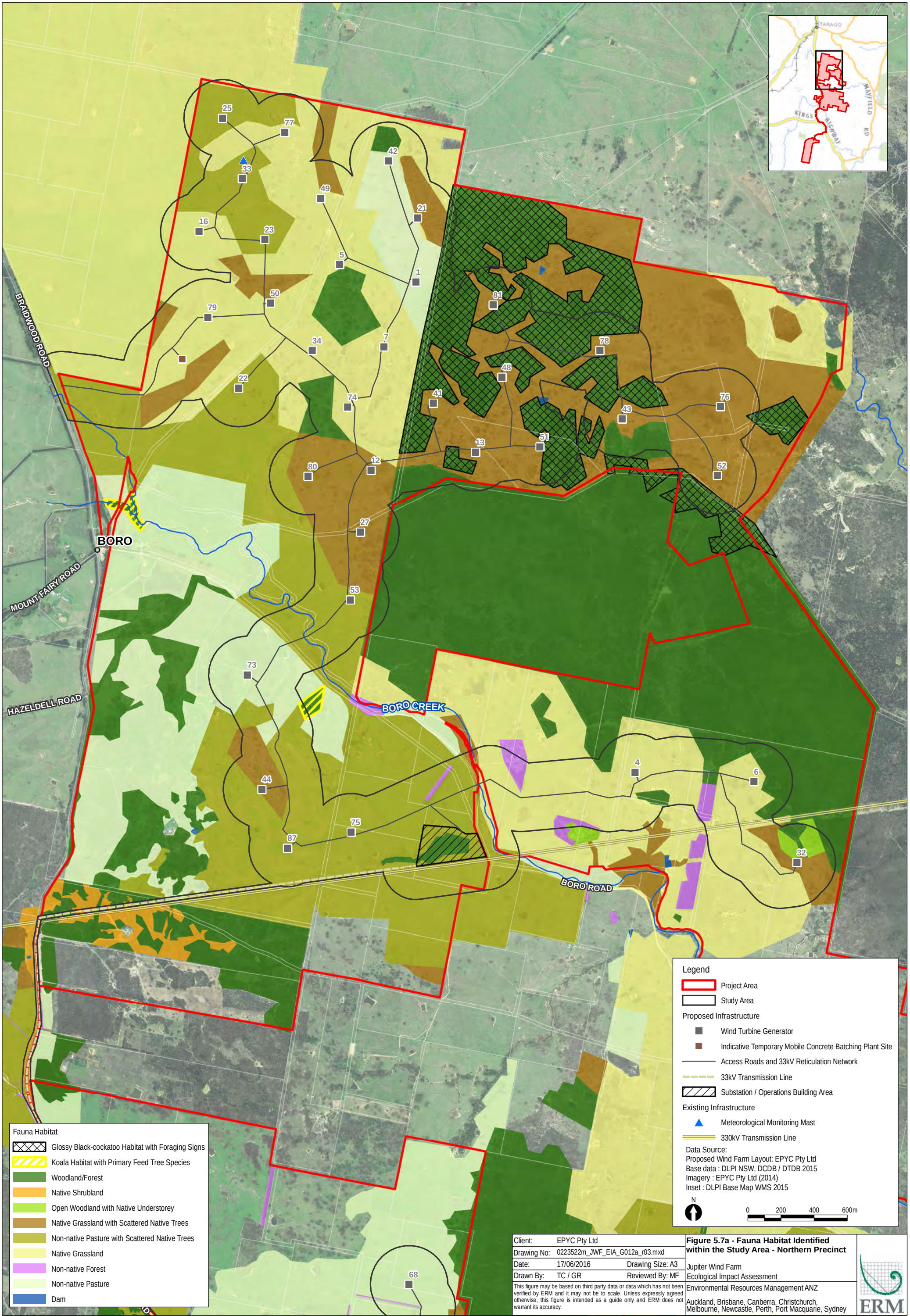
5.6.1

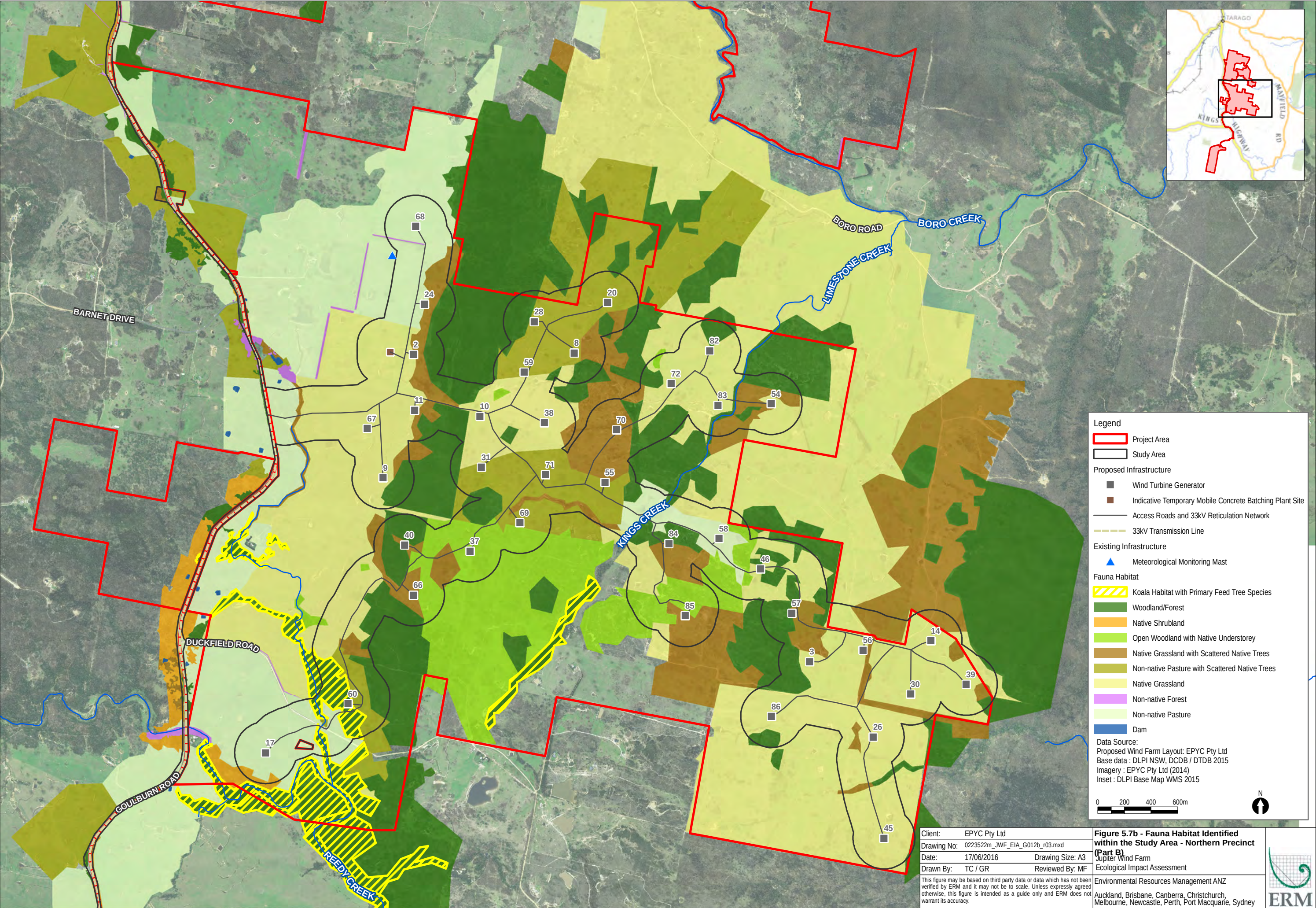
Habitat Types

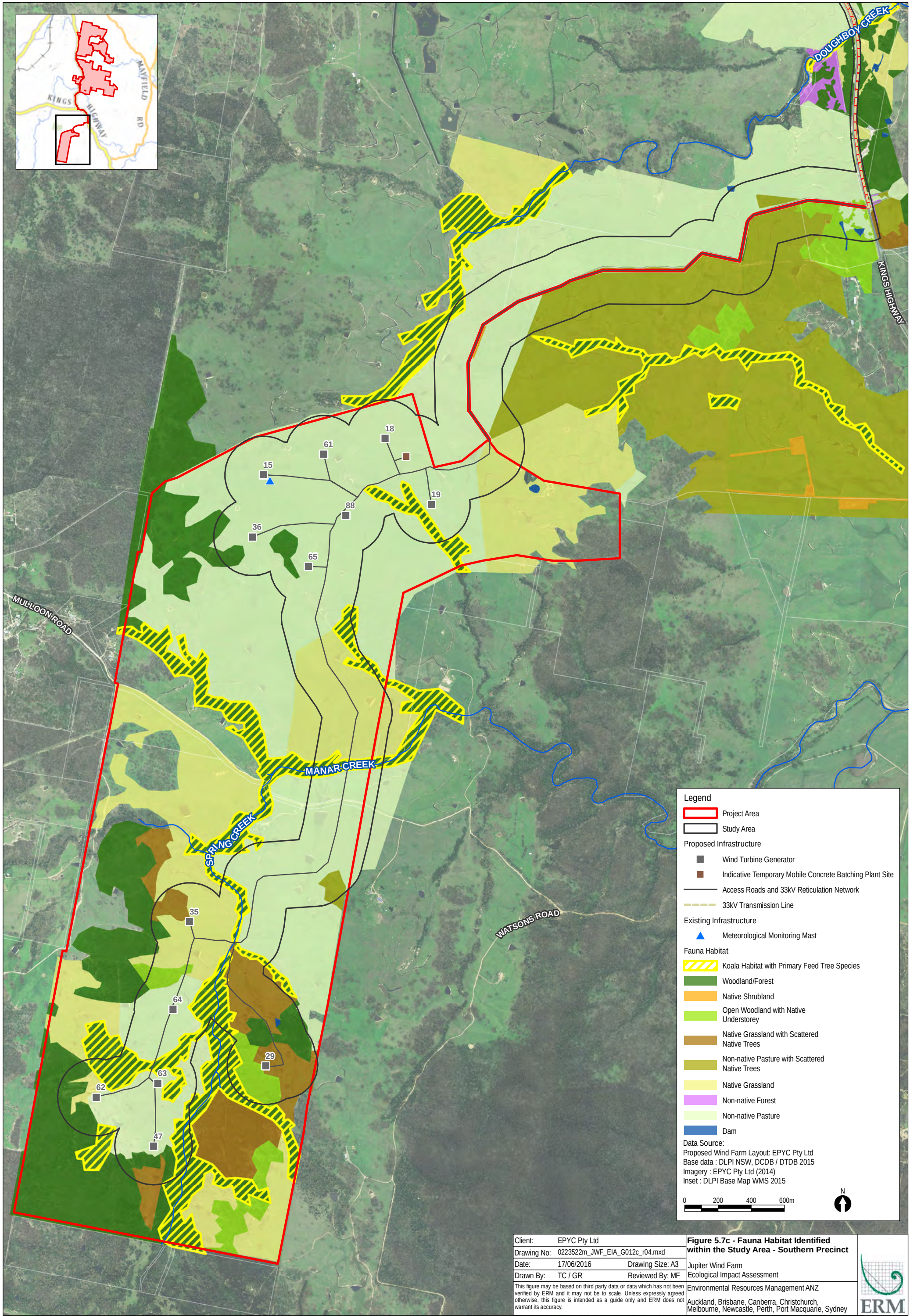
A range of fauna habitats were observed within the Study Area. These habitat types are described below and have been grouped based on fauna habitat features, vegetation structure and key vegetation species present. The various habitat types are displayed on *Figure 5.7*. Vegetation Types were used to quantify the amount of each habitat type present within the Study Area (refer *Table 5.9*). Further fauna microhabitat features found within each habitat type are discussed in further detail below (refer to *Section 5.6.2*).

Table 5.8 *Area of Fauna Habitat Type within the Study Area*

Habitat Type	Corresponding Vegetation Zone ID		Study Area (ha)
Native Habitat Types:			
Native Grassland	797_M-G_L	1093_M-G_L	674.31
	888_M-G_L	1334_L	
Native Grassland with Scattered Native Trees	650_M-G_L	1100_M-G_L	332.15
	650_M-G_P	1100_M-G_P	
	680_M-G_L	1110_M-G_L	
	680_M-G_P	1155_M-G_L	
	888_M-G_L	1155_M-G_P	
	888_M-G_P	1334_M-G_P	
	1093_M-G_L		
	1093_M-G_P		
Native Shrubland	Planted Native Vegetation	757_M-G_M	10.30
	650_M-G_S	1093_M-G_S	
	680_M-G_S		
Open Woodland with Native Understory	1334_M-G_G	1334_M-G_M	75.10
	1334_M-G_L		
Woodland/ Forest	650_M-G_M	1100_M-G_G	352.14
	650_M-G_W	1100_M-G_M	
	680_M-G_M	1100_M-G_W	
	680_M-G_W	1150_M-G_G	
	888_M-G_G	1150_M-G_M	
	888_M-G_M	1155_M-G_G	
	1093_M-G_G	1155_M-G_M	
	1093_M-G_M		
	1093_M-G_W		
Non-native Habitat Types:			
Non-native Pasture (includes non-native pasture with scattered native trees)	NA		790.29
Non-native Forest	NA		8.58
Other Land Cover:			
Hardstand	NA		24.81
Dams	NA		1.35
Subtotal	Native Habitat Types		1444.00
Subtotal	Non-native Habitat Types		798.87
Subtotal	Other Land Cover		26.16
Total			2269.03







Native Grassland

Native grassland habitats in the Study Area are dominated by native grassy groundcover with some non-native pasture species, and, in some locations, isolated native trees (refer *Photograph 5.3*). These grasslands are derived from a variety of different woodland and forest communities and are typically altered from their original species composition due to grazing.

This habitat type is typically dominated by native Wallaby Grasses (*Rytidosperma* spp.) and Speargrasses (*Austrostipa* spp.), with often only hardy and resilient native herbs and forbs ubiquitous to pastures persisting. Native grasslands derived from the Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion often displayed higher forb diversity.

Common species recorded within this habitat type include the Three-toed Earless Skink (*Hemiergis decresiensis*) and common bird species such as the Australian Magpie (*Cracticus tibicen*) and the Nankeen Kestrel (*Falco cenchroides*), among others. Some common frog species such as the Spotted Marsh Frog (*Limnodynastes tasmaniensis*) and the Smooth Toadlet (*Uperoleia laevis*) were recorded within these grassland areas where nearby ephemeral pools or drainage features were present.

The threatened Scarlet Robins were recorded in open grassland areas especially where scattered trees were present or close to houses and gardens. Areas of native grassland dominated by tussock grasses, such as Kangaroo Grass, have potential to provide suitable habitat for the threatened Striped Legless Lizard.

Photograph 5.3 ***Native Tussock Grassland within the Study Area***



Non-native Pasture

Large amounts of the Study Area comprise non-native grasslands dominated by introduced pasture grass species (refer *Photograph 5.4*). In some cases, these were improved with evidence of grading, ploughing and it is likely that fertiliser had been applied. This habitat is not likely to be important for any threatened fauna although may support common species such as those listed above. This vegetation type is widespread throughout the Study Area.

Photograph 5.4 *Non-native grassland with Scattered Trees within the Study Area.*



Scattered trees were present in areas of both native and non-native grassland. These are typically remnant trees and may provide foraging resources for insectivorous birds and provide roosting habitat for hollow-nesting birds such as the Eastern Rosella (*Platycercus eximius*) and microbats.

Woodland and Forest

Woodland and forest habitat within the Study Area is typically fragmented and patchy with the largest stands often occurring on ridges and slopes, most likely due to anthropogenic landscape modification by preferential clearance of the flatter, more fertile areas for agricultural pasture development. Areas of forest exist in the south, north and east of the Study Area connected to large areas of continuous forest that extend beyond the PA. The level of disturbance was variable across the Study Area with several areas grazed by cattle and sheep.

The majority of the forests within the Study Area are dry sclerophyll forest communities with a grassy or sparse heathy understorey (refer *Photograph 5.5* and *Photograph 5.6*). Higher densities of midstorey shrubs and small trees typically occurred on the slopes of small watercourses or where previously cleared areas have been allowed to regenerate.

Fallen timber is prevalent throughout areas of woodland, forest and scattered trees, and often includes large branches with hollows. The fallen timber provides a microhabitat feature preferred by some woodland bird species for foraging, and shelter habitat for small mammals and reptiles such as the Three-toed Earless Skink and the Common Dunnart (*Sminthopsis murina*).

Woodland birds were most abundant and diverse where shrubs and ground layer vegetation are present and where mosaic woodland habitats occur. These areas provide suitable habitat of a number of threatened species including the Speckled Warbler (*Chthonicola sagittata*), Varied Sittella (*Daphoenositta chrysoptera*) and Scarlet Robin (*Petroica boodang*). Mammals recorded within the woodland habitats include the Sugar Glider (*Petaurus breviceps*), Common Brushtail Possum (*Trichosurus vulpecula*) and Common Ringtail Possum (*Pseudocheirus peregrinus*).

Some areas of open grassy woodlands may also provide habitat for some threatened species such as the Pink-tailed Worm-Lizard (*Aprasia parapulchella*) and the Little Whip Snake. The threatened Diamond Firetail (*Stagonopleura guttata*) was recorded in the Study Area within these habitats.

Important components of the forests include the presence of Black She-oak which are patchily distributed through the woodland areas of the Study Area. Larger stands of these trees are particularly common within the woodland in the northern precinct. Black She-oak provides the most important foraging habitat for the threatened Glossy Black-Cockatoo (*Calyptrorhynchus lathami*), which was recorded in the Study Area within these habitats. The highest density of Black She-oak trees and signs of foraging were in a small portion of the northern precinct, shown in *Photograph 5.7*.

Ribbon Gum - Snow Gum grassy forest, is mainly distributed in the southern portion of the Study Area and is dominated by Ribbon Gum which is listed as the primary feed tree for Koala within the region (refer *Section 5.2.4* and *Chapter 6*).

Discrete areas of Yellow Box - Blakely's Red Gum grassy woodland were found in high ecological condition and a small patch in the central part of the Study Area. This community is often favoured by the threatened Superb Parrot, especially when the Yellow Box is flowering. A high abundance of seeding grasses present in this area also provides suitable food for the Superb Parrot and the Diamond Firetail. The high quality Yellow Box-Blakely's Red Gum grassy woodland area is mapped on *Figure 5.6*.

Photograph 5.5 Silvertop Ash - Narrow-leaved Peppermint Open Forest on ridges, with Largely Absent Understory



Photograph 5.6 Inland Scribbly Gum - Brittle Gum low woodland of the Eastern Tablelands with Grassy Understory and Fallen Timber



Photograph 5.7 *Black She-oak with Abundant Foraging Resources for the Glossy Black-cockatoo.*



Non-Native Trees (Primarily Pines)

Some small areas of non-native trees exist within the Study Area; these are largely comprised of monocultures with stands of Pine Trees, which are understood to have been planted primarily as wind breaks. These stands of non-native trees are of lower fauna habitat value, although some common woodland bird species such as the Rufous Whistler (*Pachycephala rufiventris*) and the Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*) may use these areas for foraging purposes and for shelter. These areas also have the potential to provide foraging resources for threatened woodland bird species such as the Scarlet Robin, although they are unlikely to be of high significance for these species.

Native Shrubland

This habitat type is a shrubby 'derived' form, which is likely regenerating from past clearance. It is dominated by heathy shrubs and juvenile, regenerating tree species. Native grasses are also present. This habitat has no HBTs or abundant eucalypt flowering resources, however a large number of common woodland birds were recorded, with good shelter provided by the shrubs and abundant insects and grasses for foraging.

Dams and Other Aquatic Habitats

Many small farm dams exist within the PA, however few are within the Study Area. The largest dam within the PA is approximately one hectare in size, with the majority a fraction of this size. The level of disturbance of dams within the PA is highly variable, ranging from dams, which are turbid and highly eroded by cattle and sheep to those which have clear water with submerged aquatic vegetation and fringing emergent reeds and sedges (refer *Photograph 5.8*).

The dams provide habitat for a number of water birds including the White-necked Heron (*Ardea pacifica*), Hardhead (*Aythya australis*) and Grey Teal (*Anas gracilis*). The Eastern Snake-necked Turtle (*Chelodina longicollis*) was also recorded frequently within and surrounding the farm dams. It is likely that terrestrial species of mammal including macropods and feral species such as the Pig (*Sus scrofa*) benefit from the constant water source which the dams provide. Several common frogs species were recorded breeding in the dams including Common Froglet (*Crinia signifera*) the Eastern Dwarf Tree Frog (*Litoria fallax*). No fish were observed within the dams, however targeted fish surveys were not conducted.

Photograph 5.8 *Small Farm Dam with Fringing Emergent Vegetation*



Other aquatic habitats recorded within the Study Area included small ephemeral watercourses, which were observed to hold water in small pools after recent rain events (refer to *Photograph 5.9*). Many of these watercourses are constructed or are small, modified ephemeral watercourses. Similarly, to the farm dams, the level of disturbance of these watercourses is highly variable across the site, ranging from highly eroded and turbid to those with fringing/aquatic vegetation.

Photograph 5.9 *Small Drainage Feature after Recent Rain*

These areas were observed to provide habitat for a number of frog species including the Common Froglet (*Crinia signifera*), Spotted Marsh Frog and Smooth Toadlet. One permanent watercourse, Reedy Creek, was recorded within the Study Area. Reedy Creek flows to the south east from just south of WTG 19. The creek is not likely to provide suitable habitat for threatened fish species such as the Macquarie Perch (*Macquaria australasica*) as it is too small

and has poor connectivity to the Shoalhaven River with several sections providing barriers to fish movement.

5.6.2 *Fauna Microhabitat Features*

Exposed Rock

Small areas of exposed rock are scattered throughout the Study Area particularly on the hills and ridgelines (refer *Photograph 5.10*). In the majority of these areas the rocks were deeply embedded in the soil with few loose rocks present. For this reason few of the rocks present could be overturned by hand. Cracks in the rocks were typically small and suitable to shelter small species such as the Dark-flecked Garden Skink (*Lampropholis delicata*). The features were found with the overarching fauna habitat types: woodland/forest, native and non-native grassland.

Small areas of larger cracking boulders were observed within watercourse in the south of the PA, which provides shelter for reptiles such as the Cunninghams Skink (*Egernia cunninghami*). The majority of the rock structures and cracks were not large enough to provide suitable habitats for larger species such as the Spotted-tailed Quoll, although the outcrops were searched for latrine sites.

Photograph 5.10 Area of Rocky Habitat within Grassland



Bat Roosting Habitat

A patch of Crown Land containing disused mines occurs surrounded by, but excised from, the PA (refer *Figure 2.1*). These disused mines were investigated to determine their suitability as roosting sites for microbats. The mines were considered to have low potential as roosting sites as shafts were narrow (approximately 1.5 m wide) and deep, which is likely to make it difficult for bats to enter and exit the shaft. The substrate was unconsolidated soil and

rock, which was crumbly at the entrance, and the shafts have smooth sides. This is expected to make it difficult for any bats to roost within the shaft itself.

A stone bridge over Reedy Creek may offer more suitable bat roosting habitat although none were recorded. There were a number of small cracks and the bridge may be used seasonally as a roosting site by bats, although it is unlikely to provide an important maternity roost for a large number of bats.

Hollow Bearing Trees (HBTs)

HBTs were present throughout the majority of the woodland, forest and areas where scattered trees were present. Many of the HBT had multiple hollows with an average of 1.6 hollows per tree. A summary of the HBT records from the Study Area is provided in *Table 5.10*, and the complete data is provided in *Annex D*.

Table 5.9 **HBT summary**

Size Class	Definition	Values	Number of Hollows	Number of trees with Hollows ¹
Small	0 – 5 cm	Likely to provide habitat to bats, small hollow-nesting birds, such as Pardalotes, and mammals such as Sugar Gliders (<i>Petaurus breviceps</i>).	153	97
Medium	5 – 10 cm	Likely to provide habitat to several common species including Crimson Rosella (<i>Platycercus elegans</i>), Ringtail Possum (<i>Pseudocheirus peregrinus</i>) and Brushtail Possum (<i>Trichosurus vulpecula</i>).	146	110
Large	>10 cm	May provide habitat for larger hollow nesting birds including small owls and Cockatoos.	103	83
Total			402	249

1. Total number of trees with hollows is not a sum of all values in this column due to the scoring of multiple size classes of hollows from a single tree .

A number of signs of use by fauna were observed. Many of the small and medium sized hollows had wear marks around the lip of the hollow. In most cases arboreal mammals were the most likely group to be causing the wear. No widening marks from parrots were recorded, although on some hollows the wear marks were restricted to the lowest point of the hollow and this may have been from nesting birds. A large number of HBTs had scratches on the trunk, many of which are likely to be from possums and Lace Monitor (*Varanus varius*).

Very few hollows recorded were large enough to support large owls such as the Powerful Owl (*Ninox strenua*) and those that were large enough were typically hollow trunks without the lipped-rim preferred by the species. Several hollows were found which may provide habitat for smaller species such as the Southern Boobook (*Ninox novaeseelandiae*) and the Glossy Black-cockatoo. Despite searching for signs of nesting for owls and cockatoos, none were recorded.

5.7 FAUNA SPECIES

The total number of native species recorded during the field surveys was 153, comprising 10 frogs, 13 reptiles, 103 birds, 10 non-volant mammals and up to 17 bats. Of these species, nine threatened birds and two threatened bats were recorded, all of which are listed as Vulnerable under the TSC Act. The locations in which these species were observed are shown in *Figure 5.9* and *Figure 5.12*.

Detection of fauna species can be influenced by weather conditions during surveys. During the field surveys, weather conditions were generally consistent with seasonal conditions predicted for the region. Weather observations are provided in full in *Annex D*.

5.7.1 *Golden Sun Moth*

GSM or signs of GSM were not observed in the Study Area, despite surveys being undertaken during suitable weather conditions. No other evidence of the species presence was observed. For additional information, refer to the specific survey report in *Annex F*.

There is a significant amount of derived native grassland within the Study Area, which on initial inspection appears suitable for GSM, as high densities of chief larval feed species, Wallaby Grasses, occur. The majority of these areas are however derived from vegetation communities, which are not normally associated with the GSM, predominately PCT ID 1093: Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion and PCT ID 888: Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion, and to a lesser degree, communities dominated by Snow Gum. The presumed absence of GSM from these communities may relate to unfavourable soil type, altitude and lower average temperatures.

A small proportion of the Study Area contained derived grassland in which GSM can be associated PCT ID 1334: Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion. The composition of the grassland was approximately 40% Wallaby Grass consisting of Red-anther Wallaby Grass (*Rytidosperma pallidum*) and a Ringed Wallaby Grass (*Rytidosperma* sp.) and approximately 50% Kangaroo Grass (*Themeda triandra*).

5.7.2 *Frogs*

Ten common frog species were recorded in the Study Area, none of which are listed as threatened under either the TSC Act or EPBC Act (refer to *Table 5.11* and *Annex D*). Frog activity was low during the initial targeted frog survey conducted in March 2014. This is due to the preceding dry conditions, although the surveys were conducted after recent rainfall. Targeted frog surveys were also conducted during optimal survey conditions during November 2014, which were warm, humid and following rainfall and during wet and cooler conditions on December 2014. A greater diversity of species were recorded, including several *Litoria* species, which were not detected during prior surveys. Two species, the Eastern Banjo Frog (*Limnodynastes dumerili*) and the Whistling Tree Frog (*Litoria verreauxi*) were recorded only during the tile surveys targeting Striped Legless Lizard.

Breeding habitat for frogs was found in several locations within the Study Area, ranging from small ephemeral creeks and pools to medium sized dams. Several dams had large amounts of aquatic vegetation and marginal emergent vegetation and provide suitable habitat for a number of frog species.

Table 5.10 *Frog Species Recorded during Field Surveys*

Common Name	Scientific Name	EPBC Act	TSC Act
Common Eastern Froglet	<i>Crinia signifera</i>	-	-
Beeping Froglet	<i>Crinia parinsignifera</i>	-	-
Eastern Banjo Frog	<i>Limnodynastes dumerili</i>	-	-
Striped Marsh frog	<i>Limnodynastes peronii</i>	-	-
Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>	-	-
Southern Brown Tree Frog	<i>Litoria ewingii</i>	-	-
Eastern Dwarf Tree Frog	<i>Litoria fallax</i>	-	-
Peron's Tree Frog	<i>Litoria peronii</i>	-	-
Whistling Tree Frog	<i>Litoria verreauxi</i>	-	-
Dusky Toadlet	<i>Uperoleia fusca</i>	-	-
Smooth Toadlet	<i>Uperoleia laevisgata</i>	-	-

5.7.3 *Reptiles*

Thirteen reptile species were recorded during the field surveys, including nine lizards, three snakes and one turtle (refer to Table 5.12).

Table 5.11 *Reptile Species Recorded during Field Surveys*

Common Name	Scientific Name	EPBC Act	TSC Act	Comment
Three-lined Skink	<i>Acritoscincus duperreyi</i>	-	-	under tiles and debris
Jacky Lizard	<i>Amphibolurus muricatus</i>	-	-	opportunistic offsite
Eastern Long-necked Turtle	<i>Chelodina longicollis</i>	-	-	opportunistic, in farm dams
Cunningham's Skink	<i>Egernia cunninghami</i>	-	-	opportunistic
Three-toed Earless Skink	<i>Hemiergis decresiensis</i>	-	-	under tiles and debris
Eastern Water Dragon	<i>Intellagama lesueurii</i>	-	-	opportunistic
Dark-flecked Garden Skink	<i>Lampropholis delicata</i>	-	-	under tiles
Common Garden Skink	<i>Lampropholis guichenoti</i>	-	-	under tiles and debris
Tiger Snake	<i>Notechis scutatus</i>	-	-	opportunistic
Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>	-	-	opportunistic offsite
Brown Snake	<i>Pseudonaja textilis</i>	-	-	opportunistic
Blotched Blue-tongue	<i>Tiliqua nigrolutea</i>	-	-	opportunistic
Lace Monitor	<i>Varanus varius</i>	-	-	opportunistic

Two species, the Red-bellied Black Snake (*Pseudechis porphyriacus*) and the Blotched Blue-tongue (*Tiliqua nigrolutea*) were only recorded outside of the Study Area, during offsite raptor surveys, however it is likely that these species occur within the Study Area.

None of the species recorded are listed as threatened under either the EPBC Act or the TSC Act and they are likely to occur throughout the Study Area in suitable habitat. The majority of the skink species were recorded most frequently during the tile checking for Striped Legless Lizard and were also observed during turning over other refugia (including timber, rocks and corrugated metal sheets). All of the species, other than the skinks, were recorded incidentally during other field surveys.

Six survey periods involving checking the artificial tile refugia were undertaken from October 2014 to January 2015. Four species were recorded with the total number of individuals 57 (refer to Table 5-13). There were a number of unidentified skinks recorded, which were not identified to species level as they escaped capture, typically where several individuals were found under the same tile. From brief observations none of the unidentified species had characteristics of any of the threatened target species. It was most likely that the skinks were one of the four species identified from captured individuals.

Table 5.12 *Reptile Species Recorded during the Targeted Tile Surveys*

Common Name	Species name	Grid 1	Grid 2	Grid 3	Grid 4	Grid 5	Grid 6	Total
Three-lined Skink	<i>Acritoscincus duperreyi</i>	-	-	-	1	-	8	9
Three-toed Earless Skink	<i>Hemiergis decresiensis</i>	3	1	3	2	-	5	14
Dark-flecked Garden Skink	<i>Lampropholis delicata</i>	3	1	1	-	-	-	5
Common Garden Skink	<i>Lampropholis guichenoti</i>	1	-	-	1	-	-	2
Tentative <i>Lampropholis</i> Skink	Skink (likely <i>Lampropholis</i>)	8	6	1	-	6	-	21
Unidentified Skink	Unidentified Skink	-	1	-	1	-	4	6
Total								57

5.7.4 *Birds*

In total 109 bird species were recorded during the field surveys, from December 2013 to March 2015. For a full species list refer to Annex D. Nine threatened species were recorded in the Study Area and two threatened species were recorded within the locality. One Migratory species was recorded in the Study Area and one migratory species was recorded in the locality. The following sub-sections provide a breakdown of results, initially with consideration of threatened species, followed by the results from the various bird survey methods.

Threatened Birds and Migratory Species Recorded

Nine threatened species were recorded within the PA all of which are listed Vulnerable on the TSC Act. None of the threatened species recorded were observed flying at RSA height. These species are detailed in *Table 5.14* and displayed on *Figure 5.12*.

One additional Migratory species (Common Sandpiper, *Actitis hypoleucos*) was recorded outside the PA, but within the locality. Approximately 70 birds were recorded on the periphery of Lake Bathurst approximately 6 km north of the Study Area.

Table 5.13 Threatened and Migratory Birds Recorded in Field Surveys in the PA

Species	Scientific Name	TSC Act	EPBC Act	Number of Individuals Recorded	Number of Occasions Recorded	Description of Species Occurrence
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>	V	-	12	5	Observed and also recorded aurally in small groups throughout the survey period. They were observed foraging on several occasions on Black She-oak (<i>Allocasuarina littoralis</i>). No signs of tree hollows used for breeding were recorded for this species. All of the individual observed were recorded flying below RSA height.
Glossy Black-cockatoo feeding signs	<i>Calyptorhynchus lathami</i>	V	-	19	19	Feeding signs were recorded regularly throughout suitable areas of habitat within forest and woodland containing Black She-oak, which is the main food source for the species within the locality.
Speckled Warbler	<i>Chthonicola sagittata</i>	V	-	4	1	Recorded during BUS, and may occur throughout forest and woodland areas of the Study Area. Likely to be part of a resident breeding population.
Spotted Harrier	<i>Circus assimilis</i>	V	-	1	1	Recorded in an open area flying below RSA height.
Varied Sittela	<i>Daphoenositta chrysoptera</i>	V	-	17	2	Recorded during BUS, and may occur throughout forest and woodland areas of the Study Area. Likely to be part of a resident breeding population.
White-fronted Chat	<i>Epthianura albifrons</i>	V	-	2	2	Recorded in open pasture areas including on the top of a rocky hill with patches of Bracken (<i>Pteridium esculentum</i>) and at another pasture location adjacent to cropland.
White-throated Needletail	<i>Hirundapus caudacutus</i>	-	Mi	120	2	On both occasions the species was recorded foraging in open habitat, occupying a wide range of flying heights including within RSA height. Approximately 100 individuals were recorded on a single occasion.
Blue-billed Duck	<i>Oxyura australis</i>	V	-	6	1	Recorded once.

Species	Scientific Name	TSC Act	EPBC Act	Number of Individuals Recorded	Number of Occasions Recorded	Description of Species Occurrence
Scarlet Robin	<i>Petroica boodang</i>	V	-	80	30	Recorded in 10 of the 23 survey events and was commonly encountered throughout the Study Area, largely within forested areas but also within cleared areas of pasture with minimal or absent scattered trees or other forms of vegetation. Likely to be part of a resident breeding population.
Diamond Firetail	<i>Stagonopleura guttata</i>	V	-	24	5	Records were typically from open locations, especially where grasses were in seed. They were also observed in roadside weedy patches where exotic grasses and forbs provided abundant seed and dense cover for the species.

- The number of occasions recorded relates to separate occasions when the species was observed, which could be separated by spatially or temporally.
- Glossy Black-cockatoo feeding signs were chewed *Allocasuarina littoralis* fruit.
- EPBC Act Status: Mi = Migratory
- TSC Act Status: V = Vulnerable

Non-Native Species

Five non-native bird species were recorded, none of which were recorded in high abundances within the Study Area. One species, the European Starling (*Sturnis vulgaris*) was recorded in a large flock of several hundred individuals, within the locality. All of the surveys conducted in woodland areas of the Study Area recorded no or very few non-native species. The majority of non-native species were largely restricted to open areas of farmland and on the periphery of forested areas, with highest abundances in weedy areas close to farms and buildings.

Raptor Surveys

A total of forty five (45) bird species were observed during the raptor surveys and the full results table can be found in *Annex D*. Four raptor species were recorded, including the Wedge-tailed Eagle (*Aquila audax*), White-bellied Sea-Eagle (*Haliaeetus leucogaster*), Brown Falcon (*Falco berigora*) and Nankeen Kestrel (*Falco cenchroides*). Table 5.15 shows the frequency of each raptor species recorded at the on-site survey sites (denoted by "RS##") and the off-site control sites (denoted by "RC##"). Wedge-tailed Eagles were the most frequently recorded species with 58 individuals recorded in total. Nankeen Kestrels and Brown Falcons were frequently recorded. One White-bellied Sea Eagle was observed at a control site. There were three observations of raptors which could not be identified to species level as the sightings were either too brief or the raptor was too far away to be identified confidently.

Table 5.14 **Number of Raptors Recorded at Each of the Raptor Survey Sites**

Raptor Survey Station	Wedge-tailed Eagle (<i>Aquila audax</i>)	White-bellied Sea-Eagle (<i>Haliaeetus leucogaster</i>)	Brown Falcon (<i>Falco berigora</i>)	Nankeen Kestrel (<i>Falco cenchroides</i>)	Unidentified Raptor	White-throated Needletail (<i>Hirundapus caudactutus</i>)
RS01	5	-	1	4		
RS02	5	-	3			
RS03	6	-			2	
RS04	5	-	1	1		
RS05	9	-	1	4	1	
RS06	2	-		3		
RS08		-		1		
RS09		-		2		
RS Total	32	0	6	15	3	0
RC01	6	-				
RC02	4	1				
RC03	7	-	1	1		
RC04	3	-		1		20
RC05	4	-		2		
RC06	2	-		1		
RC Totals	26	1	1	5	0	20

All of the raptor species were observed flying within the RSA height (ie between 5 m and 173 m AGL). A species was considered to be flying at RSA height if it was recorded flying within the RSA height range at any time, even if it also flew below or above RSA height during the observation period. Nankeen Kestrels and Brown Falcons were typically observed below RSA height or within the lower to mid-range of RSA height. Few Wedge-tailed Eagles were observed below RSA height, with the majority recorded in the upper reaches of RSA height or above RSA height (refer to *Table 5.16*, *Table 5.17* and *Annex D*).

Table 5.15 *Percentage of Raptors Flying Relative to RSA Height, According to Species Recorded On-Site*

Species Name	Common Name	Percentage recorded relative to RSA Height			Total number recorded
		Below RSA	Within RSA	Above RSA	
<i>Aquila audax</i>	Wedge-tailed Eagle	3	62	34	32
<i>Falco cenchroides</i>	Nankeen Kestrel	53	47		15
<i>Unidentified Raptor</i>	Unidentified Raptor	33	67		3
<i>Falco berigora</i>	Brown Falcon	50	33	17	6

1. RSA includes the range between 50 and 173 m AGL.

Table 5.16 *Percentage of Raptors Flying Relative to RSA Height, According to Species Recorded Off-Site*

Species Name	Common Name	Percentage recorded relative to RSA Height			Total number recorded
		Below RSA	Within RSA	Above RSA	
<i>Aquila audax</i>	Wedge-tailed Eagle		77	23	26
<i>Falco cenchroides</i>	Nankeen Kestrel	80	20		5
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		100		1
<i>Hirundapus caudactutus</i>	White-throated Needle-tail		100		20
<i>Falco berigora</i>	Brown Falcon			100	1

1. RSA includes the range between 50 and 173 m AGL.

There were no raptor nests recorded during the field surveys, despite the availability of suitable nesting habitat.

In addition to Raptors, one migratory species was recorded during the raptor surveys. Twenty White-throated Needle-tail (*Hirundapus caudactutus*) were observed flying within RSA height.

BUS

Sixty seven (67) species were recorded during the BUS. For the survey locations and a full species list refer to *Figure 4.3* and *Annex D*. Three species listed as Vulnerable under the TSC Act were observed: the Speckled Warbler, Scarlet Robin and Varied Sittella. The Speckled Warbler and the Varied Sittella were both only recorded once during the BUS surveys and are only likely to occur within the forested and wooded areas of the Study Area. In contrast the Scarlet Robin was recorded in 10 of 23 surveys and was commonly encountered throughout the Study Area during other field surveys including cleared areas of pasture with minimal or absent scattered trees or other forms of vegetation.

The majority of species observed were woodland birds, with several species also likely to forage in more open areas such as Sulphur-crested Cockatoo (*Cacatua galerita*). Wedge-tailed Eagles (*Aquila audax*) were observed on two occasions, flying above the canopy at approximately 25 m to 30 m. This species is likely to utilise emergent trees for nesting, while typically hunting in more open areas. Several species were unlikely to utilise woodland habitat and were recorded flying over the woodland; these include the Great Cormorant (*Phalacrocorax carbo*), Australian White Ibis (*Threskiornis molucca*) and Australian Pelican (*Pelecanus conspicillatus*).

The most abundant birds recorded within the woodland bird surveys were Thornbills which were often recorded in mixed flock containing Yellow-rumped (*Acanthiza chrysorrhoa*), Buff-rumped (*A. reguloides*) and Brown Thornbills (*A. pusilla*). Species which were not especially abundant, but occurred consistently in the majority of sites were the White-throated Treecreeper (*Cormobates leucophaea*) (19 surveys), Australian Magpie (*Cracticus tibicen*) (18 surveys) and Crimson Rosella (*Platycercus elegans*) (18 surveys).

Superb Parrot Surveys

No Superb Parrots or signs of the species were recorded during the specific Superb Parrot transect, nor during any of the other field surveys. Suitable foraging resources were recorded in the Yellow Box - Blakely's Red Gum grassy woodland.

Water Birds

Twenty species of waterbirds or species associated with the vegetation surrounding water bodies were recorded (refer *Table 5.18*). The majority of these species were recorded on or adjacent to dams within the PA. This included one threatened species, the Blue-billed Duck (refer to threatened species discussion below). Three species, the Black Swan (*Cygnus atratus*), Black-winged Stilt (*Himantopus himantopus*) and Common Sandpiper (*Actitis hypoleucos*) were only observed in Lake Bathurst which is outside of the Study Area but within the locality.

Table 5.17 *Waterbirds or Species Associated with Aquatic Habitats Recorded Within the Locality*

Common Name	Scientific Name	EPBC Act Status	TSC Act Status
Australian Reed-Warbler	<i>Acrocephalus australis</i>	-	-
Grey Teal	<i>Anas gracilis</i>	-	-
Pacific Black Duck	<i>Anas superciliosa</i>	-	-
Hardhead	<i>Aythya australis</i>	-	-
Australian Wood Duck	<i>Chenonetta jubata</i>	-	-
Silver Gull	<i>Chroicocephalus novaehollandiae</i>	-	-
Black Swan	<i>Cygnus atratus</i>	-	-
White-faced Heron	<i>Egretta novaehollandiae</i>	-	-
Eurasian Coot	<i>Fulica atra</i>	-	-
Black-winged Stilt	<i>Himantopus himantopus</i>	-	-
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	-	-
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>	-	-
Blue-billed Duck	<i>Oxyura australis</i>	-	V
Australian Pelican	<i>Pelecanus conspicillatus</i>	-	-
Great Cormorant	<i>Phalacrocorax carbo</i>	-	-
Pied Cormorant	<i>Phalacrocorax varius</i>	-	-
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>	-	-
Common Sandpiper	<i>Actitis hypoleucos</i>	Mi	-
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	-	-
Australian Shelduck	<i>Tadorna tadornoides</i>	-	-
Australian White Ibis	<i>Threskiornis molucca</i>	-	-

1. EPBC Act Status: Mi = Migratory

2. TSC Act Status: V = Vulnerable

Owls and Other Nocturnal Birds

One common owl species, the Southern Boobook (*Ninox novaeseelandiae*) and an Owlet Nightjar (*Aegotheles cristatus*) was recorded aurally during call playback and spotlighting surveys.

No threatened owl species or signs of threatened owl species were detected during the field surveys. Few of the HBTs recorded within the Study Area are likely to provide suitable nesting sites for the threatened owl species.

5.7.5

Bats

Each bat call detected was assigned a confidence ranking of either:

- **Definite** - the species can be confirmed as present from the call;
- **Probable** - it is most likely that the species was recorded, however there is some call signature overlap with other species; or
- **Possible** - the species may occur however the call cannot be differentiated from another species.

Ten (10) species of bat were recorded with Definite probability, and additional species were recorded with Possible or Probable confidence. Table 5.19 details the probability of each species, and the level at which the detection unit was located (ie at ground level or mast height).

Table 5.18 Bats Species Recorded Within the Study Area

Scientific Name	Common Name	EPBC Act	TSC Act	Ground Units	Mast Units
Definite Records					
<i>Chalinolobus gouldi</i>	Gould's Wattled Bat	-	-	Def	Def
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	-	-	Def	Def
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing Bat	-	V	Def	Def
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	-	V	Def	Def
<i>Scotorepens balstoni</i>	Eastern Broad-nosed Bat	-	-	Def	Def
<i>Scotorepens orion</i>	Western Broad-nosed Bat	-	-	Def	Def
<i>Tadarida australis</i>	White-striped Freetail Bat	-	-	Def	Def
<i>Vespadelus darlingtoni</i>	Large Forest Bat	-	-	Def	Def
<i>Vespadelus vulturnus</i>	Little Forest Bat	-	-	Def	-
<i>Vespadelus regularis</i>	Southern Forest Bat	-	-	Def	-
Other Records					
<i>Nyctophilus species (N. gouldi or N. geoffroyi)</i>	Gould's Long-eared Bat/Lesser Long-eared Bat	-	-	Either	Either
<i>Mormopterus species</i>	Freetail sp.	-	-	Pos	Pos
<i>Myotis macropus</i>	Southern Myotis	-	V	Pos	-
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	-	V	Prob	Prob
<i>Mormopterus species 2</i>	Eastern Freetail Bat	-	-	Prob	Prob
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	-	V	Prob	Pos

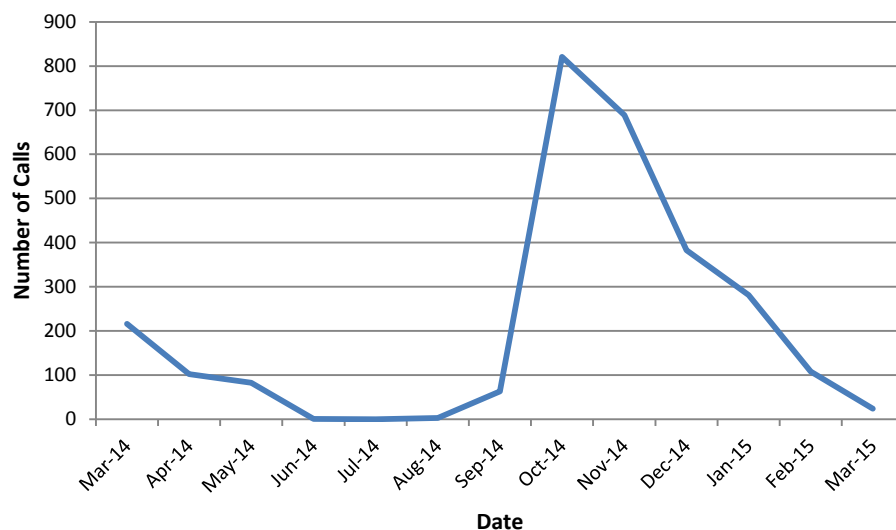
1. Def –Definite, when the species can be confirmed as present from the call;
2. Prob –Probable when it is most likely that the species was recorded, however there is some call signature overlap with other species;
3. Possible – the species may occur however the call cannot be differentiated from another species.
4. Either –Either or both species are likely to have been recorded.
5. V – Species is listed as Vulnerable on the TSC Act.

Up to sixteen species were recorded on the ground based units, with the majority of calls (3160) attributed to three common species: the White-striped Freetail Bat (820 calls), Gould's Wattled Bat (*Chalinolobus gouldi*) (601 calls) and the Large Forest Bat (*Vespadelus darlingtoni*) (627 calls).

The mast units picked up a similar amount of bat diversity as the ground units (refer to *Table 5.19*), however in the majority of cases the number of calls recorded were substantially lower than the ground based units, when accounting for the differing levels of effort.

Figure 5.8 displays the number of bat calls recorded throughout the monitoring period. There is significant seasonal variation with no bats recorded during the winter months of June, July and August. The highest activity was recorded in spring, during October and November. This trend was reflected in most of the species present; however the White-striped Freetail Bat (*Tadarida australis*) drove much of the change, being the most abundant species. During October and November, 55% and 71% of the calls were attributed to the White-striped Freetail Bat respectively.

Figure 5.8 *Total of Bat Calls Recorded per Month from the Mast-mounted Units*



Threatened Species

Potential records of six threatened species were obtained from within the PA, all of which are listed as Vulnerable under the TSC Act. No EPBC listed species were recorded. The locations of the threatened species recorded are shown in *Figure 5.9*, which includes species recorded at all of the three different confidence ratings.

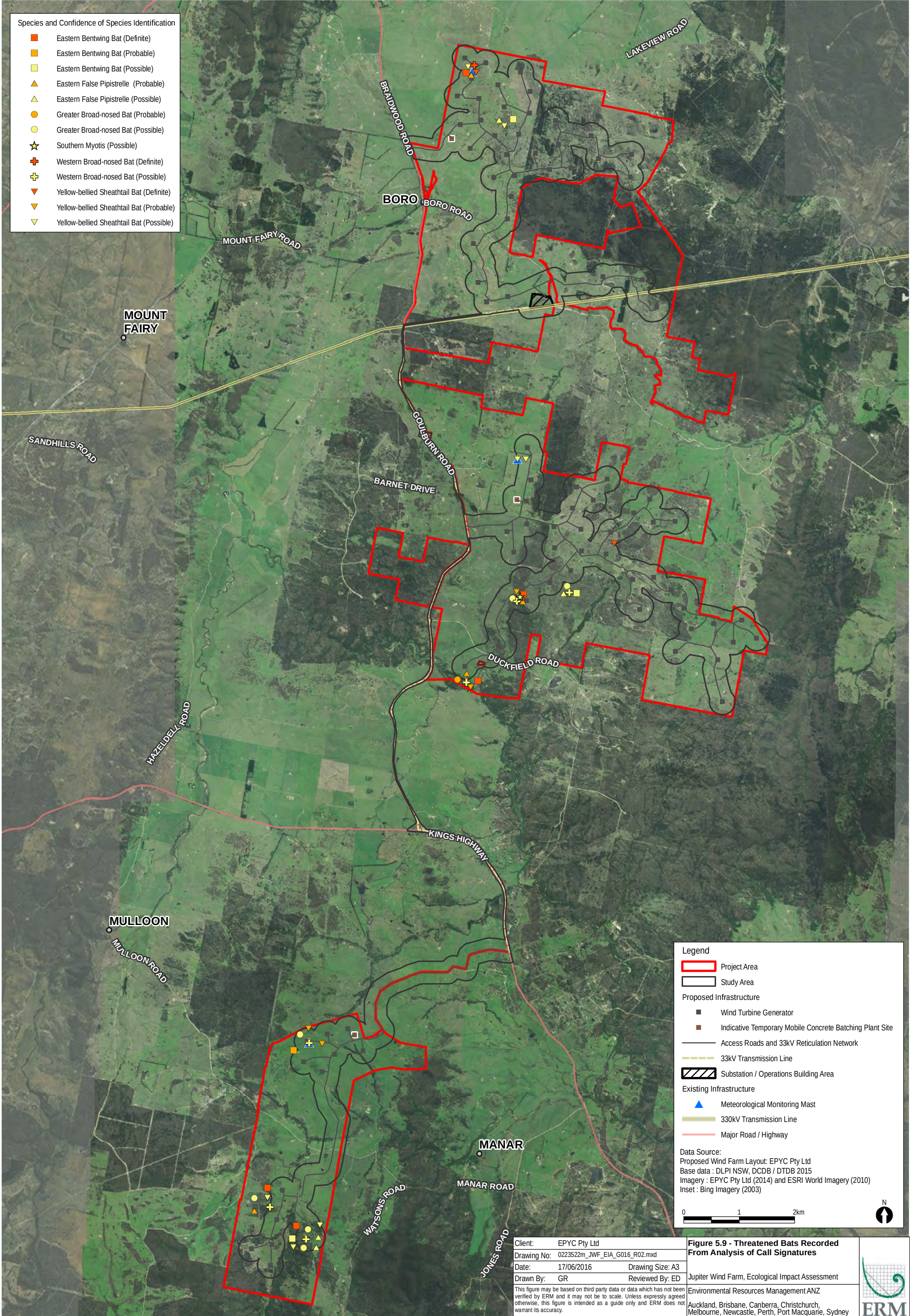
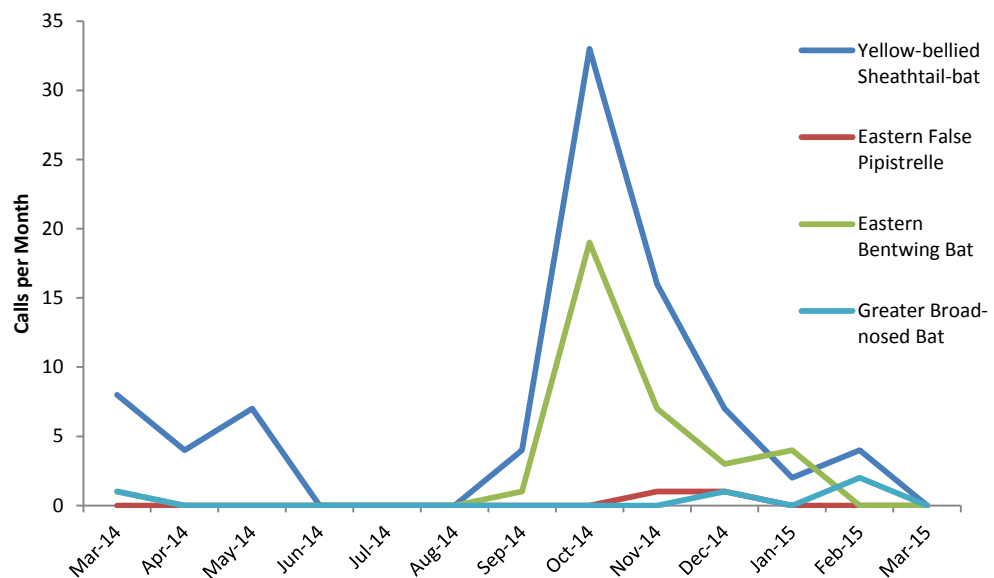


Figure 5.10 displays seasonal variation in the number of calls attributed to threatened species for the mast-mounted units throughout the monitoring period. Species diversity is highest during spring and summer, with call abundances also highest during this period. No threatened species were recorded from June to August. The highest number of calls were attributed to the Yellow-bellied Sheathtail, followed by the Eastern Bentwing Bat.

Figure 5.10 *The Number of Bat Call Recorded per Month for Threatened Species from the Mast-mounted Units*



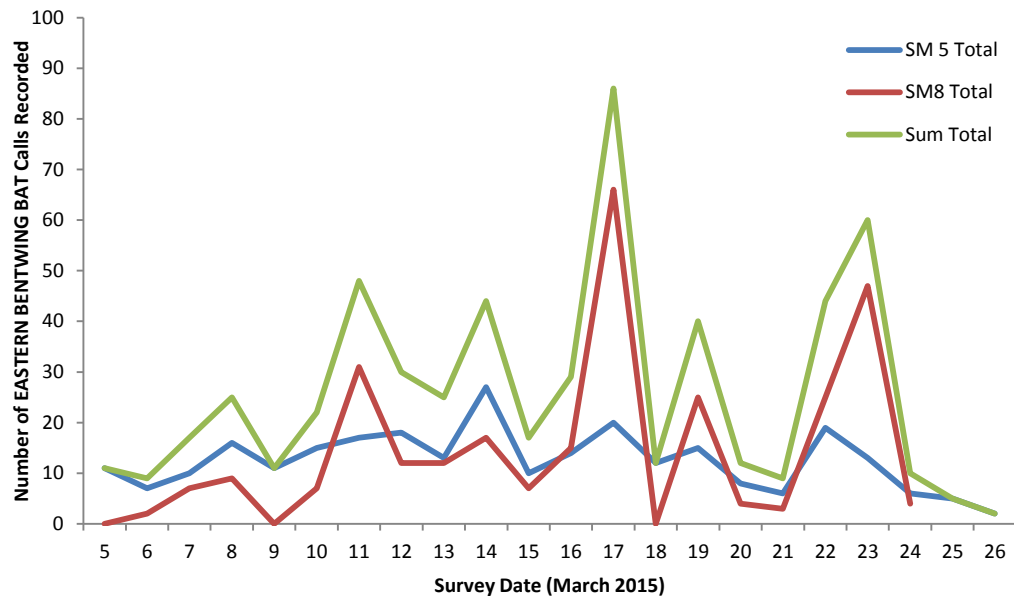
The Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) was recorded very infrequently flying at height, with one Probable call and one Possible call recorded on the mast-mounted units, over the entire survey period (refer to Annex D). The species was possibly detected more frequently on the ground, recorded at seven different locations. The confidence rating for the calls was either Possible or Probable for the majority of the calls. None of the calls were considered Definite due to possible confusion with similar calls emitted by Eastern Broad-nosed Bat (*Scotorepens orion*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Large Forest Bat (*Vespadelus darlingtoni*).

The Yellow-bellied Sheathtail-bat was recorded frequently on the mast units, with the highest activity levels recorded during October and November (refer to Figure 5.10). The species was also recorded on 10 of the ground based units. While some of the higher quality calls could be Definitely attributed to the species, several other calls were given probable or possible confidence based on possible confusion with the White-striped Free-tailed Bat.

The Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) was recorded on two of the mast units with Definite and Probable confidence rankings. The species was also recorded on four of the ground units as Definite and three of the ground units as Possible. Low quality calls can be confused with the Little Forest Bat (*Vespadelus vulturnus*) and the Southern Forest Bat (*Vespadelus regulus*). Specific surveys for the Eastern Bentwing Bat during March 2015

recorded calls on two units (SM 5 and SM 8) with the number of calls recorded provided on *Figure 5.11*. The number of calls fluctuated over the survey period on a nightly basis; however there was no observable longer term trend, or any particularly high pulses which may indicate a migrating event.

Figure 5.11 *Total of Bat Calls Recorded per Month from the Mast-mounted Units*



The Southern Myotis (*Myotis macropus*) was potentially recorded once from a series of ten calls on one of the ground based units in March 2015. These calls were not of sufficient quality to distinguish them from the similar calls emitted by *Nyctophilus* sp.

A call similar to that of the Little Bentwing Bat (*Miniopterus australis*) was possibly recorded at one mast unit from a short series of calls. The quality of the calls were poor and therefore the identification was not definitive. This species has not been recorded south of Wollongong, NSW and therefore it is considered unlikely to occur within the Study Area, furthermore the species typically occurs in well timbered, mesic vegetation, which is largely lacking within the Study Area.

Several calls were attributed to the Greater Broad-nosed Bat at Possible or Probable confidence. Calls from this species may also be confused with similar calls from the Eastern False Pipistrelle and Western Broad-nosed Bat. This species is found in a variety of wooded habitats, most frequently recorded foraging on the edge of forested areas or close above the canopy (OEH 2015). While suitable habitat may occur within the PA, due to the wide range of habitats this species is known to frequent, there are no records within the locality. The species is only known from a relatively narrow coastal strip in southern NSW, occurring below 600 m above sea level (OEH 2015). The mean altitude, above 700 m above sea level, within the PA is considered too high for this species to occur at this latitude (the species is known from the northern tablelands of NSW). The species is also associated with regions with

mild winters (Churchill 2008), which does not include the Southern Tablelands region where temperatures below freezing are common during the winter months. It is therefore considered unlikely that the Greater Broad-nosed Bat occurs within the PA. The calls potentially attributed to this species were likely to be either the Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) or Western Broad-nosed Bat (*Scotorepens balstoni*), which have similar call signatures.

5.7.6 Non-volant Mammals

Ten native mammals were recorded, all of which are common species (refer to Table 5.20). No threatened species listed on either the EPBC Act or the TSC Act, were recorded.

Table 5.19 Mammal Species Recorded During the Field Surveys

Common Name	Scientific Name	EPBC Act	TSC Act	Detection Method
Native Species				
Brown Antechinus	<i>Antechinus stuartii</i>	-	-	camera trapping
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	-	-	observed, spotlighting and camera trapping
Common Wallaroo	<i>Macropus robustus</i>	-	-	observed
Sugar Glider	<i>Petaurus bruiiceps</i>	-	-	spotlighting and camera trapping
Ringtail Possum	<i>Pseudocheirus peregrinus</i>	-	-	spotlighting and camera trapping
Common Dunnart	<i>Sminthopsis murina</i>	-	-	observed under tile targeting reptiles
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>	-	-	observed and feeding signs
Brushtail Possum	<i>Trichosurus vulpecular</i>	-	-	spotlighting and camera trapping
Common Wombat	<i>Vombatus ursinus</i>	-	-	observed, scats and burrows and camera traps
Swamp Wallaby	<i>Wallabia bicolor</i>	-	-	spotlighting, diurnal observations and camera trapping
Exotic Species				
Domestic Dog*	<i>Canis lupus familiaris</i>	-	-	camera trapping
Domestic Cat*	<i>Felis catus</i>	-	-	camera trapping
European Hare	<i>Lepus europaeus</i>	-	-	observed
European Rabbit	<i>Oryctolagus cuniculus</i>	-	-	observed, signs such as warrens and scats
Feral Pig	<i>Sus scrofa</i>	-	-	observed, signs of rooting
Deer species	<i>Unknown deer species</i>	-	-	fleeting observation
European Red Fox	<i>Vulpes vulpes</i>	-	-	spotlighting, diurnal observations, scats and camera trapping

The majority of species were frequently detected during the survey period and often by various methods, including visual observation, spotlighting, camera trapping and from signs such as scats and prints. However, the Common Dunnart (*Sminthopsis murina*), was recorded once, sheltering under roofing tiles, as part of targeted grassland reptile surveys.

Spotlighting was successful in detecting large numbers of Ringtail Possums (*Pseudocheirus peregrinus*) and Brushtail Possums (*Trichosurus vulpecula*), as well as several Sugar Gliders (*Petaurus breviceps*). No Koalas were observed, nor heard, during the nocturnal surveys.

Camera trapping recorded a wide variety of mammals with eight native species and three exotic species captured (refer to Table 5.20). In addition to carnivorous mammals, many herbivorous mammals investigated the chicken bait, including Common Wombats and macropod species. The target species, the Spotted-tailed Quoll was not detected by camera trapping.

Seven exotic mammals were observed during the field surveys (refer to Table 5.20). The European Red Fox (*Vulpes vulpes*) was common and observed during the day, during spotlighting and on 13 of the 14 camera traps. In contrast the Domestic Dog (*Canis lupis familiaris*) and Domestic Cat (*Felis catus*) were only observed once on the camera traps. All of these exotic species are likely to prey on native species within the Study Area.

Feral Pigs (*Sus scrofa*) were recorded occasionally within the Study Area, including groups with young piglets. There was extensive rooting observed in the southern area of the Study Area, with large areas of native grassland disturbed by the species.

The European Hare (*Lepus europaeus*) and European Rabbit (*Oryctolagus cuniculus*) occurred within the Study Area, however neither were observed to be in high abundances, although it is noted that population size may fluctuate temporally, especially in the case of the European Rabbit. A small herd of Deer were observed briefly and were not able to be identified to species level.

Koala

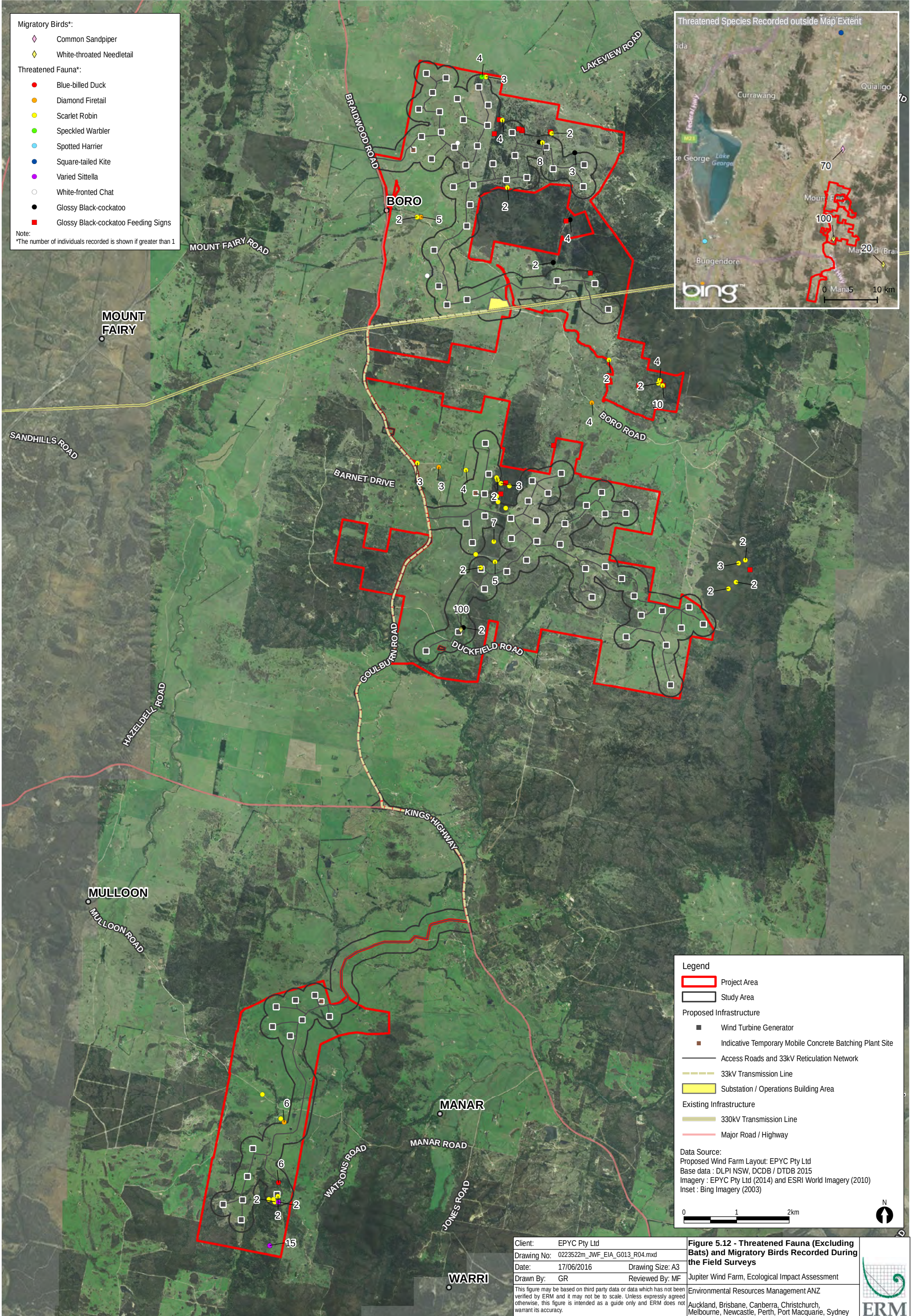
Koalas were not recorded within the Study Area and no signs directly attributable to the species, such as scats, were observed. Scratches were observed on a variety of different tree species, however they were not the typical 'poc marks' made by Koala. Scratches and marks from other more common species such as Lace Monitors, Brushtail and Ringtail Possums were often present and it is possible that occasional marks from Koala were obscured by these other marks.

Koalas feed almost exclusively on a few preferred primary and secondary food tree species. The NSW State Koala Recovery Plan (DECC 2008) identifies seven Koala Management Areas. The PA is included within Koala Management Areas 5 (Central and Southern Tablelands) and feed trees for this Koala Management Area are provided in *Table 5.21*. Based on the presence of one primary feed tree species (Ribbon Gum) and several secondary feed tree species some suitable and sub-optimal habitat for this species occurs within the Study Area. Further discussion of the habitat types present for this species and the rationale for the assessment is provided in *Section 6.2*.

Table 5.20 Koala Feed Trees Listed for Koala Management Area 5

Common Name	Species Name	Recorded in PA
Primary food tree species		
Ribbon gum	<i>Eucalyptus viminalis</i>	✓
River red gum	<i>Eucalyptus camaldulensis</i>	-
Secondary food tree species		
Candlebark	<i>Eucalyptus rubida</i>	✓
Eurabbie	<i>Eucalyptus bicosta</i>	-
Broad-leaved sally	<i>Eucalyptus camphora</i>	-
Argyle apple	<i>Eucalyptus cinerea</i>	-
Maiden's Gum	<i>Eucalyptus maidenii</i>	-
Swamp gum	<i>Eucalyptus ovata</i>	-
Bundy	<i>Eucalyptus goniacalyx</i>	-
Blakely's red gum	<i>Eucalyptus blakelyi</i>	✓
Apple-topped box	<i>Eucalyptus bridgesiana</i>	✓
White box	<i>Eucalyptus albens</i>	-
Yellow box	<i>Eucalyptus melliodora</i>	✓
Western grey box	<i>Eucalyptus microcarpa</i>	-
Red box	<i>Eucalyptus polyanthemus</i>	-
Large-flowered bundy	<i>Eucalyptus nortonii</i>	-
Snow gum	<i>Eucalyptus pauciflora</i>	✓
Tumbledown gum	<i>Eucalyptus dealbata</i>	-
Brittle gum	<i>Eucalyptus mannifera</i>	✓
Mountain gum	<i>Eucalyptus dalrympleana</i>	-
Stringybarks/supplementary species		
Red stringybark	<i>Eucalyptus macrorhyncha</i>	✓
Yellow stringybark	<i>Eucalyptus muelleriana</i>	-

1. Bold type indicates the species has been recorded within the Study Area.
2. Source: NSW State Koala Recovery Plan (DECC 2008), Appendix 2



The purpose of this section is to discuss the general aspects of the biodiversity of the Study Area and to provide rationale and justification for the inclusion or exclusion of threatened matters in the impact assessment. The likely occurrence of the threatened matters is discussed in terms of the Study Area. A summary likelihood of occurrence table is provided in this section. A full detailed likelihood of occurrence table is provided in *Annex C*. This discussion provides the basis on which the Project's potential impacts have been considered (refer *Section 7*).

6.1 THREATENED AND ENDANGERED ECOLOGICAL COMMUNITIES

As discussed in *Section 5.4* one EPBC Act listed TECs and two TSC Act listed EECs occur in the Study Area.

6.1.1 *Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT (EPBC Act Listed TEC)*

Across the known distribution of Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT (EPBC Act listed TEC) there are many forms (or associations) of this TEC that are described in terms of four sub-regions of occurrence. The PA is located in the Eastern Sub-region which is known from "areas east and north east of the ACT, covering the upper Wollondilly River, upper Shoalhaven River and Lake George catchments; it includes the towns of Taralga, Goulburn, Bungendore and Braidwood" (DoE 2015).

The TEC is described as being dominated by, moderately tall (25 cm – 50 cm) to tall (50 cm – 1 m), dense to open tussock grasses dominated by Kangaroo Grass (*Themeda triandra*), Wallaby Grasses (*Rytidosperma* spp.), Spear Grasses (*Austrostipa* spp.) and Tussock Grasses (*Poa* spp.) with up to 70% of species being forbs. Furthermore, "The community may be treeless or contain up to 10% cover of trees, shrubs or sedges" (DoE 2015). The TEC is identified as occurring in the Southern Tablelands in the altitudinal range between 560 m and 1200 m in valleys, lower slopes and broader plains (ESSS 2000). In additional information provided since the TEC was listed, the species profiles details further characteristics of the TEC as, "Natural temperate grassland is closed grassland, grassland and open grassland whose biomass is dominated by two or more of the perennial native tussock grasses Kangaroo Grass (*Themeda triandra*), Wallaby Grasses (*Austrodanthonia* [*Rytidosperma*] spp.), Speargrasses (*Austrostipa* spp.), Red-leg Grass (*Bothriochloa macra*) and/or Snowgrasses (*Poa* spp.)" (DoE 2015). Other characteristic species are Lobed Wallaby Grass (*Rytidosperma auriculatum*); Ringed Wallaby Grass (*R. caespitosum*); Short Wallaby Grass (*R. carphoides*); Wallaby Grass (*R. laeve*); Tall Speargrass (*Austrostipa bigeniculata*); Speargrass (*A. scabra* subsp. *falcata*); Tussock, River Tussock (*Poa labillardierei*); Snowgrass (*P. sieberiana*); and Red-leg Grass (*Bothriochloa macra*) (DoE 2015).

The dominance varies with landscape position with Kangaroo Grass and River Tussock "co-dominant in a variety of landscape positions and soil types." (DoE 2015). Other species assemblages influenced by landscape position are (DoE 2015):

- wetter areas, such as drainage lines, flats and lower footslopes: River Tussock, Kangaroo Grass, Wallaby Grasses and Weeping Grass with species of *Juncus* and Tall Sedge (*Carex apleura*);
- upper slopes, hill crests and ridges with well drained soils: *Austrostipa scabra subsp. falcata* and *A. bigeniculata*; and
- gentle slopes, ridges and flats with well drained, shallow to skeletal soils: Wallaby Grasses and Red-leg Grass with Wheatgrass (*Elymus scaber*).

Forb species most commonly occurring are Sheep's Burr (*Acaena ovina*), woodruffs (*Asperula spp*), Common Everlasting (*Chrysocephalum apiculatum*), Bindweed (*Convolvulus angustissima*), *Euchiton spp*, Scaly Buttons (*Leptorhynchus squamatus*), *Lomandra spp*, Variable Plantain (*Plantago varia*) and Narrow-leaf New Holland Daisy (*Vittadinia muelleri*) (DoE 2015).

Although not dominant, the tree species can compose less than 10% canopy cover (ESSS 2000). The characteristic tree species are Blakely's Red Gum (*Eucalyptus blakelyi*), Apple Box (*E. bridgesiana*), Mountain Gum (*E. dalrympleana*), Yellow Box (*E. melliodora*), Swamp Gum (*E. ovata*), Snow Gum (*E. pauciflora*), Black Sally (*E. stellulata*) and Candlebark (*E. rubida*).

The vegetation must be dominated by perennial native tussock grasses (DoE 2015) and can have 70% of species being forbs forming a distinct, lower layer of vegetation (DoE 2015). To meet the criteria to be listed as this TEC, the vegetation must be of a sufficient condition.

The TEC includes sites that:

"clearly demonstrate the natural ecological functions of grasslands, or which can recover these functions. Remnants of natural temperate grassland are considered part of the listed community if:

- they are dominated by native grasses and/or native forbs (more than 50% total vegetative cover, excluding exotic annuals), and
- a diversity of native forbs is present, or
- if disturbed, they have components of the indigenous native species (including both existing plants and reproductive propagules in the soil such as soil seed banks) sufficient to re-establish the characteristic native groundcover" (DoE 2015).

Furthermore the TEC does not include (DoE 2015):

- grassland where 50% or more of the total plant cover is dominated by perennial exotic species, and
- there is a low diversity of native forbs, or
- the native forb component (including soil seed reserves) is not sufficient to re-establish the characteristic native groundcover.

The profile also excludes derived grasslands from the TEC (DoE 2015).

Consideration Of The Vegetation Zones Of The Study Area As The TEC

Six associations are identified to describe the varied species assemblages and characteristics of the TEC (DoE 2015). An analysis of the grasslands of the Study Area is provided below. Two of the associations described by DoE (2014) were considered as candidates to occur in the PA:

- 3. Wet Tussock Grassland (River Tussock - Rush - Kangaroo Grass - Wallaby Grass - Tall Sedge - Weeping Grass wet tussock grassland) dominated by *Poa labillardieri*, *Juncus spp*, *Themeda triandra* [syn. *T. triandra*], *Rytidosperma spp*, *Carex appressa*, *Microlaena stipoides* and identified as occurring in colluvial footslopes, and alluvial drainage lines, depressions and flats (all four sub-regions); and
- 5. North-western & Eastern Wallaby Grass - Red-grass Tussock Grassland (Wallaby Grass - Red-grass - Tall Speargrass - Common Everlasting - Kangaroo Grass - Mat-rush tussock grassland) dominated by *Rytidosperma spp*, *Bothriochloa macra*, *Austrostipa bigeniculata*, *Chrysocephalum apiculatum*, *Themeda australis* [syn. *T. triandra*], *Lomandra spp* identified as occurring in moist or dry sites in North-western (including the ACT) and Eastern sub-regions.

Vegetation Zones in the Study Area that may be representative of the TEC, Sub-Association: 3. Wet Tussock Grassland (River Tussock - Rush - Kangaroo Grass - Wallaby Grass - Tall Sedge - Weeping Grass wet tussock grassland) are:

- *River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion_Mod-Good_Low*; and
- *River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion_Mod-Good_Mod*.

These are present in the Study Area along lower areas of the landscape in moist drainage lines but are dominated by sedges (mostly *Carex appressa*) and rushes (*Typha spp.*) rather than 'perennial native tussock grasses'. The perennial native tussock grasses Kangaroo Grass and River Tussock occur in these Vegetation Zones, however as a minor part of the vegetation species composition and cover. Therefore, this Vegetation Zone was excluded from being the TEC.

The Vegetation Zone in the Study Area that may be representative of the TEC, Sub-Association: 5. North-western & Eastern Wallaby Grass - Red-grass Tussock Grassland (Wallaby Grass - Red-grass - Tall Speargrass - Common Everlasting - Kangaroo Grass - Mat-rush tussock grassland) is:

- *derived grasslands of the South Eastern Highlands Bioregion and South East Corner Bioregion_Mod-Good_Low.*

This Vegetation Zone have a low diversity of native grass species (characterised mostly by only Wallaby Grasses and Speargrasses) and are herb and forb-poor and as they are grazed, are considered to have a low soil seed bank potential to re-establish characteristic native groundcover. Not only can they be excluded based on floristic composition, but furthermore, they can be excluded as they are likely derived from different vegetation types.

A large amount of the grasslands of the Study Area have a non-native grass component of more than 50% and therefore are excluded from consideration. Many other grasslands of the Study Area are native pastures dominated by Wallaby Grasses and Speargrasses with scattered eucalyptus trees of less than 10% canopy cover. Therefore the Vegetation Zones were considered as constituting the TEC however, the scattered trees throughout these areas are characteristic of dry upland woodlands (Red Stringybark, Scribbly Gum and Brittle Gum trees) and are not listed as characteristic tree species of the TEC with those on the list for the TEC being of generally lower parts of the landscape. Furthermore, these native grasslands with scattered Red Stringybark, Scribbly Gum and Brittle Gum trees are thought to represent derived grasslands.

Conclusion of Analysis Regarding Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT (EPBC Act Listed TEC)

No Vegetation Zones in the Study Area are considered to form part of the EPBC listed TEC: Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT.

6.1.2 *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act Listed TEC)*

The EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland TEC protects types of this community that are of a high ecological quality. The presence of characteristic tree species or grasses of the genera or species that are listed as characteristic of the TEC does not automatically qualify the patch as the EPBC listed TEC as there are ecological condition thresholds that a patch must satisfy to qualify.

The Commonwealth Listing Advice discusses three states of vegetation remnants recognising impacts of land development since European settlement (DoE 2006):

- an overstorey of eucalypt trees exists, but there is no substantial native understorey;
- a native understorey exists, but the trees have been cleared; and
- both a native understorey and an overstorey of eucalypts exist in conjunction.

Discussing the first state of vegetation remnant, DoE (2006) clarify that:

"The Committee considers that areas in which an overstorey exists without a substantially native understorey are degraded and are no longer a viable part of the ecological community. Although some native species may remain, in most of these areas the native understorey is effectively irretrievable." (DoE 2006), and, "In order for an area to be included in the listed ecological community, a patch must have a predominantly native understorey." (DoE 2006).

In some locations where Yellow Box (*Eucalyptus melliodora*) trees were observed in the Study Area the understorey was an improved pasture and the trees were remnant mature paddock trees. Therefore, these areas with only the Yellow Box trees over a majority non-native understorey are not considered part of the EPBC Act listed TEC.

In defining the second state of remnants where no trees are present, DoE (2006) state that:

"an understorey patch, in the absence of overstorey trees, must have a high level of native floral species diversity, but only needs to be 0.1 hectares or greater in size. A patch in which the perennial vegetation of the ground layer is dominated by native species, and which contains at least 12 native, non-grass understorey species (such as forbs, shrubs, ferns, grasses and sedges) is considered to have a sufficiently high level of native diversity to be the listed ecological community. At least one of the understorey species should be an important species (eg grazing-sensitive, regionally significant or uncommon species; such as Kangaroo Grass or orchids) in order to indicate a reasonable condition." (DoE 2006).

Vegetation Zones meeting these criteria have been included in the mapped areas of this TEC in the Study Area.

Discussing the third state of remnants, where both a native overstorey and understorey exist, DoE (2006) state that this includes remnants where the understorey conditions discussed above are met (ie they are diverse and have 'important species') or, where the understorey diversity is lower than that discussed above or 'important species' are absent, they can be considered part of the TEC if:

- they have a predominantly native understorey;
- are two hectares or above in size; and
- have either natural regeneration of the overstorey species or 20 or more mature trees per hectare.

Vegetation Zones meeting these criteria have been included in the mapped areas of this TEC in the Study Area. Remnants of this state of the TEC in the Study Area are characterised by an open woodland dominated by Yellow Box with Blakely's Red Gum (*Eucalyptus blakelyi*) and Brittle Gum (*Eucalyptus mannifera*) (refer *Photograph 6-1*). There is a sparse shrub layer with a herb and forb-rich, grassy ground layer. Many orchid species (*Diuris* spp and *Thelymitra* spp) also occur. Other species present in this TEC are provided in the following tables (refer to *Table 6-1*) set out according to lifeform.

This TEC occurs throughout the Study Area in mostly small patches in broad valley floors. The occurrences of this TEC in the Study Area of the highest ecological quality occur in the centre and in the far south.

Two Vegetation Zones meet the required condition thresholds for the EPBC Act listed TEC due to the presence of Blakely's Red Gum and Yellow Box trees and native species understorey:

- *Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Good; and*
- *Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Mod.*

Photograph 6.1 *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act Listed TEC) in the Study Area*



Table 6.1 *Flora Species Identified in White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland EPBC Act Listed TEC from the Study Area*

Common Name	Scientific Name
Sparsely Scattered Shrubs	
Ploughshare Wattle	<i>Acacia gunnii</i>
Native Cranberry	<i>Astroloma humifusum</i>
-	<i>Bossiaea prostrata</i>
Common Fringe-myrtle	<i>Calytrix tetragona</i>
-	<i>Daviesia mimosoides</i> subsp. <i>mimosoides</i>
-	<i>Dillwynia ramosissima</i>
Showy Parrot-pea	<i>Dillwynia sericea</i>
Dwarf Wedge-pea	<i>Gompholobium minus</i>
-	<i>Leptospermum</i> sp. (indeterminate)
Heath Phyllota	<i>Phyllota phyllicoides</i>
Grasses	
Shorthair Plumegrass	<i>Dichelachne micrantha</i>
Smallflower Wallaby Grass	<i>Rytidosperma setaceum</i>
Red Anther Wallaby Grass	<i>Rytidosperma pallidum</i>
Kangaroo Grass	<i>Themeda triandra</i>
Herbs and Forbs	
Native Leek	<i>Bulbine bulbosa</i>
-	<i>Cassytha pubescens</i>
Common Everlasting	<i>Chrysocephalum apiculatum</i>
Common Billy-buttons	<i>Craspedia variabilis</i>
Blueberry Lily	<i>Dianella longifolia</i> var. <i>longifolia</i>
Nodding Chocolate Lily	<i>Dichopogon fimbriatus</i>
A Sundew	<i>Drosera peltata</i>
Poverty Raspwort	<i>Gonocarpus tetragynus</i>
Forest Goodenia	<i>Goodenia hederacea</i>
Small St. John's Wort	<i>Hypericum gramineum</i>
Scaly Buttons	<i>Leptorhynchus squamatus</i> subsp. <i>squamatus</i>
Hoary Sunray	<i>Leucochrysum albicans</i> subsp. <i>albicans</i> var. <i>tricolor</i>
Many-flowered Mat-rush	<i>Lomandra multiflora</i>
-	<i>Luzula densiflora</i>
Murnong	<i>Microseris lanceolata</i>
Small Poranthera	<i>Poranthera microphylla</i>
Matted Pratia	<i>Pratia pedunculata</i>
Grass Trigger-plant	<i>Stylidium graminifolium</i>
Common Sunray	<i>Triptilodiscus pygmaeus</i>
Tall Bluebell	<i>Wahlenbergia stricta</i>
Early Nancy	<i>Wurmbea dioica</i>
Golden Everlasting	<i>Xerochrysum bracteatum</i>
Orchids	
Wedge Diuris	<i>Diuris dendrobiodes</i>
Leopard Orchid	<i>Diuris maculata</i>
Tiger Orchid	<i>Diuris sulphurea</i>
Slender Sun-orchid	<i>Thelymitra pauciflora</i>

The TSC Act listing for the White Box Yellow Box Blakely's Red Gum Woodland EEC is characterised by areas currently or formerly dominated by White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) and/or Blakely's Red Gum (*E. blakelyi*). It does not have a high threshold for the ecological quality of the vegetation in composition or structure as identified in the Scientific Committee Determination, "*Disturbed remnants are still considered to form part of the community including remnants where the vegetation, either understorey, overstorey or both, would, under appropriate management, respond to assisted natural regeneration, such as where the natural soil and associated seed bank are still at least partially intact.*" (TSSC 2002).

Two Vegetation Zones clearly meet the required condition thresholds for the TSC Act listed EEC due to the current presence of Yellow Box trees:

- *Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Good; and*
- *Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Mod.*

Two Vegetation Zones characterised by scattered Yellow Box trees over predominantly native pasture grasslands of low floristic diversity were next considered:

- *Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Poor; and*
- *Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Low.*

Another variant of this is the Vegetation Zone: *Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Weedy* which has a predominantly non-native understorey. It is unclear if these modified Vegetation Zones would respond to 'assisted natural regeneration'. It is suspected that the soil and associated seed bank have been seriously and irreversibly degraded from agricultural activity over time and therefore these may not be considered part of the TSC Act listed EEC. Notwithstanding this, a conservative approach has been adopted and these areas have been treated as the TSC Act listed community and the impact assessment process followed.

Patches of the Vegetation Zone with scattered Yellow Box trees over a predominantly non-native understorey have been excluded from consideration as this EEC. This is:

- those patches mapped as *Non Native Pasture (Paddock Trees)* that have scattered Yellow Box trees.

This EEC encompasses a range of Vegetation Zones throughout the Study Area in broad valley floors that are currently dominated by Yellow Box trees. It is generally characterised by scattered Yellow Box, over derived native grassland dominated by Kangaroo Grass and Wallaby Grasses. The understorey also contains native and non-native species, and *Juncus* spp. occur in drainage lines and depressions (refer *Photograph 6-2*).

Photograph 6.2 *An example of White Box Yellow Box Blakely's Red Gum Woodland (TSC Act Listed EEC) in the Study Area.*



6.1.4 *Tablelands Snow Gum, Black Sallee, Candlebark And Ribbon Gum Grassy Woodland In The South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion (TSC Act Listed EEC)*

In the Scientific Committee Determination the TSSC (2011) states that the Tablelands Snow Gum, Black Sallee, Candlebark And Ribbon Gum Grassy Woodland In The South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion EEC occurs, "on valley floors, margins of frost hollows, footslopes and undulating hills". The Vegetation Zones of the Study Area that meet this description are:

- *Apple Box - Candlebark - Snow Gum shrubby open forest on valley floors, southern South Eastern Highlands Bioregion:*
 - 650_Mod-Good_Low;
 - 650_Mod-Good_Mod;
 - 650_Mod-Good_Poor;
 - 650_Mod-Good_Shrubby;
 - 650_Mod-Good_Weedy;

- *Black Sallee - Tussock Grass open woodland of the South Eastern Highlands Bioregion:*
 - 680_Mod-Good_Low;
 - 680_Mod-Good_Mod;
 - 680_Mod-Good_Poor;
 - 680_Mod-Good_Shrubby;
 - 680_Mod-Good_Weedy;
- *Ribbon Gum – Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion:*
 - 1100_Mod-Good_Good;
 - 1100_Mod-Good_Mod; and
 - 1100_Mod-Good_Weedy.

This EEC occurs as Snow Gum (*Eucalyptus pauciflora*) and Ribbon Gum (*Eucalyptus viminalis*) woodland along watercourses and adjacent floodplains (refer *Photograph 6-3*), as well as Snow Gum, Black Sallee (*E. stellulata*) and Swamp Gum (*E. ovata*) woodlands in watercourses and adjacent areas. It varies in condition with areas of lower ecological integrity along creeks having introduced Willows (*Salix spp.*) and patches of former disturbance with a dense, native, shrub layer of Kunzeas (*Kunzea parvifolia* and *K. ericifolia*). The ground layer is dominated by native grass species, including Kangaroo Grass (*Themeda triandra*), Speargrasses (*Austrostipa spp.*), Tussock Grasses (*Poa sp.*) and Weeping Grass (*Microlaena stipoides*) and also contains a range of native and non-native forbs.

It is located along:

- Boro Creek (northern precinct);
- Reedy Creek (northern precinct);
- Manar Creek system (southern precinct); and
- in patches in the Goulburn-Braidwood Road and the Kings Highway road reserves.

Photograph 6.3 *An example of Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion (TSC Act Listed EEC) in the Study Area*



6.2 *THREATENED FLORA SPECIES*

This section provides some context to the assignment of potential habitats for the threatened flora species that were identified in the Study Area and those considered as having potential to occur (refer to *Annex C* for detailed threatened species likelihood of occurrence).

6.2.1 *Threatened Flora Species Known To Occur in the Study Area*

For the two threatened flora species that were identified in the Study Area (the Buttercup Doubletail and the Hoary Sunray) habitats were assigned as the areas of similar habitat adjacent to the occurrences. These two species are both only identifiable for short periods in a year and extensive searches throughout the Study Area failed to identify these species elsewhere. For this reason a differentiation of Vegetation Zones providing habitat for those species is provided under each species' sub-heading: those habitats where the species was actually observed, and those habitats that meet the species' habitat requirements according to the species' characteristics as listed by OEH, the Royal Botanic Gardens and Domain Trust and DoE. This is a conservative approach to potential habitat assignment and results in a consideration of widespread regions of potential habitats for each species.

Buttercup Doubletail (Diuris aequalis) (EPBC Act Status: Vulnerable; TSC Act Status: Endangered)

Preferred habitat for the Buttercup Doubletail orchid is listed as, “forest, low open woodland with grassy understorey” (OEH 2015). During extensive searches for the species across the Study Area, it was only identified in one area in the northern precinct in a low grassy woodland. The Vegetation Zone in which the species was actually observed was:

- *Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Mod-Good_Good.*

Potential habitat has been limited to those similar Vegetation Zones in good condition:

- *Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion_Mod-Good_Good.*

There are 6.11 ha of known and 62.62 ha of potential habitat for this species in the Study Area.

Hoary Sunray (Leucochrysum albicans subsp. albicans var. tricolor) (EPBC Act Status: Endangered)

A very broad range of Vegetation Zones is provided as potential habitat based on the species occurrence description which states: “*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*” (DoE 2015b). During extensive searches for the species across the Study Area, it was only identified in one area in the central region of the Study Area in a broad valley floor and up the adjoining cleared ridgeline. The Vegetation Zones in which the species was actually observed were:

- *Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Good;*
- *Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Mod-Good_Poor; and*
- *Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Mod-Good_Low.*

Although not having been observed in any other Vegetation Zones, a wide range that are characterised by heavier soils and that occur in lower parts of the landscape have been included as potential habitat for this species. Those are:

- *Apple Box - Candlebark - Snow Gum shrubby open forest on valley floors, southern South Eastern Highlands Bioregion:*
 - 650_Mod-Good_Mod;
 - 650_Mod-Good_Shrubby;
 - 650_Mod-Good_Low; and
 - 650_Mod-Good_Poor.
- *Black Sallee - Tussock Grass open woodland of the South Eastern Highlands Bioregion:*
 - 680_Mod-Good_Mod;
 - 680_Mod-Good_Shrubby;
 - 680_Mod-Good_Low; and
 - 680_Mod-Good_Poor.
- *Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion:*
 - 888_Mod-Good_Low;
 - 888_Mod-Good_Poor;
- *Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion:*
 - 1093_Mod-Good_Poor; and
 - 1093_Mod-Good_Low.
- *Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion:*
 - 1100_Mod-Good_Mod;
 - 1100_Mod-Good_Low; and
 - 1100_Mod-Good_Good.
- *River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion:*
 - 1110_Mod-Good_Low

- *Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion:*
 - 1155_Mod-Good_Low; and
 - 1155_Mod-Good_Poor.
- *Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion:*
 - 1334_Mod-Good_Mod;
 - 1334_Mod-Good_Low;
 - 1334_Mod-Good_Poor; and
 - 1334_Mod-Good_Good.

There are 42.97 ha of known and 482.41 ha of potential habitat for this species in the Study Area.

6.2.2 *Threatened Flora Species With Potential To Occur In The Study Area*

In addition to threatened flora species known to occur in the Study Area, six threatened flora species are considered to have potential to occur (*Annex C*). These species, and the potential habitats within the Study Area, are described in *Table 6.2*.

None of these species were identified in the Study Area despite extensive searches, however the potential habitat the Study Area has been considered using a conservative approach for the purposes of completing a thorough ecological impact assessment. The Vegetation Zones of the Study Area that match the habitat of these species listed by OEH, the Royal Botanic Gardens and Domain Trust and DoE are provided in *Table 6.2*. This is a conservative approach to potential habitat assignment and results in a consideration of extensive potential habitats across the Study Area. For example, if a species' habitat is listed as 'woodland on ridges', all mapped Vegetation Zones areas in the Study Area that are woodlands on ridges were included in the species' potential habitat. It follows accordingly that the potential habitat for these species is correspondingly extensive in the surrounding area.

Table 6.2 Potential habitat for threatened flora species in the Study Area

Species	EPBC Act	TSC Act	Occurrence in the Study Area (refer to Annex C)	Description of Potential Habitat in the Study Area	Vegetation Zones Identified As Providing Potential Habitat	Area (ha) in Study Area
Austral Toadflax (<i>Thesium australe</i>)	V	V	Not identified in the Study Area despite extensive searches across the Study Area and although its presence is suspected unlikely, the possibility of it occurring could not be completely ruled out.	The species is often found in association with Kangaroo Grass (OEH 2015).	Apple Box - Candlebark - Snow Gum shrubby open forest on valley floors, southern South Eastern Highlands Bioregion 650 Mod-Good_Mod Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion: 1334_Mod-Good_Good 1334_Mod-Good_Mod 1334_Mod-Good_Poor 1334_Mod-Good_Low	115.54
Basalt Pepper-cress (<i>Lepidium hyssopifolium</i>)	E	E	The species was not identified in the Study Area despite extensive searches across the Study Area and although its presence is suspected unlikely, the possibility of it being present could not be completely ruled out.	It is difficult to assign a potential habitat based on species presence, as establishment of the species is thought to be disturbance-driven, as opposed to habitat specific (OEH 2015) (refer to Annex C). Potential habitat has been identified as areas of soils disturbance in the lower parts of the landscape.	Apple Box - Candlebark - Snow Gum shrubby open forest on valley floors, southern South Eastern Highlands Bioregion 650_Mod-Good_Mod 650_Mod-Good_Poor 650_Mod-Good_Low Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion: 888_Mod-Good_Mod River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion: 1110_Mod-Good_Low Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion: 1334_Mod-Good_Good 1334_Mod-Good_Mod 1334_Mod-Good_Poor	214.52

Species	EPBC Act	TSC Act	Occurrence in the Study Area (refer to Annex C)	Description of Potential Habitat in the Study Area	Vegetation Zones Identified As Providing Potential Habitat	Area (ha) in Study Area
Black Gum (<i>Eucalyptus aggregata</i>)	-	V	The species was not identified in the Study Area despite extensive searches across the Study Area and although its presence is suspected unlikely, the possibility of it being present could not be completely ruled out.	This species' habitat is known as being in the alluvial, poorly-drained flats adjacent to rivers and creeks and can occur both in a woodland and as a remnant tree in a paddock (OEH 2015). Potential habitat occurs in the Vegetation Zones in the lower parts of the landscape of the Study Area.	Apple Box - Candlebark - Snow Gum shrubby open forest on valley floors, southern South Eastern Highlands Bioregion 650_Mod-Good_Mod Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion: 1100_Mod-Good_Good 1100_Mod-Good_Mod 1100_Mod-Good_Poor 1100_Mod-Good_Low River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion: 1110_Mod-Good_Mod 1110_Mod-Good_Low	90.66
Few-Seeded Bossiaea (<i>Bossiaea oligosperma</i>)	V	V	The species was not identified in the Study Area despite extensive searches across the Study Area and although its presence is suspected unlikely, the possibility of it being present could not be completely ruled out.	The species' habitat is listed as being on stony slopes or ridges on sandstone (OEH 2015). Potential habitat occurs in the drier, ridgetop woodlands of the Study Area.	Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion: 888_Mod-Good_Good 888_Mod-Good_Mod Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion: 1093_Mod-Good_Good 1093_Mod-Good_Mod	223.64

Species	EPBC Act	TSC Act	Occurrence in the Study Area (refer to Annex C)	Description of Potential Habitat in the Study Area	Vegetation Zones Identified As Providing Potential Habitat	Area (ha) in Study Area
Matted Bush-pea (<i>Pultenaea pedunculata</i>)	-	V	The species was not identified in the Study Area despite extensive searches across the Study Area and although its presence is suspected unlikely, the possibility of it being present could not be completely ruled out.	The species is known from creeklines in grassy woodlands in the Windellama region (OEH 2015) although this is distant from the Study Area. It is also known from Scribbly Gum (<i>E. rossii</i>) - Red Stringybark (<i>E. macrorhyncha</i>) woodland (OEH 2015).	Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion: 888_Mod-Good_Good 888_Mod-Good_Mod Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion 1093_Mod-Good_Good 1093_Mod-Good_Mod	223.64
Pale Pomaderris (<i>Pomaderris pallida</i>)	V	V	The species was not identified in the Study Area despite extensive searches across the Study Area and although its presence is suspected unlikely, the possibility of it being present could not be completely ruled out.	This species is known from shrub communities surrounded by Brittle Gum (<i>Eucalyptus mannifera</i>) and Red Stringybark (<i>E. macrorhyncha</i>) or <i>Callitris</i> spp. woodland (OEH 2015). Dry woodlands in the Study Area provide potential habitat.	Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion: 888_Mod-Good_Good 888_Mod-Good_Mod Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion: 1093_Mod-Good_Good 1093_Mod-Good_Mod	223.64

E = Endangered, V = Vulnerable

6.3 THREATENED FAUNA SPECIES

6.3.1 *Golden Sun Moth*

Targeted surveys for GSM in December 2013, failed to detect this species despite the surveys being conducted in suitable conditions when adult moths were flying at known reference sites (refer to *Annex F*). The majority of the native grassland within the Study Area is derived from vegetation communities which are not normally associated with GSM. The presumed absence of GSM from these communities in the Study Area, and lack of sightings in these habitats, may relate to unfavourable soil type, altitude and lower average temperatures.

A small proportion of the Study Area contained native grassland derived from PCT ID 1334: Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion, which may provide potential GSM habitat, however it is considered unlikely to support the species due to:

- isolation from other populations, the closest record of GSM is approximately 40 km south west of the Study Area (south of Googong, NSW Atlas Records); and
- due to the PA being outside the predicted geographic range of the species (OEH 2015).

The distribution of known GSM records are clustered within the Southern Tablelands of NSW and the ACT with no records existing east of Gundaroo / Sutton. The lack of any outliers east of this area suggests that the local climatic factors and habitats are 'limiting effects on the species distribution. It is therefore considered unlikely that this species occurs within the PA. Based on the above rationale it was deemed that further targeted surveys for the species during December 2014 was unnecessary. This approach was discussed with OEH and was accepted (OEH, *pers. comm.*, 28 November 2014).

6.3.2 *Frogs*

There is suitable breeding and foraging habitat for a range of common species within the Study Area. The most important habitat for frogs include ephemeral watercourses and farm dams within the PA, especially those with marginal emergent vegetation and aquatic plants present. Forest, woodland and native tussock grassland all provide suitable foraging habitat.

Several threatened frog species were highlighted in the desktop searches and as subject species within the DGRs. An assessment of likelihood of occurrence of these species in the Study Area has been provided in *Annex C*. All species are considered unlikely to occur in the PA.

No threatened species were recorded during field surveys. Four threatened reptiles were identified during the desktop searches as subject species. The Striped Legless Lizard and the Pink-tailed Worm Lizard are both listed as Vulnerable under the TSC Act and the EPBC Act. Rosenberg's Goanna and Little Whip Snake are only listed on the TSC Act. An assessment of likelihood of occurrence of these species in the Study Area has been provided in *Annex C*.

The Striped Legless Lizard is a cryptic species and suitable habitat for the species containing native perennial tussock grasses was identified within the Study Area. As this is a cryptic species, targeted surveys were conducted in accordance with SPRAT guidelines (DoE 2015) and in consultation with OEH, however no individuals were recorded (refer to *Section 4.2.7* and *Section 5.7.3*). There are no records of this species within the locality and the species has declined over much of its former range (Smith and Robertson 1999). In NSW, the species occurs at sites near Goulburn, Yass, Queanbeyan, Cooma and Tumut areas (DoE 2015). The lack of records within the locality and the failure to detect the species indicates that this species is unlikely to occur within the Study Area.

The Pink-tailed Worm Lizard occurs in similar habitats to the Striped Legless Lizard and may also be detected using the same artificial refugia techniques. However habitat in the Study Area is sub-optimal and no individuals were detected. One of the key microhabitat features for the species is an abundance of surface rocks (DoE 2015), which were restricted to several small and discreet areas within the Study Area. The Study Area is also outside of the current known range for the species (OEH 2015). The Pink-tailed Worm Lizard is considered unlikely to occur in the Study Area.

The Little Whip Snake is a cryptic species which occurs in Natural Temperate Grasslands and grassy woodlands, including those dominated by Snow Gum or Yellow Box. The Little Whip Snake also occurs in secondary grasslands derived from clearing of woodlands. It is typically found on well drained hillsides, mostly associated with scattered loose rocks (OEH 2015). Habitat for this species exists within the Study Area in grassy woodlands and derived woodlands. There are three records of the species (from 1996 to 1998) within the locality and the Study Area is within the known range for this species. Debris turning was undertaken in an attempt to locate this species in conjunction with the artificial refugia searches for the Striped Legless Lizard. This species is more likely to occur in a wider variety of habitats than the Striped Legless Lizard and as a cryptic species, the amount of survey effort undertaken is not likely to be sufficient to conclude that the species is absent from the Study Area. The species is therefore considered as having the potential to occur.

Woodland and open forest within the Study Area may provide suitable habitat for Rosenberg's Goanna especially those areas with ground termitaria present, which were recorded in the majority of the forested areas. Ground termitaria are vital for breeding as the eggs are laid and develop in a termite mound excavated by the female. The species was not observed during any of the field surveys, however this species typically occurs in low densities and can be difficult to detect. It is most active during hot periods of the day on the tablelands and this restricts the amount of time it is likely to be encountered during the field survey conducted. Rosenberg's Goanna has not been recorded within the locality, although the Study Area is within the species' known range. A conservative approach has been undertaken for this species and it is considered as having the potential to occur within the Study Area.

6.3.4

Birds

Swift Parrot

The Swift Parrot is endemic to south eastern Australia, breeding only in Tasmania, and migrates to mainland Australia in autumn (DoE 2015). On the mainland the species occurs in areas where eucalypts are flowering profusely or where there are abundant lerp infestations. There is a general paucity of autumn or winter flowering species to support this species within the Study Area. Field surveys failed to identify any significant winter foraging resources for with no flowering eucalypts observed within this period. There is a small patch of Yellow Box-Blakely's Red Gum within the Study Area, and this community is known to be utilised for by this species (DoE 2015). As the Swift Parrot is a wide ranging species it has been conservatively estimated that this species has the potential to occur within the Study Area. The Study Area is not likely to provide significant foraging resources for the species and if the species does occur within the Study Area it is likely to be intermittently or perhaps just flying over the Study Area.

Regent Honeyeater

This species was considered unlikely to occur within the Study Area, with a lack of any recent records within the locality. In NSW, the distribution is very patchy and mainly confined to the two main breeding areas within the Capertee Valley and the Bundarra-Barraba region and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests. There are some Yellow Box and Blakely's Red Gum within the Study Area, which are a foraging resource for the species. The lack of records within the locality are likely to indicate that there are insufficient quality of feeding resources and any remaining habitat is too fragmented to be optimal.

Glossy Black-Cockatoo

Glossy Black-Cockatoos were sighted foraging, resting, and flying below canopy height within woodland in the Study Area. Evidence of the species foraging was recorded in the majority of areas where Black She-oak existed. All forest and woodland areas containing Black She-oak are presumed to be suitable foraging habitat for the species. The Glossy Black-Cockatoo is dependent on large hollow bearing eucalypts for nest sites (OEH 2015) however there were no signs of nesting recorded within the Study Area and few suitable hollows observed. There is the possibility that nesting occurs within the PA or adjacent to it, for example within the Crown Land that is surrounded by the northern precinct of the PA.

Woodland Birds

A number of threatened birds were recorded within woodland and forested areas of the Study Area (refer to *Section 5.7.4*). There are a number of species, which are only likely to occur within woodland or on the periphery of woodland, including the Varied Sittella and Speckled Warbler. The Scarlet Robin were found in open areas in addition to the woodland including areas with very little or absent shrubs and trees. The species was most commonly observed in open habitats during winter, which is the non-breeding season. It is more likely to occur within woodland areas during the breeding season and during warmer months of the year. The species require the woodland habitat to be present and the use of the open areas reflects seasonal behaviour

The Diamond Firetail was also recorded in open habitat especially where there is an abundance of foraging resources such as grass seed. This species requires woodland and shrubby vegetation for nesting and is unlikely to persist in completely cleared habitat.

Additional threatened woodland birds are considered to have potential to occur, and are described in *Annex C*.

White Fronted Chat

The White-fronted Chat is normally reported to occur in damp open habitats and adjacent to swamp areas, including in saltmarshes along the coast, and near waterways in the western part of the state (OEH 2015). There are several small areas of damp grassland within the Study Area, adjacent to the ephemeral watercourses and also around the margins of farm dams. The White-fronted Chat was not found in any of these wetter habitats within the Study Area and was instead recorded in dry short grassland with bracken patches and in similar dry habitat adjacent to cropland. It is presumed that this species utilises a wide range of grassland habitats within the Study Area, especially where there is cover such as low shrubs and bracken present.

Nocturnal Birds

No threatened owl species were recorded during the field surveys, however the PA is within the known range for the Powerful Owl and Barking Owl. The majority of the Study Area is likely to provide sub-optimal habitat for threatened owls due to the highly cleared nature with sparse treed habitat and low densities of potential prey. More optimal areas of foraging habitat occurs within discrete areas of the Study Area and wider PA, which are forested with likely higher abundances of arboreal prey species such as Ringtail Possum and Sugar Gliders. The forest with the highest value are those which are well connected to large areas of forest, which occur in the extreme southern portion, furthest eastern portion and the forest in the north east of the PA. The southern extent of the PA (just outside the Study Area) and beyond may provide higher quality habitat for both species, including incised areas with higher fertility and taller forest. Breeding habitat for this species is limited within the Study Area with very few tree hollows large enough to be suitable. Those hollows of sufficient size had no sign of habitat by owls.

It is considered that the Barking Owl and Powerful Owl have the potential to occur within the Study Area although are likely to only occur in low number and intermittently owing to the sub-optimal habitat present. It is unlikely that the species breed within the Study Area although breeding may occur within the wider PA and beyond.

Wetland Birds

A number of common wetland birds were recorded within the PA, typically utilising the dams present or recorded flying over the PA.

One threatened species, the Blue-billed Duck, was recorded once in the Study Area. This species typically prefers large waterbodies with more open water present. The dams within the Study Area are only likely to be used intermittently and are not likely to provide habitat for significant numbers of the Blue-billed Duck.

It is unlikely that wetland habitats within the Study Area are particularly important for any threatened wetland species or migratory species as the habitat is largely restricted to small dams, which are common within the landscape. There is a lack of features which are typically required to provide significant resources for wetland birds, which may include wetlands of a large area, ie extensive shallow water areas (for wading species), deep extensive water (open water ducks) or extensive reed beds (for species such as the Australasian Bittern).

No threatened or migratory wetland birds were recorded flying over the Study Area, however there is a possibility that threatened or migratory wetland birds may fly over the Study Area intermittently. The most likely flying paths in the broader region is between habitats associated with Lake George and Lake Bathurst Important Bird Area. Any birds flying directly between these two water bodies would not fly over the Study Area, however if the birds took an indirect route there is the potential for birds to fly over the Study Area. Apart from these two habitat areas, there is a lack of significant habitat for wetland birds within the locality.

Movement of birds from coastal to inland water sources occurs for several species of migratory waterbirds, however birds may be dispersed over very large areas and therefore these seasonal and temporal movements are difficult to predict.

Raptors

One threatened raptor species, the Spotted Harrier, was recorded during field surveys. The Spotted Harrier disperses widely within NSW and are likely to be part of a single population (OEH 2015). The species is unlikely to be resident within the locality.

Potential also exist for the Black Falcon (*Falco subniger*) and the Little Eagle (*Hieraaetus morphnoides*) to occur within the Study Area. Both of these species have large home ranges and have the potential to forage within the Study Area. Suitable nesting habitat for the Little Eagle exists within the Study Area, however no nests were recorded. Due to the lack of observations, it is unlikely the species was nesting within the Study Area, although this does not rule out any future nesting.

These four raptor species may occur within the Study Area in low numbers intermittently. They all have large ranges or are nomadic species. All of the species listed are likely to fly at RSA height at least part of time.

6.3.5

Bats

Of the threatened species with Possible, Probably or Definite calls detected within the PA, one species (the Eastern Bentwing Bat) is considered known to occur, and four species are considered to have potential to occur.

Eastern Bentwing Bat

The Eastern Bentwing Bat has been recorded within a number of locations within the PA. The Eastern Bentwing Bat is known within the Study Area from spring through to winter and is likely to forage within the Study Area, especially within the wooded areas. As there were records of the subspecies from the mast unit, there is also evidence that it flies at height in open areas indicating some vulnerability to WTG collision.

It is a fast flying subspecies with the ability to travel up to 65 km in a single night, however they typically have a foraging radius of approximately 25 km (Dwyer and Hamilton-Smith 1965). The species typically hunts in wooded and 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, bridges and buildings and other man-made structures. Though individuals often use numerous roosts, they congregate en masse in a small number of caves to breed and hibernate (Churchill 2008). This subspecies 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 2015).

The bats typically breed in maternity caves between November and February, with vast aggregations of the subspecies occurring at one time, comprising a significant percentage of the total population. There are two key maternity caves known within the NSW Southern Tablelands, Bungonia Caves and Wee Jasper Caves. Bungonia Cave system is approximately 45 km to the north east of the PA and Wee Jasper is approximately 90 km to the east of the PA. A 'staging' cave also exists at Mount Fairy, which is approximately 6 km to the west of the Study Area. The staging cave is used during migration to the coast after leaving maternity roosts, during late summer / early autumn.

There is potential for the Study Area to be within a migratory route between the staging cave at Mount Fairy and coastal overwintering areas. Specific monitoring to detect this event was conducted during March 2015; however there was no evidence to support a migration event. No bats were recorded from the mast units during this period, although the Eastern Bentwing Bat was recorded from two ground based units. Over the three week monitoring period, there was no pulse of higher call abundance, which may indicate a large number of individuals passing through the Study Area. Instead the number of calls fluctuated from night to night with no observed trend over time. This indicates that Eastern Bentwing Bat are foraging within the Study Area, with activity levels likely to be dependent on the weather and abundance of insect prey.

Although the mast-mounted detectors did not detect the Eastern Bentwing Bat during March 2015, calls were recorded from September 2014 to February 2015, with a peak during October 2014. This corresponds with the period when subspecies gravitate towards maternity caves within the region. The number of calls recorded within this period, were still low with 19 calls attributable to the Eastern Bentwing Bat during October, across all three mast-mounted units. During winter the subspecies population is distributed over large areas (within approximately 300 km of the maternity caves, OEH 2015). It is therefore anticipated that the October migration event occurs over a very wide area of the landscape and a significant proportion of the Eastern Bentwing Bat population is unlikely to pass over the PA.

Foraging habitat for the Eastern Bentwing Bat within Study Area occurs within forest and wooded areas. However, the majority of the Study Area is sub-optimal with cleared pasture present. Roosting resources within the Study Area are very limited, although some potential roosting sites exist within the locality. These include a stone bridge and two disused mines, which were watched at dusk for any exiting bats, with Anabat detectors also used to detect any calls emitted. No bats of any species were recorded using the potential roosting sites at the time.

Eastern False Pipistrelle

The Eastern False Pipistrelle was potentially recorded in multiple locations with the majority of calls given a Possible confidence rating, with several also noted as Probable (refer to *Section 5.7.5*). It is considered likely that a substantial amount of these calls were not from the Eastern False Pipistrelle as they were recorded from areas not considered suitable habitat.

This species is documented as preferring tall and wet sclerophyll forest with a dense understorey (OEH 2015). The majority of the woodland habitat within the PA is unlikely to provide habitat for this species. The most optimal habitat occurs in the south of the Study Area where taller forest exists with connectively to large tracts of forest south of the PA.

This species is known to forage just over or below the canopy height and does not typically occur in open areas. It is considered that risk to this species from rotor strike is low. Due to the lack of optimal habitat for the species and no Definite calls being recorded, this species has been assessed as potentially occurring within the PA (as opposed to known) in discrete forested habitat.

Southern Myotis

The Southern Myotis was recorded with Possible confidence recorded once, in the northern precinct of the Study Area. The call was noted as either the Southern Myotis or a Long-eared Bat species (*Nyctophilus* sp.) (refer to *Section 5.7.5*).

The Southern Myotis is found up to 100 km from the coast between north west Australia and western Victoria (OEH 2015). The species often occurs in riparian habitats, and roost sites are located in caves, mine shafts, HBTs, storm water channels, buildings, under bridges and in dense vegetation close to slow-flowing or still water. The species forages over rivers, streams and dams in a variety of forest types (Environment Australia 1999). The species prefers aquatic foraging resources which are connected to forested areas for shelter; with open areas leaving them open to predation and with a paucity of tree hollows for roosting.

While the PA is within the species' distribution (OEH 2015) there is only sub-optimal habitat for this species within the Study Area with foraging resources restricted to farm dams, which are largely in open areas. Riparian areas with water suitable for foraging are not found within the Study Area and the majority of the watercourses are ephemeral and unlikely to support suitable concentrations of prey species.

The Possible record of Southern Myotis was not close to water and in an area of dry sclerophyll forest. It is most likely that the calls were actually from a Long-eared Bat species (*Nyctophilus* sp.), but despite this, the species has been considered as having potential to occur within the Study Area.

Yellow-bellied Sheathtail

The Yellow-bellied Sheathtail-bat was recorded in a variety of locations throughout the Study Area (refer to *Section 5.7.5*). A number of the calls can be confused with other species; however enough high quality calls were recorded to consider this species as known to occur within the PA. This species is wide ranging and has very broad habitat requirements including open treeless areas, and the entire PA is therefore considered suitable habitat.

The species was recorded regularly from spring to autumn in a variety of locations, although the highest activity levels were recorded in late spring and early summer. This species is insectivorous, flying high and fast over the forest canopy, but often lower in more open country (OEH 2015). It is expected that this species will fly at RSA height and therefore is at risk of rotor strike. This species roosts in tree hollows and buildings therefore there is potential for the species to breed in Study Area, as HBT are present.

Grey-Headed Flying Fox

The Grey-headed Flying Fox (*Pteropus poliocephalus*) feeds in the canopy of a range of vegetation communities, including rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands. It also feeds on commercial fruit crops and on introduced tree species in urban areas. The species roosts on exposed branches near water but can also use modified vegetation in urban and suburban areas (DoE 2015). Grey-headed Flying-foxes generally travel within 15 km of the roost site each night, but can travel up to 50 km per night as food resources change. The species has not been recorded within the locality, however this is a wide ranging species and the PA is within the species' distribution. The Grey-headed Flying Fox has the potential to exploit foraging resources that only occur seasonally or sporadically, such as a particularly vigorous Eucalyptus flowering event or to alter its behaviour in response to climatic conditions such as drought. For this reason it is not possible to state that the species is absent from the Study Area based on field surveys throughout one year. The closest known roosting site for the species is in Canberra and there is potential for the species to fly across the Study Area when flying to alternate roost in the more commonly frequented coastal areas. For these reasons we will take a conservative approach and assume that the species has the potential to occur within the Study Area.

The Study Area provided habitat for a variety of common native species, with several Macropod species, Short-beaked Echidna (*Tachyglossus aculeatus*) and Common Eastern Wombat (*Vombatus ursinus*) all recorded regularly within the Study Area. No threatened species mammal species were recorded (refer to Section 5.7.6).

Spotted-Tailed Quoll

Targeted surveys failed to detect the Spotted-tailed Quoll (refer to Section 5.7.6). The majority of the Study Area is characterised by large cleared areas with fragmented woodlands and these areas do not contain suitable habitat for the Spotted-tailed Quoll. Within the woodlands there is a paucity of cover for the species with limited rocky outcrops and a lack of dense understorey. However, the species is known to occasionally occur in low densities in sub-optimal habitats or as transient individuals and may avoid detection.

Discrete areas of suitable habitat (containing a large amount of fallen timber and incised ephemeral creeklines with understorey species present) for the species exist within the Study Area and the PA. These areas of woodland and forest occur in the north, east and south of the PA and are connected to large areas of forest outside the PA. Habitat may also exist within the Crown Land, adjacent to the PA. A central north-south orientated, forested ridgeline occurs within the Study Area is not connected to other larger tracts of forest, however it has some characteristics of Quoll habitat including large amounts woody debris and timber and some understorey vegetation present.

It is considered likely that the Spotted-tailed Quoll occurs within the forests adjacent to the Study Area, and that the species has the potential to occur in low densities or as transient individuals within the Study Area.

Koala

Koalas were not recorded within the Study Area, however some of the woodland and forested areas have the potential to provide habitat for the species. Several database records exist within the locality.

Koala habitat within the Study Area was mapped using PCTs. PCTs which have Koala feed trees present (refer Section 5.7.6) are considered to provide suitable Koala habitat. Communities were not listed if they only contained supplementary feed trees. The PCTs considered to provide suitable Koala habitat are described in Table 6.3.

The species was not detected, however the species is known to occur at low densities within the Southern Tablelands region. The species may also be transitory within the Study Area making detection problematic. This species is considered as having the potential to occur within the Study Area.

Table 6.3 Koala Habitat Suitability

Vegetation Zone ID	Koala Habitat Suitability
<i>Apple Box - Candlebark - Snow Gum shrubby open forest on valley floors, southern South Eastern Highlands Bioregion</i> • 650_M-G_M • 650_M-G_W	This Vegetation Zone is an open woodland dominated by Snow Gum with Candlebark. This community contains secondary koala feed tree species.
<i>Black Sallee - Tussock Grass open woodland of the South Eastern Highlands Bioregion</i> • 680_M-G_M • 680_M-G_W	This Vegetation Zone is an open woodland dominated by Black Sallee, Swamp Gum and Snow Gum generally found in wetter areas. This community contains secondary koala feed tree species.
<i>Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion</i> • 888_M-G_G • 888_M-G_M	This vegetation type is partially cleared and impacted by agricultural activity although it retains a canopy dominated by Brittle Gum and Black She-oak (<i>Allocasuarina littoralis</i>). The occurrences of Black She-oak was monospecific in some areas but also occurred as a component of the vegetation. This vegetation type occurs in a large partially cleared area and also in small patches in the the northern precinct in of the Study Area. The patchy nature of this community (due to partial clearance) reduces the value of the habitat for the Koala, however in conjunction with other vegetation types such as PCT 1093, listed below, low densities of Koala may be able to be supported.
<i>Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion</i> • 1093_M-G_G • 1093_M-G_M • 1093_M-G_W	This vegetation type is dry woodland subject to previous clearing and some agricultural disturbance (grazing) dominated by a thinned canopy of Scribbly Gums, Red Stringybark and Brittle Gum. This vegetation zone occurs in relatively small patches mostly in the centre and north of the Study Area. The habitat is likely to be suboptimal for Koala with secondary feed tree species relatively sparse owing to the thinned canopy.
<i>Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion</i> • 1100_M-G_G • 1100_M-G_M • 1100_M-G_W	This vegetation type is woodland along watercourses and adjacent floodplains of the Study Area dominated by as Snow Gum and Ribbon Gum. It occurs in the centre and south of the Study Area and supports both primary and secondary Koala feed trees.
<i>Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion</i> • 1155_M-G_G • 1155_M-G_M	The vegetation type occurs in the far south of the Study Area. Broad-leaved Peppermint and <i>Eucalyptus viminalis</i> / <i>mannifera</i> regrowth occurs in small clusters. The majority of the vegetation zone is a derived grassland dominated by Kangaroo Grass, with patches of <i>Leptospermum</i> and <i>Melaleuca</i>. This community is not suitable Koala habitat due to extensive areas of derived grassland and small amount of feed tree regrowth. Where the vegetation type is intact, south of the Study Area, it is likely to be suitable habitat for the species.
<i>Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion</i> • 1334_M-G_G • 1334_M-G_L • 1334_M-G_M	This Vegetation Zone is an open woodland dominated by Yellow Box with Blakely's Red Gum and Brittle Gum in low broad valleys of the Study Area. The three dominant tree species within this community are all secondary feed tree species.

A summary of the species known, or with potential to occur in the PA, is provided in Table 6.4, and are further described in Annex C. The rationale for the assignment of a species' likelihood of occurrence is described in Table 4.15.

Table 6.4 *Threatened Species known or with potential to occur in the Study Area*

Species group	Common Name	Species Name	TSC Act Status	EPBC Act Status
Known to occur:				
Birds	Blue-billed Duck	<i>Oxyura australis</i>	V	-
Birds	Diamond Firetail	<i>Stagonopleura guttata</i>	V	-
Birds	Glossy Black-Cockatoo	<i>Calyptrorhynchus lathami</i>	V	-
Birds	Scarlet Robin	<i>Petroica boodang</i>	V	-
Birds	Speckled Warbler	<i>Chthonicola sagittata</i>	V	-
Birds	Spotted Harrier	<i>Circus assimilis</i>	V	-
Birds	Varied Sittella	<i>Daphoenositta chrysoptera</i>	V	-
Birds	White-fronted Chat	<i>Epthianura albifrons</i>	V	-
Flora	Buttercup Doubletail	<i>Diuris aequalis</i>	E	V
Flora	Hoary Sunray, Grassland Paper-daisy	<i>Leucochrysum albicans</i> subsp. <i>albicans</i> var. <i>tricolor</i>	-	E
Mammals	Eastern Bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>	V	-
Potential to occur:				
Birds	Barking Owl	<i>Ninox connivens</i>	V	-
Birds	Black Falcon	<i>Falco subniger</i>	V	-
Birds	Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	V	-
Birds	Curlew Sandpiper	<i>Calidris ferruginea</i>	E	CE, Mi, Ma
Birds	Flame Robin	<i>Petroica phoenicea</i>	V	Ma
Birds	Freckled Duck	<i>Stictonetta naevosa</i>	V	-
Birds	Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	V	-
Birds	Hooded Robin	<i>Melanodryas cucullata cucullata</i>	V	-
Birds	Little Eagle	<i>Hieraetus morphnoides</i>	V	
Birds	Pink Robin	<i>Petroica rodinogaster</i>	V	-
Birds	Powerful Owl	<i>Ninox strenua</i>	V	-
Birds	Swift Parrot	<i>Lathamus discolor</i>	E	E, Ma
Flora	Austral Toadflax	<i>Thesium australe</i>	V	V
Flora	Basalt Pepper-cress	<i>Lepidium hyssopifolium</i>	E	E
Flora	Black Gum	<i>Eucalyptus aggregata</i>	V	-
Flora	Few-seeded Bossiaea	<i>Bossiaea oligosperma</i>	V	V
Flora	Matted Bush-pea	<i>Pultenaea pedunculata</i>	E	-
Flora	Pale Pomaderris	<i>Pomaderris pallida</i>	V	V
Mammals	Eastern False Pipistrelle	<i>Eastern False Pipistrelle</i>	V	
Mammals	Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	V

Species group	Common Name	Species Name	TSC Act Status	EPBC Act Status
Mammals	Koala	<i>Phascolarctos cinereus</i>	V	V
Mammals	Southern Myotis	<i>Myotis macropus</i>	V	-
Mammals	Spot-tailed Quoll, Spotted-tail Quoll	<i>Dasyurus maculatus maculatus</i>	V	E
Mammals	Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>	V	-
Reptiles	Little Whip Snake	<i>Suta flagellum</i>	V	-
Reptiles	Rosenberg's Goanna	<i>Varanus rosenbergi</i>	V	-

TSC Act Status and EPBC Act Status: V – Vulnerable, E – Endangered, CE – Critically Endangered, Mi – Migratory, Ma – Marine

6.5

LIMITATIONS

6.5.1

Vegetation and Flora

The purpose of the vegetation and flora studies was to identify threatened flora species and map the vegetation in accordance with the methods recommended in the original DGRs. Due to the agricultural land use of the Study Area there has been modification of the floristic and structural characteristics of the vegetation from its pre-European settlement character. In derived grassland communities limited site data exists to assign these to a PCT. In these cases any flora species present has been used to assist in assigning the most appropriate PCT. Vegetation boundaries have been mapped across the Study Area based on field observation and interpretation of aerial imagery. A conservative approach has been taken where communities of conservation significance occurred.

Surveys were conducted over late summer in early 2014, spring / summer in the latter part of 2014 and early 2015, and winter 2015, therefore providing a snapshot of the vegetation and flora at those times. The composition of vegetation communities can vary depending on climatic patterns and level of agricultural activity. Not all species of flora that may occur in a given area are identifiable at all times during the year. The main field survey effort was planned to focus on the times when the most number of flora species were identifiable in the Study Area (spring and summer). The results of the flora surveys provide a list of flora that were present and identifiable during field surveys. In most cases flora samples were identifiable to species level, but in some cases due to an absence of appropriate material (eg reproductive parts of the plant), the sample may have only been reliably identified to genus or family level.

The road reserves of Goulburn-Braidwood Road and the Kings Highway were not subjected to detailed targeted threatened flora surveys. The vegetation types have been qualitatively mapped during site walkovers within the road reserve. Private land either side of the road reserve were inaccessible and not visited. The transmission line alignment has been chosen in an area of least disturbance along the road edge immediately adjacent to the hardstand. The alignment has been chosen as the lowest ecological impact achievable.

Mitigation measures have been included to overcome any limitations in survey effort.

Impact area calculations have been based on a self-defined Study Area which, for the purposes of having a defined shapefile, adopted the cadastral road reserve for the relevant sections of the Goulburn-Braidwood Road and the Kings Highway. This does not exactly align with the physical location of the paddock boundary fences in the field.

6.5.2 *Fauna*

As with all ecological impact 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.

The majority of survey effort ecological study was constrained to approximately 18 months and therefore has limitations compared to long-term multi-annual studies. In order to address any deficiencies of the survey, the precautionary principle has been adopted in considering the likelihood of threatened species presence.

Bird surveys were generally limited to early morning and late afternoon as these are periods when birds are most active. Raptor 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 smaller species flying below RSA height was detected during mid-day surveys, although the affect was less noticeable for the larger species especially raptors such as the Wedge-tailed Eagle, which were typically observed throughout the day. It is considered that a representative sample of birds flying at RSA height was undertaken, as a wide range of different survey times were selected, from just after dawn to before dusk. Each raptor survey site aimed to be located in vantage points, which offer unimpeded view of the surrounding countryside, such as a hilltop or ridgeline. In several situations the vantage point did not offer a full 360 degree view due to the presence of forest. The locations were selected to offer the best coverage of the Study Area possible and the locations were selected to achieve the best compromise between coverage and visibility, for example, a forested ridgeline occurs within the central part of the Study Area, which may represent important foraging and possibly breeding habitat for raptors. A raptor survey site was located on this ridgeline despite the view being slightly reduced.

HBTs were mapped within a 200 m radius of WTGs and in the publicly accessible road reserve area along Goulburn-Braidwood Road and the Kings Highway between the paddock boundary fences (ie existing physical road reserve). Note that this does not exactly align with the existing cadastral road reserve (which was used to define the Study Area). HBTs were not mapped inside the paddock fences due to limitations in accessing private land beyond the public road reserve. During HBT surveys, the field team did not physically visit two WTGs (WTG 83 and WTG 54) due to accessibility constraints, and these areas were observed from a distance using binoculars.

Ultrasonic bat detection units were used to identify bats utilising the Study Area. The species results from calls have been given a ranking based on the confidence of the identification, either Definite, Probable or Possible. Several species cannot be differentiated from their calls alone and when this occurs the species complex was listed.

Baited camera traps were used to target the Spotted-tailed Quoll with chicken carcasses used as bait. Despite the chicken carcass bait being attached to trees and logs with wire, persistent Corvids were successful in removing the bait on several occasions. There appeared to be enough residual smell at the previously baited location to continue to attract a wide variety of animals. There was no difference noted between the amount and abundance of animals recorded at those camera locations where the bait persisted compared to those where the bait was removed.

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.

Impacts to biodiversity and specifically the listed ecological values assessed as known, or with potential to occur, within the PA were assessed based on the Project Description presented in *Chapter 2*. The Development Footprint presented in *Chapter 2* incorporates recommendations for avoidance of sensitive ecological areas provided throughout the field survey program.

The identification of potential impacts, corresponding mitigation measures, and the assessment of significance of residual impacts was undertaken using the Project-specific Impact Assessment process described in *Section 4.4*. The full results of this assessment are provided in *Annex H*, and the following sections provide the outcomes of this assessment.

7.1 POTENTIAL IMPACTS OF THE PROJECT

There are a range of potential impacts associated with the Project including direct and indirect impacts, as discussed in the following sub-sections. The potential impacts to native biodiversity associated with the construction and operation of wind farms includes the following impacts:

- Direct Impacts:
 - removal and disturbance of vegetation during construction (habitat loss);
 - removal or damage to threatened flora species;
 - fauna mortality during construction and operation;
 - introduction of weed species and / or pathogens;
- Indirect impacts;
 - alienation of habitat; and
 - fragmentation of ecological communities and habitat.

7.1.1

Habitat Loss

Terrestrial Habitat

Habitat loss is a direct consequence of the Project infrastructure construction. Habitat loss is the direct impact caused by the Development Footprint of the Project removing vegetation. The Development Footprint is made up of the components discussed in *Chapter 2* and covers 86.27 ha. Following construction, some areas of the Development Footprint (such as laydown areas) will be rehabilitated to the pre-development state. This will include revegetation, spreading mulched or cleared vegetation and spreading native grass seed with local species in accordance with an approved Construction and Environmental Management Plan.

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 the *EIS Chapter 5* and *Section 7.2* respectively. The habitat loss associated with the Project is quantified in *Section 7.3.1*.

Aquatic Habitat

The majority of the watercourses throughout the Study Area are ephemeral in nature. Infrastructure, such as access roads have largely been sited to avoid watercourses. Impacts are typically limited to widening of existing crossings over small ephemeral watercourses. This may result in some limited impacts to including stream bank and stream bed disturbance.

No fish were observed in any of the ephemeral watercourses. Crossings that impede fish passage can result in a major loss of breeding and foraging habitat by fragmentation.

Alienation of Habitat

The alienation of habitat involves changes in behaviour of species. Species may respond to the introduction of WTG and associated infrastructure by avoiding breeding or foraging resources and habitat utilisation around where WTGs are located due to the unfamiliar object being perceived as a potential threat. The *Natural England Technical Information Note TIN051: Bats and Onshore Wind Turbines Interim Guidance* (Natural England 2012) contains an approach to consider WTG setback distances from habitat features used by bats such as HBTs and woodland/forest habitat edges to avoid habitat alienation of those features. The setback analysis is based on seeking to maintain separation between the outside edge of the RSA and the nearest habitat feature (such as tree canopy of woodland or HBT). It uses an equation containing the blade length, hub height and height of the habitat feature (ie tree canopy height for HBTs and woodlands/forests). For this reason, the setback analysis is applied to each WTG individually once the specific design is known including exact location, hub height, rotor length and topographical profile between WTG position and habitat feature. It is not useful to apply the analysis based on

estimated design features such as using the largest rotor length and maximum hub height because the result will overestimate the recommended setback. Smaller WTG components, if selected, will generally result in smaller required setbacks. Setback analyses will be undertaken during detailed design, when specific WTG dimensions and locations are known, with consideration made to avoidable impacts within functional parameters using micro-siting.

7.1.2 *Habitat Degradation*

Machinery required for the construction and operation of the Project has the potential to introduce weed species and / or pathogens into the Study Area. Any introduction of weed species or pathogens has the potential to reduce the flora species diversity and structure of vegetation communities.

In addition, habitat adjacent to construction areas can be impacted by sediment laden run-off, air pollution leading to dust settling on vegetation and inhibiting photosynthesis, and accidental damage to vegetation or microhabitat features proposed to be retained.

7.1.3 *Fragmentation of Habitat*

The landscape of the Study Area is already highly fragmented, comprising patches of native woodland with the majority native and exotic pasture grassland. The proposed Project comprises a Development Footprint that is nodal (that is, a series of WTG points linked by a network of linear access roads). Furthermore, the Development Footprint has been designed to avoid areas of woodland.

In the BBAM (2014) (OEH 2014a), OEH define connected vegetation as those separated by:

- <100 m for woody vegetation (or <30 m for grassland vegetation); or
- any distance where the separation is caused by a 'hostile link' such as a large water body, a dual carriageway, wider highway or similar in affect.

The maximum widths of vegetation separation that the Development Footprint will create in the Study Area are shown in *Table 7.1*.

Table 7.1 *Fragmentation Caused by Project Infrastructure*

Infrastructure Type	Longest Possible Separation Caused	Configuration	Infrastructure Creating 'Hostile Link'?	Maintenance of Connectivity
Access roads	8 m	Linear	No	Connectivity maintained.
WTG and crane hardstand	75 m (assumed longest possible axis of permanent infrastructure)	Nodal	No	Yes, if thought of as a piece of infrastructure in isolation, then the WTG and crane hardstand footprint sever connectivity across their maximum possible width, however at the points where the footprint measures 75 m on its greatest axis, the footprint will correspondingly be only 25 m wide at that WTG. The Development Footprint is nodal with the WTGs and crane hardstand locations occurring as points connected by narrow access roads. The landscape connectivity will be maintained around each WTG and crane hardstand location.
Substation	200 m	Nodal	No	No. The substation footprint will be great enough to sever connectivity across it, however it is a discreet point in the Development Footprint and is located in grassland. The grassland will remain connected surrounding the substation.
Transmission line linking the southern precinct to the substation in the northern precinct	4 m	Linear	No	Yes. Connectivity maintained. Furthermore, the 4 m wide impact will be immediately adjacent to the main road edge, which is often gravel road base and compacted soils. The 4 m wide clearing adjacent to the road will not sever the linear connectivity along the roadway as the road reserve is wider than 4 m and vegetation will be retained in the remainder of the road reserve.

The proposed Development Footprint will not exacerbate the existing fragmentation in the Study Area, PA or locality. The Project comprises small and narrow linear elements spread across a wide area and as such, the resulting permanently cleared areas are unlikely to negatively affect the connectivity of the existing ecological processes occurring in the Study Area.

Several species of birds and bats may avoid areas of the Study Area where WTGs are present, as discussed in the *Section 7.1.5*. This may have an indirect fragmentation effect, larger than that of the development area. It is anticipated that the species are sufficiently mobile to navigate around clusters of WTGs and large areas of habitat are unlikely to be avoided by species.

7.1.4 *Fauna Mortality*

Operational wind farms pose a risk of mortality due to WTG collision or barotrauma to birds and bats leading to injury or mortality.

Barotrauma

The decompression hypothesis proposes that many bats are killed by barotrauma that is caused by rapid air-pressure reduction near moving WTG blades (Baerwald *et al.* 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 *et al.* 2008). As with any airfoil, moving WTG blades create zones of low pressure as the air flows over them. Animals entering these low pressure areas may suffer barotrauma (Baerwald *et al.* 2008).

Species most at risk of barotrauma within the Study Area are species of microbats. All reported fatalities of bats from WTG, in Australia and overseas, have been microbats (Australian Bat Society Undated). Where reliable data are available, the bat deaths reported range from 1.6 per WTG per year to over 90 bats per WTG per year (Australian Bat Society Undated).

Collision-Related Birds Mortality

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. In Australia, birds are generally considered to avoid flying through operational WTGs at a rate of 95% to 99% (Biosis Research Pty Ltd 2006). This avoidance affect essentially leads to a loss of habitat within the footprint of the proposed development, but it also greatly reduces the number of birds interacting with WTGs once the wind farm is operational.

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

- high collision rates have been recorded at several large wind farms using older technology consisting of small, fast spinning models or using lattice masts where roosting can occur located in areas where large concentrations of birds are present (eg Altamont Pass in California, USA; Tarifa and Navarra in Spain) (BL&A 2011). 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. Concentrations of wetland birds are known from the nearby Lake Bathurst however there were no observations of large numbers of wetland birds or migratory birds flying over the Study Area to or from Lake Bathurst. There is a general lack of foraging resources for threatened and migratory wetland species within or directly south of the Study Area. It is considered that birds are likely to disperse from Lake Bathurst or travel in directions other than towards the south ie directly over the Study Area. It is acknowledged that only very long term studies could confirm this theory. Wedge-tailed Eagles were frequently observed within the Study Area, soaring at RSA height and may be susceptible to rotor strike;
- large birds with poor manoeuvrability (such as larger waterbirds) are generally at greater risk of collision with WTG. Species that habitually fly at dawn, dusk or at night are also less likely to detect and avoid WTG. Three large water birds species were recorded within the PA, including the Australasian Pelican (*Pelecanus conspicillatus*), Great Cormorant (*Phalacrocorax carbo*) and Australian White Ibis (*Threskiornis molucca*). All of these species may be at risk of rotor strike however, they are common species and were recorded infrequently in low numbers, with the Study Area supporting a very small number of individual compared to the broader NSW region. Although Wedge-tailed Eagles are large birds, they are manoeuvrable and are likely to avoid the WTG in most cases 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. The field surveys over the course of one year did not detect any migratory species or threatened species likely to exploit the foraging resources within the Study Area. There are several threatened species such as the Swift Parrot, which have the potential to occur within the Study Area, however based on the lack of abundant records, field observations or optimal habitat occurring, it was deemed likely that these species would only occur in low numbers and as occasional visitors to the Study Area.

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 10,000 and 40,000 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 gauge 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 (Biosis Research Pty Ltd 2006). 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 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 (Biosis Research Pty Ltd 2006). Therefore, the cumulative impacts of collision with WTG 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 (Biosis Research Pty Ltd 2006).

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.

Collision-Related Bat Mortality

Limited data is available on wind farm impacts on bats in Australia. The only mortality rate data in the public domain in Australia is 1.86 bats per WTG per year from Woolnorth Wind Farm (published by Hydro-Tasmania). This rate is comparable to that recorded for most North American and European wind farms. Several hypotheses have been suggested in an attempt to determine how and why bats are killed by WTG, these include:

- sensory failure where bats are unable to visually or acoustically detect moving WTG blades (non-echo locating bats are less able to avoid collision);
- roost attraction where bats may mistake WTG for a roost;
- acoustic attraction where bats are attracted to sounds generated by WTG;
- 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 (eg hilltops and ridges), therefore in prime foraging habitat for bats. Open spaces around WTG may also create favourable foraging habitats; and
- decompression – sudden changes in air pressure created by WTG turbulence which can cause barotraumas in some species. In Australia, bats display some migratory behaviour but migrations are local and not considered to cover significant distances compared to the USA (BL&A 2011).

7.1.5 *Threatened Flora Species Removal*

There is potential for threatened flora species to occur in as-yet unidentified locations (refer *Section 6.2.2*). There is potential for as-yet unidentified threatened flora to be removed or damaged, unknowingly, during vegetation clearing or construction.

7.2 *MITIGATION MEASURES*

A series of mitigation measures have been developed to address the identified potential impacts (refer to *Table 7-2*). The mitigation measures draw on management recommendations available in threatened species recovery plans and conservation advices, and threat abatement plans. These measures will be implemented by the Proponent, and the Proponent will bear the costs of implementation.

The mitigation measures will be captured in the following overarching plans:

- Flora and Fauna Management Plan (FFMP) in the Construction Environmental Management Plan (CEMP) including Weed Management Plan;
- Decommissioning and Rehabilitation Plan (*Annex O* of the EIS);
- Soil and Water Management Plan;
- Bird and Bat Adaptive Management Program; and
- Operational Environmental Management Plan (OEMP).

These plans will be prepared and submitted to DP&E for approval in consultation with agencies primarily OEHL, prior to commencement of construction.

Each plan will define governance requirements, and a monitoring and evaluation process for the plan. This will include:

- estimated costs of implementation of the plan;
- performance criteria to assess effectiveness of the plan;
- corrective actions to be implemented in the event that performance criteria are not achieved; and
- responsibilities and timeframe for implementation of each action.

An independent process for reviewing the environmental performance of the Project, considering regulatory requirements and implementation of approved plans, during construction and operation will be outlined in the management plans.

Table 7.2 Proposed mitigation measures

Mitigation measures	Impact Targeted	Environmental Outcome	Timing for Implementation	Plan
PRE-CONSTRUCTION				
A pre-clearance protocol will be established and will define survey and management requirements for fauna during clearing.	Fauna mortality	Reduce risk of fauna injury or mortality, or disruption to breeding fauna.	Protocol established prior to vegetation clearing.	FFMP CEMP
Infrastructure will be micrositied to avoid native vegetation, proximity to woodland/forest edges and avoid microhabitat features, such as HBTs, surface rock and termite mounds.	Habitat Loss	Retention of microhabitat features. Turbine setback guidance considered during detailed design.	During detailed design	Pre-construction
Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of native vegetation and habitat.	Habitat Loss	Reduction in area of native vegetation or habitat removed.	During detailed design	Pre-construction
Watercourse crossings will be designed to avoid blockage of fish passage.	Habitat/Ecological Community Degradation	Minimise impacts to fish movement or aquatic habitats.	Guidelines incorporated during detailed design.	Detailed Design
CONSTRUCTION				
Weed management and biosecurity measures will be implemented, including: - importing only weed-free materials; - importing machinery only when clean; - regular weed checks in and around construction zones; and - controlling existing weed infestations with consideration to potential adverse effects of chemicals or other mechanisms on potentially occurring threatened species.	Habitat/Ecological Community Degradation	Prevention of weed invasion into native vegetation communities and habitats, including threatened ecological communities.	Implementation of plan to occur prior to, and during, construction.	Weed Management Plan

Mitigation measures	Impact Targeted	Environmental Outcome	Timing for Implementation	Plan
An Environmental Compliance Manager or field officer qualified in the handling of fauna will be present on-site during clearing to capture and re-release fauna (where appropriate).	Fauna mortality	Reduce risk of fauna injury or mortality, or disruption to breeding fauna, during vegetation clearing.	During vegetation clearing.	CEMP
Where trenches are to remain open overnight a ramp will be constructed (at 1 in 4 grade) in the trench to allow for fauna escape.	Fauna mortality	Prevent injury or distress to fauna.	Fencing will be installed as soon as trenches established.	CEMP
Trenches will be regularly checked during construction by the Environmental Compliance Manager to ensure any captured fauna are released according to the Construction Environmental Management Plan.	Fauna mortality	Minimise injury or distress to fauna.	Through the duration that trenches are open.	CEMP
Moveable microhabitat features, such as large woody debris and surface rocks, will be relocated from the clearing area to adjacent habitat.	Habitat Loss	Retention of microhabitat features.	During vegetation clearing/site preparation.	CEMP
Hollows removed will be replaced with artificial hollows within adjacent suitable habitat at a suitable replacement ratio to be calculated.	Habitat Loss	Maintenance of roosting and nesting habitat features for hollow-roosting birds, bat and arboreal mammals.	Artificial hollows to be replaced within one month of removal.	CEMP
Areas will be reinstated and rehabilitated as soon as no longer required for construction (eg laydown areas following construction).	Habitat Loss	Replacement of removed habitat and native vegetation. Prevention of erosion and sediment runoff from disturbed areas.	Reinstatement to occur within one month of completion of use. Rehabilitation to be monitored as per the Rehabilitation Plan.	CEMP Decommissioning and Rehabilitation Plan
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.	Habitat/Ecological Community Degradation	Avoid unnecessary disturbance to native vegetation and habitats.	Prior to vegetation removal.	CEMP

Mitigation measures	Impact Targeted	Environmental Outcome	Timing for Implementation	Plan
Appropriate erosion and sediment controls will be defined in the Construction Environmental Management Plan and implemented.	Habitat/Ecological Community Degradation	Reduced erosion, avoiding deposition of sediment to surrounding terrestrial and increased sediment load in aquatic habitats.	Plan prepared prior to construction, and implemented during construction, and until temporary disturbance areas have been reinstated to an erosion-resistant state.	Soil and Water Plan in the CEMP
In-stream habitat features at watercourse crossings, such as rocks, cobbles and woody debris will be left in place or relocated nearby within the same creek system.	Habitat/Ecological Community Degradation	Retention of aquatic habitat features.	Prior to construction of watercourse crossings.	CEMP
Appropriate sanitation procedures will be implemented to reduce the risk of introduction of <i>Phytophthora cinnamomi</i> . If a risk of <i>Phytophthora cinnamomi</i> is suspected, boots, vehicle tyres, tools and machinery will be regularly cleaned of any soil and drenched in a 1% solution of bleach.	Habitat/Ecological Community Degradation	Prevent introduction or spread of <i>Phytophthora cinnamomi</i> .	Sanitation procedures implemented throughout construction period.	FFMP
Tree Protection Zones will be established to prevent damage to trees to be retained close to the Development Footprint.	Habitat/Ecological Community Degradation	Maintain health of retained trees.	Tree Protection Zones to be identified and established prior to construction commencing at that location.	CEMP
Pre-clearance surveys will be undertaken in areas of potential habitat and a chance-finds procedure will be developed to outline the appropriate actions if a threatened flora species population is identified.	Threatened Flora Species Removal	Prevent inadvertent clearing of unidentified threatened flora.	Pre-clearance surveys to be undertaken at least two weeks prior to clearing.	CEMP
OPERATION				

Mitigation measures	Impact Targeted	Environmental Outcome	Timing for Implementation	Plan
A Bird and Bat Adaptive Management and Monitoring Program will be developed which includes details of techniques for monitoring, frequency of monitoring, adaptive management provisions; and reporting requirements.	Fauna mortality	Identify bird and bat mortalities to understand impact of the project, add to body of knowledge of collision impacts in an Australian context, and identify corrective actions.	The monitoring plan will be prepared prior to construction, and implemented throughout the operation period.	Bird and Bat Adaptive Management Plan
DECOMMISSIONING				
Following completion of the Project, disturbed areas should be rehabilitated in accordance with the Jupiter Wind Farm Decommissioning and Rehabilitation Plan (refer to <i>Annex O</i> of the EIS).	Habitat Loss	Replace lost habitat in areas no longer required for use.	Implemented following completion of the project.	Decommissioning and Rehabilitation Plan (existing plan)
WHOLE OF PROJECT				
Vehicle speed limits of a maximum 60 km/hour will be introduced, to reduce the risk of vehicle strike.	Fauna mortality	Reduced risk of fauna mortality or injury due to vehicle strike.	Implemented for vehicle access throughout the Project.	CEMP/OEMP
Vehicles will remain on formed roads designed specifically for the purposes of the wind farm construction and operation where possible;	Habitat/Ecological Community Degradation	Avoid unnecessary disturbance to native vegetation and habitats.	Implemented for vehicle access throughout the Project.	CEMP/OEMP

7.3

RESIDUAL IMPACTS

This section identifies the direct and indirect 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.

Some residual impacts, such as native vegetation removal within the Development Footprint, are quantifiable (although at this stage is an indicative area). The extent of other impacts is currently unknown, or unpredictable. These unknown or unpredictable impacts include:

- the extent of habitat alienation resulting from the operation of WTGs; and
- the extent of impacts from WTG collision or barotrauma.

The possible extent of unknown or unpredictable impacts is discussed in consideration of available information. Where uncertainty exists, a precautionary approach has been applied.

7.3.1

Impacts to Habitat

Native Vegetation Removal

Removal of native vegetation, which provides habitat for native flora and fauna will be required for the construction of the Project. Of the 86.27 ha of clearing required for the indicative Development Footprint, 49.09 ha is native vegetation and 37.18 ha is non-native vegetation and other land cover types. The area of removal proposed for each Vegetation Zone is shown in *Table 7.3*.

Threatened and Endangered Ecological Community Loss

Vegetation clearance will remove areas of TEC and EEC. The areas proposed for removal within the Development Footprint are:

- 1.63 ha of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act Listed TEC);
- 2.19 ha of White Box Yellow Box Blakely's Red Gum Woodland (TSC Act Listed EEC); and
- 4.70 ha of Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion (TSC Act Listed TEC).

The significance of the proposed impacts on these species is discussed further in *Section 7.4*.

Table 7.3 Areas of Each Native Vegetation Zone in the Study Area and Development Footprint

PCT	Vegetation Zone ID	Equivalent EEC	Equivalent TEC	Study Area (ha)	Development Footprint (ha)	Percentage of area in Study Area that is within Development Footprint
Apple Box - Candlebark - Snow Gum shrubby open forest on valley floors, southern South Eastern Highlands Bioregion	650_M-G_L	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		2.08	0.00	0.00
	650_M-G_M	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		19.05	0.32	1.70
	650_M-G_P	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		0.08	0.00	0.00
	650_M-G_S	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		0.55	0.00	0.00
	650_M-G_W	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		1.22	0.06	5.23
Black Sallee - Tussock Grass open woodland of the South Eastern Highlands Bioregion	680_M-G_L	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		0.09	0.00	0.00
	680_M-G_M	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		5.69	3.39	59.55
	680_M-G_P	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		0.18	0.05	29.71
	680_M-G_S	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		1.66	0.12	7.38
	680_M-G_W	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		4.99	0.15	2.94
Burgan - Pink Kunzea derived tall shrubland, South Eastern Highlands Bioregion and South East Corner Bioregion	757_M-G_M			5.18	0.29	5.54
Derived grasslands of the South Eastern Highlands Bioregion and South East Corner Bioregion	797_M-G_L			158.45	4.59	2.90
Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion	888_M-G_G			6.31	0.00	0.00
	888_M-G_L			104.27	5.47	5.25
	888_M-G_M			81.20	0.67	0.83
	888_M-G_P			4.91	0.36	7.26

PCT	Vegetation Zone ID	Equivalent EEC	Equivalent TEC	Study Area (ha)	Development Footprint (ha)	Percentage of area in Study Area that is within Development Footprint
Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	1093_L			515.86	21.78	4.22
	1093_M-G_G			56.31	0.41	0.73
	1093_M-G_L			38.86	1.84	4.74
	1093_M-G_M			79.82	0.78	0.97
	1093_M-G_P			136.52	5.06	3.71
	1093_M-G_S			0.93	0.11	12.41
	1093_M-G_W			0.18	0.03	16.96
Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion	1100_M-G_G	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		0.61	0.00	0.00
	1100_M-G_M	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		47.61	0.58	1.22
	1100_M-G_W	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		0.14	0.02	14.31
River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion	1110_M-G_L			15.78	0.08	0.48
Silvertop Ash - Blue-leaved Stringybark shrubby open forest on ridges, north east South Eastern Highlands Bioregion	1150_M-G_G			46.68	0.07	0.16
	1150_M-G_M			1.04	0.00	0.00
Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion	1155_M-G_G			0.34	0.00	0.00
	1155_M-G_L			12.59	0.48	3.80
	1155_M-G_M			0.96	0.00	0.00
	1155_M-G_P			3.01	0.03	0.99
Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion	1334_M-G_G	White Box Yellow Box Blakely's Red Gum Woodland	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	31.57	0.91	2.89
	1334_M-G_L	White Box Yellow Box Blakely's Red Gum Woodland		0.16	0.00	0.00
	1334_M-G_M	White Box Yellow Box Blakely's Red Gum Woodland	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	43.37	0.72	1.66
	1334_M-G_P	White Box Yellow Box Blakely's Red Gum Woodland		13.78	0.55	3.97
	1334_M-G_W	White Box Yellow Box Blakely's Red Gum Woodland		0.33	0.01	2.63
Planted Native Vegetation	NA			1.98	0.15	7.51
Total EPBC Act Listed EEC				74.94	1.63	2.18
Total TSC Act Listed TEC				173.15	6.89	3.98
Total Native Vegetation				1444.33	49.09	3.40
1. This is a combination of the PCT Code and condition class as: M-G_G = Mod-Good_Good M-G_M = Mod-Good_Mod M-G_W = Mod-Good_Weedy M-G_S = Mod-Good_Shrubby M-G_P = Mod-Good_Poor M-G_L = Mod-Good_Low L = Low						

Threatened Flora Loss

Of the two threatened flora identified in the Study Area (Buttercup Doubletail and Hoary Sunray), only the Hoary Sunray occurs in the Development Footprint. Using the estimated average density of 200 individuals per hectare (refer *Section 5.5.1*) it is estimated that the total population occurring comprises 25,000 individuals (based on the known area of occurrence in the PA; a polygon measuring 125 ha in an area of the PA). Of this total population, it is estimated there are 8,594 individuals in the Study Area (42.97 ha of known habitat) and 342 individuals in the Development Footprint (1.71 ha). Therefore, the Project will remove 3.98% of the population in the Study Area and 1.37% of the estimated local population.

Habitat Loss

The ongoing revisions of the Project Development Footprint to avoid ecologically sensitive areas have assisted in minimising impacts to fauna habitat. However, some habitat loss will be unavoidable for the Project. A summary of the areas of each fauna habitat type within the Study Area and Development Footprint are provided in *Table 7.4* and habitat loss for threatened flora and fauna species are provided in *Table 7-5*, *Table 7-6* and *Table 7.7*.

Table 7-6 is a worst case scenario as each species are unlikely to occur through the whole habitat in the Study Area and it is likely that much smaller areas than described here will be utilised by the species or may represent optimal habitat for the species. Further, it is noted that woodland patches are frequent throughout the wider PA and have similar habitat value to those in the Study Area. The impacted area is not unique within the locality and the most important areas of habitat have been avoided through iterative design modifications.

Table 7.4 Impacts to Fauna Habitat

Habitat Type	Corresponding Vegetation Zone ID	Study Area (ha)	Development Footprint (ha)	Percentage of habitat type in Study Area also within Development Footprint
<i>Native Habitat Types:</i>				
Native Grassland	797_M-G_L 888_M-G_L 1093_M-G_L 1334_L	674.31	26.37	3.91
Native Grassland with Scattered Native Trees	650_M-G_L 650_M-G_P 680_M-G_L 680_M-G_P 888_M-G_L 888_M-G_P 1093_M-G_L 1093_M-G_P 1100_M-G_L 1100_M-G_P 1110_M-G_L 1155_M-G_L 1155_M-G_P 1334_M-G_P	332.15	13.92	4.19
Native Shrubland	Planted Native Vegetation 650_M-G_S6 680_M-G_S 757_M-G_M 1093_M-G_S 1334_M-G_G 1334_M-G_L 1334_M-G_M	10.30	0.67	6.54
Open Woodland with Native Understory		75.10	1.63	2.17

Habitat Type	Corresponding Vegetation Zone ID	Study Area (ha)	Development Footprint (ha)	Percentage of habitat type in Study Area also within Development Footprint
Woodland/ Forest	650_M-G_M 650_M-G_W 680_M-G_M 680_M-G_W 888_M-G_G 888_M-G_M 1093_M-G_G 1093_M-G_M 1093_M-G_W 1100_M-G_G 1100_M-G_M 1100_M-G_W 1150_M-G_G 1150_M-G_M 1155_M-G_G 1155_M-G_M	352.14	6.49	1.84
Non-native Habitat Types:				
Non-native Pasture (includes non-native pasture with scattered native trees)	NA	790.29	34.34	4.35
Non-native Forest	NA	8.58	0.20	2.36
Other Land Cover:				
Hardstand	NA	24.81	2.58	10.40
Dams	NA	1.35	0.07	5.02
Subtotal	Native Habitat Types	1444.00	49.09	3.40
Subtotal	Non-native Habitat Types	798.87	34.54	4.32
Subtotal	Other Land Cover	26.16	2.65	10.12
Total		2269.03	86.27	

Table 7.5 Threatened Flora Habitat Proposed to be Removed

Common Name	Species Name	TSC Act	EPBC Act	Potential Habitat			Known Habitat		
				Study Area (ha)	Development Footprint (ha)	Percentage of Habitat in Study Area that is within Development Footprint	Study Area (ha)	Development Footprint (ha)	Percentage of Habitat in Study Area that is within Development Footprint
Few-Seeded Bossiaea	<i>Bossiaea oligosperma</i>	V	V	223.64	1.86	0.83	-	-	-
Buttercup Doubletail	<i>Diuris aequalis</i>	E	V	62.62	0.41	0.65	6.11	0.00	0.00
Black Gum	<i>Eucalyptus aggregata</i>	V	-	90.66	4.55	5.02	-	-	-
Basalt Pepper-cress	<i>Lepidium hyssopifolium</i>	E	E	214.52	6.81	3.17	-	-	-
Hoary Sunray	<i>Leucochrysum albicans</i>	-	E	482.41	19.96	4.14	42.97	1.71	3.98
Pale Pomaderris	<i>Pomaderris pallida</i>	E	V	223.64	1.86	0.83	-	-	-
Matted Bush-pea	<i>Pultenaea pedunculata</i>	E	-	223.64	1.86	0.83	-	-	-
Austral Toadflax	<i>Thesium australe</i>	V	V	115.54	6.07	5.25	-	-	-

V = Vulnerable, E = Endangered

Table 7.6 Habitat impact areas for threatened fauna species known to occur in the PA

Common/Species Name	TSC Act	EPBC Act	Habitat Type						Study Area (ha)	Development Footprint (ha)	Percentage of area in Study Area that is within Development Footprint
			Native Grassland	Native Grassland with Scattered Native Trees	Native Shrubland	Open Woodland with Native Understory	Woodland / Forest	Dam			
Birds											
Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i>	V	-				S	S, F		427.24	8.12	1.90
Speckled Warbler <i>Chthonicola sagittata</i>	V	-				F, S	F, S		427.24	8.12	1.90
Spotted Harrier <i>Circus assimilis</i>	V	-		F		F, S	F, S		759.39	22.03	2.90
Varied Sittella <i>Daphoenositta chrysoptera</i>	V	-				F, S	F, S		427.24	8.12	1.90
White-fronted Chat <i>Epthianura albifrons</i>	V	-	F						674.31	26.37	3.91
Blue-billed Duck <i>Oxyura australis</i>	V	-						F, S	1.35	0.07	5.02
Scarlet Robin <i>Petroica boodang</i>	V	-				F, S	F, S		427.24	8.12	1.90
Diamond Firetail <i>Stagonopleura guttata</i>	V	-		F		F, S	F, S		759.39	22.03	2.90
Mammals											
Eastern Bentwing Bat <i>Miniopterus schreibersii oceanensis</i>	V	-				F, S	F, S		427.24	8.12	1.90

TSC Act Status and EPBC Act Status: V – Vulnerable, E – Endangered, CE – Critically Endangered, Ma – Marine
F = Foraging Habitat, S = Sheltering Habitat

Table 7.7 Habitat impact areas for threatened fauna species with potential to occur

Common Name	Species Name	TSC Act	EPBC Act	Habitat Type						Study Area (ha)	Development Footprint (ha)	Percentage of area in Study Area that is within Development Footprint
				Native Grassland	Native Grassland with Scattered Native Trees	Native Shrubland	Open Woodland with Native Understory	Woodland/ Forest	Dam			
Birds												
Curlew Sandpiper	<i>Calidris ferruginea</i>	E	CE, Mi, Ma							0.00	0.00	0.00
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	V	-				F, S	F, S		427.24	8.12	1.90
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	V	-				F, S	F, S		427.24	8.12	1.90
Black Falcon	<i>Falco subniger</i>	V	-		F		F, S	F, S		759.39	22.03	2.90
Little Eagle	<i>Hieraaetus morphnoides</i>	V			F		F, S	F, S		759.39	22.03	2.90
Swift Parrot	<i>Lathamus discolor</i>	E	E, Ma		F*					89.21	2.19	2.45
Hooded Robin	<i>Melanodryas cucullata cucullata</i>	V	-				F, S	F, S		427.24	8.12	1.90
Barking Owl	<i>Ninox connivens</i>	V	-				F, S	F, S		427.24	8.12	1.90
Powerful Owl	<i>Ninox strenua</i>	V	-				F, S	F, S		427.24	8.12	1.90
Flame Robin	<i>Petroica phoenicea</i>	V	Ma				F, S	F, S		427.24	8.12	1.90
Pink Robin	<i>Petroica rodinogaster</i>	V	-				F, S	F, S		427.24	8.12	1.90
Freckled Duck	<i>Stictonetta naevosa</i>	V	-						F, S	1.35	0.07	5.02

Common Name	Species Name	TSC Act	EPBC Act	Habitat Type						Study Area (ha)	Development Footprint (ha)	Percentage of area in Study Area that is within Development Footprint
				Native Grassland	Native Grassland with Scattered Native Trees	Native Shrubland	Open Woodland with Native Understory	Woodland/ Forest	Dam			
Mammals												
Spot-tailed Quoll, Spotted-tail Quoll	<i>Dasyurus maculatus maculatus</i>	V	E				F, S	F, S		427.24	8.12	1.90
Southern Myotis	<i>Myotis macropus</i>	V	-				F, S	F, S		427.24	8.12	1.90
Koala	<i>Phascolarctos cinereus</i>	V	V				F, S	F, S		427.24	8.12	1.90
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	V				F	F		427.24	8.12	1.90
Yellow-bellied Sheath-tail Bat	<i>Saccolaimus flaviventris</i>	V	-		F		F, S	F, S		759.39	22.03	2.90
Reptiles												
Little Whip Snake	<i>Suta flagellum</i>	V	-	F, S	F		F, S	F, S		1433.70	48.40	3.38
Rosenberg's Goanna	<i>Varanus rosenbergi</i>	V	-				F, S	F, S		427.24	8.12	1.90

TSC Act Status and EPBC Act Status: V – Vulnerable, E – Endangered, CE – Critically Endangered, Ma – Marine

F = Foraging Habitat, S = Sheltering Habitat

*Potential habitat is a sub-set of this habitat type only.

Habitat Fragmentation

The Development Footprint is located in an agricultural landscape containing poor native habitat connectivity. It is generally described as patches of native woodland separated by large areas of agricultural grassland (both native and non-native). Habitat fragmentation prior to development of this Project is currently high.

The WTGs and infrastructure have been located to avoid the removal of large tracts of forest or woodland associated with wildlife corridors within the Study Area and locality. The ultimate footprint of the infrastructure will not lead to habitat fragmentation as the footprint will generally be a network of up to 8 m wide linear access roads resembling farm tracks linking the WTG pads. Each WTG pad is like an 'island' of impact where any habitats adjacent to the pad will remain connected around the pad.

The 33 kV transmission line linking the northern and southern precincts is narrow (4 m wide) and is immediately adjacent to the existing road shoulder. The impact will be similar to road widening, and vegetation removal to construct the transmission line will not exacerbate habitat fragmentation because the vegetation in the road reserves is already fragmented and the narrow strip of required clearing will allow some vegetation retention within the road reserve adjacent to the cleared area.

Habitat Alienation

Raptors, including the threatened Spotted Harrier, have the potential to be alienated from the habitats immediately surrounding WTGs, although this is not likely to result in any significant impact on the species as they range over wide areas and the habitat within the Study Area is not unique or of particularity high value for the species. Alienation may result in a positive outcome reducing the risk of rotor strike further.

There is potential for microbat species to avoid the WTGs however, the level of avoidance is difficult to determine. If microbat species do exhibit avoidance behaviour, this could be considered a positive as it reduces the risk of barotrauma or rotor strike. The alienation of the foraging habitat is not considered significant, as the Study Area is unlikely to provide important habitat for a population of bats or regionally important habitat. Habitat alienation specific to the habitat features near each WTG following Natural England (2012) can be considered among other parameters during detailed design.

7.3.2

Collision Risk and Barotrauma

Two groups of species are at risk from rotor blade collision; birds and bats, with bats the only group likely to be affected by barotrauma.

Birds

Field survey and desktop analysis did not identify any important bird flight paths occurring across the Study Area and no large aggregations of birds were observed migrating through the Study Area. It is expected that in the majority of circumstances birds will take avoiding action or avoid the area where WTGs are present. It is suggested that an avoidance rate of 99% is conservative enough for collision risk assessment (Biosis Research Pty Ltd 2006).

The data collected in this study indicates that the most abundant bird species flying at RSA height were Wedge-tailed Eagle with other species flying within RSA height including the White-throated Needletail, Australian Raven, and Sulphur Crested Cockatoo. Given the abundance and wide distribution of the species recorded flying at RSA height, population scale impacts are not considered likely within the Study Area. The White-throated Needletail is listed as migratory and was recorded in aggregation of up to 100 individual within the locality (outside of the Study Area). This species is not expected to have a high risk of rotor strike as it is anticipated to have high avoidance capability based on its very fast, manoeuvrable flight and small size (compared to large raptors).

The Spotted Harrier, recorded within the PA, typically flies close to the ground while hunting. It is also likely to hunt in the low lying areas of the Study Area rather than over the top of ridgelines and hilltops, where the WTGs will be located. The highest risk for this species is expected to be when they travel between different foraging areas. Use of thermals and gaining height to travelling distances may put the species at risk. The species was recorded once within the survey period and a low number of birds are likely to be affected. Specific levels of avoidance was not found in the literature for this species, however avoidance behaviour has been demonstrated for several other Australian raptors including the Wedge-tailed Eagle (Biosis Research Pty Ltd 2006).

Currently, there is limited research in Australia on the actual rate of mortality of raptors as a result of WTG collision. One study undertaken monitored bird and bat fatalities at two Tasmanian wind farms: Bluff Point Wind Farm, with 38 WTGs monitored over eight years; and the Studland Bay Wind Farm, with 25 WTGs monitored over three years (Hull et al 2013). Bird utilisation surveys recorded the related White-bellied Sea Eagle (*Haliaeetus leucogaster*), Swamp Harrier (*Circus approximans*), Brown Falcon (*Falco berigora*), Australian Kestrel (*F. cenchroides*), Peregrine Falcon (*F. peregrinus*) and Australian Hobby (*F. longipennis*). Of these species, the following fatalities were recorded throughout the study period across the two windfarms: three White-bellied Sea Eagles, two Swamp Harriers, and six Brown Falcons. The findings of this study can be used to gain an understanding of the potential scale of fatalities of raptors a result of the Project.

There is anticipated to be mortality of birds especially common species associated with the development of the wind farm. The number of individual affected is likely to be low and not involve any significant proportions of any threatened or migratory species. A bird and bat monitoring plan will be implemented during the operational phase of the Wind Farm which will help quantify the impact of the Project.

Bats

There are two threatened bat species recorded within the Study Area, which may be susceptible to rotor strike and barotrauma due to their habit of flying at RSA height and being highly mobile over large areas. These are the Eastern Bentwing Bat and the Yellow-bellied Sheathtail-bat. One other species, the Grey-headed Flying Fox has the potential to occasionally occur in the Study Area and is also vulnerable to these risks.

The Eastern Bentwing Bat was recorded flying at height within the Study Area and is most likely to do so, when exhibiting directed movement, such as during migrations between coastal overwintering habitats and inland maternity roosts. When foraging the species is more likely to fly closer to wooded areas, reducing the risk of the rotor impacts. There was no evidence to suggest that significant proportions of the population pass through the Study Area at height and therefore it is anticipated that the impacts will not affect the subspecies population as a whole. Further monitoring post construction will determine the number of individuals likely to be affected.

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 (OEH 2015). This species was recorded flying at height and is likely to be vulnerable to rotor impacts while foraging. As the Study Area does not include unique habitat and similar habitat is widespread in the region there is no reason to suggest that the Study Area hosts a higher concentration of the species than surrounding areas. The number of individuals likely to be affected by the proposal is difficult to ascertain due to the lack of knowledge of detailed population sizes and movements of the species within eastern Australia. Post construction monitoring will be vital to assuring that this species is not significantly impacted.

The Grey-headed Flying Fox is at risk from rotor strike as it typically flies between foraging areas at RSA height. The species was not recorded within the PA and no records exist within the locality, with only sub-optimal habitat recorded. The species may not occur within the Study Area or rarely occur on an intermittent basis. Due to the low likelihood of occurrence the collision risk is considered low.

Other threatened bat species, such as the Eastern False Pipistrelle and Southern Myotis, which may occur within the Study Area have a low risk of rotor strike and barotrauma. These species tend not to fly at height in open areas, preferring to forage under or just above the forest canopy including riparian corridors. In the unlikely event of rotor strike or barotrauma, a very low number of individuals would be impacted on an occasional basis. No impacts to the local populations are anticipated.

7.4

ASSESSMENTS OF SIGNIFICANCE

In addition to the Project-specific impact assessment, the significance of impacts to each TSC and EPBC Act-listed species and community known to occur within the PA, or assessed as having potential to occur, was assessed using the guidance provided in the Threatened Species Assessment Guidelines (DECC 2007) (refer to *Annex E*) and Significant Impact Guidelines 1.1 (DoE 2013a) (refer to *Annex I*). An overview of the results of the assessments of significance using the Project-specific impact assessment, the Threatened Species Assessment Guidelines and the Significant Impact Guidelines 1.1 is provided in *Table 7.8*. Mitigation measures are detailed in *Section 7.2* and *Annex H*.

Two matters are assessed as having likely significant residual impacts, in accordance with the relevant guidelines, based on application of the precautionary principle:

- the Glossy Black-cockatoo was considered as likely to be significantly impacted, relating to potential exclusion of areas of high quality foraging habitat, if the species was to avoid areas habitats immediately surrounding WTGs; and
- removal of 1.63 ha of the EPBC Act-listed community White Box-Yellow Box-Blakeley's Red Gum Grassy Woodland may be considered a significant impact in accordance with the Significant Impact Guidelines 1.1 (DoE 2013a).

Table 7.8 Summary of Significance Assessments

Ecological Feature / Value	TSC Act Status	EPBC Act Status	Occurrence (refer to Annex C)	Project-specific Impact Assessment (refer Annex H)	TSC Act Assessment (refer to Annex E)	EPBC Act Assessment (refer to Annex I)
Non-threatened Matters:						
Birds (non-threatened)	-	-	Known	Not Significant	NA	NA
Bats (non-threatened)	-	-	Known	Not Significant	NA	NA
Flora Species (non-threatened)	-	-	Known	Not Significant	NA	NA
Non-volant Fauna Species (non-threatened)	-	-	Known	Not Significant	NA	NA
Fauna habitats	-	-	Known	Not Significant	NA	NA
Threatened Ecological Communities:						
White Box, Yellow Box, Blakely's Red Gum Woodland and Derived Native Grassland	-	CE	Known	Moderate	NA	Potential significant impact
White Box Yellow Box Blakely's Red Gum Woodland	E	-	Known	Moderate	Significant impact unlikely	NA
Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion	E	-	Known	Moderate	Significant impact unlikely	NA
Threatened Flora:						
Buttercup Doubletail (<i>Diuris aequalis</i>)	E	V	Known	Moderate	Significant impact unlikely	Significant impact unlikely
Hoary Sunray (<i>Leucochrysum albicans</i> subsp. <i>albicans</i> var. <i>tricolor</i>)	-	E	Known	Moderate	Significant impact unlikely	Significant impact unlikely
Few-seeded Bossiaea (<i>Bossiaea oligosperma</i>)	V	V	Potential	Not Significant	Significant impact unlikely	Significant impact unlikely
Black Gum (<i>Eucalyptus aggregata</i>)	V	-	Potential	Not Significant	Significant impact unlikely	Significant impact unlikely
Basalt Pepper-cress (<i>Lepidium hyssopifolium</i>)	E	E	Potential	Not Significant	Significant impact unlikely	Significant impact unlikely
Pale Pomaderris (<i>Pomaderris pallida</i>)	V	V	Potential	Not Significant	Significant impact unlikely	Significant impact unlikely

Ecological Feature / Value	TSC Act Status	EPBC Act Status	Occurrence (refer to Annex C)	Project-specific Impact Assessment (refer Annex H)	TSC Act Assessment (refer to Annex E)	EPBC Act Assessment (refer to Annex I)
Matted Bush-pea (<i>Pultenaea pedunculata</i>)	E	-	Potential	Not Significant	Significant impact unlikely	Significant impact unlikely
Austral Toadflax (<i>Thesium australe</i>)	V	V	Potential	Not Significant	Significant impact unlikely	Significant impact unlikely
Threatened Birds:						
Glossy Black-Cockatoo (<i>Calyptorhynchus lathami</i>)	V	-	Known	Moderate	Potential significant impact	NA
Speckled Warbler (<i>Chthonicola sagittata</i>)	V	-	Known	Not Significant	Significant impact unlikely	NA
Spotted Harrier (<i>Circus assimilis</i>)	V	-	Known	Minor	Significant impact unlikely	NA
Varied Sittella (<i>Daphoenositta chrysoptera</i>)	V	-	Known	Not Significant	Significant impact unlikely	NA
White-fronted Chat (<i>Epthianura albifrons</i>)	V	-	Known	Not Significant	Significant impact unlikely	NA
Blue-billed Duck (<i>Oxyura australis</i>)	V	-	Known	Minor	Significant impact unlikely	NA
Scarlet Robin (<i>Petroica boodang</i>)	V	-	Known	Not Significant	Significant impact unlikely	NA
Diamond Firetail (<i>Stagonopleura guttata</i>)	V	-	Known	Not Significant	Significant impact unlikely	NA
Curlew Sandpiper (<i>Calidris ferrunginea</i>)		CE, Mi	Potential	Not Significant	NA	Significant impact unlikely
Brown Treecreeper (eastern subspecies) (<i>Climacteris picummus victoriae</i>)	V	-	Potential	Not Significant	Significant impact unlikely	NA
Gang-gang Cockatoo (<i>Callocephalon fimbriatum</i>)	V	-	Potential	Not Significant	Significant impact unlikely	NA
Barking Owl (<i>Ninox connivens</i>)	V	-	Potential	Minor	Significant impact unlikely	NA
Powerful Owl (<i>Ninox strenua</i>)	V	-	Potential	Minor	Significant impact unlikely	NA
Flame Robin (<i>Petroica phoenicea</i>)	V	-	Potential	Not Significant	Significant impact unlikely	NA
Pink Robin (<i>Petroica rodinogaster</i>)	V	-	Potential	Not Significant	Significant impact unlikely	NA
Hooded Robin (<i>Melanodryas cucullata cucullata</i>)	V	-	Potential	Not Significant	Significant impact unlikely	NA
Black Falcon (<i>Falco subniger</i>)	V	-	Potential	Not Significant	Significant impact unlikely	NA
Little Eagle (<i>Hieraaetus morphnoides</i>)	V	-	Potential	Minor	Significant impact unlikely	NA
Swift Parrot (<i>Lathamus discolor</i>)	E	E	Potential	Moderate	Significant impact unlikely	Significant impact unlikely
Freckled Duck (<i>Stictonetta naevosa</i>)	V	-	Potential	Minor	Significant impact unlikely	NA

Ecological Feature / Value	TSC Act Status	EPBC Act Status	Occurrence (refer to Annex C)	Project-specific Impact Assessment (refer Annex H)	TSC Act Assessment (refer to Annex E)	EPBC Act Assessment (refer to Annex I)
Curlew Sandpiper (<i>Calidris ferruginea</i>)	E	CE, M	Potential	Not Significant	Significant impact unlikely	Significant impact unlikely
Threatened Mammals:						
Eastern Bentwing Bat (<i>Miniopterus schreibersii oceanensis</i>)	V	-	Known	Moderate	Significant impact unlikely	NA
Yellow-bellied Sheath-tail Bat (<i>Saccolaimus flaviventris</i>)	V	-	Known	Moderate	Significant impact unlikely	NA
Koala (<i>Phascolarctos cinereus</i>)	V	V	Potential	Minor	Significant impact unlikely	Significant impact unlikely
Spotted-tail Quoll (<i>Dasyurus maculatus maculatus</i>)	V	E	Potential	Not Significant	Significant impact unlikely	Significant impact unlikely
Eastern False Pipistrelle (<i>Falsistrellus tasmaniensis</i>)	V	-	Potential	Not Significant	Significant impact unlikely	NA
Southern Myotis (<i>Myotis macropus</i>)	V	-	Potential	Not Significant	Significant impact unlikely	NA
Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>)	V	V	Potential	Not Significant	Significant impact unlikely	Significant impact unlikely
Threatened Reptiles:						
Little Whip Snake (<i>Suta flagellum</i>)	V	-	Potential	Minor	Significant impact unlikely	NA
Rosenberg's Goanna (<i>Varanus rosenbergi</i>)	V	-	Potential	Minor	Significant impact unlikely	NA
Migratory Birds:						
Common Greenshank (<i>Tringa nebularia</i>)	-	M	Potential	Not Significant	NA	Significant impact unlikely
Common Sandpiper (<i>Actitis hypoleucos</i>)	-	M	Potential	Not Significant	NA	Significant impact unlikely
Fork-tailed Swift (<i>Apus pacificus</i>)	-	M	Potential	Not Significant	NA	Significant impact unlikely
Pectoral Sandpiper (<i>Calidris melanotos</i>)	-	M	Potential	Not Significant	NA	Significant impact unlikely
White-winged Black Tern (<i>Chlidonias leucopterus</i>)	-	M	Potential	Not Significant	NA	Significant impact unlikely
Bar-tailed Godwit (<i>Limosa lapponica</i>)	-	M	Potential	Not Significant	NA	Significant impact unlikely
White-throated Needletail (<i>Hirundapus caudacutus</i>)	-	M	Known	Not Significant	NA	Significant impact unlikely

Ecological Feature / Value	TSC Act Status	EPBC Act Status	Occurrence (refer to <i>Annex C</i>)	Project-specific Impact Assessment (refer <i>Annex H</i>)	TSC Act Assessment (refer to <i>Annex E</i>)	EPBC Act Assessment (refer to <i>Annex I</i>)
Rainbow Bee-eater (<i>Merops ornatus</i>)	-	M	Potential	Not Significant	NA	Significant impact unlikely
Satin Flycatcher (<i>Myiagra cyanoleuca</i>)	-	M	Potential	Not Significant	NA	Significant impact unlikely
Great Egret, White Egret (<i>Ardea alba</i>)	-	M	Potential	Not Significant	NA	Significant impact unlikely
Cattle Egret (<i>Ardea ibis</i>)	-	M	Potential	Not Significant	NA	Significant impact unlikely
Glossy Ibis (<i>Plegadis falcinellus</i>)	-	M	Potential	Not Significant	NA	Significant impact unlikely
Sharp-tailed Sandpiper (<i>Calidris acuminata</i>)	-	M	Potential	Not Significant	NA	Significant impact unlikely
Red-necked Stint (<i>Calidris ruficollis</i>)	-	M	Potential	Not Significant	NA	Significant impact unlikely

7.4.1 *Key Threatening Processes*

Key threatening processes are listed under Schedule 3 of the TSC Act, and include processes that adversely affect threatened species, populations or ecological communities or that may cause species, populations or ecological communities that are not threatened to become threatened. The Project will result in the operation of the following key threatening processes:

- clearing of native vegetation;
- removal of dead wood and dead trees; and
- removal of HBT.

The impacts of these key threatening processes resulting from the Project on threatened species and ecological communities in the Study Area are discussed in the Assessments of Significance provided in *Annex E*.

7.5 *OFFSET CALCULATIONS*

A combination of desktop analysis and field data was used to conduct a preliminary calculation of the biodiversity offset required by the Development Footprint. Calculations were made by an Accredited Assessor using the guidance in the BBAM (2009 & 2014) (DECC 2009, OEH 2014a) and by using the BBCC. A full offset calculations report is provided as an annex to this report (refer to *Annex G*). The calculation provides a metric representation of the biodiversity impacts of the indicative Development Footprint. The full offset requirement will be determined following detailed project design. Offsets for the Project may be provided through a range of alternative options to ensure the long term protection and management of the offset sites which may include either BioBanking credits or other means such as registered Conservation Agreements (more detail is contained in *Annex G*).

7.6 *CUMULATIVE IMPACTS*

A summary of the operational and proposed wind farms near the PA is provided in *Table 7.9*. A number of other proposed wind farms may be in feasibility, planning and investigation stages however, this discussion provides a synthesis of the publically available information.

Table 7.9 Operational and Proposed Wind Farms near the PA

Wind Farm Name	Status	Size (Turbines and/or MW) ¹	Region	Approximate Distance from PA
Capital ²	Operational	67 WTG; 140.7 MW	Bungendore	13 km west
Capital 2 ³	Planning approval received; investment decision pending	41 WTG	Bungendore	14 km west
Crookwell ²⁴	Approved	46 WTG; 92 MW	Crookwell	64 km north
Crookwell ³⁵	In planning approval process	30 WTG; 54-102 MW	Crookwell	56 km north
Cullerin Range ⁶	Operational	30 MW	Gunning	43 km north west
Gullen Range ⁷	Operational	73 WTG; 165.5 MW	Gunning – Crookwell	56 km north west
Gunning ⁸	Operational	31 WTG; 46.5 MW	Gunning	54 km north west
Woodlawn ^{4, 5, 9}	Operational	23 WTG; 48.3 MW	Bungendore	6 km north west
1. Generation capacity is provided with WTG numbers where possible. In some cases, both figures could not be found. MW capacity is approximately proportional to number of WTG with variation provided by the wind resource and the generator type. It is provided as a comparative measure to this Project, which is for up to a proposed 88 WTG with a capacity of 350 MW. 2.-10. Wind farm information from: 2 = Infigen (2015a); 3 = Infigen (2015b); 4 = Union Fenosa (2015a); 5 = Union Fenosa (2015b); 6 = Origin Energy (2015); 7 = Goldwind (2015); 8 = Acciona Energy (2015) and 10 = Infigen (2015c)				

Of the wind farms identified in *Table 7.9* six are located approximately 40 km away or greater. Any contribution the Project may make to the regional ecological impacts caused by those projects is unclear and beyond the scope of this assessment.

Three projects are located around 6-10 km away to the west, north west from the Project. These are the Capital, Capital 2 and Woodlawn Wind Farms (refer to *Table 7.9*). Two of these are operational and have a combined WTG amount of 90 WTG, around an equal number to the number proposed for this Project. The third (Capital 2) is awaiting an investment decision (Infigen 2015b) and its future is unknown.

This Project will contribute to regional ecological impacts when considered in combination with the Capital and Woodlawn Projects.

Wide ranging and migratory birds and bats have the potential to encounter several wind farms while flying within the immediate locality. Accordingly, the cumulative risk of rotor strike for these species is increased. However, there is no evidence to suggest that any wide ranging species identified within the Project Area will be attracted to the ecological attributes or habitat of the other wind farms in the locality at a rate higher than that of the surrounding landscape. Given that the nearest wind farm is over 6 km away from the Project, it is likely that these wide ranging birds and bats will spend the vast proportion of their lifecycle in areas without WTGs and therefore the cumulative risks, though present, are low.

Furthermore, defined migration routes that are used repeatedly (either seasonally or interannually) are not common for Australian species. Australian species are more likely to respond to ephemeral resource availability and change movement patterns accordingly. Field observation and data supports this with a lack of regular, directional movement recorded. Distinct movement pathways through or around the PA were not observed and therefore have not been mapped for the PA or surrounds. There are no known distinct migratory corridors (for birds or bats) between the Project or any of the closest wind farms. Much of the landscape within the locality is cleared with no connecting forests and no connecting valleys that may provide defined flight paths or encourage direct movement of birds and bats between the wind farms. A north-south orientated ridgeline exists west of the PA between Bungendore Road and Goulburn-Braidwood Road, and while birds and bats will fly across the ridgeline, it may act to discourage regular movement between the Project and the closest wind farms, which are located west of that ridge.

Due to the distance between the wind farms and the lack of connecting vegetation, it is considered that the majority of birds and bats recorded within the Study Area will not encounter any of the other wind farms identified in *Table 7.9*. This includes the majority of sedentary and territorial woodland bird species and those species of bat, which avoid flying in large open areas, instead using vegetated corridors as flight paths.

Biosis (2006) highlight the difficulty in drawing conclusions about cumulative operational risk. Based on collision risk modelling and population viability analysis, the assessment of significance of cumulative risk from all wind farms operational in Australia at that time (2005) was inconclusive due to variation in site specific factors and poor scientific knowledge of bird populations (Biosis 2006).

The Project would add to the cumulative habitat loss caused by wind farms within the area. In the regional context, the amount of habitat loss is likely to be insignificant owing to the relatively small clearance footprint required for the wind farms and due to the large amount of remaining habitat within the landscape. Furthermore, wind farms are located in predominately cleared areas with areas of high ecological value typically avoided.

In addition to the impact footprint of wind farms, WTGs may also change the movement and behaviour of birds and bats, if they exhibit avoidance of the WTGs. The Project is not directly adjacent to any other wind farm with a minimum of 6 km between the Project and other wind farms in the locality. If birds and bats demonstrate avoidance behaviour it is most likely to result in alienation from the habitats immediately surrounding WTGs rather than acting over distances that would coincide with corresponding alienation immediately around the WTGs of neighbouring wind farms. Furthermore, there are not anticipated to be any cumulative landscape-scale avoidance of large tracts of habitat caused by this Project as the WTGs of all wind farms combined will not form a continuous length of WTGs. Bird and bat species will be able to move through habitats between the wind farms (ie the individuals would not have to penetrate a continuous length of WTGs to move from one side of the region to the other).

It is considered that the cumulative impacts for this project are insignificant given that there is at least 6 km of separation between adjacent wind farms and the chance of impacts interacting are expected to be minimal. Nevertheless, it is recommended that the results of operational bird and bat carcass monitoring are pooled to give an idea of the cumulative strike risk. This may highlight any cumulative issues relating to a particular threatened species or migratory species, which may be impacted at several wind farms. The Bird and Bat Monitoring Plan will attempt to address this uncertainty and provide a mechanism for adaptive management.

This report has been prepared to identify the ecological values of the PA and to assess the potential impacts to ecological values that may result from the development of up to 88 WTGs and associated infrastructure.

Since late 2013, substantial ecology desktop research and field surveys have been undertaken to identify the ecological values of the PA, and throughout this period, the Proponent has drawn on the data collected to refine the Development Footprint with an aim to avoid impacts to ecological values.

The land within the PA is primarily used for agricultural grazing and consists of both native and improved pasture. Woodland and forest habitat occur in patches throughout the PA, with limited connectivity. The ecology surveys identified one EPBC Act-listed TEC, two TSC Act-listed EECs, two threatened flora species and numerous threatened bird species occurring within the PA. A conservative approach has assessed additional threatened flora and fauna species as having potential to occur within the PA.

Potential impacts to threatened matters, as well as general ecological values, were identified, and mitigation measures have been developed to minimise potential impacts. With the implementation of mitigation measures, and notwithstanding the application of the precautionary principle where the extent of impacts are uncertain, the Project is considered unlikely to have a significant residual impact on the majority of threatened matters known, or considered to have potential to occur on within the PA.

Two threatened matters are assessed as having likely significant residual impacts, in accordance with the relevant guidelines, based on application of the precautionary principle:

- the Glossy Black-cockatoo was considered as likely to be significantly impacted, relating to potential exclusion of areas of high quality foraging habitat, if the species was to avoid areas habitats immediately surrounding WTGs; and
- removal of 1.63 ha of the EPBC Act-listed community White Box-Yellow Box-Blakeley's Red Gum Grassy Woodland may be considered a significant impact in accordance with the Significant Impact Guidelines 1.1 (DoE 2013a).

An offset package will be prepared when the Development Footprint is finalised. This will include analysis of options to achieve the required offset, not limited to using the BioBanking scheme. The BioBanking Assessment Methodology (BBAM) was used as a metric to quantify the biodiversity impacts using the indicative Development Footprint. The result of the preliminary calculation is that the Project will require 1430 ecosystem credits and three species will require species credits: the fauna species Speckled Warbler (*Chthonicola sagittata*) and the Eastern Bentwing-bat (*Miniopterus schreibersii subsp. oceanensis*); and the flora species Hoary Sunray (*Leucochrysum albicans subsp. albicans var. tricolor*).

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Annex A

Qualifications of Personnel

Table A1 *Environmental Specialists Involved in the Ecological Assessment*

Personnel	Organisation	Discipline	Qualifications	Experience	Involvement
David Dique	ERM	Principal Ecologist	PhD BNatRes (Hons 1)	>20 Years	Technical review and advice
Naomi Buchhorn	ERM	Senior Ecologist	BSc (Hons 1)	>20 Years	Technical review and revisions
Adam Greenhalgh	ERM	Senior Ecologist	BAppSc DipAppSc	8 Years	Field Survey
Matthew Flower	ERM	Senior Ecologist	MSc(Hons 1) BEnvSc Accredited BioBanking Assessor	8 Years	Field Survey and Report Preparation
Eugene Dodd	ERM	Senior Ecologist	MRes BMarBio (Hons 1)	6 Years	Field Survey and Report Preparation
Josh Morris	ERM	Ecologist	BSc	5 Years	Field Survey and Report Preparation
Steven De Luzuriaga	ERM	Ecologist	MMarSc BEnvSc	4 Years	Field Survey and Report Preparation
Jasmin Lightbody	ERM	Ecologist	BEnvMgmt (Hons 1)	3 Years	Field Survey and Report Preparation
Chris Page	ERM	Environmental Consultant	BSC(Hons)	4 years	Field survey
Tom Cotter	ERM	Ecologist and Spatial Analyst	BSc	4 years	Field Survey and GIS Analysis
Tom O'Sullivan	Bluegum Ecological Consulting	Senior Ecologist	BA	20 Years	Field survey
Narrawan Williams	Ecotone Ecological Consultants	Senior Ecologist	CertII CALM	18 Years	Microchiropteran bat data analysis

Annex B

Commonwealth Protected Matters Search



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: 10/09/15 09:23:31

[Summary](#)

[Details](#)

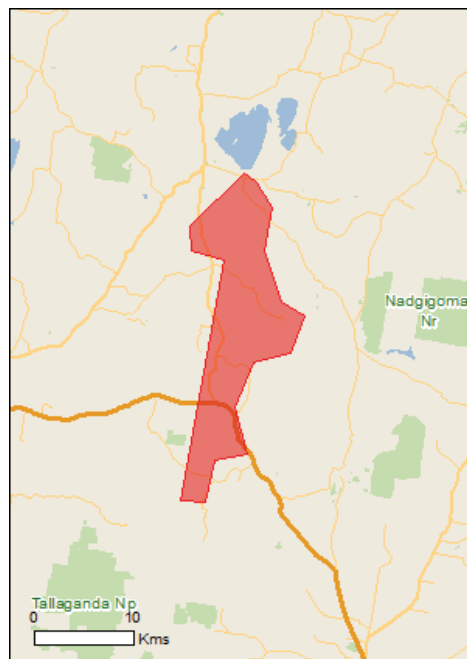
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

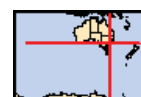
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Buffer: 10.0Km



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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	35
Listed Migratory Species:	21

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. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage/index.html>

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:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	27
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	4
Regional Forest Agreements:	1
Invasive Species:	34
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

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
Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory	Endangered	Community likely to 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		

Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area

Fish

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

Name	Status	Type of Presence area
Frogs		
Litoria castanea Yellow-spotted Tree Frog, Yellow-spotted Bell Frog [1848]	Endangered	Species or species habitat likely to occur within area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	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
Mammals		
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to 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
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Bossiaea oligosperma [10059]	Vulnerable	Species or species habitat likely to occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area
Commersonia prostrata Dwarf Kerrawang [87152]	Endangered	Species or species habitat likely to occur within area
Diuris aequalis Buttercup Doubletail [21588]	Vulnerable	Species or species habitat likely to occur within area
Dodonaea procumbens Trailing Hop-bush [12149]	Vulnerable	Species or species habitat likely to occur within area
Grevillea acanthifolia subsp. paludosa Bog Grevillea [21872]	Endangered	Species or species habitat may occur within area
Lepidium hyssopifolium Basalt Pepper-cress, Peppercress, Rubble Pepper-cress, Pepperweed [16542]	Endangered	Species or species habitat likely to occur within area
Leucochrysum albicans var. tricolor Hoary Sunray, Grassland Paper-daisy [56204]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Pelargonium sp. Striatellum (G.W.Carr 10345) Omeo Stork's-bill [84065]	Endangered	Species or species habitat known to occur within area
Phyllota humifusa Dwarf Phyllota [10133]	Vulnerable	Species or species habitat may occur within area
Pomaderris pallida Pale Pomaderris [13684]	Vulnerable	Species or species habitat may occur within area
Prasophyllum petilum Tarengo Leek Orchid [55144]	Endangered	Species or species habitat may occur within area
Prasophyllum sp. Wybong (C.Phelps ORG 5269) a leek-orchid [81964]	Critically Endangered	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	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

Migratory Terrestrial Species

Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to 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 known to occur within area

Migratory Wetlands Species

Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to 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 - 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

Name	Threatened	Type of Presence
Ardea alba Great Egret, White Egret [59541]	Critically Endangered	habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Endangered	Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Breeding likely to occur within area
Himantopus himantopus Black-winged Stilt [870]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Numenius madagascariensis Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Nadgigomar	NSW
Scott	NSW
Tallaganda	NSW
Tallaganda	NSW

Regional Forest Agreements	[Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
Southern RFA	New South Wales

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 Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur

Name	Status	Type of Presence
Anas platyrhynchos Mallard [974]		within area Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur

Name	Status	Type of Presence
Rattus rattus Black Rat, Ship Rat [84]		within area Species or species habitat likely to occur within area
Sus scrofa Pig [6]		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

Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to 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
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands		[Resource Information]
Name		State
Lake Bathurst		NSW

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 and National Heritage properties, Wetlands of International and National 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.

Coordinates

-35.076033 149.689723,-35.082776 149.700709,-35.082776 149.700709,-35.100755 149.714442,-35.100755 149.714442,-35.133331 149.707576,-35.171508 149.722682,-35.18161 149.744655,-35.208544 149.732295,-35.215276 149.697963,-35.248928 149.681483,-35.282566 149.69247,-35.288171 149.663631,-35.318431 149.655391,-35.317311 149.632045,-35.14007 149.67187,-35.133331 149.641658,-35.11536 149.640285,-35.076033 149.689723

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.

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Annex C

Threatened Species Likelihood of Occurrence Assessment

Annex C

Threatened Species Likelihood of Occurrence Assessment

C.1

OCCURRENCE OF THREATENED ECOLOGICAL COMMUNITIES IN THE STUDY AREA

Ecological community	TSC Act Status ¹	EPBC Act Status ²	Source ³	Occurrence
White Box, Yellow Box, Blakely's Red Gum Woodland and Derived Native Grassland Box Gum Woodland	-	CE	DGR; PMST	Present
White Box Yellow Box Blakely's Red Gum Woodland	EEC	-	DGR	Present
Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory	-	E	PMST	Absent
Natural Temperate Grass of the Southern Tablelands of New South Wales (NSW) and the Australian Capital Territory (ACT)	-	E	PMST	Absent
Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion	EEC	-	DGR	Present
Tablelands Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	EEC	-	DGR	Absent
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions	EEC	E	DGR	Absent
1. TSC Act Status: EEC – Endangered Ecological Community				
2. EPBC Act Status: V – Vulnerable, E – Endangered, CE – Critically Endangered				
3. Source: DGR – Director General's Requirements, PMST – Protected Matters Search Tool				

C.2 LIKELIHOOD OF THREATENED FLORA SPECIES OCCURRING IN THE STUDY AREA

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Plants							
Bombay Bossiaea	<i>Bossiaea bombayensis</i>	PEA, DGR, NSW Atlas	V	-	NSW Atlas (1) 2006	The Bombay Bossiaea is restricted to the Shoalhaven River valley between Warri and Bombay, about 10 km west of Braidwood. Bombay Bossiaea grows in the steeply incised valley of the Shoalhaven River, near Braidwood on the Southern Tablelands. It is mainly found on sandy, rocky slopes and terraces above the frequent flood line in a shrubland of <i>Callitris endlicheri</i> , <i>Grevillea arenaria</i> , <i>Lomandra longifolia</i> , <i>Micrantheum hexandrum</i> , <i>Pomaderris andromedifolia</i> and <i>Leptospermum polygalifolium</i> (OEH 2015).	Unlikely – part of the PA south of Kings Highway is within the species' distribution, shown in OEH (2012), and there is one record, from 2006 within the locality. However, suitable habitat consistent with known records has not been observed within the Study Area.
Few-seeded Bossiaea	<i>Bossiaea oligosperma</i>	PMST, PEA	V	V		Occurs on stony slopes or ridges on sandstone in the Yerranderie area (Warragamba) and on loamy soil in low woodland in the Windellama area (TSSC 2008). It is locally abundant in the Windellama area (OEH 2015).	Potential - the species has not been recorded within the PA, however the PA is within the species' distribution (DoE 2015) and eucalypt woodland within the PA may provide suitable habitat.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Thick-lipped Spider-orchid, Daddy Long-legs	<i>Caladenia tessellata</i>	PMST, PEA, DGR	E	V	-	The Thick-lipped Spider-orchid is known to favour low, dry sclerophyll woodland (for example open <i>Kunzea</i> woodland) with a heathy or sometimes grassy understory on clay loams or sandy soils. The population at Braidwood occurs in dry, low Brittle Gum (<i>Eucalyptus mannifera</i>), Inland Scribbly Gum (<i>E. rossii</i>) and <i>Allocasuarina</i> spp. woodland with a sparse understory and stony soil (DoE 2015).	Unlikely – the PA is within the species' distribution (DoE 2015), however, there are no database records of the species within the locality and targeted searches undertaken at a time when the species was expected to be flowering (OEH <i>pers. comm.</i>) did not detect the species.
Dwarf Kerrawang	<i>Commersonia prostrata</i>	PMST, PEA, NSW Atlas	E	E	NSW Atlas (4) 2007	Occurs on sandy, sometimes peaty soils in a wide variety of habitats: Snow Gum (<i>Eucalyptus pauciflora</i>) woodland and ephemeral wetland floor at Rowes Lagoon; Blue leaved Stringybark (<i>E. agglomerata</i>) open forest at Tallong; and in Brittle Gum (<i>E. mannifera</i>) low open woodland at Penrose; Scribbly Gum (<i>E. haemostoma</i>)/ Swamp Mahogany (<i>E. robusta</i>) ecotonal forest at Tomago. Associated native species may include <i>Imperata cylindrica</i> , <i>Empodisma minus</i> and <i>Leptospermum continentale</i> (OEH 2015).	Unlikely - four records of the species from 2007 are from within the locality but they are from the broad, open shores of the lake complex adjacent to Lake Bathurst. These habitat types are not present in the Study Area. Although the species has been identified in woodland similar to the woodland of the Study Area, those records are from outside the locality east of Marulan.
Kydra Dampiera	<i>Dampiera fusca</i>	PEA, NSW Atlas	E	-	NSW Atlas (2) 2010	Recorded in montane heath, also amongst rock platform and tors interspersed with closed heath. Habitat in the Canberra area is generally restricted to granite ridgetops and plateaux on very shallow soils supporting heath, scrub and heathy snow gum and/or mallee woodland (OEH 2015).	Unlikely – there are two records of the species, from 2010, within the locality. However, due to the absence of heathland or mallee woodland, suitable habitats have not been identified within the Study Area.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Michelago Parrot-pea	<i>Dillwynia glauca</i>	PEA, NSW Atlas	E	-	NSW Atlas (11) 2010	Occurs on exposed patches of clay or on rocky outcrops in eucalypt woodland often dominated by Scribbly Gum (<i>Eucalyptus rossii</i>), Snow Gum (<i>E. pauciflora</i>), Broad-leaved Peppermint (<i>E. dives</i>) and Red Stringybark (<i>E. macrorhyncha</i>). The understorey may be either grassy or shrubby. Grows adjacent to Natural Temperate Grassland in the Michelago area.	Unlikely - the species has not been recorded within the PA, however there are 11 records of the species, from 2010, within the locality. No suitable habitat (rocky outcrops in eucalypt woodland) was identified in the Study Area.
Buttercup Doubletail	<i>Diuris aequalis</i>	PMST, PEA, DGR, NSW Atlas	E	V	NSW Atlas (14) 1976 – 2012	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 2015).	Known - this species was recorded in a woodland patch within the PA during recent field surveys. There are an additional 14 records, from between 1976 and 2012, in the locality.
Trailing Hop-bush	<i>Dodonaea procumbens</i>	PMST, PEA, DGR, NSW Atlas	V	V	NSW Atlas (2) 1994 – 2007	Grows in Natural Temperate Grassland or fringing eucalypt woodland of Snow Gum (<i>Eucalyptus pauciflora</i>). Grows in open bare patches where there is little competition from other species. Found on sandy-clay soils, usually on or near vertically-tilted shale outcrops. Often occurs on roadside batters. Does not persist in heavily grazed pastures of the Monaro (OEH 2015).	Unlikely - the species has not been recorded within the PA, however there are two records of the species (from 1994 and 2007) within the locality. Snow Gum woodland and native grassland is present in the Study Area but shale outcropping is absent.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Black Gum	<i>Eucalyptus aggregata</i>	PEA, DGR, NSW Atlas	V	-	NSW Atlas (6) 1971 - 2010	Grows on alluvial soils, on cold, poorly-drained flats and hollows adjacent to creeks and small rivers. Often grows with other cold-adapted eucalypts, such as Snow Gum (<i>Eucalyptus pauciflora</i>), Ribbon Gum (<i>E. viminalis</i>), Candlebark (<i>E. rubida</i>), Black Sallee (<i>E. stellulata</i>) and Swamp Gum (<i>E. ovata</i>). Black Gum usually occurs in an open woodland formation with a grassy ground layer dominated either by River Tussock (<i>Poa labillardierei</i>) or Kangaroo Grass (<i>Themeda australis</i>), but with few shrubs. Also occurs as isolated paddock trees in modified native or exotic pastures (OEH 2015).	Potential - the species has not been recorded within the PA, however there are six records of the species (including a record of 20 individuals in 2010) within the locality. Alluvial areas of the Study Area may provide suitable habitat.
Mongarlowe Mallee	<i>Eucalyptus recurva</i>	PEA	CE	E	-	Found in shallow soils on gentle slopes in low heathland and in some cases at the margins of the heathland and adjacent low woodland; the woodlands are dominated by Brittle Gum (<i>Eucalyptus mannifera</i>) and Snow Gum (<i>E. pauciflora</i>), but scattered Candlebark (<i>E. rubida</i>) and Broad-leafed Peppermint (<i>E. dives</i>) trees are also nearby at some sites; in the Mongarlowe area the heathland is dominated by Stunted She-oak (<i>Allocasuarina nana</i>), with emergent shrubs of Finger Hakea (<i>Hakea dactyloides</i>) (OEH 2015).	Unlikely – the PA is within the species' distribution (OEH 2015), however, there are no records of the speices in the locality and, due to the absence of heathland, the Study Area does not contain suitable habitat for the species.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Bog Grevillea	<i>Grevillea acanthifolia</i> subsp. <i>paludosa</i>	PMST, PEA	E	E	-	This species grows on low hummocks in peaty swamps at approximately 1000 m altitude and has been found in association with <i>Leptospermum scoparium</i> , <i>L. lanigerum</i> , <i>Gahnia sieberiana</i> , <i>Boronia deanei</i> , <i>Sprengelia incarnata</i> , <i>Gleichenia dicarpa</i> , <i>Pultenaea subumbellata</i> and <i>Bauera rubioides</i> (TSSC 2008).	Unlikely – the PA is within the species' distribution (DoE 2015), however due to the absence of peaty swamps the Study Area is unlikely to provide suitable habitat.
Basalt Pepper- cress	<i>Lepidium hyssopifolium</i>	PMST	E	E	-	Generally, the Basalt Pepper-cress is known to establish on open, bare ground with limited competition from other plants. The Basalt Pepper-cress has been recorded from eucalypt woodland with a grassy ground cover, low open <i>Casuarina</i> woodland with a grassy ground cover, tussock grassland and exotic pasture. The species has been recorded in areas of high soil disturbance. Establishment of the species is thought to be disturbance-driven, as opposed to habitat specific. Soils at known sites are light to heavy clay loams that are often friable and the species is known to tolerate a range of environmental conditions (DoE 2015).	Potential - the species has not been recorded within the locality or the PA, however the PA is within the species' distribution (DoE 2015), and areas of open, bare ground within the Study Area may provide suitable habitat.
Hoary Sunray, Grassland Paper-daisy	<i>Leucochrysum albicans</i> subsp. <i>albicans</i> var. <i>tricolor</i>	PMST, PEA, NSW Atlas	-	E	NSW Atlas (3) 2010	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 (DoE 2015).	Known – this species was recorded within the PA during field surveys. In addition, there are three records of the species, from 2010, within the locality.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Omeo Stork's-bill	<i>Pelargonium sp.</i> (G.W.Carr 10345) [syn. <i>P. striatellum</i>]	PMST, PEA, DGR, NSW Atlas	E	E	NSW Atlas (1) 2008	It has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities. It sometimes colonises exposed lake beds during dry periods (OEH 2015).	Unlikely - the species has not been recorded within the PA, however 40 individuals have been recorded around Lake Bathurst to the north of the PA.
Dwarf Phyllota	<i>Phyllota humifusa</i>	PMST, PEA	V	V	-	The species occurs in dry sclerophyll forest, sometimes near swamps, in deep sandy soils or gravely loams over a sandstone substrate. Accompanying trees are often Brittle Gum <i>Eucalyptus mannifera</i> , Narrow-leafed Peppermint <i>E. radiata</i> or Sydney Peppermint <i>E. piperita</i> (OEH 2015).	Unlikely - the PA is not within the species' distribution, as shown by DoE (2014) and OEH (2012) and no records of the species occur in the locality.
Delicate Pomaderris	<i>Pomaderris delicata</i>	DGR	CE		NSW Atlas (3) 2002 – 2008	Grows in dry sclerophyll forest on shallow soils dominated by Silvertop Ash with a dense shrubby understorey of She-oaks (<i>Allocasuarina</i> spp.). Known only from two locations which are both in roadside habitats (OEH 2015).	Unlikely – there are three records, from within the locality. However, the Development Footprint does not impact suitable habitat.
Pale Pomaderris	<i>Pomaderris pallida</i>	PMST, PEA, NSW Atlas	V	V	NSW Atlas (1) 2008	This species usually grows in shrub communities surrounded by Brittle Gum (<i>Eucalyptus mannifera</i>) and Red Stringybark (<i>E. macrorhyncha</i>) or <i>Callitris</i> spp. Woodland (OEH 2015).	Potential - the species has not been recorded within the PA, however there is one record, from 2008, within the locality. Red Stringy Bark and Brittle Gum woodland in the Study Area may provide suitable habitat.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Tarengo Leek Orchid	<i>Prasophyllum petilum</i>	PMST	E	E	-	When first described in 1991, the Tarengo Leek Orchid was known only from the Hall Cemetery in the ACT. It has since been found at four sites in New South Wales: Captains Flat Cemetery, Ilford Cemetery, Steves Travelling Stock Route at Delegate and the Tarengo Travelling Stock Route near Boorowa. The Tarengo Leek Orchid occurs on relatively fertile soils in grassy woodland or natural grassland (DoE 2015).	Unlikely - the PA is not within the species' known or predicted distribution, as shown by OEH (2015) and there are no records of the species in the locality.
A Leek Orchid	<i>Prasophyllum</i> sp. Wybong (C.Phelps ORG 5269)	PMST	-	CE	-	<i>Prasophyllum</i> sp. Wybong is now included with <i>Prasophyllum petilum</i> (DoE 2015). Refer to <i>Prasophyllum petilum</i> for habitat details.	Unlikely - <i>Prasophyllum</i> sp. Wybong is now included with <i>Prasophyllum petilum</i> (DoE 2015). The Study Area is not within the distribution of <i>Prasophyllum</i> sp. Wybong or <i>Prasophyllum petilum</i> , as mapped by OEH (2015).

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Matted Bush-pea	<i>Pultenaea pedunculata</i>	PEA, DGR, NSW Atlas	E	-	NSW Atlas (3) 2000	The Matted Bush-pea occurs in a range of habitats. NSW populations are generally among woodland vegetation but plants have also been found on road batters and coastal cliffs. Southern Tablelands populations are at 560-620 m ASL and on friable loam soils underlain by Tertiary basalt and Quaternary sediments. In the Windellama area on the Southern Tablelands, <i>P. pedunculata</i> generally grows in creek lines within grassy woodland dominated by Brittle Gum (<i>Eucalyptus mannifera</i>). Broad-leaved Peppermint (<i>E. dives</i>) and <i>E. gregsoniana</i> are also often present. A few populations occur within Scribbly Gum (<i>E. rossii</i>) – Red Stringybark (<i>E. macrorhyncha</i>) woodland (OEH 2015).	Potential - the species has not been recorded within the PA, however there are three records of the species, from 2000, within the locality. Eucalypt woodland within the Study Area, particularly woodland of Brittle Gum, Scribbly Gum and/or Red Stringybark on creek lines may provide suitable habitat.
Austral Toadflax	<i>Thesium australe</i>	PMST, PEA	V	V	-	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (<i>Themeda australis</i>) (OEH 2015).	Potential - the species has not been recorded within the PA, however the PA is within the species' distribution (DoE 2015), and native grasslands dominated by Kangaroo Grass within the Study Area may provide suitable habitat.
Round-leaved Wilsonia	<i>Wilsonia rotundifolia</i>	PEA, DGR, NSW Atlas	E	-	NSW Atlas (5) 1904 - 2007	Grows in mud in coastal saltmarsh and inland saline or brackish lake beds. In undisturbed habitat, it can be a good coloniser as the creeping stems root from the nodes (OEH 2015).	Unlikely – there are five records, from Lake Bathurst between 1904 and 2007, within the locality. However, the Study Area does not provide suitable habitat due to the absence of brackish lakes.

C.3 LIKELIHOOD OF THREATENED FAUNA SPECIES OCCURRING IN THE STUDY AREA

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Birds							
Magpie Goose	<i>Anseranas semipalmata</i>	NSW Atlas	V	Ma	NSW Atlas (1) 1967	The Magpie Goose had disappeared from south-east Australia by 1920, although since the 1980s there have been an increasing number of records in central and northern NSW. Vagrants can follow food sources to south-eastern NSW. Mainly found in shallow wetlands with dense growth of rushes or sedges. Equally at home in aquatic or terrestrial habitats; often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. Activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off. Breeding unlikely to occur within south-eastern NSW (OEH 2015).	Unlikely - There is a record in the locality from 1967, however the species range has since contracted. The PA is not within the species' current known distribution, as shown by DoE (2014), and OEH (2012).

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Regent Honeyeater	<i>Anthochaera phrygia</i>	PMST, DGR	CE	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. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Key eucalypt species include Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), Yellow Box (<i>E. melliodora</i>), Blakely's Red Gum (<i>E. blakelyi</i>), White Box (<i>E. albens</i>) and Swamp Mahogany (<i>E. robusta</i>). A shrubby understorey is an important source of insects and nesting material (OEH 2015).	Unlikely - the species has not been recorded within the locality and the habitat within the PA is considered poor. Field surveys did not detect the species.
Australasian Bittern	<i>Botaurus poiciloptilus</i>	PMST, DGR	E	E	-	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha</i> spp.) and spikerushes (<i>Eleocharis</i> spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands (OEH 2015).	Unlikely - Habitat for this species does not occur within the PA. The majority of dams are small in size with only limited fringing emergent vegetation. There are no records of this species within the locality.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Curlew Sandpiper	<i>Calidris ferruginea</i>	DGR, NSW Atlas	E	CE, Mi	NSW Atlas (1) 1988	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. The species is occasionally recorded in the Tablelands (DoE 2015).	Potential –there is one record of the species, from 1988, within the locality, and the species has been recorded in large numbers at the nearby Lake Bathurst Important Bird Area (BirdLife International 2015). The Study Area is within the species' distribution (OEH 2015). The species has the potential to fly over the site, however habitat within the Study Area is sub-optimal.
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	DGR	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 2015).	Potential - the species has not been recorded within the PA, however the PA is within the species' distribution (OEH 2015), and forest and woodland areas of the PA may provide suitable habitat.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Glossy Black-Cockatoo	<i>Calyptrorhynchus lathamii</i>	DGR, NSW Atlas	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 (<i>Allocasuarina littoralis</i>), Forest She-oak (<i>A. torulosa</i>) or Drooping She-oak (<i>A. verticillata</i>) occur. It feeds almost exclusively on the seeds of these species.. The species is dependent on large hollow-bearing eucalypts for nest sites (OEH 2015).	Known - this species was recorded within the PA during recent field surveys.
Speckled Warbler	<i>Chthonicola sagittata</i>	DGR, NSW Atlas	V	-	NSW Atlas (1) 1999	The Speckled Warbler 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 (OEH 2015).	Known - this species was recorded within the PA during recent field surveys. In addition, there is one record, from 1999, within the locality.
Spotted Harrier	<i>Circus assimilis</i>	DGR, NSW Atlas	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. It preys on terrestrial mammals, birds and reptiles, occasionally insects and carrion (OEH 2015).	Known - this species was recorded within the PA during recent field surveys.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	DGR	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 (<i>Eucalyptus camaldulensis</i>). Hollows in standing dead or live trees and tree stumps are essential for nesting (OEH 2015).	Potential - the species has not been recorded within the PA, however the PA is within the species' distribution (OEH 2015), and open forest and woodland within the PA may provide suitable habitat.
Varied Sittella	<i>Daphoenositta chrysoptera</i>	DGR, NSW Atlas	V	-	NSW Atlas (5) 1985 - 2012	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 <i>Acacia</i> woodland (OEH 2015).	Known - this species was recorded within the PA during recent field surveys. In addition there are five database records of the species from between 1985 and 2012.
White-fronted Chat	<i>Epthianura albifrons</i>	DGR, NSW Atlas	V	-	NSW Atlas (5) 1988 - 2012	Gregarious species, usually found foraging on bare or grassy ground in wetland areas. 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 2015).	Known - this species was recorded within the PA during recent field surveys. In addition there are five database records of the species from between 1988 and 2012.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Black Falcon	<i>Falco subniger</i>	DGR, NSW Atlas	V	-	NSW Atlas (2) 1983	The Black Falcon inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. The Black Falcon is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts (OEH 2015).	Potential – there are two records of the species, from 1983, within the locality, and woodland, shrubland and cleared areas of the PA may provide suitable habitat.
Painted Honeyeater	<i>Grantiella picta</i>	DGR	V	V	-	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. Feeds on mistletoes, preferring mistletoes of the genus <i>Amyema</i> , and nests in drooping eucalypts, she-oak, paperbark or mistletoe branches (OEH 2015).	Unlikely – the PA is not within the known distribution of the species, as shown in OEH (2014) and ALA (2014).
Little Eagle	<i>Hieraaetus morphnoides</i>	DGR	V	-	-	The Little Eagle is found throughout the Australian mainland. The species occupies open eucalypt forest, woodland or open woodland. Sheoak or <i>Acacia</i> woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch (OEH 2015).	Potential - the species has not been recorded within the PA, however the PA is within the species' distribution (OEH 2015), and forest and woodland within the PA may provide suitable habitat.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Swift Parrot	<i>Lathamus discolor</i>	PMST, DGR, NSW Atlas	E	E, Ma	NSW Atlas (1) 2002	The Swift Parrot is endemic to south eastern Australia. It breeds only in Tasmania, and migrates to mainland Australia in autumn. 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 (DoE 2015).	Potential – the species has been recorded within the locality in 2002, and White Box, Yellow Box, Blakely's Red Gum Woodland within the PA may provide foraging habitat for the species.
Malleefowl	<i>Leipoa ocellata</i>	PEA	E	V	-	Predominantly inhabit mallee communities, preferring the tall, dense and floristically-rich mallee found in higher rainfall (300 mm – 450 mm mean annual rainfall) areas. Utilises mallee with a spinifex understorey, but usually at lower densities than in areas with a shrub understorey. Less frequently found in other eucalypt woodlands, such as Inland Grey Box, Ironbark or Bimble Box Woodlands with thick understorey, or in other woodlands such dominated by Mulga or native Cypress Pine species (OEH 2015).	Unlikely – this PA is not within the species' distribution, and the PA does not contain suitable habitat for the species.
Hooded Robin	<i>Melanodryas cucullata cucullata</i>	DGR	V	-	-	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.	Potential - the species has not been recorded within the PA, however the PA is within the species' distribution (DoE 2015), and open eucalypt woodland within the PA may provide suitable habitat.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Barking Owl	<i>Ninox connivens</i>	DGR	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 midstory trees with dense foliage such as <i>Acacia</i> and <i>Casuarina</i> species. Requires very large permanent territories in most habitats due to sparse prey densities (OEH 2015).	Potential - the species has not been recorded within the PA, however the PA is within the species' distribution (ALA 2014), and wooded and partly cleared areas throughout the PA may provide suitable habitat.
Powerful Owl	<i>Ninox strenua</i>	DGR	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 2015).	Potential - the species has not been recorded within the PA, however the PA is within the species' distribution (DoE 2015), and woodland and forest within the PA may provide suitable habitat.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Eastern Curlew	<i>Numenius madagascariensis</i>	PMST	-	CE, Ma, Mi	-	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (DoE 2015).	Unlikely – this species has not been recorded within 10 km of the Study Area and, due to the inland location of the Study Area, the Study Area is unlikely to provide suitable habitat.
Blue-billed Duck	<i>Oxyura australis</i>	DGR, NSW Atlas	V	-	NSW Atlas (3) 1984 - 1989	The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and overwintering lakes with some long-distance dispersal to breed during spring and early summer. Blue-billed Ducks usually nest solitarily in Cumbungi over deep water between September and February. Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes (OEH 2015)	Known - this species was recorded within the PA during recent field surveys. In addition, there are three records in the locality from 1984 and 1989 (total of 96 individuals).

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Plains Wanderer	<i>Pedionomus torquatus</i>	PEA	E	V	-	The Plains-wanderer inhabits sparse, treeless, lowland native grasslands with approximately 50% bare ground, most vegetation less than 5 cm in height, with some widely-spaced plants up to 30 cm high. These sparse native grasslands usually occur on hard, red-brown clay soils that do not support dense pasture growth under any conditions (DoE 2015).	Unlikely - the PA is not within the species' current known distribution (DoE 2015).
Scarlet Robin	<i>Petroica boodang</i>	DGR, NSW Atlas	V	-	NSW Atlas (14) 1985 - 2012	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 2015).	Known - this species was recorded within the PA during recent field surveys. In addition, there are 14 records in the locality from 1985 and 2012.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Flame Robin	<i>Petroica phoenicea</i>	DGR, NSW Atlas	V	Ma	NSW Atlas (4) 1980 - 2004	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 sedgeland. The species prefers clearings or areas with open understoreys (OEH 2015).	Potential - the species has not been recorded within the PA, however there are four records of the species (from 1980 and 2004) within the locality. Woodland and grassland areas of the PA may provide wintering habitat.
Pink Robin	<i>Petroica rodinogaster</i>	DGR	V	-	-	In the breeding season (September to March) Pink Robins are seen singly or in pairs in deep gullies in dense shrub layers of damp and wet forests or rainforests. In winter, they are found in more open and drier habitats (BirdLife Australia 2014). Nests in an upright or oblique fork, from 30 cm to 6 m above the ground, in deep undergrowth (OEH 2015).	Potential – the species has not been recorded within the PA, however the PA is on the edge of the species' range (ALA 2014, OEH 2015), and may provide suitable winter habitat.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Superb Parrot	<i>Polytelis swainsonii</i>	PMST, DGR	V	V	-	In NSW the Superb Parrot mostly occurs west of the Great Divide, where it mainly inhabits the Riverina region. They mainly inhabit forests and woodlands dominated by eucalypts, especially River Red Gums and box eucalypts such as Yellow Box or Grey Box (DoE 2015b).	Unlikely – Field surveys have failed to detect this species and there are no records within the locality. The PA is outside of the core range for this species (NSW Atlas records).
Grey-crowned Babbler	<i>Pomatostornus temporalis temporalis</i>	DGR	V	-	-	Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains.	Unlikely - the PA is not within the species' distribution (OEH 2015, ALA 2014).
Australian Painted Snipe	<i>Rostratula australis</i>	PMST, DGR		E	-	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. The nest consists of a scrape in the ground, lined with grasses and leaves (OEH 2015).	Unlikely – the species has not been recorded within the locality and suitable habitat does not exist within the Study Area.
Diamond Firetail	<i>Stagonopleura guttata</i>	DGR, NSW Atlas	V	-	NSW Atlas (2) 2012	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum (<i>Eucalyptus pauciflora</i>) 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 2015).	Known - this species was recorded within the PA during recent field surveys. In addition, there are two records of the species from 2012 within the NSW Atlas search area (NSW Atlas).

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Freckled Duck	<i>Stictonetta naevosa</i>	DGR, NSW Atlas	V	-	NSW Atlas (4) 1983 - 1999	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. Nests are usually located in dense vegetation at or near water level (OEH 2015).	Potential - the species has not been recorded within the PA, however the PA is within the species' distribution (OEH 2015) and there are four records of the species, between 1983 and 1999, within the locality (NSW Atlas). Some dams and creeks within the PA may provide suitable habitat.
Fish							
Murray Cod	<i>Maccullochella peelii</i>	PMST	-	V	-	The Murray Cod is found extensively throughout the Murray Darling Basin in the south-eastern region of Australia. The Murray Cod has the ability to live in a diverse range of habitats, including clear rocky streams (such as those found in the upper western slopes of NSW), to slow flowing, turbid rivers and billabongs. Within the large range of habitats, the Murray Cod is usually found in deeper water (>2.4 m) near complex structural cover such as large rocks, snags, overhanging vegetation and other woody structures (DoE 2015b).	Unlikely - the PA is within the species' distribution (DoE 2015), however due to the absence of deep streams, the PA is unlikely to provide habitat for the species.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Macquarie Perch	<i>Macquaria australasica</i>	PMST	E	E	-	The Macquarie Perch is a riverine, schooling species. It prefers clear water and deep, rocky holes with lots of cover. As well as aquatic vegetation, additional cover may comprise of large boulders, debris and overhanging banks. Spawning occurs just above riffles. Spawning sites used by the Macquarie Perch in the rivers flowing into Lake Eildon (between 1966–69) consisted of rubble substrate of small boulders, pebbles and gravel. Water depth was 0.2–0.9 m (usually 0.4–0.6 m) and water velocity was 0.3–0.6 m/s. There was also a pool (usually 15–30 m long and at least 1.5 m deep) immediately upstream, and fast-flowing broken water immediately downstream. (DoE 2015).	Unlikely – there is no suitable habitat within the Study Area. All of the creeks observed were small in size and ephemeral.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Frogs							
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	PEA	V	V	-	Found in heath, woodland and open dry sclerophyll forest. Breeding habitat of this species is generally soaks or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water, and infrequently in semi-permanent to permanent constructed dams with a sandy silt or clay base (OEH 2015, DoE 2015). The species spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites (OEH 2015).	Unlikely – the species has not been recorded within the locality and NSW Atlas records indicate that the PA is likely to be outside the species known distribution.
Green and Golden Bell Frog	<i>Litoria aurea</i>	DGR, NSW Atlas	E	V	NSW Atlas (1) 1985	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (<i>Typha</i> spp.) or spikerushes (<i>Eleocharis</i> spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (<i>Gambusia holbrooki</i>), have a grassy area nearby and diurnal sheltering sites available (OEH 2015).	Unlikely - the species has been recorded historically within the locality (NSW Atlas, 1985), however there have not been any recent records and the species is thought to be extinct in the area. In NSW, the species disappeared completely from all highland areas above 250 m (except for one population near Captains Flat (DoE 2015).

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Yellow-spotted Tree Frog, Yellow-spotted Bell Frog	<i>Litoria castanea</i>	PMST	CE	E	-	Require large permanent ponds (including farm dams) or slow flowing streams with plenty of emergent vegetation such as bulrushes (DoE 2015b, OEH 2015). Move and forage at night on grassy banks or float on the water's surface. Shelter during autumn and winter under fallen timber, rocks, other debris or thick vegetation (OEH 2015).	Unlikely - the species has not been recorded within the locality and is outside the known range of the species (OEH 2015).
Littlejohn's Tree Frog, Heath Frog	<i>Litoria littlejohni</i>	PEA	V	V	-	This species breeds in the upper reaches of permanent streams and in perched swamps. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation, and hunts for invertebrate prey either in shrubs or on the ground (OEH 2015).	Unlikely – the PA is outside of the known species range (based on NSW Atlas Records) and suitable habitat does not exist within the PA.
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog	<i>Litoria raniformis</i>	PEA	E	V	-	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 (OEH 2015). The species is found amongst emergent vegetation in swamps, lagoons, lakes, ponds and farm dams (DoE 2015).	Unlikely – the PA is outside of the species known range (based on NSW Atlas Records) and suitable habitat does not exist within the PA.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Mammals							
Large-eared Pied Bat, Large Pied Bat	<i>Chalinolobus dwyeri</i>	PEA	V	V	-	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (<i>Petrochelidon ariel</i>), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years (OEH 2015).	Unlikely - the species has not been recorded within the locality and the PA is outside the known range for the species based on Atlas records.
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	DGR, NSW Atlas	V	-	NSW Atlas (18) 1980 - 1999	Occurs in 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 (OEH 2015). Relatively little is known of the biology of the species, however due to the size and shape of the species' wings, the species could be expected to be highly mobile with a large foraging range (Strahan 1998).	Potential - calls detected for this species through had Probable and Possible confidence levels, at both ground-level and mast-mounted detectors. Due to the lack of optimal habitat for the species and no Definite calls being recorded, this species is not considered to be known to occur within the PA, and is instead considered to have potential to occur within the PA in discrete forested habitat.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Eastern Bentwing Bat	<i>Miniopterus schreibersii oceanensis</i>	DGR, NSW Atlas	V	-	NSW Atlas (6) 1999 - 2004	Hunts in forested areas, and roosts primarily in caves, as well as derelict mines, storm-water tunnels, buildings and other man-made structures. Maternity caves are used annually in spring and summer, and the species disperses within about 300 km of maternity caves at other times of the year (OEH 2015).	Known - the species was recorded within the PA during the targeted survey. There are also six records of the species (from 1999 and 2004) within the locality. Forest and woodland within the Study Area provide suitable foraging habitat.
Southern Myotis	<i>Myotis macropus</i>	DGR	V	-	-	Roosts in caves, mines, tree hollows, aqueduct tunnels and under bridges and in dense vegetation in the vicinity of bodies of slow-flowing or still water (including estuaries). Almost exclusively forages over water (rivers, streams, dams) for aquatic prey in a variety of forest types. Preferred habitat is riparian (Lumsden <i>et al.</i> 1999).	Potential - the species was potentially recorded once from a series of ten calls, on one of the ground based units. These calls were not of sufficient quality to distinguish them from the similar calls emitted by <i>Nyctophilus</i> sp. Riparian areas with water suitable for foraging are not found within the Study Area and the majority of the creeks are ephemeral and unlikely to support suitable concentrations of prey species. It is therefore considered likely that the calls were actually from a Long-eared Bat species (<i>Nyctophilus</i> sp.), however, this assessment has taken a conservative approach and considers the Southern Myotis to have potential to occur.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Yellow-bellied Sheathtail Bat	<i>Saccolaimus flaviventris</i>	PEA	V	-		Forages for insects in most habitats across its very wide range. 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. 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 2015).	Known - the Yellow-bellied Sheathtail-bat was recorded in a variety of locations throughout the Study Area. A number of the calls can be confused with other species, however enough high quality calls were recorded to consider this species 'definitely' occurring in several locations within the PA.
Spot-tailed Quoll, Spotted-tail Quoll	<i>Dasyurus maculatus maculatus</i>	PMST, DGR, NSW Atlas	V	E	NSW Atlas (6) 2002 - 2010	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 HBTs, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites (OEH 2015).	Potential - the PA is within the species' distribution and there are six records of the species from between 2002 and 2010 within the locality. Woodland areas with fallen logs and a gully in the south of the PA containing large boulders may provide suitable habitat.
Brush-tailed Rock-wallaby	<i>Petrogale penicillata</i>	PMST	E	V	-	Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees (OEH 2015).	Unlikely - while the PA is within the species' distribution (DoE 2015), due to the limited extent of rocky areas in the PA, the PA is unlikely to provide habitat for the species.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Koala	<i>Phascolarctos cinereus</i>	PMST, DGR, NSW Atlas	V	V	NSW Atlas (14) 1978 - 2004	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 (OEH 2015).	Potential – there are 14 records of the species in the locality area from between 1968 and 2004, and eucalypt forest and woodland within the PA may provide suitable habitat.
Long-nosed Potoroo	<i>Potorous tridactylus tridactylus</i>	PMST, DGR, NSW Atlas	V	V	NSW Atlas (1) 1982	There is no consistent pattern to the habitat of the Long-nosed Potoroo (SE mainland); it can be found in wet eucalypt forests to coastal heaths and scrubs. The main factors would appear to be access to some form of dense vegetation for shelter and the presence of an abundant supply of fungi for food (DoE 2015).	Unlikely – the PA is within the species distribution and there is one record of the species (from 1982) within the locality, however suitable habitats (with sufficient understory shelter and an abundance of fungi) have not been identified within the Study Area, and the PA is on the periphery of the species' range, with the majority of records occurring closer to the coast.
New Holland Mouse	<i>Pseudomys novaehollandiae</i>	PMST	-	V	-	In NSW, the New Holland Mouse is known from: Royal National Park and the Kangaroo Valley; Kuringai Chase National Park; and Port Stephens to Evans Head near the Queensland border. The New Holland Mouse has been found from coastal areas and up to 100 km inland on sandstone country, and inhabits open heathland, open woodland with a heathland understorey and vegetated sand dunes (DoE 2015).	Unlikely – the PA is not within the species' known or predicted distribution (OEH 2015).

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	PMST	V	V	-	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy (OEH 2015). The primary food source is blossom from Eucalyptus and related genera but in some areas it also utilises a wide range of rainforest fruits (DoE 2015b).	Potential - the species has not been recorded within the locality however this is a wide ranging species and the PA is within the species' distribution (DoE 2015). Eucalypts may provide seasonal foraging resources for the species or the species may simply fly over the PA.
Reptiles							
Pink-tailed Worm-lizard, Pink-tailed Legless Lizard	<i>Aprasia parapulchella</i>	PMST, DGR	V	V	-	This species is only known from the Central and Southern Tablelands, and the South Western Slopes. The Pink-tailed Worm-lizard occurs in primary and secondary grassland, grassy woodland and woodland communities including mallee, and box-ironbark forest. Microhabitat attributes, such as rockiness and the presence of ground-layer species (especially native grasses) is likely to be the could be the principal determinants of its occurrence (DoE 2015).	Unlikely - there are no records within the locality, and the PA is outside the current known range for the species (OEH 2015), furthermore the habitat for the species is sub-optimal with few areas of abundant surface rock.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Striped Legless Lizard	<i>Delma impar</i>	PMST, DGR	V	V	-	Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass (<i>Themeda australis</i>), Speargrasses (<i>Austrostipa</i> spp.) and Poa tussocks (<i>Poa</i> spp.), and occasionally Wallaby Grasses (<i>Austrodanthonia</i> spp). Found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component, secondary grassland near Natural Temperature Grassland, and occasionally in open Box-Gum Woodland (OEH 2015).	Unlikely - habitat for this species exists within the PA however no records exist within the locality. Targeted field surveys have failed to detect this species.
Little Whip Snake	<i>Suta flagellum</i>	DGR, NSW Atlas	V	-	NSW Atlas (3) 1996 - 1998	Occurs in Natural Temperate Grasslands and grassy woodlands, including those dominated by Snow Gum (<i>Eucalyptus pauciflora</i>) or Yellow Box (<i>E. melliodora</i>). Also occurs in secondary grasslands derived from clearing of woodlands. Found on well drained hillsides, mostly associated with scattered loose rocks (OEH 2015).	Potential - the species has not been recorded within the PA, however there are three records of the species (from 1996 to 1998) within the locality. Native grassland within the PA may provide suitable habitat.
Rosenberg's Goanna	<i>Varanus rosenbergi</i>	DGR	V	-	-	Found in heath, open forest and woodland. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component. 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 (OEH 2015).	Potential - the species has not been recorded within the PA, however the PA is within the species' distribution (DoE 2015), and suitable habitat of woodland with termite mounds has been identified in the PA.

Common Name	Species Name	Source ¹	TSC Act Status ²	EPBC Act Status ²	Records (Number of records)	Habitat Preference ³	Likelihood of occurrence – in referral
Invertebrates							
Golden Sun Moth	<i>Synemon plana</i>	DGR	E	CE	-	The species occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which the groundlayer is dominated by wallaby grasses (<i>Austrodanthonia</i> spp). Habitat may contain several wallaby grass species, which are typically associated with other grasses particularly spear-grasses (<i>Austrostipa</i> spp.) or Kangaroo Grass (<i>Themeda australis</i>) (OEH 2015). Sites supporting Golden Sun Moth populations have generally been subject to light grazing. Based on recent observations at two ACT sites there is a possibility that Golden Sun Moth larvae feed on Chilean Needle Grass (<i>Nassella neesiana</i>) and Redleg Grass (<i>Bothriochloa macra</i>) (DoE 2015).	Unlikely – Some suitable habitat exists within the PA, however the PA is outside the known distribution of the species (NSW Atlas Records). Field surveys did not detect the species.

1. Source: PEA – Preliminary Ecological Assessment, DGR – Director General’s Requirements, PMST – Protected Matters Search Tool, NSW Atlas – Atlas of NSW Wildlife.2. EPBC Act Status: M – Marine

3. Species habitat preferences are taken directly from the DoE Species Profile and Threats Database (DoE 2015) and EPBC Act Conservation Advice (TSSC 2008), unless otherwise referenced, as these sources provide the authority on species’ habitat. The source of habitat preferences for each species is indicated at the end of each description.

C.4 LIKELIHOOD OF LISTED MIGRATORY SPECIES OCCURRING IN THE STUDY AREA

Common Name	Species Name	Source ¹	EPBC Act Status ²	Records	Habitat Preference ³	Likelihood of occurrence within the Ecology Study Area
Migratory Marine Birds						
Common Greenshank	<i>Tringa nebularia</i>	NSW Atlas	M	NSW Atlas (4) 1989 - 1991	The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats (DoE 2015).	Potential to fly over the Study Area. No habitat exists within the Study Area.
Common Sandpiper	<i>Actitis hypoleucos</i>	ERM	M	-	The species utilises a wide range of coastal wetlands and some inland wetlands. The species is mostly found around muddy margins or rocky. The species has been recorded in estuaries and deltas of streams, as well as on banks further upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. Generally the species forages in shallow water and on bare soft mud at the edges of wetlands; often where obstacles project from substrate, e.g. rocks or mangrove roots. Birds sometimes venture into grassy areas adjoining wetlands. Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves (DoE 2015).	Potential – the species was recorded at Lake Bathurst, approximately 5.6 km from the Study Area during field surveys. The species is likely to fly over the site enroute to habitat at the Lake Bathurst Important Bird Area, and may use dams within the Study Area.

Common Name	Species Name	Source ¹	EPBC Act Status ²	Records	Habitat Preference ³	Likelihood of occurrence within the Ecology Study Area
Fork-tailed Swift	<i>Apus pacificus</i>	PMST	M	-	The species is of Asian origin and is primarily aerial during its migratory stay in Australia. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. (DoE 2015).	Potential – this species has not been recorded within 10 km of the Study Area, however due to the species generalist habitat requirements, there is potential for the species to fly over the site.
Pectoral Sandpiper	<i>Calidris melanotos</i>	NSW Atlas	M	NSW Atlas (3) 1988 - 1989	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. The species breeds in northern Russia and North America (DoE 2015).	Potential - the species has been recorded within the locality and may rarely fly over the Study Area. Suitable habitat for this species does not exist within the Study Area.
White-winged Black Tern	<i>Chlidonias leucopterus</i>	NSW Atlas	M	NSW Atlas (4) 1990 – 1992	Widespread east of the Great Divide, mainly south to about Wollongong, but with scattered records further south along the coast and on inland wetlands west of the Great Divide, for example Lake Cowal, Narran Lake and as far west as the Menindee Lakes. In inland areas, the White-winged Black Terns frequent swamps, lakes, billabongs, rivers, floodplains, reservoirs, saltworks, sewage ponds and outfalls. Wetlands may be open, or with floating emergent or marginal vegetation. They rarely occur on inland wetlands in Australia (DoE 2015).	Potential - the species has been recorded within the locality and may rarely fly over the Study Area. Suitable habitat for this species does not exist within the Study Area.

Common Name	Species Name	Source ¹	EPBC Act Status ²	Records	Habitat Preference ³	Likelihood of occurrence within the Ecology Study Area
Bar-tailed Godwit	<i>Limosa lapponica</i>	NSW Atlas	M	NSW Atlas (1) 1989	The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is rarely found on inland wetlands or in areas of short grass, such as farmland, paddocks and airstrips (DoE 2015).	Potential - the species has been recorded within the locality and may rarely fly over the Study Area.
Grey Plover	<i>Pluvialis squatarola</i>	NSW Atlas	M	NSW Atlas (1) 1990	In non-breeding grounds in Australia, Grey Plovers occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes. The species is also very occasionally recorded further inland, where they occur around wetlands or salt-lakes (DoE 2015).	Unlikely - the Study Area is not within the species' current known distribution (DoE 2015).
Migratory Terrestrial Species						
Curlew Sandpiper	<i>Calidris ferrunginea</i>	PMST, DGRs	CE, M	-	Refer to threatened species table.	
White-throated Needletail	<i>Hirundapus caudacutus</i>	PMST, NSW Atlas	M	NSW Atlas (4) 1999 - 2012	In Australia, the White-throated Needletail is almost exclusively aerial, and due to this it has been stated that habitat descriptions are inapplicable. However, they are probably recorded most often above wooded areas. When flying above farmland, they are more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks (DoE 2015).	Known - the White-throated Needletail was recorded on two occasions within the Study Area, including up to 100 individuals being recorded on one occasion.
Rainbow Bee-eater	<i>Merops ornatus</i>	PMST	M	-	The Rainbow Bee-eater occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation (DoE 2015).	Potential - the Rainbow bee-eater is widely distributed across Australia and, due to the species generalist habitat requirements, the species has potential to occur in the Study

Common Name	Species Name	Source ¹	EPBC Act Status ²	Records	Habitat Preference ³	Likelihood of occurrence within the Ecology Study Area
Black-faced Monarch	<i>Monarcha melanopsis</i>	PMST	M	-	The Black-faced Monarch mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest (DoE 2015).	Area. No suitable breeding habitat was recorded. Unlikely – this species has not been recorded within 10 km of the Study Area and, due to the absence of rainforest, the Study Area is unlikely to provide habitat.
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	PMST	M	-	Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests (DoE 2015).	Potential – the Study Area is within the species' distribution and woodland within the Study Area may provide suitable habitat for the species when on migration.
Rufous Fantail	<i>Rhipidura rufifrons</i>	PMST	M	-	In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood (<i>Eucalyptus microcorys</i>), Mountain Grey Gum (<i>E. cypellocarpa</i>), Narrow-leaved Peppermint (<i>E. radiata</i>), Mountain Ash (<i>E. regnans</i>), Alpine Ash (<i>E. delegatensis</i>), Blackbutt (<i>E. pilularis</i>) or Red Mahogany (<i>E. resinifera</i>); usually with a dense shrubby understory often including ferns (DoE 2015). When on passage, they are sometimes recorded in drier sclerophyll forests and woodlands, including Spotted Gum (<i>Eucalyptus maculata</i>), Yellow Box (<i>E. melliodora</i>), ironbarks or stringybarks, often with a shrubby or heath understory.	Unlikely – Habitat within the Study Area is not optimal for the species. The species was not recorded within the Study Area.

Common Name	Species Name	Source ¹	EPBC Act Status ²	Records	Habitat Preference ³	Likelihood of occurrence within the Ecology Study Area
Migratory Wetland Species						
Great Egret, White Egret	<i>Ardea alba</i>	PMST	M	-	The Eastern Great Egret has been reported in a wide range of wetland habitats, including swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs (DoE 2015).	Potential – the Study Area is within the species' distribution and damp grassland and dams may provide suitable habitat.
Cattle Egret	<i>Ardea ibis</i>	PMST	M	-	The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It is commonly associated with the habitats of farm animals, particularly cattle, but also pigs, sheep, horses and deer (DoE 2015).	Potential – the Study Area is within the species' distribution and temporally damp grassland may provide suitable habitat.
Glossy Ibis	<i>Plegadis falcinellus</i>	NSW Atlas	M	NSW Atlas (1) 1978	The Glossy Ibis' preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation (DoE 2015).	Potential – the Study Area is within the species distribution. While the Study Area does not provide suitable habitat for the species, the species has potential to fly over the site.
Ruddy Turnstone	<i>Arenaria interpres</i>	PMST	M	-	In Australasia, the Ruddy Turnstone is mainly found on coastal regions with exposed rock coast lines or coral reefs. It also lives near platforms and shelves, often with shallow tidal pools and rocky, shingle or gravel beaches.	Unlikely – this species has not been recorded within 10 km of the Study Area in the last 10 years and, due to the inland location of the Study Area, the Study Area is unlikely to provide habitat.

Common Name	Species Name	Source ¹	EPBC Act Status ²	Records	Habitat Preference ³	Likelihood of occurrence within the Ecology Study Area
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	PMST	M	-	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgeland and other ephemeral wetlands, but leave when they dry (DoE 2015).	Potential – Dams in the Study Area may provide sub optimal habitat, and the species may fly over the Study Area.
Red Knot, Knot	<i>Calidris canutus</i>	PMST	M	-	In Australasia the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps	Unlikely – the Red Knot is a coastal species and has not been recorded in the locality.
Red-necked Stint	<i>Calidris ruficollis</i>	PMST	M	-	In Australasia, the Red-necked Stint is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. They also occur in saltworks and sewage farms; saltmarsh; ephemeral or permanent shallow wetlands near the coast or inland, including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats. They sometimes use flooded paddocks or damp grasslands.	Potential – the species has not been recorded within the locality, however the Study Area is within the species' distribution. Habitat within the Study Area is sub-optimal for the species.

Common Name	Species Name	Source ¹	EPBC Act Status ²	Records	Habitat Preference ³	Likelihood of occurrence within the Ecology Study Area
Double-banded Plover	<i>Charadrius bicinctus</i>	PMST	M	-	The Double-banded Plover is found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture.	Potential – the species has not been recorded within the locality, however the PA is within the species' distribution. This species may fly over the Study Area however foraging habitat is sub optimal.
Latham's Snipe, Japanese Snipe	<i>Gallinago hardwickii</i>	PMST	M	-	In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies) (DoE 2015).	Unlikely – the species has not been recorded within the locality and suitable wetland habitats do not occur within the Study Area.
Eastern Curlew	<i>Numenius madagascariensis</i>	PMST	CE, M	-	Refer to threatened species table.	
Little Curlew, Little Whimbrel	<i>Numenius minutus</i>	PMST	M	-	The Little Curlew is most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated.	Potential – the species has been recorded within the locality and has the potential to fly over the Study Area. Foraging for this species is suboptimal within the Study Area.
Osprey	<i>Pandion haliaetus</i> ⁴	PMST	M	-	The species occurs in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes (DoE 2015).	Unlikely – the Study Area is not within the species' distribution, as shown by OEH (2015). While there are occasional records of the species outside the mapped distribution, these outlying records are typically located along major river systems. As the Study Area is outside the species mapped distribution and is not close to a major river system, it is unlikely that the species would occur within or fly over the Study Area.

Common Name	Species Name	Source ¹	EPBC Act Status ²	Records	Habitat Preference ³	Likelihood of occurrence within the Ecology Study Area
Pacific Golden Plover	<i>Pluvialis fulva</i>	PMST, NSW Atlas	M	NSW Atlas (7) 1988 - 1991	Pacific Golden Plovers usually occur on beaches, mudflats and sandflats (sometimes in vegetation such as mangroves, low saltmarsh such as <i>Sarcocornia</i> , or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks. They are less often recorded in terrestrial habitats, usually wetlands such as fresh, brackish or saline lakes, billabongs, pools, swamps and wet claypans, especially those with muddy margins and often with submerged vegetation or short emergent grass. Refer to threatened species table.	Potential – the Study Area is within the species distribution. While the Study Area does not provide suitable habitat for the species, the species has potential to fly over the Study Area.
Painted Snipe	<i>Rostratula benghalensis (sensu lato)</i>	PMST	E,M			
Marsh Sandpiper, Little Greenshank	<i>Tringa stagnatilis</i>	PMST, NSW Atlas	M	NSW Atlas (2) 1982 - 1983	The Marsh Sandpiper lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, salt pans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks.	Potential – the Study Area is within the species distribution. While the Study Area does not provide suitable habitat for the species, the species has potential to fly over the Study Area.

1. Source: PEA – Preliminary Ecological Assessment, DGR – Director General’s Requirements, PMST – Protected Matters Search Tool, NSW Atlas – Atlas of NSW Wildlife.2. EPBC Act Status: M – Marine

3. Species habitat preferences are taken directly from the DoE Species Profile and Threats Database (DoE 2015) and EPBC Act Conservation Advice (TSSC 2008), unless otherwise referenced, as these sources provide the authority on species’ habitat. The source of habitat preferences for each species is indicated at the end of each description.

4. Listed migratory as *Pandion haliaetus*, however now listed as *Pandion cristatus* under the TSC Act and other sources.

Annex D

Field Survey Data

Annex D

Field Survey Data

D.1

WEATHER CONDITIONS

Table D.1 provides the weather conditions for each day of field investigations in the Study Area.

Table D.1 *Weather Conditions During Field Investigations*

Date	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)	9 am Wind Speed (km/h)	3 pm Wind Speed (km/h)
11/12/2013	1.4	23.6	0	37	41
12/12/2013	3.6	26.5	0	13	26
13/12/2013	4.3	28.6	0	6	26
3/02/2014	11.9	36.9	0	20	13
4/02/2014	17.8	18.5	0.6	31	26
5/02/2014	10.7	21.1	0.8	17	24
6/02/2014	10.7	26.3	0	15	15
7/02/2014	5	33.1	0	4	11
10/02/2014	13.8	29.5	0	19	20
11/02/2014	15.6	33	0	15	19
12/02/2014	17	28.5	0	19	19
13/02/2014	14.8	29.9	0	19	19
14/02/2014	16.4	26.8	13	4	19
5/03/2014	10.4	24.3	0	7	24
19/05/2014	2.5	19.2	0	7	26
20/05/2014	1.9	18.6	0	13	28
21/05/2014	1.5	19.1	0.2	6	22
22/05/2014	1.8	19.6	0	9	22
23/05/2014	2.9	20.5	0	20	30
7/07/2014	3.9	10.5	0	24	33
8/07/2014	-1	10.4	0	15	22
9/07/2014	-6	14.4	0	17	28
10/07/2014	1.6	9	4	22	46
11/07/2014	4.6	8.6	0.2	22	41
21/07/2014	-5.1	12.7	0.2	Calm	7
22/07/2014	-0.9	13	0	Calm	9
23/07/2014	-0.4	13.4	0.2	7	9
15/10/2014	5.7	14.6	12.8	22	26
16/10/2014	-0.4	15.6	0	19	28
17/10/2014	2.6	16.3	0	19	11
27/10/2014	8	26.5	0.2	9	39
28/10/2014	5.2	18.5	0	31	44
29/10/2014	6.1	22.7	0	26	24
30/10/2014	1.8	24.7	0	20	35
31/10/2014	1.9	29.6	0	2	24
10/11/2014	13.6	28.1	0	15	15
11/11/2014	12.2	21.1	0	15	26
12/11/2014	9.9	26	0	7	11
13/11/2014	12.3	29.8	0	13	15
14/11/2014	8	34.7	0	11	35

Date	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)	9 am Wind Speed (km/h)	3 pm Wind Speed (km/h)
24/11/2014	17.4	28.9	0.8	7	24
25/11/2014	13.1	23.7	0.2	24	26
26/11/2014	5	25.8	0	17	19
27/11/2014	12.9	21.7	0	15	20
28/11/2014	9.1	25.4	0	22	11
8/12/2014	11.7	27.2	0	9	28
9/12/2014	15.6	24	0	15	20
10/12/2014	15.5	28.2	0	13	22
11/12/2014	17	18.8	11	20	24
12/12/2014	10.9	20.2	2.4	20	28
19/01/2015	14	16.8	0	17	24
20/01/2015	12.5	22.8	0	24	30
21/01/2015	16	26.2	0	11	22
22/01/2015	13.9	27.3	0	19	17
23/01/2015	12.8	31.3	0	6	17
12/08/2015	-5.5	9.3	0	6	37
13/08/2015	2.7	10.2	2.8	35	41
14/08/2015	2.8	13.2	0	22	26
Source: Bureau of Meteorology, Goulburn Airport AWS (station 070330).					

Environmental Resources Management Australia Pty Ltd

Family	Binomial	Common Name	TSC Act	EPBC Act	Native	Introduced?	General Incidental?	Plot 26	Plot 27	Plot 28	Plot 29	Plot 30	Plot 31	Plot 32	Plot 33	Plot 34	Plot 35	Plot 36	Plot 37	Plot 38	Plot 39	Plot 40	Plot 41	Plot 42	Plot 43	Plot 44
								Status	Cover (%)	Number	Form	Status	Cover (%)	Number	Form	Status	Cover (%)	Number	Form	Status	Cover (%)	Number	Form	Status	Cover (%)	Number
Asteriaceae	Bechopogon fibrilatus	Nodding Chocolate Lily			N																					
Asteriaceae	Thysanotus patersonii	Twining Fringe Lily			N																					
Asteriaceae	Thysanotus edulis	Yellow Autumn-lily			N																					
Apiaceae	Hydrocotyle laevis	Stinking Pennywort			N																					
Aquilegiaceae	Bluebell	Native Leek			N																					
Asteraceae	Asterella candelata	Clareweed			N																					
Asteraceae	Asteraceae sp. (indeterminate - insufficient material)				N																					
Asteraceae	Castanea australis	Gilly Bush			N																					
Asteraceae	Chouffilla juncea	Glutton Weed			N																					
Asteraceae	Chrysanthemum apiculatum	Common Everlasting			N																					
Asteraceae	Crocan volucre	Scotch Thistle			N																					
Asteraceae	Conoselinum scorpioides	Button Everlasting			N																					
Asteraceae	Cragedia sp. (indeterminate)				N																					
Asteraceae	Cragedia variabilis	Common Billy buttons			N																					
Asteraceae	Cymbonotus leucostachyus	Bear's Ear			N																					
Asteraceae	Isachne japonica	Creeping Cutweed			N																					
Asteraceae	Isachne sphenocarpa				N																					
Asteraceae	Gemocharta calycarpa	Cutweed			N																					
Asteraceae	Hypochaeris glabra	Jerusalem Caper			N																					
Asteraceae	Hypochaeris radicata	Cats Ears			N																					
Asteraceae	Leptorhynchus squamatus subsp. squamatus	Scaly Butters			N																					
Asteraceae	Leptorhynchus elongatus	Lanky Butters			N																					
Asteraceae	Leucanthemum album subsp. albicans var. tricolor	Heary Sunray			N																					
Asteraceae	Microseris lanceolata	Murmoing			N																					
Asteraceae	Oxypetalum litorale	Rhyan Thistle			N																					
Asteraceae	Quathamus diurnifolius	Rice Flower			N																					
Asteraceae	Senecio sp. (indeterminate - insufficient material)				N																					
Asteraceae	Senecio sp. (indeterminate - insufficient material)				N																					
Asteraceae	Senecio sp. (indeterminate - insufficient material)				N																					
Asteraceae	Senecio sp. (indeterminate - insufficient material)				N																					
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Asteraceae	Senecio sp. (indeterminate - insufficient material)				N																					
Asteraceae	Senecio sp. (indeterminate - insufficient material)		</																							

Note: E = Endangered; V = Vulnerable
 Note: % cover is estimated for all spp >5% cover ie > those scored 1 or 2
 Note: Data collected for Plots 26 - 41 include additional parameters due to introduction of revised BBAM (OEH 2014)
 Note: Form: T=Tree S=Shrub; G=Grass; F=Forb
 Note: Stratum: G=Ground; M=Midstorey; U=Upper

Note: E = Endangered; V = Vulnerable
 Note: % cover is estimated for all spp >5% cover ie > those scored 1 or 2
 Note: Data collected for Plots 26 - 41 include additional parameters due to introduction of revised BBAM (OEH 2014)
 Note: Form: T=Tree S=Shrub; G=Grass; F=Forb
 Note: Stratum: G=Ground; M=Midstorey; U=Upper

Common Name	Scientific Name	EPBC Act Status	TSC Act Status
FROGS			
Common Eastern Froglet	<i>Crinia signifera</i>		
Beeping Froglet	<i>Crinia parinsignifera</i>		
Eastern Banjo Frog	<i>Limnodynastes dumerili</i>		
Striped Marsh frog	<i>Limnodynastes peronii</i>		
Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>		
Southern Brown Tree Frog	<i>Litoria ewingii</i>		
Eastern Dwarf Tree Frog	<i>Litoria fallax</i>		
Peron's Tree Frog	<i>Litoria peronii</i>		
Whistling Tree Frog	<i>Litoria verreauxi</i>		
Dusky Toadlet	<i>Uperoleia fusca</i>		
Smooth Toadlet	<i>Uperoleia laevisgata</i>		
REPTILES			
Three-lined Skink	<i>Acritoscincus duperreyi</i>		
Jacky Lizard	<i>Amphibolurus muricatus</i>		
Eastern Long-necked Turtle	<i>Chelodina longicollis</i>		
Cunningham's Skink	<i>Egernia cunninghami</i>		
Three-toed Earless Skink	<i>Hemiergis decresiensis</i>		
Eastern Water Dragon	<i>Intellagama lesueurii</i>		
Dark-flecked Garden Skink	<i>Lampropholis delicata</i>		
Common Garden Skink	<i>Lampropholis guichenoti</i>		
Tiger Snake	<i>Notechis scutatus</i>		
Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>		
Brown Snake	<i>Pseudonaja textilis</i>		
Blotched Blue-tongue	<i>Tiliqua nigrolutea</i>		
Lace Monitor	<i>Varanus varius</i>		
BIRDS			
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>		
Striated Thornbill	<i>Acanthiza lineata</i>		
Yellow Thornbill	<i>Acanthiza nana</i>		
Brown Thornbill	<i>Acanthiza pusilla</i>		
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>		
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>		
Brown Goshawk	<i>Accipiter fasciatus</i>		
Australian Reed-Warbler	<i>Acrocephalus australis</i>		
Common Sandpiper	<i>Actitis hypoleucos</i>	Mi	
Owlet Nightjar	<i>Aegotheles cristatus</i>		
Eurasian Skylark*	<i>Alauda arvensis*</i>		
Grey Teal	<i>Anas gracilis</i>		
Pacific Black Duck	<i>Anas superciliosa</i>		
Red Wattlebird	<i>Anthochaera carunculata</i>		

Common Name	Scientific Name	EPBC Act Status	TSC Act Status
Australasian Pipit	<i>Anthus novaeseelandiae</i>		
Wedge-tailed Eagle	<i>Aquila audax</i>		
Dusky Woodswallow	<i>Artamus cyanopterus</i>		
White-browed Woodswallow	<i>Artamus superciliosus</i>		
Hardhead	<i>Aythya australis</i>		
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>		
Brush Cuckoo	<i>Cacomantis variolosus</i>		
Yellow-tailed Black-cockatoo	<i>Calyptorhynchus funereus</i>		
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>		V
European Goldfinch*	<i>Carduelis carduelis</i> *		
Red-capped Plover	<i>Charadrius ruficapillus</i>		
Australian Wood Duck	<i>Chenonetta jubata</i>		
Silver Gull	<i>Chroicocephalus novaehollandiae</i>		
Speckled Warbler	<i>Chthonicola sagittata</i>		V
Spotted Harrier	<i>Circus assimilis</i>		V
Grey Shrike-thrush	<i>Colluricincla harmonica</i>		
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>		
White-winged Chough	<i>Corcorax melanorhamphos</i>		
White-throated Treecreeper	<i>Cormobates leucophaea</i>		
Australian Raven	<i>Corvus coronoides</i>		
Little Raven	<i>Corvus mellori</i>		
Pied Butcherbird	<i>Cracticus nigrogularis</i>		
Australian Magpie	<i>Cracticus tibicen</i>		
Grey Butcherbird	<i>Cracticus torquatus</i>		
Black Swan	<i>Cygnus atratus</i>		
Laughing Kookaburra	<i>Dacelo novaeguineae</i>		
Varied Sittella	<i>Daphoenositta chrysoptera</i>		V
White-faced Heron	<i>Egretta novaehollandiae</i>		
Black-shouldered Kite	<i>Elanus axillaris</i>		
Galah	<i>Eolophus roseicapilla</i>		
Eastern Yellow Robin	<i>Eopsaltria australis</i>		
White-fronted Chat	<i>Epthianura albifrons</i>		V
Eastern Koel	<i>Eudynamis orientalis</i>		
Brown Falcon	<i>Falco berigora</i>		
Nankeen Kestrel	<i>Falco cenchroides</i>		
Eurasian Coot	<i>Fulica atra</i>		
Western Gerygone	<i>Gerygone fusca amalia</i>		
White-throated Gerygone	<i>Gerygone olivacea</i>		
Magpie Lark	<i>Grallina cyanoleuca</i>		
Black-winged Stilt	<i>Himantopus himantopus</i>		
White-throated Needletail	<i>Hirundapus caudacutus</i>	Mi	
Welcome Swallow	<i>Hirundo neoxena</i>		
White-winged Triller	<i>Lalage sueurii</i>		
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>		
White-eared Honeyeater	<i>Lichenostomus leucotis</i>		
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>		
Square-tailed Kite	<i>Lophoictinia isura</i>		V

1 - *denotes a Non-native species
2- TSC Act Status: V - Vulnerable

Common Name	Scientific Name	EPBC Act Status	TSC Act Status
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>		
Superb Fairy Wren	<i>Malurus cyaneus</i>		
Variegated Fairy Wren	<i>Malurus lamberti</i>		
Noisy Miner	<i>Manorina melanocephala</i>		
White-throated Honeyeater	<i>Melithreptus albogularis</i>		
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>		
White-naped Honeyeater	<i>Melithreptus lunatus</i>		
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>		
Jacky Winter	<i>Microeca fascians</i>		
Black Kite	<i>Milvus migrans</i>		
Leaden Flycatcher	<i>Myiagra rubecula</i>		
Red-browed Finch	<i>Neochmia temporalis</i>		
Southern Boobook	<i>Ninox novaeseelandiae</i>		
Crested Pigeon	<i>Ocyphaps lophotes</i>		
Olive-backed Oriole	<i>Oriolus sagittatus</i>		
Blue-billed Duck	<i>Oxyura australis</i>		V
Golden Whistler	<i>Pachycephala pectoralis</i>		
Rufous Whistler	<i>Pachycephala rufiventris</i>		
Spotted Pardalote	<i>Pardalotus punctatus</i>		
Striated Pardalote	<i>Pardalotus striatus</i>		
House Sparrow*	<i>Passer domesticus*</i>		
Australian Pelican	<i>Pelecanus conspicillatus</i>		
Tree Martin	<i>Petrochelidon nigricans</i>		
Scarlet Robin	<i>Petroica boodang</i>		V
Red-capped Robin	<i>Petroica goodenovii</i>		
Great Cormorant	<i>Phalacrocorax carbo</i>		
Pied Cormorant	<i>Phalacrocorax varius</i>		
Common Bronzewing	<i>Phaps chalcoptera</i>		
Noisy Friarbird	<i>Philemon corniculatus</i>		
Crimson Rosella	<i>Platycercus elegans</i>		
Eastern Rosella	<i>Platycercus eximius</i>		
Striped Honeyeater	<i>Plectorhyncha lanceolata</i>		
Hoary-headed Grebe	<i>Poliocephalus poliocephalus</i>		
Red-rumped Parrot	<i>Psephotus haematonotus</i>		
Grey Fantail	<i>Rhipidura albiscapa</i>		
Willie Wagtail	<i>Rhipidura leucophrys</i>		
White-browed Scrubwren	<i>Sericornis frontalis</i>		
Weebill	<i>Smicrornis brevirostris</i>		
Diamond Firetail	<i>Stagonopleura guttata</i>		V
Pied Currawong	<i>Strepera graculina</i>		
Indian Myna*	<i>Sturnus tristis*</i>		
European Starling*	<i>Sturnus vulgaris*</i>		
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>		
Australian Shelduck	<i>Tadorna tadornoides</i>		
Australian White Ibis	<i>Threskiornis molucca</i>		
Masked Lapwing	<i>Vanellus miles</i>		
Silvereye	<i>Zosterops lateralis</i>		

1 - *denotes a Non-native species
2- TSC Act Status: V - Vulnerable

Common Name	Scientific Name	EPBC Act Status	TSC Act Status
BATS			
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>		
Chocolate Wattled Bat	<i>Chalinolobus morio</i>		
Eastern Bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>		
A Long-eared Bat	<i>Nyctophilus</i> sp.		
Large Forest Bat	<i>Vespadelus darlingtoni</i>		
Southern Forest Bat	<i>Vespadelus regulus</i>		
Little Forest Bat	<i>Vespadelus vulturnus</i>		
MAMMALS (other than bats)			
Brown Antechinus	<i>Antechinus stuartii</i>		
Domestic Dog*	<i>Canis lupus familiaris</i> *		
Domestic Cat*	<i>Felis catus</i> *		
European Hare*	<i>Lepus europaeus</i> *		
Eastern Grey Kangaroo	<i>Macropus giganteus</i>		
Common Wallaroo	<i>Macropus robustus</i>		
European Rabbit*	<i>Oryctolagus cuniculus</i> *		
Sugar Glider	<i>Petaurus brviceps</i>		
Ringtail Possum	<i>Pseudocheirus peregrinus</i>		
Common Dunnart	<i>Sminthopsis murina</i>		
Feral Pig*	<i>Sus scrofa</i> *		
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>		
Brushtail Possum	<i>Trichosurus vulpecular</i>		
Deer species*	<i>Unknown deer species</i> *		
Common Wombat	<i>Vombatus ursinus</i>		
European Red Fox*	<i>Vulpes vulpes</i> *		
Swamp Wallaby	<i>Wallabia bicolor</i>		

1 - *denotes a Non-native species
2- TSC Act Status: V - Vulnerable

				BUS Survey Location Number																					
Common Name	Scientific Name	EPBC Act	TSC Act	SUMMER 2014				AUTUMN 2014					WINTER 2014					SPRING 2014					SUMMER 2015		
				1	2	3	4	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	Superb Parrot	6	
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>			✓														✓					✓		
Striated Thornbill	<i>Acanthiza lineata</i>							✓		✓	✓	✓		✓		✓					✓				
Yellow Thornbill	<i>Acanthiza nana</i>																				✓				
Brown Thornbill	<i>Acanthiza pusilla</i>				✓			✓				✓			✓										
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>			✓						✓	✓	✓			✓							✓			
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>							✓						✓	✓	✓		✓							
Red Wattlebird	<i>Anthochaera carunculata</i>			✓						✓	✓	✓													
Wedge-tailed Eagle	<i>Aquila audax</i>			✓								✓					✓		✓	✓	✓				
White-browed Woodswallow	<i>Artamus superciliosus</i>														✓			✓	✓	✓	✓		✓		
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>						✓				✓				✓			✓	✓	✓	✓		✓		
Brush Cuckoo	<i>Cacomantis variolosus</i>																			✓					
Glossy Black-cockatoo	<i>Calyptorhynchus lathami</i>			✓ ①				✓ ①		✓ ①	✓ ①														
Red-capped Plover	<i>Charadrius ruficapillus</i>																								
Australian Wood Duck	<i>Chenonetta jubata</i>																			✓					
Speckled Warbler	<i>Chthonicola sagittata</i>		✓							✓															
Grey Shrike-thrush	<i>Colluricincla harmonica</i>				✓						✓				✓		✓	✓		✓					
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>																				✓				
White-winged Chough	<i>Corcorax melanorhamphos</i>			✓	✓			✓	✓											✓					
White-throated Treecreeper	<i>Cormobates leucophaea</i>			✓		✓	✓	✓		✓	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓		
Australian Raven	<i>Corvus coronoides</i>			✓							✓						✓	✓			✓				
Little Raven	<i>Corvus mellori</i>			✓										✓											
Australian Magpie	<i>Cracticus tibicen</i>			✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		
Grey Butcherbird	<i>Cracticus torquatus</i>			✓			✓										✓	✓	✓		✓	✓			
Laughing Kookaburra	<i>Dacelo novaeguineae</i>			✓		✓				✓							✓	✓	✓		✓	✓	✓		
Varied Sittella	<i>Daphoenositta chrysoptera</i>		✓																						
White-faced Heron	<i>Egretta novaehollandiae</i>					✓																			
Galah	<i>Eolophus roseicapilla</i>			✓				✓				✓							✓						
Eastern Yellow Robin	<i>Eopsaltria australis</i>																						✓		
Eastern Koel	<i>Eudynamis orientalis</i>																		✓						
Nankeen Kestrel	<i>Falco cenchroides</i>																			✓		✓	✓		
White-throated Gerygone	<i>Gerygone albobularis</i>									✓			✓							✓	✓		✓		
Western Gerygone	<i>Gerygone fusca amalia</i>																				✓				
Magpie-lark	<i>Grallina cyanoleuca</i>				✓																				
White-winged Triller	<i>Lalage sueurii</i>																					✓			
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>																				✓	✓	✓		
White-eared Honeyeater	<i>Lichenostomus leucotis</i>						✓				✓	✓		✓		✓	✓		✓		✓	✓			
Superb Fairy Wren	<i>Malurus cyaneus</i>			✓	✓				✓						✓				✓		✓	✓	✓		
Variegated Fairy Wren	<i>Malurus lamberti</i>							✓		✓				✓	✓	✓									
Noisy Miner	<i>Manorina melanoccephala</i>			✓																					
White-throated Honeyeater	<i>Melithreptus albobularis</i>														✓										
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>																					✓			
Jacky Winter	<i>Microeca fascians</i>			✓																					
Leaden Flycatcher	<i>Myiagra rubecula</i>																			✓					
Red-browed Finch	<i>Neochmia temporalis</i>												✓												
Olive-backed Oriole	<i>Oriolus sagittatus</i>																			✓					
Golden Whistler	<i>Pachycephala pectoralis</i>						✓			✓		✓													
Rufous Whistler	<i>Pachycephala rufiventris</i>			✓											✓			✓	✓	✓	✓	✓	✓		
Spotted Pardalote	<i>Pardalotus punctatus</i>						✓					✓	✓				✓			✓	✓	✓			
Striated Pardalote	<i>Pardalotus striatus</i>						✓										✓	✓		✓	✓	✓	✓		
Australian Pelican	<i>Pelecanus conspicillatus</i>					✓														✓	✓	✓	✓		
Scarlet Robin	<i>Petroica boodang</i>		✓	✓					✓	✓	✓	✓	✓			✓	✓	✓		✓					
Great Cormorant	<i>Phalacrocorax carbo</i>										✓														
Common Bronzewing	<i>Phaps chalcoptera</i>						✓							✓		✓									
Noisy Friarbird	<i>Philemon corniculatus</i>																		✓		✓	✓			
Crimson Rosella	<i>Platycercus elegans</i>			✓	✓		✓	✓			✓	✓	✓		✓	✓		✓		✓	✓	✓	✓		
Eastern Rosella	<i>Platycercus eximius</i>			✓	✓													✓		✓		✓	✓		
Red-rumped Parrot	<i>Psephotus haematonotus</i>						✓													✓					
Grey Fantail	<i>Rhipidura albiscapa</i>			✓							✓	✓					✓	✓		✓	✓	✓	✓		
Willie Wagtail	<i>Rhipidura leucophrys</i>			✓	✓																	✓			
White-browed Scrubwren	<i>Sericornis frontalis</i>											✓	✓								✓		✓		
Weebill	<i>Smicromis brevirostris</i>						✓																		
Pied Currawong	<i>Strepera graculina</i>																✓			✓	✓	✓	✓		
Indian Myna*	<i>Sturnus bistris*</i>																				✓				
European Starling*	<i>Sturnus vulgaris*</i>				✓														✓						
Australian White Ibis	<i>Threskiornis molucca</i>					✓																			
Sacred Kingfisher	<i>Todiramphus sanctus</i>																			✓	✓				
Silvereye	<i>Zosterops lateralis</i>				✓																				

Notes: ①denotes feeding signs with no birds observed
* denotes a Non-native species
TSC Act Status: V - Vulnerable

RS Location	Date	Temp	Cloud Cover %	Wind Speed (km/hr)	Wind Direction	Scientific Name	Common Name	No.	Time Start	Time End	Distance (m)	Bearing	Location	Height (m)	Height Range (m)	Elevation (m)	Landscape Position	Direction	Behaviour
RS01	41681	18	100	10	NE	Falco cenchroides	Nankeen Kestrel	1	0	0	80	35	Air	10	10-15	759	Ridge	Parallel	Hovering
RS01	41681	18	100	10	NE	Eolophus roseicapillus	Galah	3	0	0	30	8	Air	10	11-15	759	Valley	Away	Powered
RS01	41681	18	100	10	NE	Corvus mellori	Little Raven	3	0	0	100	260	Perched	2	1-2	759	Ridge	Parallel	Resting
RS01	41681	18	100	10	NE	Falco berigora	Brown Falcon	1	0	0	100	115	Perched	7	7-8	759	Ridge	Parallel	Resting
RS02	41681	23	10	4	NE	Corvus coronoides	Australian Raven	1	1	1	20	150	Air	7	6-8	725	Ridge	Parallel	Powered
RS02	41681	23	10	4	NE	Rhipidura leucophrys	Willie Wagtail	1	1	1	15	230	Perched	3	3-6	725	Ridge	Parallel	Resting
RS02	41681	23	10	4	NE	Cracticus tibicen	Australian Magpie	1	1	1	150	130	Air	15	10-15	725	Ridge	Parallel	Powered
RS02	41681	23	10	4	NE	Artamus cyanopterus	Dusky Woodswallow	1	1	1	15	230	Perched	6	5-6	725	Ridge	Parallel	Resting
RS02	41681	23	10	4	NE	Rhipidura albiscapa	Grey Fantail	1	1	1	15	230	Perched	5	5-6	725	Ridge	Parallel	Resting
RS02	41681	23	10	4	NE	Anthochaera carunculata	Red Wattlebird	1	1	1	70	120	Perched	7	6-8	725	Valley	Parallel	Resting
RS03	41682	20	80	8	NE	Cracticus tibicen	Australian Magpie	3	1	1	60	274	Air	5	4-6	744	Ridge	Parallel	Powered
RS03	41682	20	80	8	NE	Corvus coronoides	Australian Raven	1	1	1	100	93	Air	10	7-10	744	Ridge	Parallel	Powered
RS03	41682	20	80	8	NE	Cacatua galerita	Sulphur Crested Cockatoo	1	1	1	300	22	Air	15	15-20	744	Valley	Away	Powered
RS07	41681	30	0	9	SE	Platycercus elegans	Crimson Rosella	2	1	1	20	205	Air	6	6-7	687	Ridge	Parallel	Powered
RS07	41681	30	0	9	SE	Corcorax melanorhamphos	White-winged Chough	4	1	1	30	103	Ground	0	0-2	687	Ridge	Parallel	Resting
RS04	41683	28	60	2	N	Cracticus tibicen	Australian Magpie	2	0	0	30	180	Perched	3	3-5	750	Ridge	-	Resting
RS05	41682	28	50	4	NNE	Aquila audax	Wedge-tailed Eagle	1	1	1	30	163	Air	200	150-200	704	Ridge	Circling	Soaring
RS05	41682	28	50	4	NNE	Cracticus tibicen	Australian Magpie	2	1	1	400	229	Ground	0	-	704	Ridge	Parallel	Resting
RS05	41682	28	50	4	NNE	Corvus coronoides	Australian Raven	2	1	1	400	229	Ground	0	-	704	Ridge	Parallel	Resting
RS05	41682	28	50	4	NNE	Aquila audax	Wedge-tailed Eagle	1	1	1	500	256	Air	100	80-110	704	Valley	Circling	Soaring
RS05	41682	28	50	4	NNE	Falco cenchroides	Nankeen Kestrel	1	1	1	300	350	Air	20	10-20	704	Ridge	Circling	Hovering
RS06	41682	28	50	12	E	Cracticus tibicen	Australian Magpie	2	1	1	100	332	Perched	7	5-8	695	Valley	-	Resting
RS08	41683	29	90	3	N	Corvus coronoides	Australian Raven	1	1	1	80	200	Perched	2	2-3	720	Valley	-	Resting
RS08	41683	29	90	3	N	Rhipidura leucophrys	Willie Wagtail	1	1	1	10	134	Perched	2	2-3	720	Ridge	-	Resting
RS08	41683	29	90	3	N	Falco cenchroides	Nankeen Kestrel	1	1	1	400	272	Air	30	25-30	720	Ridge	Parallel	Hovering
RS08	41683	29	90	3	N	Corvus coronoides	Australian Raven	1	1	1	300	180	Air	5	5-7	720	Valley	Parallel	Powered
RS08	41683	29	90	3	N	Cracticus tibicen	Australian Magpie	2	1	1	500	30	Perched	5	5-6	720	Ridge	-	Resting
RS09	41683	30	80	8	N	Falco cenchroides	Nankeen Kestrel	1	1	1	100	320	Air	80	70-100	730	Ridge	Circling	Hovering
RS09	41683	30	80	8	N	Falco cenchroides	Nankeen Kestrel	2	1	1	100	240	Air	50	50-70	730	Ridge	Circling	Hovering
RS09	41683	30	80	8	N	Cracticus tibicen	Australian Magpie	2	1	1	50	75	Ground	0	0-2	730	Ridge	Parallel	Foraging
RS01	41928	18	35	14	W	Cracticus tibicen	Australian Magpie	20	1	1	200	330	Ground	0	-	750	Ridge	Away	Foraging
RS01	41928	18	35	14	W	Cacatua galerita	Sulphur-crested Cockatoo	18	1	1	300	180	Ground	0	-	750	Ridge	Away	Foraging
RS01	41928	18	35	14	W	Cincloramphus mathewsi	Rufous Songlark	1	1	1	100	60	Air	20	0-20	750	Ridge	Parallel	Hovering
RS01	41928	18	35	14	W	Falco cenchroides	Nankeen Kestrel	1	1	1	50	310	Air	10	0-10	750	Ridge	Parallel	Gliding
RS02	41929	14	55	5	SE	Platycercus eximius	Eastern Rosella	2	0	0	50	210	Air	5	5-10	750	Ridge	Parallel	Powered
RS02	41929	14	55	5	SE	Platycercus elegans	Crimson Rosella	2	0	0	50	210	Air	5	5-10	750	Ridge	Away	Powered
RS02	41929	14	55	5	SE	Cacatua galerita	Sulphur-crested Cockatoo	1	0	0	100	180	Ground	0	-	750	Valley	-	Foraging
RS02	41929	14	55	5	SE	Cacatua galerita	Sulphur-crested Cockatoo	1	0	0	80	320	Air	20	20-30	750	Ridge	Parallel	Powered
RS02	41929	14	55	5	SE	Petrochelidon nigricans	Tree Martin	7	0	0	60	33	Air	15	15-20	750	Ridge	Circling	Powered
RS02	41929	14	55	5	SE	Cracticus tibicen	Australian Magpie	1	1	1	100	33	Air	10	10-15	750	Ridge	Parallel	Powered
RS02	41929	14	55	5	SE	Sturnus vulgaris	Common Starling	1	1	1	50	42	Air	5	5-8	750	Slope	Parallel	Powered
RS02	41929	14	55	5	SE	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	100	200	Air	20	10-20	750	Valley	Parallel	Powered
RS02	41929	14	55	5	SE	Platycercus eximius	Eastern Rosella	2	1	1	50	180	Air	10	5-10	750	Ridge	Away	Powered
RS02	41929	14	55	5	SE	Psephodus haematonotus	Red-rumped Parrot	1	1	1	50	150	Perched	5	-	750	Ridge	-	Resting
RS02	41929	14	55	5	SE	Falco berigora	Brown Falcon	1	1	1	150	30	Perched	10	-	750	Ridge	-	Resting
RS01	41941	18	0	22	NW	Cracticus tibicen	Australian Magpie	3	0	0	200	30	Air	10	5-10	750	Ridge	Away	Powered
RS01	41941	18	0	22	NW	Alauda arvensis	Eurasian Skylark	2	0	0	20	270	Air	10	0-10	750	Ridge	Parallel	Hovering
RS01	41941	18	0	22	NW	Corvus coronoides	Australian Raven	1	0	0	50	70	Air	20	10-20	750	Ridge	Parallel	Powered
RS01	41941	18	0	22	NW	Aquila audax	Wedge-tailed Eagle	5	0	0	10	100	Air	200	150-300	750	Ridge	Circling	Soaring
RS01	41941	18	0	22	NW	Corvus coronoides	Australian Raven	1	0	0	10	220	Air	10	5-10	750	Ridge	Circling	Powered
RS01	41941	18	0	22	NW	Corvus coronoides	Australian Raven	1	0	0	200	10	Perched	5	0-5	750	Ridge	-	Resting
RS01	41941	18	0	22	NW	Falco cenchroides	Nankeen Kestrel	1	0	0	200	290	Air	300	20-30	750	Ridge	Parallel	Hovering
RS01	41941	18	0	22	NW	Sturnus vulgaris	Common Starling	4	0	0	100	5	Air	10	10-20	750	Ridge	Away	Powered
RS04	41941	20	0	11	NW	Dacelo novaeguineae	Laughing Kookaburra	1	1	1	40	90	Air	3	0-5	750	Ridge	Parallel	Powered
RS04	41941	20	0	11	NW	Aquila audax	Wedge-tailed Eagle	1	1	1	0	0	Air	200	150-500	750	Ridge	Circling	Soaring
RS04	41941	20	0	11	NW	Corvus coronoides	Australian Raven	1	1	1	50	180	Air	30	20-30	750	Ridge	Away	Powered
RS04	41941	20	0	11	NW	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	50	180	Air	20	20-30	750	Ridge	Away	Powered
RS04	41941	20	0	11	NW	Cracticus tibicen	Australian Magpie	2	1	1	20	210	Air	5	5-10	750	Ridge	Parallel	Powered
RS04	41941	20	0	11	NW	Coracina novaehollandiae	Black-faced Cuckoo-shrike	2	1	1	10	180	Perched	5	5-10	750	Ridge	-	Resting
RS04	41941	20	0	11	NW	Oriolus sagittatus	Olive-backed Oriole	1	1	1	5	180	Perched	5	5-8	750	Ridge	-	Resting
RS04	41941	20	0	11	NW	Lichenostomus chrysops	Yellow-faced Honeyeater	6	1	1	5	300	Air	5	5-10	750	Ridge	Parallel	Powered
RS04	41941	20	0	11	NW	Philemon corniculatus	Noisy Friarbird	1	1	1	5	300	Air	5	5-10	750	Ridge	Parallel	Powered
RS06	41941	23	5	14	NW	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	100	180	Air	30	30-40	675	Valley	Away	Powered
RS06	41941	23	5	14	NW	Sturnus vulgaris	Common Starling	40	1	1	100	180	Air	5	5-10	675	Valley	Away	Powered
RS06	41941	23	5	14	NW	Egretta novaehollandiae	White-faced Heron	1	1	1	100	180	Air	5	5-10	675	Valley	Away	Powered
RS06	41941	23	5	14	NW	Falco longipennis	Australian Hobby	1	1	1	100	130	Air	10	5-10	675	Valley	Circling	Powered
RS06	41941	23	5	14	NW	Corvus coronoides	Australian Raven	1	1	1	100	100	Perched	7	7-10	675	Valley	-	Resting
RS06	41941	23	5	14	NW	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	100	10	Air	40	40-50	675	Valley	Away	Powered
RS06	41941	23	5	14	NW	Petrochelidon nigricans	Tree Martin	2	1	1	100	90	Air	8	8-10	675	Valley	Away	Powered
RS06	41941	23	5	14	NW	Corvus coronoides	Australian Raven	2	1	1	100	120	Air	10	5-10	675	Valley	Away	Powered



RS Location	Date	Temp	Cloud Cover %	Wind Speed (km/hr)	Wind Direction	Scientific Name	Common Name	No.	Time Start	Time End	Distance (m)	Bearing	Location	Height (m)	Height Range (m)	Elevation (m)	Landscape Position	Direction	Behaviour
RC06	41941	25	0	4	NW	Cacomantis flabelliformis	Fan-tailed Cuckoo	1	1	1	20	300	Perched	5	5-10	615	Ridge	-	Resting
RC06	41941	25	0	4	NW	Manorina melanocephala	Noisy Miner	3	1	1	20	250	Perched	5	5-10	615	Ridge	-	Resting
RC06	41941	25	0	4	NW	Aquila audax	Wedge-tailed Eagle	1	1	1	300	220	Air	500	400-600	615	Ridge	Parallel	Soaring
RC06	41941	25	0	4	NW	Corvus coronoides	Australian Raven	1	1	1	100	300	Air	10	10-20	615	Ridge	Away	Powered
RC06	41941	25	0	4	NW	Sturnus vulgaris	Common Starling	2	1	1	30	180	Air	7	5-10	615	Ridge	Away	Powered
RC06	41941	25	0	4	NW	Cracticus tibicen	Australian Magpie	1	1	1	70	180	Perched	7	5-10	615	Ridge	-	Resting
RC06	41941	25	0	4	NW	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	150	300	Perched	8	5-10	615	Ridge	-	Resting
RC06	41941	25	0	4	NW	Eolophus roseicapillus	Galah	2	1	1	30	40	Air	10	10-20	615	Ridge	Parallel	Powered
RC06	41941	25	0	4	NW	Corvus coronoides	Australian Raven	1	1	1	20	310	Air	7	5-10	615	Ridge	Parallel	Powered
RC06	41941	25	0	4	NW	Platycercus elegans	Crimson Rosella	1	1	1	50	350	Air	5	5-10	615	Ridge	Away	Powered
RC06	41941	25	0	4	NW	Platycercus eximius	Eastern Rosella	1	1	1	70	200	Air	5	0-5	615	Ridge	Parallel	Powered
RC06	41941	25	0	4	NW	Petrochelidon nigricans	Tree Martin	1	1	1	0	360	Air	50	40-70	615	Ridge	Parallel	Powered
RS03	41942	21	10	36	W	Sturnus vulgaris	Common Starling	2	0	0	40	5	Ground	0	-	730	Ridge	-	Foraging
RS03	41942	21	10	36	W	Corvus coronoides	Australian Raven	2	0	0	100	30	Air	10	10-20	730	Ridge	Parallel	Powered
RS03	41942	21	10	36	W	Cracticus tibicen	Australian Magpie	8	0	0	50	180	Ground	0	0-5	730	Ridge	-	Foraging
RS03	41942	21	10	36	W	Epthianura albiglans	White-fronted Chat	2	0	0	70	190	Ground	0	0-20	730	Ridge	-	Resting
RS03	41942	21	10	36	W	Aquila audax	Wedge-tailed Eagle	2	0	0	150	90	Air	350	200-400	730	Ridge	Parallel	Gliding
RS03	41942	21	10	36	W	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	200	90	Air	20	20-30	730	Ridge	Parallel	Powered
RS05	41942	23	5	25	W	Aquila audax	Wedge-tailed Eagle	1	1	1	800	180	Air	100	0-150	680	Ridge	Circling	Powered
RS05	41942	23	5	25	W	Falco cenchroides	Nankeen Kestrel	1	1	1	900	180	Air	100	40-100	680	Ridge	Circling	Hovering
RS05	41942	23	5	25	W	Cracticus tibicen	Australian Magpie	5	1	1	800	180	Ground	0	0-10	680	Ridge	-	Foraging
RS05	41942	23	5	25	W	Sturnus vulgaris	Common Starling	30	1	1	800	180	Air	15	10-20	680	Ridge	Parallel	Powered
RS05	41942	23	5	25	W	Corvus coronoides	Australian Raven	1	1	1	400	160	Air	50	50-70	680	Ridge	Parallel	Powered
RS05	41942	23	5	25	W	Falco berigora	Brown Falcon	1	1	1	500	90	Air	100	100-500	680	Ridge	Circling	Soaring
RS05	41942	23	5	25	W	Aquila audax	Wedge-tailed Eagle	1	1	1	900	210	Air	400	400-800	680	Ridge	Circling	Gliding
RS05	41942	23	5	25	W	Rhipidura leucophrys	Willie Wagtail	1	1	1	5	190	Air	5	0-5	680	Ridge	Parallel	Powered
RC05	41942	25	5	18	W	Epthianura albiglans	White-fronted Chat	2	1	1	5	90	Perched	1	0-3	570	Valley	-	Resting
RC05	41942	25	5	18	W	Ocyphaps lophotes	Crested Pigeon	1	1	1	5	100	Perched	1	0-3	570	Valley	-	Resting
RC05	41942	25	5	18	W	Cracticus tibicen	Australian Magpie	3	1	1	100	270	Air	20	10-30	570	Valley	Parallel	Powered
RC05	41942	25	5	18	W	Corvus coronoides	Australian Raven	2	1	1	100	270	Air	20	10-30	570	Valley	Parallel	Powered
RC05	41942	25	5	18	W	Cacatua galerita	Sulphur-crested Cockatoo	10	1	1	1000	180	Air	25	20-30	570	Valley	Away	Powered
RC03	41942	26	0	25	NW	Corvus coronoides	Australian Raven	1	1	1	50	170	Ground	0	0-5	630	Slope	-	Foraging
RC03	41942	26	0	25	NW	Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	1	1	0	180	Air	8	5-100	630	Slope	Away	Powered
RC03	41942	26	0	25	NW	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	200	180	Air	10	5-10	630	Slope	Away	Powered
RC03	41942	26	0	25	NW	Threskiornis molucca	Australian White Ibis	15	1	1	500	90	Air	1000	800-1200	630	Slope	Away	Soaring
RC03	41942	26	0	25	NW	Aquila audax	Wedge-tailed Eagle	4	1	1	100	180	Air	100	100-800	630	Slope	Circling	Soaring
RC03	41942	26	0	25	NW	Strepera graculina	Pied Currawong	1	1	1	200	110	Air	30	20-40	630	Slope	Away	Powered
RC03	41942	26	0	25	NW	Hirundo neoxena	Welcome Swallow	4	1	1	5	0	Air	5	0-8	630	Slope	Circling	Powered
RC01	41942	24	0	36	SW	Platycercus elegans	Crimson Rosella	1	1	1	5	270	Air	5	0-10	610	Ridge	Parallel	Powered
RC01	41942	24	0	36	SW	Petrochelidon nigricans	Tree Martin	1	1	1	50	300	Air	30	20-40	610	Ridge	Away	Powered
RC01	41942	24	0	36	SW	Eolophus roseicapillus	Galah	2	1	1	40	310	Air	15	10-20	610	Ridge	t	Powered
RC01	41942	24	0	36	SW	Rhipidura albiscapa	Grey Fantail	1	1	1	10	90	Air	10	5-10	610	Ridge	Parallel	Powered
RC01	41942	24	0	36	SW	Corvus coronoides	Australian Raven	1	1	1	300	280	Air	200	10-40	610	Ridge	Parallel	Powered
RC01	41942	24	0	36	SW	Aquila audax	Wedge-tailed Eagle	2	1	1	1000	110	Air	400	300-600	610	Ridge	Parallel	Soaring
RC01	41942	24	0	36	SW	Cracticus torquatus	Grey Butcherbird	1	1	1	20	180	Perched	15	-	610	Ridge	-	Resting
RS02	41943	23	<5	36	NW	Cacatua galerita	Sulphur-crested Cockatoo	1	0	0	150	180	Air	10	10-20	730	Ridge	Away	Powered
RS02	41943	23	<5	36	NW	Petrochelidon nigricans	Tree Martin	2	0	0	100	310	Air	10	5-25	730	Ridge	Parallel	Powered
RS02	41943	23	<5	36	NW	Sturnus vulgaris	Common Starling	1	0	0	20	180	Air	2	2-5	730	Ridge	Away	Powered
RS02	41943	23	<5	36	NW	Eolophus roseicapillus	Galah	2	0	0	170	160	Air	30	20-40	730	Ridge	Parallel	Powered
RS02	41943	23	<5	36	NW	Manorina melanocephala	Noisy Miner	1	0	0	90	150	Air	10	10-15	730	Ridge	Parallel	Powered
RS02	41943	23	<5	36	NW	Corvus coronoides	Australian Raven	2	0	0	300	270	Air	25	20-30	730	Ridge	Parallel	Powered
RS02	41943	23	<5	36	NW	Falco berigora	Brown Falcon	1	1	1	100	10	Air	15	10-20	730	Ridge	Parallel	Powered
RS06	41953	24	5	4	N	Corvus coronoides	Australian Raven	1	1	1	300	220	Air	15	2-25	680	Slope	Parallel	Powered
RS06	41953	24	5	4	N	Anas gracilis	Grey Teal	4	1	1	100	250	Ground	0	-	680	Slope	-	Resting
RS06	41953	24	5	4	N	Cacatua galerita	Sulphur Crested Cockatoo	4	1	1	200	180	Air	10	5-15	680	Valley	Away	Powered
RS06	41953	24	5	4	N	Petrochelidon nigricans	Tree Martin	5	1	1	50	90	Air	20	15-40	680	Valley	Circling	Powered
RS06	41953	24	5	4	N	Egretta novaehollandiae	White-faced Heron	1	1	1	100	250	Air	15	0-25	680	Valley	Parallel	Powered
RS06	41953	24	5	4	N	Cracticus tibicen	Australian Magpie	2	1	1	200	270	Air	10	0-15	680	Valley	Away	Powered
RS06	41953	24	5	4	N	Anthus novaeseelandiae	Australasian Pipit	1	1	1	250	110	Perched	0	0-5	680	Valley	Away	Powered
RS06	41953	24	5	4	N	Falco cenchroides	Nankeen Kestrel	1	1	1	500	360	Air	40	5-60	680	Valley	Circling	Soaring
RS06	41953	24	5	4	N	Hirundo neoxena	Welcome Swallow	2	1	1	20	180	Air	20	5-40	680	Valley	Circling	Powered
RC06	41953	25	<5	4	NW	Pardalotus striatus	Striated Pardalote	1	1	1	5	230	Perched	3	2-3	620	Valley	-	Foraging
RC06	41953	25	<5	4	NW	Manorina melanocephala	Noisy Miner	6	1	1	15	190	Perched	5	0-10	620	Valley	Away	Foraging
RC06	41953	25	<5	4	NW	Cracticus tibicen	Australian Magpie	2	1	1	20	240	Perched	5	0-10	620	Valley	-	Resting
RC06	41953	25	<5	4	NW	Sturnus vulgaris	Starling	4	1	1	10	270	Air	3	2-3	620	Valley	Away	Powered
RC06	41953	25	<5	4	NW	Platycercus eximius	Eastern Rosella	2	1	1	40	240	Perched	4	0-5	620	Valley	-	Resting
RC06	41953	25	<5	4	NW	Cacatua galerita	Sulphur Crested Cockatoo	1	1	1	50	180	Air	10	10-20	620	Valley	Away	Powered
RC06	41953	25	<5	4	NW	Corvus coronoides	Australian Raven	2	1	1	10	135	Air	10	10-20	620	Valley	Away	Powered
RC06	41953	25	<5	4	NW	Acanthiza lineata	Striated Thornbill	1	1	1	15	190	Perched	5	3-5	620	Valley	-	Foraging
RC04	41953	26	<5	4	ESE	Anthus novaeseelandiae	Australasian Pipit	1	1	1	10	315	Perched	2	0-2			Away	Powered
RC04	41953	26	<5	4	ESE	Cracticus tibicen	Australian Magpie	2	1	1	40	320	Perched	2	0-4			Toward	Powered



RS Location	Date	Temp	Cloud Cover %	Wind Speed (km/hr)	Wind Direction	Scientific Name	Common Name	No.	Time Start	Time End	Distance (m)	Bearing	Location	Height (m)	Height Range (m)	Elevation (m)	Landscape Position	Direction	Behaviour
RC04	41953	26	<5	4	ESE	Eolophus roseicapillus	Galah	4	1	1	40	320	Air	2	0-4			Toward	Powered
RC04	41953	26	<5	4	ESE	Cacatua galerita	Sulphur Crested Cockatoo	1	1	1	50	320	Air	3	0-10			Away	Powered
RC04	41953	26	<5	4	ESE	Platycercus eximius	Eastern Rosella	2	1	1	10	10	Air	3	2-5			Toward	Powered
RC04	41953	26	<5	4	ESE	Acanthiza nana	Yellow Thornbill	5	1	1	30	320	Perched	1	0-3			-	Resting
RC04	41953	26	<5	4	ESE	Petrochelidon nigricans	Tree Martin	1	1	1	300	60	Air	4	0-10			Away	Powered
RC04	41953	26	<5	4	ESE	Corvus coronoides	Australian Raven	1	1	1	350	200	Air	15	10-15			Away	Powered
RC04	41953	26	<5	4	ESE	Acanthiza nana	Yellow Thornbill	5	1	1	15	180	Perched	1	0-3			-	Resting
RC04	41953	26	<5	4	ESE	Corvus coronoides	Australian Raven	1	1	1	200	270	Air	5	5-10			Away	Powered
RC04	41953	26	<5	4	ESE	Eolophus roseicapillus	Galah	4	1	1	200	135	Air	8	5-10			Away	Powered
RC02	41953	26	<5	22	S	Cracticus tibicen	Australian Magpie	1	1	1	50	190	Air	1	0-4	600	Valley	Away	Powered
RC02	41953	26	<5	22	S	Cacatua galerita	Sulphur Crested Cockatoo	2	1	1	90	200	Air	10	5-20	600	Valley	Away	Powered
RC02	41953	26	<5	22	S	Egretta novaehollandiae	White-faced Heron	1	1	1	400	200	Air	8	5-20	600	Valley	Parallel	Powered
RC02	41953	26	<5	22	S	Corvus coronoides	Australian Raven	1	1	1	300	250	Air	10	5-25	600	Valley	Away	Powered
RC02	41953	26	<5	22	S	Cacatua galerita	Sulphur Crested Cockatoo	1	1	1	300	315	Air	15	15-20	600	Valley	Parallel	Powered
RC02	41953	26	<5	22	S	Anthus novaeseelandiae	Australasian Pipit	1	1	1	30	20	Air	2	0-2	600	Valley	Parallel	Powered
RC02	41953	26	<5	22	S	Cacatua galerita	Sulphur Crested Cockatoo	11	1	1	200	315	Air	2	0-5	600	Valley	Parallel	Powered
RC02	41953	26	<5	22	S	Eolophus roseicapillus	Galah	10	1	1	150	180	Air	10	5-30	600	Valley	Away	Powered
RC02	41953	26	<5	22	S	Hirundo neoxena	Welcome Swallow	1	1	1	50	190	Air	15	15-30	600	Valley	Away	Powered
RC02	41953	26	<5	22	S	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	1	1	1	4	160	Perched	2	1-3	600	Valley	-	Resting
RS03	41954	20	5	13	E	Cracticus tibicen	Australian Magpie	11	0	0	50	160	Air	1	0-5	730	Ridge	Parallel	Powered
RS03	41954	20	5	13	E	Corvus coronoides	Australian Raven	1	0	0	40	340	Perched	3	0-10	730	Ridge	-	Resting
RS03	41954	20	5	13	E	Sturnus vulgaris	Starling	1	0	0	10	270	Air	2	1-4	730	Ridge	Away	Powered
RS03	41954	20	5	13	E	Corvus coronoides	Australian Raven	1	0	0	80	45	Air	25	20-30	730	Ridge	Away	Powered
RS03	41954	20	5	13	E	Cacatua galerita	Sulphur Crested Cockatoo	1	0	0	500	65	Air	40	30-50	730	Ridge	Parallel	Powered
RS03	41954	20	5	13	E	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	5	0	0	30	10	Perched	1	0-2	730	Ridge	-	Foraging
RS03	41954	20	5	13	E	Cacatua galerita	Sulphur Crested Cockatoo	2	0	0	20	270	Air	20	20-100	730	Ridge	Away	Soaring
RS03	41954	20	5	13	E	Grallina cyanoleuca	Magpie-lark	1	0	0	20	270	Air	3	2-5	730	Ridge	Parallel	Powered
RS03	41954	20	5	13	E	Aquila audax	Wedge-tailed Eagle	1	0	0	500	340	Air	250	250-700	730	Ridge	Circling	Soaring
RS03	41954	20	5	13	E	Aquila audax	Wedge-tailed Eagle	1	0	0	300	360	Air	200	200-1000	730	Ridge	Circling	Soaring
RS01	41954	22	<5	12	E	Cracticus tibicen	Australian Magpie	22	1	1	100	50	Perched	2	0-2	760	Ridge	-	Resting
RS01	41954	22	<5	12	E	Corvus coronoides	Australian Raven	1	1	1	100	10	Air	30	20-30	760	Ridge	Parallel	Powered
RS01	41954	22	<5	12	E	Falco cenchroides	Nankeen Kestrel	1	1	1	110	110	Air	70	40-80	760	Ridge	Circling	Hovering
RS01	41954	22	<5	12	E	Cacatua galerita	Sulphur Crested Cockatoo	1	1	1	300	135	Air	40	30-40	760	Ridge	Parallel	Powered
RS01	41954	22	<5	12	E	Cacatua galerita	Sulphur Crested Cockatoo	2	1	1	150	270	Air	20	10-40	760	Ridge	Parallel	Powered
RS05	41954	25	15	8	E	Anthus novaeseelandiae	Australasian Pipit	2	1	1	10	160	Perched	1	0-2		Ridge	-	Resting
RS05	41954	25	15	8	E	Cracticus tibicen	Australian Magpie	4	1	1	100	180	Ground	0	0-5		Ridge	-	Foraging
RS05	41954	25	15	8	E	Corvus coronoides	Australian Raven	1	1	1	400	90	Air	20	20-30		Ridge	Parallel	Powered
RS05	41954	25	15	8	E	Cacatua galerita	Sulphur Crested Cockatoo	1	1	1	400	90	Air	30	30-40		Ridge	Parallel	Powered
RS05	41954	25	15	8	E	Aquila audax	Wedge-tailed Eagle	2	1	1	3000	225	Air	150	50-400		Ridge	Circling	Powered
RS05	41954	25	15	8	E	Corvus coronoides	Australian Raven	4	1	1	3000	225	Air	150	150-200		Ridge	Parallel	Powered
RS05	41954	25	15	8	E	Falco cenchroides	Nankeen Kestrel	1	1	1	150	180	Air	40	10-50		Ridge	Parallel	Powered
RS05	41954	25	15	8	E	Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	1	1	150	180	Air	30	20-40		Ridge	Parallel	Powered
RS05	41954	25	15	8	E	Aquila audax	Wedge-tailed Eagle	1	1	1	3500	315	Air	50	50-150		Ridge	Parallel	Soaring
RS05	41954	25	15	8	E	Eolophus roseicapillus	Galah	3	1	1	200	150	Air	30	20-40		Ridge	Parallel	Powered
RC05	41954	19	80	13	E	Aquila audax	Wedge-tailed Eagle	2	1	1	500	250	Air	100	100-500		Valley	Away	Soaring
RC05	41954	19	80	13	E	Corvus coronoides	Australian Raven	2	1	1	500	250	Air	100	80-100		Valley	Away	Powered
RC05	41954	19	80	13	E	Rhipidura leucophrys	Willie Wagtail	1	1	1	10	250	Perched	1	0-1		Valley	-	Resting
RC05	41954	19	80	13	E	Corvus coronoides	Australian Raven	4	1	1	20	90	Air	5	5-10		Valley	Parallel	Powered
RC05	41954	19	80	13	E	Cracticus tibicen	Australian Magpie	2	1	1	30	0	Perched	5	0-10		Valley	-	Resting
RC05	41954	19	80	13	E	Eolophus roseicapillus	Galah	5	1	1	30	315	Air	5	3-8		Valley	Parallel	Powered
RC05	41954	19	80	13	E	Corvus mellori	Little Raven	26	1	1	300	170	Ground	0	0-2		Valley	Parallel	Resting
RC05	41954	19	80	13	E	Ocyphaps lophotes	Crested Pigeon	1	1	1	200	315	Air	2	1-2		Valley	Parallel	Powered
RC05	41954	19	80	13	E	Egretta novaehollandiae	White-faced Heron	1	1	1	150	220	Air	3	0-8		Valley	Parallel	Powered
RS02	41955	19	2	6	NNW	Cacatua galerita	Sulphur Crested Cockatoo	1	0	0	8	50	Air	5	5-10	738	Ridge	Parallel	Powered
RS02	41955	19	2	6	NNW	Petrochelidon nigricans	Tree Martin	3	1	1	100	315	Air	6	1-6	738	Ridge	Parallel	Powered
RS02	41955	19	2	6	NNW	Corvus coronoides	Australian Raven	9	1	1	120	315	Air	10	10-40	738	Ridge	Parallel	Powered
RS02	41955	19	2	6	NNW	Platycercus eximius	Eastern Rosella	1	1	1	50	225	Perched	3	1-4	738	Ridge	-	Resting
RS02	41955	19	2	6	NNW	Chalcites basalis	Horsfield's Bronze-Cuckoo	1	1	1	10	130	Perched	3	2-5	738	Ridge	Away	Resting
RS02	41955	19	2	6	NNW	Anthus novaeseelandiae	Australasian Pipit	1	1	1	10	135	Perched	3	0-4	738	Ridge	Away	Resting
RS02	41955	19	2	6	NNW	Coracina novaehollandiae	Black-faced Cuckoo-shrike	2	1	1	70	95	Perched	5	5-15	738	Ridge	Parallel	Resting
RS02	41955	19	2	6	NNW	Cacatua galerita	Sulphur Crested Cockatoo	3	1	1	300	20	Air	20	10-20	738	Ridge	Toward	Powered
RS02	41955	19	2	6	NNW	Eolophus roseicapillus	Galah	2	1	1	250	0	Air	20	10-35	738	Ridge	Parallel	Powered
RS02	41955	19	2	6	NNW	Falco berigora	Brown Falcon	1	1	1	1000	10	Air	200	200-400	738	Ridge	Circling	Soaring
RS02	41955	19	2	6	NNW	Aquila audax	Wedge-tailed Eagle	1	1	1	3000	10	Air	400	400-700	738	Ridge	Circling	Soaring
RS02	41955	19	2	6	NNW	Aquila audax	Wedge-tailed Eagle	2	1	1	10	10	Air	100	100-400	738	Ridge	Circling	Soaring
RS02	41955	19	2	6	NNW	Aquila audax	Wedge-tailed Eagle	2	1	1	45	45	Air	200	200-300	738	Ridge	Toward	Soaring
RS02	41955	19	2	6	NNW	Epthianura albiglans	White-fronted Chat	1	1	1	150	150	Perched	4	1-4	738	Ridge	-	Resting
RS04	41955	25	0	7	W	Colluricincla harmonica	Grey Shrike-thrush	1	1	1	20	10	Ground	0	0-5	738	Ridge	Away	Foraging
RS04	41955	25	0	7	W	Dacelo novaeguineae	Laughing Kookaburra	1	1	1	15	90	Air	1	1-2	738	Ridge	Parallel	Powered
RS04	41955	25	0	7	W	Platycercus elegans	Crimson Rosella	1	1	1	10	270	Perched	4	-	738	Ridge	-	Resting
RS04	41955	25	0	7	W	Cracticus tibicen	Australian Magpie	2	1	1	100	135	Perched	2	-	738	Ridge	-	Resting



RS Location	Date	Temp	Cloud Cover %	Wind Speed (km/hr)	Wind Direction	Scientific Name	Common Name	No.	Time Start	Time End	Distance (m)	Bearing	Location	Height (m)	Height Range (m)	Elevation (m)	Landscape Position	Direction	Behaviour
RC03	41955	25	0	3	N	Cracticus tibicen	Australian Magpie	1	1	1	10	45	Perched	3	-	630	Valley	-	Resting
RC03	41955	25	0	3	N	Petrochelidon nigricans	Tree Martin	6	1	1	10	200	Air	4	2-10	630	Valley	Away	Powered
RC03	41955	25	0	3	N	Falco berigora	Brown Falcon	1	1	1	40	45	Air	200	200-400	630	Valley	Circling	Soaring
RC03	41955	25	0	3	N	Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	1	1	50	40	Air	3	2-8	630	Valley	Parallel	Powered
RC03	41955	25	0	3	N	Cracticus tibicen	Australian Magpie	4	1	1	150	40	Air	3	2-15	630	Valley	Parallel	Powered
RC03	41955	25	0	3	N	Corvus coronoides	Australian Raven	1	1	1	50	50	Ground	0	0-3	630	Valley	Away	Resting
RC03	41955	25	0	3	N	Calyptrorhynchus funereus	Yellow-tailed Black-Cockatoo	2	1	1	150	315	Air	2	1-5	630	Valley	Away	Powered
RC03	41955	25	0	3	N	Dacelo novaeguineae	Laughing Kookaburra	1	1	1	70	50	Air	3	1-5	630	Valley	Away	Powered
RC03	41955	25	0	3	N	Rhipidura albiscapa	Grey Fantail	1	1	1	5	45	Air	3	2-4	630	Valley	Parallel	Powered
RC01	41955	28	0	2	NE	Coracina novaehollandiae	Black-faced Cuckoo-shrike	2	1	1	40	135	Perched	5	2-10	623	Ridge	-	Resting
RC01	41955	28	0	2	NE	Daphoenositta chrysoptera	Varied Sittella	1	1	1	20	315	Perched	3	2-3	623	Ridge	-	Foraging
RC01	41955	28	0	2	NE	Rhipidura leucophrys	Willie Wagtail	1	1	1	10	315	Perched	4	1-4	623	Ridge	-	Resting
RC01	41955	28	0	2	NE	Rhipidura albiscapa	Grey Fantail	2	1	1	3	300	Air	4	1-5	623	Ridge	-	Powered
RC01	41955	28	0	2	NE	Todiramphus sanctus	Sacred Kingfisher	1	1	1	25	355	Perched	3	2-3	623	Ridge	-	Resting
RC01	41955	28	0	2	NE	Corvus coronoides	Australian Raven	1	1	1	30	310	Air	5	4-8	623	Ridge	Parallel	Powered
RC01	41955	28	0	2	NE	Phaps chalcoptera	Common Bronzewing	1	1	1	15	50	Air	2	1-3	623	Ridge	Parallel	Powered
RC01	41955	28	0	2	NE	Pachycephala rufiventris	Rufous Whistler	1	1	1	5	10	Perched	6	-	623	Ridge	-	Resting
RC01	41955	28	0	2	NE	Acanthiza lineata	Striated Thornbill	3	1	1	5	10	Perched	4	3-5	623	Ridge	-	Foraging
RS04	41956	23	40	4	SE	Platycercus elegans	Crimson Rosella	2	0	0	20	245	Perched	5	-	738	Ridge	-	Resting
RS04	41956	23	40	4	SE	Rhipidura albiscapa	Grey Fantail	1	0	0	25	240	Perched	2	-	738	Ridge	-	Resting
RS04	41956	23	40	4	SE	Falco berigora	Brown Falcon	1	0	0	300	160	Air	150	100-200	738	Ridge	Circling	Soaring
RS04	41956	23	40	4	SE	Aquila audax	Wedge-tailed Eagle	2	0	0	300	110	Air	300	250-500	738	Ridge	Circling	Soaring
RS04	41956	23	40	4	SE	Corvus coronoides	Australian Raven	1	0	0	300	110	Air	250	200-250	738	Ridge	Parallel	Powered
RS04	41956	23	40	4	SE	Phalacrocorax carbo	Great Cormorant	1	0	0	300	110	Air	200	70-250	738	Ridge	Parallel	Soaring
RS04	41956	23	40	4	SE	Dacelo novaeguineae	Laughing Kookaburra	1	0	0	15	40	Air	1	1-2	738	Ridge	Parallel	Powered
RS04	41956	23	40	4	SE	Colluricincla harmonica	Grey Shrike-thrush	1	0	0	25	135	Air	1	1-3	738	Ridge	Parallel	Powered
RS04	41956	23	40	4	SE	Aquila audax	Wedge-tailed Eagle	2	0	0	30	350	Air	150	100-200	738	Ridge	Away	Soaring
RS04	41956	23	40	4	SE	Falco cenchroides	Nankeen Kestrel	1	0	0	50	350	Air	30	10-40	738	Ridge	Parallel	Powered
RS06	41956	24	20	5	NW	Corvus coronoides	Australian Raven	4	1	1	15	110	Air	2	1-3		Ridge	Parallel	Powered
RS06	41956	24	20	5	NW	Petrochelidon nigricans	Tree Martin	1	1	1	15	110	Air	5	2-20		Ridge	Circling	Powered
RS06	41956	24	20	5	NW	Sturnus vulgaris	Common Starling	1	1	1	100	180	Air	1	1-3		Ridge	Parallel	Powered
RS06	41956	24	20	5	NW	Falco cenchroides	Nankeen Kestrel	1	1	1	70	140	Air	40	0-40		Ridge	Circling	Soaring
RS06	41956	24	20	5	NW	Egretta novaehollandiae	White-faced Heron	1	1	1	80	230	Air	2	1-5		Ridge	Parallel	Powered
RS06	41956	24	20	5	NW	Cracticus tibicen	Australian Magpie	2	1	1	90	350	Perched	1	-		Ridge	-	Resting
RS06	41956	24	20	5	NW	Cracticus tibicen	Australian Magpie	2	1	1	150	270	Perched	10	-		Ridge	-	Resting
RS06	41956	24	20	5	NW	Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	1	1	12	110	Air	2	1-4		Ridge	Away	Powered
RS06	41956	24	20	5	NW	Anthus novaeseelandiae	Australasian Pipit	2	1	1	20	300	Perched	1	0-2		Ridge	-	Resting
RS06	41956	24	20	5	NW	Aquila audax	Wedge-tailed Eagle	1	1	1	300	20	Air	10	10-80		Ridge	Away	Powered
RC04	41956	31	5	1	N	Cracticus tibicen	Australian Magpie	1	1	1	25	5	Perched	2	1-3		Valley	-	Resting
RC04	41956	31	5	1	N	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	2	1	1	10	290	Perched	1	1-2		Valley	-	Resting
RC04	41956	31	5	1	N	Corvus coronoides	Australian Raven	1	1	1	100	135	Air	1	1-2		Valley	Away	Powered
RC04	41956	31	5	1	N	Platycercus eximius	Eastern Rosella	1	1	1	15	160	Air	1	1-3		Valley	Away	Powered
RC04	41956	31	5	1	N	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	5	1	1	15	160	Air	1	1-3		Valley	Away	Powered
RC02	41956	29	5	7	NW	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	350	10	Air	2	1-4		Valley	Parallel	Powered
RC02	41956	29	5	7	NW	Egretta novaehollandiae	White-faced Heron	1	1	1	200	200	Air	3	1-4		Valley	Parallel	Powered
RC02	41956	29	5	7	NW	Manorina melanoccephala	Noisy Miner	2	1	1	200	200	Perched	3	2-3		Valley	-	Resting
RC02	41956	29	5	7	NW	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	8	90	Air	5	4-12		Valley	Away	Powered
RC02	41956	29	5	7	NW	Corvus coronoides	Australian Raven	2	1	1	70	70	Air	1	0-2		Valley	Parallel	Powered
RC02	41956	29	5	7	NW	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	2	1	1	5	160	Perched	1	1-4		Valley	-	Resting
RC02	41956	29	5	7	NW	Sturnus vulgaris	Common Starling	1	1	1	100	100	Air	2	0-3		Valley	Parallel	Powered
RS05	41957	30	10	9	NW	Aquila audax	Wedge-tailed Eagle	2	0	0	350	180	Air	150	50-150		Ridge	Parallel	Soaring
RS05	41957	30	10	9	NW	Corvus coronoides	Australian Raven	1	0	0	350	180	Air	80	40-80		Ridge	Parallel	Powered
RS05	41957	30	10	9	NW	Anthus novaeseelandiae	Australasian Pipit	2	0	0	4	180	Perched	1	0-2		Ridge	-	Resting
RS05	41957	30	10	9	NW	Falco cenchroides	Nankeen Kestrel	1	0	0	350	180	Air	50	50-180		Ridge	Parallel	Soaring
RS05	41957	30	10	9	NW	Unidentified (Grey Raptor)		1	0	0	250	150	Air	30	10-30		Ridge	Parallel	Gliding
RS03	41957	31	60	22	NW	Aquila audax	Wedge-tailed Eagle	1	0	1	3000	25	Air	200	50-600		Ridge	Parallel	Soaring
RS03	41957	31	60	22	NW	Corvus coronoides	Australian Raven	1	0	0	15	10	Air	2	2-4		Ridge	Parallel	Powered
RS03	41957	31	60	22	NW	Cracticus tibicen	Australian Magpie	1	1	1	20	200	Air	2	1-2		Ridge	Parallel	Powered
RS03	41957	31	60	22	NW	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	800	270	Air	50	20-50		Ridge	Parallel	Powered
RS03	41957	31	60	22	NW	Cracticus tibicen	Australian Magpie	1	1	1	30	150	Air	2	1-5		Ridge	Parallel	Powered
RS03	41957	31	60	22	NW	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	8	1	1	20	20	Air	1	0-2		Ridge	Away	Powered
RS01	41957	25	25	27	NW	Cracticus tibicen	Australian Magpie	8	1	1	50	5	Perched	1	0-5		Ridge	Away	Resting
RC02	41967	27	100	9	SE	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	5	1	1	10	160	Perched	2	0-3		Valley	-	Resting
RC02	41967	27	100	9	SE	Sturnus vulgaris	Common Starling	1	1	1	50	200	Air	2	1-2		Valley	Away	Powered
RC02	41967	27	100	9	SE	Cracticus tibicen	Australian Magpie	1	1	1	100	270	Air	1	0-2		Valley	Parallel	Powered
RC02	41967	27	100	9	SE	Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	1	1	30	135	Air	3	2-4		Valley	Parallel	Powered
RC02	41967	27	100	9	SE	Eolophus roseicapillus	Galah	2	1	1	430	330	Air	10	8-15		Valley	Parallel	Powered
RC02	41967	27	100	9	SE	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	150	5	Perched	10	-		Valley	-	Resting
RC02	41967	27	100	9	SE	Cacatua galerita	Sulphur-crested Cockatoo	2	1	1	120	50	Perched	1	0-1		Valley	-	Resting
RC02	41967	27	100	9	SE	Eolophus roseicapillus	Galah	4	1	1	150	5	Perched	8	8-15		Valley	-	Resting
RC04	41967	30	90	5	SW	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	4	1	1	20	160	Perched	2	0-3		Valley	-	Resting



RS Location	Date	Temp	Cloud Cover %	Wind Speed (km/hr)	Wind Direction	Scientific Name	Common Name	No.	Time Start	Time End	Distance (m)	Bearing	Location	Height (m)	Height Range (m)	Elevation (m)	Landscape Position	Direction	Behaviour
RC04	41967	30	90	5	SW	Hirundapus caudactutus	White-throated Needletail	20	1	1	100	40	Air	200	100-300		Valley	Circling	Soaring
RC04	41967	30	90	5	SW	Corvus mellori	Little Raven	4	1	1	300	200	Air	10	5-20		Valley	Parallel	Powered
RC04	41967	30	90	5	SW	Rhipidura leucophrys	Willie Wagtail	1	1	1	20	350	Air	5	4-15		Valley	Away	Powered
RC04	41967	30	90	5	SW	Corvus coronoides	Australian Raven	1	1	1	200	90	Air	50	30-50		Valley	Parallel	Powered
RC04	41967	30	90	5	SW	Platycercus elegans	Crimson Rosella	1	1	1	30	140	Air	2	1-3		Valley	Parallel	Powered
RC04	41967	30	90	5	SW	Cracticus tibicen	Australian Magpie	1	1	1	150	220	Perched	3	-		Valley	-	Resting
RC06	41967	28	60	7	W	Cacatua galerita	Sulphur-crested Cockatoo	3	0	0	10	70	Air	15	10-20		Valley	Away	Powered
RC06	41967	28	60	7	W	Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	0	0	15	200	Perched	8	8-10		Valley	-	Resting
RC06	41967	28	60	7	W	Cracticus tibicen	Australian Magpie	1	0	0	20	250	Perched	4	-		Valley	-	Resting
RC06	41967	28	60	7	W	Threskiornis spinicollis	Straw-necked Ibis	9	0	0	2000	270	Air	100	70-100		Valley	Circling	Soaring
RC06	41967	28	60	7	W	Pardalotus striatus	Striated Pardalote	1	0	0	10	280	Perched	12	8-15		Valley	-	Resting
RC06	41967	28	60	7	W	Sturnus vulgaris	Common Starling	1	0	0	20	180	Air	4	4-5		Valley	Parallel	Powered
RC06	41967	28	60	7	W	Malurus cyaneus	Superb Fairy-wren	1	0	0	8	250	Perched	1	0.5-1		Valley	Parallel	Resting
RC06	41967	28	60	7	W	Corvus coronoides	Australian Raven	1	0	0	15	10	Air	8	8-10		Valley	Parallel	Powered
RC06	41967	28	60	7	W	Manorina melanoccephala	Noisy Miner	1	0	1	30	65	Perched	8	6-10		Valley	-	Resting
RC06	41967	28	60	7	W	Cacatua galerita	Sulphur-crested Cockatoo	1	0	1	2000	270	Air	30	10-50		Valley	Parallel	Powered
RC06	41967	28	60	7	W	Falco cenchroides	Nankeen Kestrel	1	0	0	50	230	Air	20	20-80		Valley	Circling	Powered
RC06	41967	28	60	7	W	Malurus cyaneus	Superb Fairy-wren	1	0	1	4	320	Perched	1	0-3		Valley	-	Resting
RC05	41968	25	<5	5	N	Cracticus tibicen	Australian Magpie	2	1	1	40	300	Ground	0	0-2		Valley	-	Foraging
RC05	41968	25	<5	5	N	Rhipidura leucophrys	Willie Wagtail	1	1	1	15	320	Perched	1	0-2		Valley	-	Resting
RC05	41968	25	<5	5	N	Corvus mellori	Little Raven	12	1	1	60	90	Air	3	1-10		Valley	Parallel	Powered
RC05	41968	25	<5	5	N	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	2	1	1	5	20	Perched	1	0-1		Valley	Away	Resting
RC05	41968	25	<5	5	N	Cracticus tibicen	Australian Magpie	25	1	1	100	160	Ground	0	0-5		Valley	-	Resting
RC05	41968	25	<5	5	N	Anthus novaeseelandiae	Australasian Pipit	1	1	1	10	90	Perched	1	0-2		Valley	-	Resting
RS05	41968	25	<5	11	W	Anthus novaeseelandiae	Australasian Pipit	1	1	1	10	270	Air	2	1-2		Ridge	Away	Powered
RS05	41968	25	<5	11	W	Hirundo neoxena	Welcome Swallow	1	1	1	50	250	Air	25	10-50		Ridge	Parallel	Powered
RS05	41968	25	<5	11	W	Corvus coronoides	Australian Raven	1	1	1	150	30	Air	3	1-5		Ridge	Parallel	Powered
RS03	41968	21	5	13	W	Cacatua galerita	Sulphur-crested Cockatoo	60	1	1	300	210	Air	30	10-50		Ridge	Parallel	Powered
RS03	41968	21	5	13	W	Aquila audax	Wedge-tailed Eagle	1	1	1	1000	190	Air	40	40-20		Ridge	Parallel	Powered
RS03	41968	21	5	13	W	Corvus coronoides	Australian Raven	9	1	1	1000	190	Air	40	40-100		Ridge	Parallel	Powered
RS03	41968	21	5	13	W	Cracticus tibicen	Australian Magpie	5	1	1	30	190	Ground	0	0-4		Ridge	-	Resting
RS03	41968	21	5	13	W		Unidentified raptor	2	1	1	50	180	Air	30	30-100		Ridge	Parallel	Powered
RS03	41968	21	5	13	W	Eolophus roseicapillus	Galah	2	1	1	30	170	Air	2	2-3		Ridge	Parallel	Powered
RS03	41968	21	5	13	W	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	6	1	1	10	350	Air	1	0-2		Ridge	Parallel	Powered
RS01	41968	19	10	13	W	Cracticus tibicen	Australian Magpie	8	0	0	70	10	Perched	2	0-4		Ridge	Away	Resting
RS01	41968	19	10	13	W	Corvus coronoides	Australian Raven	2	0	0	80	300	Air	1	0-5		Ridge	Away	Powered
RC03	41969	24	1	7	SW	Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	1	1	2	300	Air	3	2-4		Valley	Parallel	Powered
RC03	41969	24	1	7	SW	Calyptrorhynchus funereus	Yellow-tailed Black-Cockatoo	3	1	1	50	10	Air	5	5-10		Valley	Parallel	Powered
RC03	41969	24	1	7	SW	Cracticus tibicen	Australian Magpie	1	1	1	70	330	Ground	0	0-1		Valley	-	Resting
RC03	41969	24	1	7	SW	Corvus coronoides	Australian Raven	2	1	1	60	20	Air	3	3-12		Valley	Parallel	Powered
RC03	41969	24	1	7	SW	Platycercus eximius	Eastern Rosella	1	1	1	15	10	Air	2	1-3		Valley	Parallel	Powered
RC03	41969	24	1	7	SW	Hirundo neoxena	Welcome Swallow	1	1	1	20	45	Air	2	1-8		Valley	Parallel	Powered
RC03	41969	24	1	7	SW	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	400	315	Air	25	25-60		Valley	Parallel	Powered
RC01	41969	27	<5	2	W	Anthochaera carunculata	Red Wattlebird	1	1	1	100	330	Air	3	2-4		Ridge	Parallel	Powered
RC01	41969	27	<5	2	W	Anthochaera carunculata	Red Wattlebird	1	1	1	40	190	Perched	1	0-2		Ridge	-	Resting
RC01	41969	27	<5	2	W	Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	1	1	15	250	Perched	6	5-6		Ridge	-	Resting
RC01	41969	27	<5	2	W	Platycercus elegans	Crimson Rosella	1	1	1	30	350	Air	3	2-3		Ridge	Parallel	Powered
RC01	41969	27	<5	2	W	Aquila audax	Wedge-tailed Eagle	1	1	1	3000	240	Air	150	150-800		Ridge	Circling	Soaring
RC01	41969	27	<5	2	W	Aquila audax	Wedge-tailed Eagle	1	1	1	2500	240	Air	100	50-100		Ridge	Circling	Soaring
RS06	41969	24	0	5	SW	Aquila audax	Wedge-tailed Eagle	1	1	1	1000	270	Air	100	100-600		Valley	Circling	Soaring
RS06	41969	24	0	5	SW	Corvus coronoides	Australian Raven	1	1	1	1000	270	Air	100	10-100		Valley	Toward	Powered
RS06	41969	24	0	5	SW	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	200	250	Air	15	10-25		Valley	Parallel	Powered
RS06	41969	24	0	5	SW	Anthus novaeseelandiae	Australasian Pipit	1	1	1	40	260	Air	10	1-15		Valley	Parallel	Powered
RS06	41969	24	0	5	SW	Petrochelidon nigricans	Tree Martin	1	1	1	150	160	Air	20	10-30		Valley	Circling	Powered
RS06	41969	24	0	5	SW	Cracticus tibicen	Australian Magpie	1	1	1	250	330	Perched	8	0-8		Valley	-	Resting
RS06	41969	24	0	5	SW	Hirundo neoxena	Welcome Swallow	2	1	1	15	170	Air	6	1-20		Valley	Circling	Powered
RS06	41969	24	0	5	SW	Cacatua galerita	Sulphur-crested Cockatoo	50	1	1	700	240	Air	20	10-30		Valley	Parallel	Powered
RS06	41969	24	0	5	SW	Falco cenchroides	Nankeen Kestrel	1	1	1	70	100	Air	15	15-40		Valley	Circling	Soaring
RS06	41969	24	0	5	SW	Sturnus vulgaris	Common Starling	1	1	1	300	280	Air	15	10-25		Valley	Parallel	Powered
RS02	41969	21	1	10	NW	Eolophus roseicapillus	Galah	1	0	0	150	300	Air	15	10-20		Ridge	Parallel	Powered
RS02	41969	21	1	10	NW	Corvus coronoides	Australian Raven	2	0	0	100	120	Air	8	5-20		Ridge	Parallel	Powered
RS02	41969	21	1	10	NW	Egretta novaehollandiae	White-faced Heron	1	0	0	120	260	Air	20	15-30		Ridge	Parallel	Powered
RS02	41969	21	1	10	NW	Calyptrorhynchus funereus	Yellow-tailed Black-Cockatoo	3	0	0	60	20	Air	15	10-20		Ridge	Parallel	Powered
RS02	41969	21	1	10	NW	Anthus novaeseelandiae	Australasian Pipit	1	0	0	20	350	Perched	1	-		Ridge	-	Resting
RS02	41969	21	1	10	NW	Psephotus haematonotus	Red-rumped Parrot	2	0	0	15	150	Air	2	1-4		Ridge	Parallel	Powered
RS02	41969	21	1	10	NW	Artamus cyanopterus	Dusky Woodswallow	2	0	1	30	20	Air	10	10-25		Ridge	Circling	Powered
RS02	41969	21	1	10	NW	Corvus coronoides	Australian Raven	2	0	0	200	270	Air	25	10-35		Ridge	Parallel	Powered
RS02	41969	21	1	10	NW	Philemon corniculatus	Noisy Friarbird	1	0	0	30	40	Air	2	1-4		Ridge	Away	Powered
RS02	41969	21	1	10	NW	Cacatua galerita	Sulphur-crested Cockatoo	2	1	1	200	90	Air	2	1-3		Ridge	Parallel	Powered
RS04	41969	19	25	8	W	Cracticus tibicen	Australian Magpie	1	0	0	8	270	Ground	0	0-4		Ridge	Away	Resting
RS04	41969	19	25	8	W	Cacatua galerita	Sulphur-crested Cockatoo	2	0	0	2200	250	Air	30	20-40		Ridge	Parallel	Powered



RS Location	Date	Temp	Cloud Cover %	Wind Speed (km/hr)	Wind Direction	Scientific Name	Common Name	No.	Time Start	Time End	Distance (m)	Bearing	Location	Height (m)	Height Range (m)	Elevation (m)	Landscape Position	Direction	Behaviour
RS04	41969	19	25	8	W	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	2	0	0	22	260	Air	3	2-3		Ridge	Parallel	Powered
RS04	41969	19	25	8	W	Pelecanus conspicillatus	Australian Pelican	1	0	0	200	180	Air	300	300-400		Ridge	Parallel	Gliding
RS04	41969	19	25	8	W	Platycercus elegans	Crimson Rosella	1	0	0	20	270	Air	1	1-3		Ridge	Parallel	Powered
RS04	41969	19	25	8	W	Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	0	0	25	270	Air	2	2-3		Ridge	Parallel	Powered
RC02	41970	20	55	15	E	Platycercus eximius	Eastern Rosella	1	1	1	20	100	Air	4	2-4		Valley	Parallel	Powered
RC02	41970	20	55	15	E	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	400	20	Air	40	40-50		Valley	Parallel	Powered
RC02	41970	20	55	15	E	Aquila audax	Wedge-tailed Eagle	1	1	1	600	0	Air	100	75-200		Valley	Circling	Soaring
RC02	41970	20	55	15	E	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	4	1	1	10	30	Air	2	0-4		Valley	Parallel	Powered
RC02	41970	20	55	15	E	Cracticus tibicen	Australian Magpie	3	1	1	40	120	Air	4	3-4		Valley	Away	Powered
RC02	41970	20	55	15	E	Eolophus roseicapillus	Galah	1	1	1	150	340	Perched	10	-		Valley	-	Resting
RC02	41970	20	55	15	E	Haliaeetus leucogaster	White-bellied Sea-Eagle	1	1	1	300	100	Air	70	70-120		Valley	Away	Powered
RC02	41970	20	55	15	E	Anas superciliosa	Pacific Black Duck	20	1	1	300	90	Air	2	2-10		Valley	Parallel	Powered
RC02	41970	20	55	15	E	Corvus coronoides	Australian Raven	2	1	1	300	100	Air	70	70-120		Valley	Away	Powered
RC02	41970	20	55	15	E	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	200	100	Air	10	7-10		Valley	Away	Powered
RC02	41970	20	55	15	E	Eolophus roseicapillus	Galah	6	1	1	100	100	Air	15	10-20		Valley	Parallel	Powered
RC02	41970	20	55	15	E	Cacatua galerita	Sulphur-crested Cockatoo	3	1	1	75	160	Air	4	1-8		Valley	Away	Powered
RC06	41970	19	75	4	SE	Manorina melanoccephala	Noisy Miner	4	1	1	40	150	Air	3	2-5		Valley	Parallel	Powered
RC06	41970	19	75	4	SE	Sturnus vulgaris	Common Starling	1	1	1	40	100	Air	15	10-20		Valley	Parallel	Powered
RC06	41970	19	75	4	SE	Sturnus vulgaris	Common Starling	2	1	1	40	200	Air	2	1-10		Valley	Away	Powered
RC06	41970	19	75	4	SE	Cracticus tibicen	Australian Magpie	1	1	1	100	200	Perched	2	0-6		Valley	Parallel	Resting
RC06	41970	19	75	4	SE	Platycercus eximius	Eastern Rosella	2	1	1	40	200	Perched	6	5-8		Valley	-	Resting
RC06	41970	19	75	4	SE	Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	1	1	60	150	Air	6	5-12		Valley	Parallel	Powered
RC06	41970	19	75	4	SE	Aquila audax	Wedge-tailed Eagle	1	1	1	3000	50	Air	800	600-1000		Valley	Circling	Soaring
RC06	41970	19	75	4	SE	Corvus coronoides	Australian Raven	1	1	1	70	200	Air	12	8-15		Valley	Toward	Powered
RC04	41970	19	55	13	E	Platycercus eximius	Eastern Rosella	1	1	1	25	10	Air	4	1-5		Valley	Away	Powered
RC04	41970	19	55	13	E	Cracticus tibicen	Australian Magpie	1	1	1	120	110	Air	2	1-4		Valley	Parallel	Powered
RC04	41970	19	55	13	E	Platycercus eximius	Eastern Rosella	2	1	1	25	190	Air	3	2-4		Valley	Away	Powered
RC04	41970	19	55	13	E	Sturnus vulgaris	Common Starling	1	1	1	150	90	Air	2	1-3		Valley	Parallel	Powered
RC04	41970	19	55	13	E	Eolophus roseicapillus	Galah	2	1	1	70	210	Air	15	10-20		Valley	Parallel	Powered
RC04	41970	19	55	13	E	Hirundo neoxena	Welcome Swallow	1	1	1	30	240	Air	15	15-20		Valley	Parallel	Powered
RC04	41970	19	55	13	E	Cracticus tibicen	Australian Magpie	2	1	1	100	330	Ground	0	0-2		Valley	-	Foraging
RC04	41970	19	55	13	E	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	400	40	Air	25	20-40		Valley	Parallel	Powered
RC05	41971	23	<5	6	E	Cracticus tibicen	Australian Magpie	2	1	1	15	90	Ground	0	0-3		Valley	-	Resting
RC05	41971	23	<5	6	E	Corvus coronoides	Australian Raven	5	1	1	20	160	Air	3	2-4		Valley	Away	Powered
RC05	41971	23	<5	6	E	Anthus novaeseelandiae	Antusian Pipit	1	1	1	15	120	Air	1	1-10		Valley	Circling	Powered
RC03	41971	22	0	3	N	Eolophus roseicapillus	Galah	2	0	0	20	0	Air	4	3-6		Valley	Away	Powered
RC03	41971	22	0	3	N	Cacatua galerita	Sulphur-crested Cockatoo	1	0	0	70	40	Air	6	4-8		Valley	Parallel	Powered
RC03	41971	22	0	3	N	Rhipidura leucophrys	Willie Wagtail	1	0	1	10	45	Air	1	1-2		Valley	Parallel	Powered
RC03	41971	22	0	3	N	Falco cenchroides	Nankeen Kestrel	1	0	0	350	260	Air	15	10-25		Valley	Parallel	Powered
RC03	41971	22	0	3	N	Pachycephala rufiventris	Rufous Whistler	2	1	1	10	90	Air	1	1-3		Valley	Parallel	Powered
RC03	41971	22	0	3	N	Lichenostomus leucotis	White-eared Honeyeater	2	1	1	25	0	Air	1	1-3		Valley	Away	Powered
RC03	41971	22	0	3	N	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	4	1	1	10	80	Air	2	1-4		Valley	Parallel	Powered
RC03	41971	22	0	3	N	Platycercus eximius	Eastern Rosella	2	1	1	30	90	Air	2	2-6		Valley	Parallel	Powered
RC03	41971	22	0	3	N	Eolophus roseicapillus	Galah	2	1	1	500	340	Air	20	20-70		Valley	Parallel	Powered
RC03	41971	22	0	3	N	Corvus coronoides	Australian Raven	2	1	1	250	225	Air	30	20-30		Valley	Away	Powered
RC03	41971	22	0	3	N	Aquila audax	Wedge-tailed Eagle	1	1	1	2000	250	Air	100	100-800		Valley	Circling	Soaring
RC03	41971	22	0	3	N	Egretta novaehollandiae	White-faced Heron	1	1	1	180	110	Air	5	1-6		Valley	Parallel	Powered
RC03	41971	22	0	3	N	Artamus cyanopterus	Dusky Woodswallow	1	1	1	75	120	Air	6	4-15		Valley	Circling	Powered
RC01	41971	19	1	1	N	Platycercus elegans	Crimson Rosella	2	0	0	30	90	Air	2	2-4		Ridge	Toward	Powered
RC01	41971	19	1	1	N	Acanthiza reguloides	Buff-rumped Thornbill	1	0	0	150	200	Air	6	5-6		Ridge	Parallel	Powered
RC01	41971	19	1	1	N	Colluricincla harmonica	Grey Shrike-thrush	1	0	0	15	300	Perched	6	4-8		Ridge	Parallel	Resting
RC01	41971	19	1	1	N	Coracina novaehollandiae	Black-faced Cuckoo-shrike	2	0	0	200	250	Air	10	8-10		Ridge	Parallel	Powered
RC01	41971	19	1	1	N	Aquila audax	Wedge-tailed Eagle	2	0	0	2300	250	Air	800	800-1300		Ridge	Circling	Soaring
RC06	41981	27	50	7	West	Coracina novaehollandiae	Black-faced Cuckoo-shrike	2	1	1	35	260	Air	5	4-9		Valley	Parallel	Powered
RC06	41981	27	50	7	West	Petrochelidon nigricans	Tree Martin	3	1	1	10	100	Air	20	5-30		Valley	Away	Powered
RC06	41981	27	50	7	West	Malurus cyaneus	Superb Fairy-wren	1	1	1	3	320	Perched	2	1-4		Valley	Parallel	Resting
RC06	41981	27	50	7	West	Platycercus eximius	Eastern Rosella	2	1	1	60	160	Perched	3	-		Valley	-	Resting
RC06	41981	27	50	7	West	Egretta novaehollandiae	White-faced Heron	1	1	1	100	150	Air	5	1-6		Valley	Parallel	Powered
RC06	41981	27	50	7	West	Manorina melanoccephala	Noisy Miner	1	1	1	10	270	Perched	10	8-10		Valley	Parallel	Resting
RC04	41981	26	70	9	West	Cracticus tibicen	Australian Magpie	2	1	1	80	40	Perched	4	-		Valley	-	Resting
RC04	41981	26	70	9	West	Corvus coronoides	Australian Raven	2	1	1	120	280	Air	10	8-12		Valley	Away	Powered
RC04	41981	26	70	9	West	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	1	1	1	8	250	Air	2	1-3		Valley	Toward	Powered
RC04	41981	26	70	9	West	Falco cenchroides	Nankeen Kestrel	1	1	1	200	300	Air	15	10-40		Valley	Away	Powered
RC04	41981	26	70	9	West	Sturnus vulgaris	Common Starling	2	1	1	250	30	Air	20	10-25		Valley	Parallel	Powered
RC04	41981	26	70	9	West	Aquila audax	Wedge-tailed Eagle	2	1	1	4500	220	Air	150	100-700		Valley	Circling	Soaring
RC04	41981	26	70	9	West	Aquila audax	Wedge-tailed Eagle	1	1	1	200	280	Air	100	80-150		Valley	Away	Gliding
RC04	41981	26	70	9	West	Corvus mellori	Little Raven	9	1	1	400	90	Air	20	10-25		Valley	Toward	Powered
RC05	41982	23	30	6	NE	Falco cenchroides	Nankeen Kestrel	2	1	1	100	10	Perched	8	5-20		Valley	Away	Powered
RC05	41982	23	30	6	NE	Petrochelidon nigricans	Tree Martin	2	1	1	100	10	Air	10	5-30		Valley	Circling	Powered
RC05	41982	23	30	6	NE	Corvus coronoides	Australian Raven	1	1	1	400	300	Air	30	10-30		Valley	Parallel	Powered
RC05	41982	23	30	6	NE	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	400	280	Air	30	20-30		Valley	Parallel	Powered



RS Location	Date	Temp	Cloud Cover %	Wind Speed (km/hr)	Wind Direction	Scientific Name	Common Name	No.	Time Start	Time End	Distance (m)	Bearing	Location	Height (m)	Height Range (m)	Elevation (m)	Landscape Position	Direction	Behaviour
RC05	41982	23	30	6	NE	Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	1	1	150	260	Air	20	15-25		Valley	Parallel	Powered
RC05	41982	23	30	6	NE	Aquila audax	Wedge-tailed Eagle	2	1	1	400	110	Air	50	50-250		Valley	Circling	Soaring
RC05	41982	23	30	6	NE	Corvus mellori	Little Raven	8	1	1	300	30	Air	15	10-25		Valley	Parallel	Powered
RC05	41982	23	30	6	NE	Anthus novaeseelandiae	Australasian Pipit	1	1	1	100	160	Air	4	1-4		Valley	Toward	Powered
RC05	41982	23	30	6	NE	Sturnus vulgaris	Common Starling	1	1	1	10	180	Air	5	3-10		Valley	Away	Powered
RC05	41982	23	30	6	NE	Eolophus roseicapillus	Galah	2	1	1	70	80	Air	4	1-15		Valley	Parallel	Powered
RC03	41982	22	20	11	NE	Platycercus eximius	Australian Raven	4	1	1	60	40	Air	6	6-10		Valley	Parallel	Powered
RC03	41982	22	20	11	NE	Petrochelidon nigricans	Tree Martin	3	1	1	80	120	Air	10	5-30		Valley	Circling	Powered
RC03	41982	22	20	11	NE	Corvus coronoides	Australian Raven	4	1	1	120	170	Air	2	1-4		Valley	Parallel	Powered
RC03	41982	22	20	11	NE	Aquila audax	Wedge-tailed Eagle	2	1	1	4000	270	Air	70	50-200		Valley	Circling	Soaring
RC03	41982	22	20	11	NE	Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	1	1	10	250	Air	15	10-20		Valley	Away	Powered
RC03	41982	22	20	11	NE	Egretta novaehollandiae	White-faced Heron	1	1	1	200	210	Air	25	20-30		Valley	Toward	Powered
RC03	41982	22	20	11	NE	Lichenostomus chrysops	Yellow-faced Honeyeater	1	1	1	10	90	Air	3	1-10		Valley	Parallel	Powered
RC03	41982	22	20	11	NE	Cacatua galerita	Sulphur-crested Cockatoo	2	1	1	150	310	Air	8	0-10		Valley	Parallel	Powered
RC01	41982	22	80	4	NE	Cracticus tibicen	Australian Magpie	1	1	1	200	240	Air	5	1-10		Ridge	Parallel	Powered
RC01	41982	22	80	4	NE	Coracina novaehollandiae	Black-faced Cuckoo-shrike	1	1	1	400	240	Perched	15	-		Ridge	-	Resting
RC01	41982	22	80	4	NE	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	20	190	Air	50	40-60		Ridge	Away	Powered
RC01	41982	22	80	4	NE	Rhipidura leucophrys	Willie Wagtail	1	1	1	15	190	Perched	8	5-10		Ridge	Away	Resting
RC02	41985	18	70	15	SE	Cracticus tibicen	Australian Magpie	3	1	1	10	90	Perched	0	0		Valley	-	Foraging
RC02	41985	18	70	15	SE	Aquila audax	Wedge-tailed Eagle	1	1	1	250	200	Air	50	30-80		Valley	Away	Gliding
RC02	41985	18	70	15	SE	Egretta novaehollandiae	White-faced Heron	1	1	1	200	180	Air	30	20-40		Valley	Parallel	Powered
RC02	41985	18	70	15	SE	Aquila audax	Wedge-tailed Eagle	2	1	1	800	10	Air	100	100-200		Valley	Circling	Soaring
RC02	41985	18	70	15	SE	Cracticus tibicen	Australian Magpie	1	1	1	50	90	Air	30	25-35		Valley	Parallel	Powered
RC02	41985	18	70	15	SE	Corvus coronoides	Australian Raven	2	1	1	300	350	Air	5	3-15		Valley	Parallel	Powered
RC02	41985	18	70	15	SE	Cacatua galerita	Sulphur-crested Cockatoo	1	1	1	350	250	Air	10	10-25		Valley	Parallel	Powered
RC02	41985	18	70	15	SE	Corvus coronoides	Australian Raven	1	1	1	350	340	Air	10	10-15		Valley	Parallel	Powered

ID	Tree Species	DBH (cm)	Tree Height (m)	Small Hollows (2.5 cm - 5 cm)		Medium Hollows (6 - 10 cm)		Large Hollows (>10 cm)		Latitude	Longitude	Collection Date	Within Development Footprint?	Within Study Area?	Outside Study Area?
				Count	Height (m)	Count	Height (m)	Count	Height (m)						
1	Stag	70	12	1	5	2	4	0	0	-35.281671	149.64132	1/01/2015		Y	
2	Broadleaf peppermint	100	6	0	0	0	0	1	2	-35.27896	149.643906	1/01/2015		Y	
3	Broadleaf peppermint	50	5	1	2	0	0	0	0	-35.278846	149.643683	1/01/2015		Y	
4	Broadleaf peppermint	60	6	1	4	0	0	0	0	-35.278881	149.643656	1/01/2015		Y	
5	Broadleaf peppermint	60	6	2	3	2	4	0	0	-35.278692	149.643391	1/01/2015		Y	
6	Broadleaf peppermint	100	7	0	0	0	0	1	0.5	-35.278793	149.643382	1/01/2015		Y	
7	Broadleaf peppermint	100	7	2	4	1	3	0	0	-35.278686	149.643137	1/01/2015		Y	
8	Broadleaf peppermint	30	4	1	1	0	0	0	0	-35.278415	149.643543	1/01/2015		Y	
9	Stag	80	6	0	0	0	0	1	3	-35.278508	149.644226	1/01/2015		Y	
10	Peppermint	30	5	0	1	2	0	0	0	-35.278002	149.648779	1/01/2015		Y	
11	Peppermint	30	6	0	0	1	4	0	0	-35.27802	149.648725	1/01/2015		Y	
12	Peppermint	50	5	2	4	2	4	0	0	-35.277978	149.648355	1/01/2015		Y	
13	Stag	50	7	2	3	1	2	1	4	-35.278054	149.64819	1/01/2015		Y	
14	Stag	100	6	1	4	1	4	0	0	-35.277765	149.647343	1/01/2015		Y	
15	Stag	100	7	0	0	2	5	1	6	-35.278278	149.647114	1/01/2015		Y	
16	Peppermint	70	6	1	5	0	0	0	0	-35.278396	149.647238	1/01/2015		Y	
17	Peppermint	50	10	1	2	0	0	0	0	-35.28399	149.643963	1/01/2015		Y	
18	Peppermint	80	14	1	5	0	0	0	0	-35.285036	149.644932	1/01/2015		Y	
19	Stag	100	8	0	0	2	3	0	0	-35.285144	149.645195	1/01/2015		Y	
20	Stag	100	6	0	0	2	4	0	0	-35.28414	149.645204	1/01/2015		Y	
21	Peppermint	40	6	1	3	0	0	0	0	-35.284507	149.641731	1/01/2015		Y	
22	Ribbon gum	70	14	0	0	0	0	1	3	-35.284942	149.641223	1/01/2015		Y	
23	Peppermint	50	10	1	5	0	0	0	0	-35.284801	149.640972	1/01/2015		Y	
24	Brittle gum	120	9	3	4	1	3	0	0	-35.283912	149.641485	1/01/2015		Y	
25	Stag	80	6	0	0	0	0	1	5	-35.159639	149.708137	1/01/2015		Y	
26	Stringybark/stag	60	9	0	0	1	6	0	0	-35.158792	149.708214	1/01/2015		Y	
27	Stag	100	9	0	0	2	6	3	6	-35.158515	149.707627	1/01/2015		Y	
28	Red stringybark	80	12	0	0	1	5	0	0	-35.157926	149.7088	1/01/2015		Y	
29	Scribbly gum	90	10	1	4	1	6	0	0	-35.158465	149.709355	1/01/2015		Y	
30	Stag	90	9	0	0	0	0	1	6	-35.158508	149.709484	1/01/2015		Y	
31	Stag	90	12	1	5	0	0	0	0	-35.158286	149.708822	1/01/2015		Y	
32	Stringybark	90	10	0	0	1	7	0	0	-35.153712	149.695728	1/01/2015		Y	
33	Stringybark	80	8	1	4	1	5	0	0	-35.155667	149.706003	1/01/2015		Y	
34	Stringybark	80	9	1	6	0	0	0	0	-35.155391	149.704278	1/01/2015		Y	
35	Brittle gum	80	10	0	0	1	5	0	0	-35.122408	149.673069	1/01/2015		Y	
36	Brittle gum	120	12	0	0	2	5	0	0	-35.126313	149.674	1/01/2015		Y	
37	Brittle gum	150	10	0	0	1	4	0	0	-35.128266	149.674319	1/01/2015		Y	
38	Brittle gum	150	10	1	6	0	0	0	0	-35.128428	149.675622	1/01/2015		Y	
39	Brittle gum	90	10	1	5	0	0	0	0	-35.13337	149.68209	1/01/2015		Y	
40	Brittle gum	40	10	0	0	1	5	0	0	-35.134744	149.676688	1/01/2015		Y	
41	Brittle gum	80	8	1	2	0	0	0	0	-35.1336	149.676711	1/01/2015		Y	
42	Brittle gum	60	7	2	5	0	0	0	0	-35.133189	149.676272	1/01/2015		Y	
43	Brittle gum	80	10	1	4	0	0	0	0	-35.134085	149.675819	1/01/2015		Y	
44	Brittle gum	60	10	0	0	0	0	1	4	-35.134008	149.675659	1/01/2015		Y	
45	Brittle gum	100	7	0	0	1	5	0	0	-35.130697	149.676759	1/01/2015		Y	
46	Brittle gum	90	10	0	0	0	0	1	5	-35.130174	149.676268	1/01/2015		Y	
47	Brittle gum	90	10	0	0	0	0	1	4	-35.128746	149.671193	1/01/2015		Y	
48	Brittle gum	100	10	0	0	0	0	1	4	-35.128393	149.67093	1/01/2015		Y	
49	Brittle gum	90	10	1	6	0	0	0	0	-35.1289	149.672615	1/01/2015		Y	
50	Brittle gum	100	8	0	0	1	5	0	0	-35.138448	149.675265	1/01/2015		Y	
51	Stag	100	8	0	0	0	0	1	4	-35.138344	149.676351	1/01/2015		Y	
52	Brittle gum	100	6	2	2	0	0	0	0	-35.142319	149.677804	1/01/2015		Y	
53	Stag	80	8	0	0	0	0	1	2	-35.142714	149.676862	1/01/2015		Y	
54	Brittle gum	60	6	1	2	0	0	0	0	-35.148359	149.679393	1/01/2015			Y
55	Brittle gum	120	14	3	5	0	0	0	0	-35.304696	149.636702	1/01/2015		Y	
56	Stag	0	5	0	0	1	0.5	0	0	-35.30464	149.636586	1/01/2015		Y	
57	Peppermint	0	8	0	0	0	0	0	0	-35.304071	149.637469	1/01/2015		Y	
58	Stag	0	8	0	0	0	0	0	0	-35.303452	149.637852	1/01/2015		Y	
59	Peppermint	0	7	0	0	0	0	0	0	-35.303508	149.637978	1/01/2015		Y	
60	Broad leaf peppermint	0	8	0	0	0	0	0	0	-35.303758	149.637942	1/01/2015		Y	
61	Stag	0	8	0	0	0	0	0	0	-35.303985	149.638366	1/01/2015		Y	
62	Stag	0	8	0	0	0	0	0	0	-35.303633	149.63842	1/01/2015		Y	
63	Broad leaf peppermint	0	7	0	0	0	0	0	0	-35.30335	149.638722	1/01/2015		Y	
64	Broad leaf peppermint	0	9	0	0	0	0	0	0	-35.302917	149.637918	1/01/2015		Y	
65	Smooth bark	0	8	0	0	0	0	0	0	-35.312017	149.637495	1/01/2015		Y	
66	Snow gum	0	6	0	0	0	0	0	0	-35.313378	149.638138	1/01/2015		Y	
67	Ribbon gum	0	13	0	0	0	0	0	0	-35.314864	149.639023	1/01/2015		Y	
68	Brittle gum	0	5	0	0	0	0	0	0	-35.317912	149.636405	1/01/2015		Y	

ID	Tree Species	DBH (cm)	Tree Height (m)	Small Hollows (2.5 cm - 5 cm)		Medium Hollows (6 - 10 cm)		Large Hollows (>10 cm)		Latitude	Longitude	Collection Date	Within Development Footprint?	Within Study Area?	Outside Study Area?
				Count	Height (m)	Count	Height (m)	Count	Height (m)						
69	Brittle gum	0	10	0	0	0	0	0	0	-35.31796	149.636248	1/01/2015		Y	
70	Brittle gum	90	10	1	2	1	2	0	0	-35.312544	149.643807	1/01/2015		Y	
71	Stag	90	8	4	4	1	2	0	0	-35.312144	149.643326	1/01/2015		Y	
72	Peppermint	20	5	1	2	0	0	0	0	-35.313434	149.643707	1/01/2015		Y	
73	Brittle gum	50	8	1	1	2	5	1	4	-35.313404	149.6438	1/01/2015		Y	
74	Brittle gum	30	8	1	2	0	0	0	0	-35.313514	149.644308	1/01/2015		Y	
75	Peppermint	80	10	0	0	1	6	0	0	-35.313481	149.644341	1/01/2015		Y	
76	Peppermint	80	10	2	5	0	0	0	0	-35.313614	149.644486	1/01/2015		Y	
77	Brittle gum	70	8	0	0	1	2	0	0	-35.313619	149.644509	1/01/2015		Y	
78	Stag	0	10	0	0	0	0	0	0	-35.202516	149.705054	1/01/2015		Y	
79	Peppermint	0	7	0	0	0	0	0	0	-35.206795	149.706272	1/01/2015		Y	
80	Yellow box	0	13	0	0	0	0	0	0	-35.207068	149.70481	1/01/2015		Y	
81	Yellow box	0	9	0	0	0	0	0	0	-35.207249	149.705399	1/01/2015		Y	
82	Red stringybark	30	5	2	4	0	0	0	0	-35.19423	149.679051	1/01/2015		Y	
83	Red stringybark	20	4	2	4	0	0	0	0	-35.194279	149.679044	1/01/2015		Y	
84	Red stringybark	30	5	0	0	0	0	1	2	-35.19422	149.678978	1/01/2015		Y	
85	Red stringybark	20	6	0	0	0	0	1	5	-35.194183	149.679063	1/01/2015		Y	
86	Scribbly gum	80	9	4	7	0	0	4	6	-35.204116	149.694156	1/01/2015		Y	
87	Scribbly gum	80	10	0	0	1	6	2	5	-35.20325	149.693692	1/01/2015		Y	
88	Scribbly gum	80	7	0	0	0	0	1	4	-35.202194	149.693091	1/01/2015		Y	
89	Stag	70	8	1	4	0	0	0	0	-35.202574	149.692441	1/01/2015		Y	
90	Scribbly gum	80	10	0	0	0	0	1	6	-35.203034	149.692134	1/01/2015		Y	
91	Yellow box	90	10	0	0	1	6	0	0	-35.203778	149.687927	1/01/2015		Y	
92	Yellow box	90	10	0	0	1	8	1	6	-35.203735	149.687752	1/01/2015		Y	
93	Stag	90	8	0	0	2	6	0	0	-35.204415	149.691018	1/01/2015		Y	
94	Scribbly gum	90	5	1	4	1	4	0	0	-35.20442	149.692319	1/01/2015		Y	
95	Scribbly gum	30	5	0	0	1	2	0	0	-35.204509	149.692317	1/01/2015		Y	
96	Scribbly gum	30	6	1	4	0	0	0	0	-35.204211	149.693643	1/01/2015		Y	
97	Scribbly gum	30	6	0	0	1	4	0	0	-35.204153	149.69362	1/01/2015		Y	
98	Scribbly gum	80	7	1	5	2	6	1	4	-35.204144	149.694143	1/01/2015		Y	
99	Red stringybark	40	8	0	0	1	4	0	0	-35.20824	149.686114	1/01/2015		Y	
100	Red stringybark	50	7	0	0	1	6	0	0	-35.205001	149.684294	1/01/2015		Y	
101	Stag	20	6	0	0	0	0	1	5	-35.203879	149.68343	1/01/2015		Y	
102	Scribbly gum	15	6	0	0	1	5	0	0	-35.203806	149.683329	1/01/2015		Y	
103	Scribbly gum	0	9	0	0	1	4	1	2	-35.203803	149.683202	1/01/2015		Y	
104	Scribbly gum	0	5	0	0	0	0	0	0	-35.203776	149.683214	1/01/2015		Y	
105	Scribbly gum	0	10	0	0	0	0	0	0	-35.203774	149.683219	1/01/2015		Y	
106	Scribbly gum	0	8	0	0	0	0	0	0	-35.203833	149.683069	1/01/2015		Y	
107	Scribbly gum	50	8	0	0	0	0	1	6	-35.203655	149.683092	1/01/2015		Y	
108	Scribbly gum	15	5	1	4	0	0	0	0	-35.203654	149.683007	1/01/2015		Y	
109	Scribbly gum	15	6	0	0	2	5	0	0	-35.203609	149.683061	1/01/2015		Y	
110	Scribbly gum	30	8	0	0	0	0	2	7	-35.203657	149.682898	1/01/2015		Y	
111	Scribbly gum	30	7	0	0	2	5	0	0	-35.203668	149.682843	1/01/2015		Y	
112	Scribbly gum	50	7	0	0	0	0	1	5	-35.203592	149.682799	1/01/2015		Y	
113	Scribbly gum	40	8	1	5	0	0	0	0	-35.203637	149.682723	1/01/2015		Y	
114	Scribbly gum	50	10	0	0	0	0	1	6	-35.203521	149.682564	1/01/2015		Y	
115	Scribbly gum	30	7	2	5	2	6	0	0	-35.203518	149.682535	1/01/2015		Y	
116	Scribbly gum	40	7	0	0	1	4	0	0	-35.203521	149.682469	1/01/2015		Y	
117	Scribbly gum	20	7	0	0	1	6	0	0	-35.203382	149.682111	1/01/2015		Y	
118	Scribbly gum	60	8	0	0	2	5	0	0	-35.203496	149.682118	1/01/2015		Y	
119	Scribbly gum	40	5	0	0	0	0	1	3	-35.203626	149.682033	1/01/2015		Y	
120	Scribbly gum	70	8	2	7	2	5	0	0	-35.203775	149.68209	1/01/2015		Y	
121	Scribbly gum	30	6	0	0	0	0	1	5	-35.203828	149.682016	1/01/2015		Y	
122		0		0	0	0	0	0	0	-35.203976	149.682019	1/01/2015		Y	
123	Peppermint	20	5	1	2	1	2	0	0	-35.203975	149.682038	1/01/2015		Y	
124	Stag	30	5	1	3	0	0	1	2	-35.204067	149.682072	1/01/2015		Y	
125	Scribbly gum	40	10	0	0	0	0	2	4	-35.204285	149.682317	1/01/2015		Y	
126	Scribbly gum	20	8	0	0	0	0	1	2	-35.204364	149.68234	1/01/2015		Y	
127	Scribbly gum	30	5	0	0	0	0	2	4	-35.204435	149.682237	1/01/2015		Y	
128	Scribbly gum	30	5	1	4	0	0	0	0	-35.204548	149.682213	1/01/2015		Y	
129	Scribbly gum	50	10	1	8	0	0	0	0	-35.20461	149.682159	1/01/2015		Y	
130	Stag	30	7	0	0	0	0	1	2	-35.204669	149.682044	1/01/2015		Y	
131	Peppermint	40	7	1	6	1	5	0	0	-35.204767	149.682141	1/01/2015		Y	
132	Scribbly gum	60	10	0	0	0	0	1	5	-35.2048	149.682484	1/01/2015		Y	
133	Stag	50	5	2	5	0	0	1	5	-35.204217	149.682995	1/01/2015		Y	
134	Stag	30	5	0	0	0	0	2	4	-35.204025	149.682904	1/01/2015		Y	
135	Stag	50	7	2	6	0	0	0	0	-35.203047	149.680853	1/01/2015			Y
136	Peppermint	40	6	0	0	1	4	0	0	-35.202904	149.680962	1/01/2015			Y

ID	Tree Species	DBH (cm)	Tree Height (m)	Small Hollows (2.5 cm - 5 cm)		Medium Hollows (6 - 10 cm)		Large Hollows (>10 cm)		Latitude	Longitude	Collection Date	Within Development Footprint?	Within Study Area?	Outside Study Area?
				Count	Height (m)	Count	Height (m)	Count	Height (m)						
137	Stag	40	4	1	4	1	4	0	0	-35.201694	149.681318	1/01/2015		Y	
138	Stag	20	5	1	2	0	0	0	0	-35.201583	149.681539	1/01/2015		Y	
139	Stag	30	7	1	4	0	0	0	0	-35.201382	149.682027	1/01/2015		Y	
140	Stag	40	8	2	4	0	0	0	0	-35.201261	149.682341	1/01/2015		Y	
141	Peppermint	40	5	0	0	2	4	0	0	-35.199051	149.682719	1/01/2015		Y	
142	Scribbly gum	90	7	0	0	1	5	0	0	-35.199151	149.682179	1/01/2015		Y	
143	Stag	30	4	0	0	0	0	1	4	-35.198271	149.682722	1/01/2015		Y	
144	Stag	40	6	0	0	2	5	0	0	-35.198291	149.682787	1/01/2015		Y	
145	Scribbly gum	30	7	0	0	0	0	1	4	-35.197542	149.683818	1/01/2015		Y	
146	Scribbly gum	50	8	0	0	1	4	2	6	-35.196922	149.684237	1/01/2015		Y	
147	Scribbly gum	60	10	0	0	0	0	2	4	-35.197089	149.684244	1/01/2015			Y
148	Stag	20	6	0	0	0	0	1	6	-35.197398	149.684508	1/01/2015			Y
149	Stag	20	5	2	4	0	0	0	0	-35.197465	149.684948	1/01/2015			Y
150	Scribbly gum	40	10	2	7	3	7	0	0	-35.197375	149.684503	1/01/2015			Y
151	Scribbly gum	50	7	0	0	1	6	3	5	-35.196371	149.684547	1/01/2015		Y	
152	Peppermint	40	7	0	0	0	0	1	4	-35.196095	149.684028	1/01/2015		Y	
153	Brittle gum	50	9	0	0	1	6	1	5	-35.195631	149.684357	1/01/2015		Y	
154	Brittle gum	40	8	1	6	2	6	2	5	-35.195027	149.684481	1/01/2015		Y	
155	Brittle gum	100	6	3	5	0	0	0	0	-35.195041	149.684845	1/01/2015		Y	
156	Brittle gum	50	10	0	0	0	0	1	6	-35.195593	149.684701	1/01/2015		Y	
157	Stag	10	5	0	0	0	0	1	5	-35.195763	149.684922	1/01/2015		Y	
158	Brittle gum	90	8	0	0	2	4	0	0	-35.194969	149.68359	1/01/2015		Y	
159	Brittle gum	80	7	3	4	0	0	0	0	-35.194699	149.683088	1/01/2015		Y	
160	Brittle gum	70	7	1	4	0	0	0	0	-35.194533	149.682648	1/01/2015		Y	
161	Brittle gum	30	7	2	4	1	2	0	0	-35.194315	149.682449	1/01/2015		Y	
162	Scribbly gum	50	6	3	3	0	0	0	0	-35.214863	149.68008	1/01/2015		Y	
163	Scribbly gum	50	11	1	7	0	0	0	0	-35.214202	149.680719	1/01/2015		Y	
164	Stringybark	80	6	0	0	0	0	1	2	-35.21414	149.680924	1/01/2015		Y	
165	Scribbly gum	90	11	0	0	2	5	0	0	-35.21427	149.680656	1/01/2015		Y	
166	Brittle gum	100	10	2	3	0	0	0	0	-35.214055	149.680776	1/01/2015		Y	
167	Brittle gum	20	5	0	0	1	2	0	0	-35.214339	149.67993	1/01/2015	Y	Y	
168	Stag	100	7	2	4	1	5	0	0	-35.215434	149.679314	1/01/2015		Y	
169	Stag	100	10	1	4	1	6	0	0	-35.215611	149.679771	1/01/2015		Y	
170	Brittle gum	90	8	2	3	0	0	0	0	-35.215662	149.679498	1/01/2015		Y	
171	Ribbon gum	0	10	0	0	0	0	0	0	-35.215786	149.679364	1/01/2015		Y	
172	Brittle gum	40	7	0	0	0	0	1	2	-35.214411	149.724844	1/01/2015		Y	
173	Red stringybark	50	7	0	0	0	0	1	5	-35.212326	149.729999	1/01/2015		Y	
174	Red stringybark	70	10	1	5	1	7	0	0	-35.210117	149.728554	1/01/2015		Y	
175	Brittle gum	90	8	0	0	1	6	2	7	-35.215197	149.713499	1/01/2015		Y	
176	Brittle gum	100	10	1	5	0	0	0	0	-35.214327	149.714712	1/01/2015		Y	
177	Red stringybark	60	9	3	6	1	6	0	0	-35.21404	149.712923	1/01/2015		Y	
178	Red stringybark	10	5	1	4	0	0	0	0	-35.191084	149.703922	1/01/2015		Y	
179	Red stringybark	20	5	0	0	0	0	2	4	-35.19105	149.703945	1/01/2015		Y	
180	Stag	10	5	0	0	2	5	0	0	-35.192215	149.70377	1/01/2015		Y	
181	Brittle gum	30	7	0	0	1	6	0	0	-35.192278	149.703637	1/01/2015		Y	
182	Red stringybark	20	5	1	5	0	0	0	0	-35.192419	149.703604	1/01/2015		Y	
183	Scribbly gum	10	5	1	2	0	0	0	0	-35.192367	149.703797	1/01/2015		Y	
184	Brittle gum	10	8	0	0	1	4	0	0	-35.192519	149.703751	1/01/2015		Y	
185	Red stringybark	30	10	0	0	1	6	0	0	-35.192622	149.703758	1/01/2015		Y	
186	Brittle gum	40	10	0	0	1	6	0	0	-35.192683	149.704123	1/01/2015		Y	
187	Stag	10	5	1	2	0	0	0	0	-35.19279	149.704101	1/01/2015		Y	
188	Scribbly gum	40	8	1	6	1	2	0	0	-35.192764	149.704097	1/01/2015		Y	
189	Red stringybark	50	10	1	5	1	8	0	0	-35.191707	149.706238	1/01/2015		Y	
190	Red stringybark	40	10	3	5	0	0	0	0	-35.191116	149.706854	1/01/2015		Y	
191	Red stringybark	80	10	1	8	0	0	0	0	-35.190987	149.707124	1/01/2015		Y	
192	Red stringybark	20	6	1	5	1	5	0	0	-35.189785	149.70836	1/01/2015		Y	
193	Red Stringybark	15	4	0	0	0	0	1	4	-35.189769	149.708311	1/01/2015		Y	
194	Red stringybark	80	9	0	0	2	5	3	5	-35.189533	149.708268	1/01/2015		Y	
195	Yellow box	30	10	1	5	2	7	0	0	-35.189047	149.708011	1/01/2015		Y	
196	Brittle gum	20	5	0	0	0	0	1	1	-35.188941	149.708217	1/01/2015		Y	
197	Snow Gum	48	12	0	0	2	0	0	0	-35.182818	149.681388	1/10/2014		Y	
198	Red Stringybark	50	8	1	4	1	4	0	0	-35.194017	149.686725	1/10/2014		Y	
199	Red Stringybark	40	6.5	0	0	1	5	0	0	-35.193583	149.686552	1/10/2014		Y	
200	Red Stringybark (Stag)	50	14	1	13	2	0	0	0	-35.192363	149.686704	1/10/2014			Y
201	Red Stringybark (Stag)	75	9	0	0	3	0	1	5.5	-35.1887	149.686294	1/10/2014		Y	
202	Red Stringybark (Stag)	45	6	1	4	2	0	1	6	-35.18885	149.686314	1/10/2014		Y	
203	Red Stringybark (Stag)	35	9	0	0	1	5	0	0	-35.189074	149.686149	1/10/2014		Y	
204	Red Stringybark	80	12	0	0	1	4.5	1	7	-35.187637	149.687153	1/10/2014			Y

ID	Tree Species	DBH (cm)	Tree Height (m)	Small Hollows (2.5 cm - 5 cm)		Medium Hollows (6 - 10 cm)		Large Hollows (>10 cm)		Latitude	Longitude	Collection Date	Within Development Footprint?	Within Study Area?	Outside Study Area?
				Count	Height (m)	Count	Height (m)	Count	Height (m)						
205	Red Stringybark	80	7	1	6	1	4	0	0	-35.190327	149.684065	1/10/2014		Y	
206	Red Stringybark (Stag)	75	9	0	0	1	6	1	7.5	-35.194621	149.687766	1/10/2014		Y	
207	Red Stringybark (Stag)	70	10	4	0	2	6	0	0	-35.193123	149.691857	1/10/2014		Y	
208	Red Stringybark (Stag)	65	8	2	7	1	6	0	0	-35.193207	149.69158	1/10/2014		Y	
209	Stag	90	10	2	0	2	4	0	0	-35.189496	149.695057	1/10/2014		Y	
210	Stag	34	5	0	0	0	0	1	4.5	-35.186873	149.688633	1/10/2014			Y
211	Red Stringybark (Stag)	55	8	0	0	0	0	1	5	-35.186841	149.688582	1/10/2014			Y
212	Red Stringybark	40	8	0	0	0	0	1	4	-35.186751	149.688505	1/10/2014			Y
213	Scribbly Gum	100	12	3	0	0	0	1	4	-35.195121	149.701234	1/10/2014		Y	
214	Scribbly Gum	70	7	2	0	0	0	0	0	-35.196869	149.701669	1/10/2014		Y	
215	Scribbly Gum	60	8	2	0	2	2	0	0	-35.197243	149.701697	1/10/2014		Y	
216	Scribbly Gum	50	9	0	0	0	0	1	5	-35.197644	149.70128	1/10/2014		Y	
217	Scribbly Gum	50	7	0	0	1	4.5	0	0	-35.197482	149.698345	1/10/2014		Y	
218	Scribbly Gum	70	9	1	6	1	5	0	0	-35.196101	149.698472	1/10/2014		Y	
219	Scribbly Gum	120	14	0	0	0	0	1	7	-35.195816	149.699788	1/10/2014		Y	
220	Scribbly Gum	120	10	0	0	2	4.5	0	0	-35.195254	149.694853	1/10/2014		Y	
221	Scribbly Gum	102	7	0	0	1	4	0	0	-35.196478	149.692389	1/10/2014		Y	
222	Scribbly Gum	110	7	0	0	0	0	1	4	-35.196185	149.69228	1/10/2014		Y	
223	Yellow Box	70	8	2	7	0	0	1	5	-35.198965	149.691978	1/10/2014		Y	
224	Yellow Box	85	9	0	0	0	0	1	4.5	-35.19914	149.692067	1/10/2014		Y	
225	Peppermint	0		2	0	1	3	0	0	-35.317256	149.646206	1/05/2014			Y
226	Candlebark	0		0	0	1	3	0	0	-35.317401	149.646275	1/05/2014			Y
227	Stag	0		3	0	0	0	0	0	-35.317445	149.646256	1/05/2014			Y
228	Ribbon Gum	0		0	0	4	0	0	0	-35.3197	149.639226	1/05/2014			Y
229	Peppermint	0		2	0	0	0	0	0	-35.321373	149.642585	1/05/2014			Y
230	Peppermint	0		3	4	0	0	0	0	-35.321505	149.642175	1/05/2014			Y
231	Stag	0		0	0	0	0	1	4	-35.321759	149.640729	1/05/2014			Y
232	Peppermint	0		2	0	0	0	0	0	-35.321347	149.641661	1/05/2014			Y
233	Peppermint	0		1	3	0	0	0	0	-35.321141	149.642263	1/05/2014			Y
234	Scribbly Gum	0		1	4	0	0	5	0	-35.118842	149.682347	1/05/2014			Y
235	Scribbly Gum	0		0	0	1	6	0	0	-35.11889	149.682665	1/05/2014			Y
236	Scribbly Gum	0		1	5	0	0	0	0	-35.118973	149.68297	1/05/2014			Y
237	Scribbly Gum	0		1	0	0	0	1	4	-35.119052	149.683076	1/05/2014			Y
238	Scribbly Gum	0		0	0	2	0	2	0	-35.119054	149.683164	1/05/2014			Y
239	Brittle gum	35	8	0	0	0	0	1	4	-35.267445	149.6744	12/08/2015		Y	
240	Brittle gum	40	9	0	0	0	0	1	3.5	-35.267594	149.674411	12/08/2015		Y	
241	Brittle gum	75	9	0	0	0	0	1	1.6	-35.266987	149.674464	12/08/2015	Y	Y	
242	Brittle gum	80	11	0	0	2	2.5	0	0	-35.264401	149.678338	12/08/2015		Y	
243	Brittle gum	40	9	1	3	3	3.5	0	0	-35.259585	149.681184	12/08/2015			Y
244	Brittle gum	30	7	1	7	1	2	0	0	-35.259484	149.681287	12/08/2015		Y	
245	Brittle gum	40	8	0	0	1	2	0	0	-35.259353	149.681143	12/08/2015			Y
246	Brittle gum	40	11	0	0	0	0	1	1.8	-35.259288	149.681104	12/08/2015			Y
247	Brittle gum	40	5	0	0	1	1.2	0	0	-35.259279	149.681211	12/08/2015			Y
248	Broadleaf peppermint	50	7	0	0	0	0	1	2	-35.245531	149.666855	12/08/2015		Y	
249	Broadleaf peppermint	55	7	1	2.5	0	0	0	0	-35.245588	149.667214	12/08/2015		Y	
250	Brittle gum	40	8	7	3	0	0	0	0	-35.245605	149.667334	12/08/2015		Y	
251	Brittle gum	40	6	0	0	0	0	1	2	-35.245665	149.66787	12/08/2015		Y	
252	Dead	40	4	0	0	0	0	1	2	-35.245716	149.667985	12/08/2015		Y	
253	Broad Leaved Peppermint	40	5	0	0	0	0	1	1.5	-35.246277	149.669175	12/08/2015			Y
254	Dead	25	5	2	4	1	2	0	0	-35.246251	149.668884	12/08/2015			Y
255	Broad Leaved Peppermint	35	10	0	0	1	2	0	0	-35.246135	149.667514	12/08/2015			Y
256	Broad Leaved Peppermint	0	6	1	2	0	0	2	0	-35.246119	149.667444	12/08/2015			Y
257	Stag	25	3	0	0	1	2	0	0	-35.246056	149.666989	12/08/2015			Y
258	Broad Leaved Peppermint	15	6	1	1.6	0	0	0	0	-35.245973	149.666578	12/08/2015			Y
259	Brittle gum	1	14	0	0	1	0	1	0	-35.245788	149.665818	12/08/2015		Y	
260	Candle Bark	1.2	15	0	0	0	0	1	2.5	-35.244766	149.664195	12/08/2015		Y	
261	Snow gum	20	5	1	2	0	0	0	0	-35.229678	149.659163	13/08/2015			Y
262	Snow gum	25	6	1	0	0	0	0	0	-35.229678	149.659163	13/08/2015			Y
263	Snow gum	0		0	0	0	0	0	0	-35.229696	149.659172	13/08/2015			Y
264	Broad Leaved Peppermint	15	1.1	0	0	0	0	1	4	-35.225208	149.658292	13/08/2015		Y	
265	Broad Leaved Peppermint	0		3	2.5	0	0	1	2.5	-35.2223	149.661213	13/08/2015	Y	Y	
266	Broad Leaved Peppermint	1	6	1	2	0	0	0	0	-35.222074	149.661082	13/08/2015		Y	
267	Ribbon gum	1.2	14	0	0	1	2	0	0	-35.205581	149.666514	13/08/2015			Y
268	Snow gum	60	7	0	0	1	2	0	0	-35.205458	149.666911	13/08/2015		Y	
269	Snow gum	50	7	1	2	1	2.5	0	0	-35.194474	149.671305	13/08/2015			Y
270	Dead	45	7	1	2	1	2.5	0	0	-35.195096	149.671487	13/08/2015			Y
271	Snow gum	30	7	1	1.5	0	0	0	0	-35.193552	149.671311	13/08/2015	Y	Y	
272	Stag	60	4	0	0	1	0	0	0	-35.193552	149.671311	13/08/2015	Y	Y	

ID	Tree Species	DBH (cm)	Tree Height (m)	Small Hollows (2.5 cm - 5 cm)		Medium Hollows (6 - 10 cm)		Large Hollows (>10 cm)		Latitude	Longitude	Collection Date	Within Development Footprint?	Within Study Area?	Outside Study Area?
				Count	Height (m)	Count	Height (m)	Count	Height (m)						
273	Snow gum	60	8	0	0	1	2	1	2	-35.192815	149.670935	13/08/2015			Y
274	Swamp gum	1.2	14	0	0	1	4	0	0	-35.18605	149.667858	13/08/2015		Y	
275	Swamp gum	45	6	0	0	0	0	1	2	-35.186224	149.668002	13/08/2015			Y
276	Swamp gum	1	12	0	0	1	3	1	2.5	-35.186238	149.668009	13/08/2015			Y
277	Swamp gum	60	13	0	0	1	3	0	0	-35.18629	149.668032	13/08/2015			Y
278	Swamp gum	55	10	0	0	1	2.5	0	0	-35.186309	149.668103	13/08/2015			Y
279	Swamp gum	1.1	13	0	0	2	0	0	0	-35.186428	149.668153	13/08/2015			Y
280	Swamp gum	0	11	1	6	1	5	0	0	-35.186657	149.668333	13/08/2015			Y
281	Swamp gum	1.3	13	0	0	3	0	0	0	-35.186897	149.668457	13/08/2015			Y
282	Swamp gum	0	10	0	0	0	0	1	2	-35.184882	149.666617	13/08/2015		Y	
283	Swamp gum	1.2	13	0	0	1	4.5	2	0	-35.183275	149.66471	13/08/2015			Y
284	Swamp gum	1.3	14	0	0	1	10	0	0	-35.183392	149.664852	13/08/2015			Y
285	Swamp gum	0	15	1	6	1	4	0	0	-35.18394	149.665462	13/08/2015			Y
286	Broad Leaved Peppermint	0	7	0	0	1	2	0	0	-35.267331	149.674688	13/08/2015		Y	
287	Brittle gum	1	14	0	0	1	2.5	1	2.5	-35.180745	149.66292	13/08/2015		Y	
288	Brittle gum	1	14	0	0	0	0	1	5	-35.180819	149.662627	13/08/2015		Y	
289	Brittle gum	90	14	0	0	0	0	2	5	-35.180669	149.662605	13/08/2015		Y	
290	Red stringy bark	75	9	1	4	0	0	0	0	-35.162576	149.663794	13/08/2015		Y	
291	Red stringy bark	45	9	2	0	0	0	0	0	-35.162315	149.665522	13/08/2015		Y	
292	Red stringy bark	40	13	0	0	1	1.5	0	0	-35.162275	149.665913	13/08/2015		Y	
293	Unidentified	0		0	0	0	0	0	0	-35.159658	149.684708	14/08/2015	Y	Y	
294	Brittle gum	70	13	0	0	1	4	0	0	-35.160307	149.680453	14/08/2015		Y	
295	Stag	45	4	0	0	0	0	1	2	-35.160554	149.677878	14/08/2015		Y	
296	Brittle gum	80	12	0	0	0	0	1	0	-35.161814	149.667299	14/08/2015			Y
297	Snow gum	80	8	0	0	0	0	1	2	-35.159601	149.683442	14/08/2015	Y	Y	
298	Swamp gum	0	13	0	0	1	5	1	4	-35.159443	149.684583	14/08/2015	Y	Y	
299	Swamp gum	60	15	0	0	3	0	0	0	-35.159474	149.684241	14/08/2015	Y	Y	
300	Stag	30	4	0	0	1	4	0	0	-35.159324	149.684436	14/08/2015	Y	Y	
301	Swamp gum	0		0	0	1	0	0	0	-35.159443	149.68435	14/08/2015	Y	Y	
302	Swamp gum	0	12	0	0	1	2.5	0	0	-35.159387	149.6846	14/08/2015	Y	Y	
303	Swamp gum	55	12	0	0	1	6	0	0	-35.15939	149.684682	14/08/2015	Y	Y	



Species	TSC Act Status	Number of calls recorded per month per species													
		Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Total
<i>C.morio/V.vulturnus</i>		0	0	0	0	0	1	0	3	1	2	0	0	0	7
<i>Chalinolobus gouldi</i>		23	12	14	0	0	1	19	109	42	43	66	14	4	347
<i>Chalinolobus morio</i>		0	0	0	0	0	0	0	4	1	0	0	0	0	5
<i>Falsistrellus tasmaniensis</i>	V	0	0	0	0	0	0	0	0	1	1	0	0	0	2
<i>M.oceanensis/C.morio/V.vulturnus</i>		0	0	1	0	0	0	0	1	3	0	0	0	0	5
<i>Miniopterus australis</i>		0	0	0	0	0	0	0	1	0	1	0	0	0	2
<i>Miniopterus schreibersii oceanensis</i>	V	1	0	0	0	0	0	1	19	7	3	4	0	0	35
<i>Mormopterus species 2</i>		7	3	2	0	0	0	2	5	2	1	3	0	0	25
<i>Mormopterus species/ C. gouldi</i>		26	11	6	0	0	0	5	34	18	10	23	5	0	138
<i>Nyctophilus species (N. gouldi or N.geoffroyi)</i>		0	0	0	0	0	0	0	2	0	0	0	0	1	3
<i>Saccolaimus flaviventris</i>	V	8	4	7	0	0	0	4	33	16	7	2	4	0	85
<i>Scoteanax rueppellii</i>	V	1	0	0	0	0	0	0	0	0	1	0	2	0	4
<i>Scotorepens balstoni</i>		3	1	1	0	0	0	0	1	0	3	3	0	0	12
<i>Scotorepens orion</i>		1	14	11	0	0	0	0	1	0	0	0	2	0	29
<i>T. australis/S. flaviventris</i>		28	11	17	0	0	0	5	21	64	6	14	6	7	179
<i>Tadarida australis</i>		116	45	22	1	0	0	25	476	499	293	166	33	12	1688
<i>Vespadelus darlingtoni</i>		2	0	0	0	0	0	0	83	26	8	0	37	0	156
<i>Vespadelus vulturnus</i>		0	1	2	0	0	1	2	28	9	4	0	5	0	52
Total		216	102	83	1	0	3	63	821	689	383	281	108	24	2774

Annex E

Assessment of Significance (TSC Act)

E ASSESSMENTS OF SIGNIFICANCE

E.1 ASSESSMENTS OF SIGNIFICANCE

E.1.1 Birds

GLOSSY BLACK-COCKATOO (*Calyptorhynchus lathami*) - Vulnerable

This species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW. It inhabits open forest and woodlands and has specific food requirements, primarily eating the seeds of She-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*). The Glossy Black-Cockatoo is dependent on large hollow-bearing eucalypts for nest sites (OEH 2015).

Approximately 80 ha of high quality foraging habitat, dominated by Black She-oak is present in the north of the Study Area. Other areas of woodland and forest throughout the PA may provide sub-optimal sheltering or foraging habitat with a total of 427 ha of potential habitat mapped for this species. This species was recorded five times in the central and northern precincts of the PA, and feeding signs were identified throughout habitat in these areas.

(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 key potential impact to the Glossy Black-Cockatoo is the species' potential avoidance of the high quality foraging habitat in the north of the Study Area due to the presence of WTGs. Avoidance of this habitat may impact the local population by forcing birds to fly further in search of food and potentially reducing the carry capacity of the immediate region, resulting in lower population sizes to be sustained.

The impact of direct habitat loss is minimal, as infrastructure has been sited to avoid impacts to forest and woodland habitat, resulting in removal of 8.12 ha of sub-optimal foraging habitat, and only 0.67 ha of high quality foraging habitat.

During field surveys, Glossy Black-Cockatoos were sighted foraging, resting, and flying below canopy height within woodland. No Glossy Black-Cockatoos were observed flying at RSA height during the raptor surveys. While there is potential for the individuals to fly at RSA height while travelling between patches of foraging habitat within the PA, field observations suggest the species predominately occurs below RSA height, reducing the risk of collision.

(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)	<i>the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>
	Infrastructure has been sited to avoid woodland areas, including Glossy Black-Cockatoo habitat where practicable. Clearing of 8.12 ha of woodland habitat which may be used as shelter for the species is proposed, and clearing of 0.67 ha of habitat containing feed trees will be removed. A large amount of similar habitat containing feed trees will be retained with less than 2% cleared within the Study Area Very few tree hollows of sufficient size were recorded within the Study Area, and micro-siting of infrastructure should be able to avoid any suitable nesting trees recorded. Due to the small proportion of foraging habitat within the PA to be cleared, direct habitat loss resulting from the Project is unlikely to substantially affect the species. However, avoidance of foraging habitat in areas close to WTGs could substantially affect this species.
(ii)	<i>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</i>
	Where possible, infrastructure has been sited to avoid woodland. Some areas of Glossy Black-Cockatoo habitat will be intersected by access tracks. Access tracks will be less than eight metres wide and are unlikely to affect the mobility of Glossy Black-Cockatoo. This species is capable of flying large distances between different foraging areas.
(iii)	<i>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,</i>
	The habitat to be removed as part of the Project is unlikely to be crucial to the long-term survival of the species in the locality. The habitat to be removed is a small portion (less than 2%) of the available foraging habitat in the Study Area, and infrastructure has been sited to avoid clearing within large intact areas of habitat. In addition, extensive woodland to the east and south of the PA is likely to contain further areas of suitable habitat. The habitat to be removed does not play an important role in habitat connectivity as infrastructure has been sited to avoid clearing within large intact areas of habitat, and instead clearing will occur in patchily distributed habitat of the edges of larger areas of habitat. The proposed clearing will not substantially alter the configuration of habitat within the PA. Infrastructure micro-siting will be undertaken with the assistance of a qualified ecologist, and will aim to avoid trees with hollows suitable for Glossy Black-Cockatoo nesting.
(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
(f)	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
(g)	<i>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.</i>

Key Threatening Processes that specifically acknowledge impacts to the Glossy Black-Cockatoo are:

- clearing of native vegetation;
- loss of hollow bearing trees;
- removal of dead wood and dead trees;
- forest eucalypt dieback associated with over-abundant psyllids and Bell Miners;
- competition from feral honeybees; and
- ecological consequences of high frequency fires.

The Project will involve the clearing of native vegetation; however infrastructure has been sited to avoid woodland areas, which has reduced the extent of clearing to less than 2% of Glossy Black-Cockatoo foraging habitat in the Study Area.

Infrastructure micro-siting will be undertaken with the assistance of a qualified ecologist, and will aim to avoid trees with hollows suitable for Glossy Black-Cockatoo nesting.

Canopy dieback associated with psyllids and Bell Miners generally occurs in landscapes disturbed by habitat fragmentation, logging, nutrient enrichment, altered fire regimes and/or weed invasion (NSW Scientific Committee 2008). The Project is not expected to significantly enhance these disturbances.

The Project is unlikely to lead to nutrient enrichment or altered fire regimes, and weed management measures will be implemented. While some clearing of woodland will be unavoidable, vegetation in the PA currently exhibits a high level of fragmentation and infrastructure has been sited to minimise disturbance to large, intact areas of woodland.

The Project is unlikely to affect competition from feral honey bees or the ecological consequences of high frequency fires.

Conclusion

Impacts of direct habitat loss are considered to be minimal, and the species is not considered to be at significant risk of WTG collision. The key potential impact to the Glossy Black-Cockatoo is the species' potential avoidance of the high quality foraging habitat in the north of the Study Area due to the presence of WTGs. Avoidance of this habitat may impact the local population by forcing birds to fly further in search of food and potentially reducing the carry capacity of the immediate region, resulting in lower population sizes to be sustained.

WOODLAND BIRDS

Speckled Warbler (*Chthonicola sagittata*), Varied Sittella (*Daphoenositta chrysoptera*), Scarlet Robin (*Petroica boodang*), Hooded Robin (*Melanodryas cucullata cucullata*), Flame Robin (*Petroica phoenicea*), Pink Robin (*Petroica rodinogaster*)

Speckled Warbler (Chthonicola sagittata) - Vulnerable

The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100 ha survive (OEH 2015). The species lives in a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat includes 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 (OEH 2015). The species was recorded in the north of the PA during field surveys.

Varied Sittella (Daphoenositta chrysoptera) - Vulnerable

The distribution of the Varied Sittella in NSW is nearly continuous from the coast to the far west. The species inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland (OEH 2015). The species was recorded in two locations in the south of the PA.

Scarlet Robin (Petroica boodang) - Vulnerable

In NSW, the Scarlet Robin occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and 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. Nests are located in the

fork of a tree, often in a dead branch in a live tree, or in a dead tree or shrub (OEH 2015). There were 30 Scarlet Robin sightings within the PA during the field survey, as well as four records approximately 1 km from the PA.

Hooded Robin (Melanodryas cucullata cucullata) – Vulnerable

The Hooded Robin occurs in open eucalypt woodland, acacia scrub and mallee, often in or near clearings of open areas. The species requires structurally diverse habitat featuring mature eucalypts, saplings, low shrubs and tall native grasses. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season. Nests are located in a tree fork or crevice, between less than 1 m and up to 5 m above ground. The species was not recorded during field surveys, and no database records have been identified within the locality.

Flame Robin (Petroica phoenicea) – Vulnerable

The Flame Robin is endemic to south eastern Australia. In NSW, it 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 species 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 sedgeland. The species prefers clearings or areas with open understoreys (OEH 2015). The species was not recorded during field surveys; however there are four records of the species within the locality from between 1980 and 2004.

Pink Robin (Petroica rodinogaster) – Vulnerable

In the breeding season (September to March) Pink Robins are seen singly or in pairs in deep gullies in dense shrub layers of damp and wet forests or rainforests. In winter, they are found in more open and drier habitats (BirdLife Australia 2014). Nests in an upright or oblique fork, from 30 cm to 6 m above the ground, in deep undergrowth (OEH 2015). The species was not recorded during field surveys, and no database records have been identified within the locality.

(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,*

Infrastructure has been sited to minimise clearing of woodland areas. The total area of woodland habitat in the Development Footprint suitable as breeding habitat for these species is 8.12 ha, which is 1.90% of the total habitat within the Study Area. In addition, extensive woodland habitats also suitable for these species' breeding exist within the PA and within the locality to the east and south of the PA. It is anticipated that retained woodland will continue to provide sufficient foraging and breeding habitat, so that the lifecycles of local woodland bird populations will not be substantially impacted.

(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*

Infrastructure has been sited to minimise clearing of woodland areas. The total area of woodland habitat to be removed within the development footprint is 8.12 ha, which is 1.90% of the total habitat within the Study Area. Extensive woodland habitats exist to the east and south of the PA.

(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

Infrastructure has been sited to avoid large patches of woodland. Linear infrastructure has been located to follow existing roads and access tracks where possible. At some locations, smaller patches of woodland will be intersected by access tracks, which will require the clearing of corridors up to 8 m wide. The transmission line linking the southern precinct to the substation in the northern precinct is aligned immediately adjacent to the existing main roads and will be no greater than 4 m wide. These corridors will not cause insurmountable fragmentation of habitats for these woodland bird species.

Fragmentation or habitat isolation through WTG placement is not relevant for these woodland bird species as they typically fly at or below canopy height and are not expected to fly within RSA height, therefore no impacts are anticipated from rotor collision.

(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 habitat to be removed includes open woodland and areas of scattered trees. These areas do not play a substantial role in connectivity, and larger, better connected areas of woodland will be retained. In the context of other available habitat within and outside the PA, the habitat to be removed is not of particular importance.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Not applicable.

whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Not applicable.

(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.

Five Key Threatening Processes specifically acknowledge adverse impacts to one or more of these woodland species, including:

- clearing of native vegetation;
- aggressive exclusion of birds by Noisy Miners (*Manorina melanocephala*);
- invasion of native plant communities by exotic perennial grasses;
- invasion and establishment of Scotch broom; and
- anthropogenic Climate Change.

The Project will involve the clearing of native vegetation; however infrastructure has been sited to avoid woodland areas, which has reduced the extent of clearing to less than 1.90% of woodland habitat within the Study Area.

The Noisy Miner often occurs in lightly timbered areas and habitat edges, and Noisy Miner colonies dominate many small (<20 ha) patches of woodland (NSW Scientific Committee 2013). The species was identified in Study Area. Infrastructure has been sited to avoid large patches of woodland, however at some locations, the creation of new edges, which may favour the Noisy Miner, will be unavoidable to accommodate linear infrastructure. This will occur at only a few locations, and will occur within an already fragmented landscape. As such, it is not expected to have a substantial impact on the dominance of the Noisy Miner.

Weed management practices will be implemented to avoid the invasion of non-native species. Additionally, regeneration of native flora in areas required to be temporarily cleared will be encouraged.

The generation of wind energy from the Project will avoid the emission of climate change-inducing greenhouse gases released from the production of energy from other sources.

Conclusion

The key potential impacts of the Project on woodland birds are habitat loss and habitat alienation. Collision risk is not anticipated to be a problem for this suite of species. Infrastructure has been sited to minimise clearing of woodland areas and avoid habitat fragmentation. Less than 1.90% of woodland habitat within the Study Area will be removed. Corridors required to be cleared for access tracks will be narrow enough to prevent inhibition of movement of woodland birds. It is unlikely that the proposal will lead to a significant impact on these species.

OWLS

Barking Owl (*Ninox connivens*), Powerful Owl (*Ninox strenua*)

Barking Owl (*Ninox connivens*) - Vulnerable

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. The species is sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (eg western NSW) due to the higher density of prey on these fertile soils. It roosts in shaded portions of tree canopies, including tall mid story trees with dense foliage, such as *Acacia* and *Casuarina* species (OEH 2015). The species nests in a large open hollow in eucalypts or *Melaleuca* species (NSW NPWS 2003). Nest-hollow entrances are 2 m – 35 m above the ground with a diameter of 20 cm - 46 cm and depth of 20 cm – 300 cm (NSW NPWS 2003).

Powerful Owl (*Ninox strenua*) - Vulnerable

The Powerful Owl is endemic to eastern and south-eastern Australia. The species occurs in a range of habitats including woodland, open sclerophyll forest, tall open wet forest and rainforest. The species requires large tracts of forest or woodland but can also occur in fragmented habitats. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80 cm – 240 cm) that are at least 150 years old (OEH 2015).

Both Owls were not recorded during field surveys, and no database records were identified in the locality, however the PA is within the species' distribution and the PA may provide suitable habitat. The majority of the habitat within the Study Area is considered sub-optimal for both species, although more optimal habitat is likely to occur within the PA and locality. No potential nesting hollows for either species was noted within the Development Footprint or road reserves investigated for the 33 kV transmission line. If the threatened owl species occur within the Study Area it is likely to be limited to occasional foraging, rather than being resident or breeding within the Study Area.

(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 potential impacts of the Project on these owl species include loss of potential habitat and WTG collision.

The Project will clear 8.12 ha of sub-optimal woodland/forest habitats, equivalent to 1.90% of woodland/forest habitat within the Study Area. Further woodland and forest areas are available to the east and south of the PA.

No suitable nesting trees have been identified within the Development Footprint or road reserve investigated for the 33 kV transmission line. Infrastructure micro-siting will be undertaken with involvement of an ecologist and, if any suitable nesting trees are identified, these will be avoided where practicable. Given the small proportion of sub-optimal habitat to be cleared, and the lack of suitable nesting hollows, habitat loss is unlikely to disrupt breeding such that a local populations of these species is at risk of extinction.

The Powerful Owl generally hunts within dense forest and is likely to move through the open areas containing WTG rarely, when moving between larger areas of habitat. The Barking Owl forages in open areas and may be at greater risk of WTG collision, however *Ninox* owls are likely to hunt at lower heights than diurnal raptors and therefore have lower risk of rotor strike. Currently there is little available evidence of the rate of WTG collision for these species.

(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) <i>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,</i>	
Not applicable.	
(d) <i>in relation to the habitat of a threatened species, population or ecological community:</i>	
(i) <i>the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>	The Project will clear 8.12 ha of sub-optimal woodland and forest habitats, equivalent to 1.90% of available habitat within the Study Area. Further woodland and forest areas are available to the east and south of the PA. No suitable nesting trees have been identified within 200 m of WTGs, or within the road corridor investigated for the 33 kV transmission line. Micrositing of access tracks and other areas not yet surveyed for HBTs will be undertaken with involvement from an ecologist, and any suitable nesting trees will be avoided, where practicable.
(ii) <i>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</i>	Where possible, infrastructure has been located in cleared areas, and linear infrastructure has been located to follow existing roads and access tracks. At some locations, smaller patches of woodland will be intersected by access tracks, which will require the clearing of approximately 8 m corridors. The transmission line linking the southern precinct to the substation in the northern precinct is aligned immediately adjacent to the existing main roads and will be no greater than 4 m wide. This clearing would not inhibit the movement of the Powerful Owl or Barking Owl, and therefore will not substantially isolate or fragment areas of habitat.
(iii) <i>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,</i>	Infrastructure has been sited to avoid large and well-connected areas of woodland. The quality of habitat to be retained is generally consistent with the quality of habitat to be removed, and habitat to be removed is therefore not considered to be of particular importance. It is acknowledged that HBTs are of particular importance to these species. HBT surveys within 200 m of WTGs and within the road reserve proposed to contain the 33 kV transmission line, have not identified any hollows suitable for Powerful Owl and Barking Owl nest sites. Micrositing of access tracks and other areas not yet surveyed for HBTs will be undertaken with involvement from an ecologist, and any suitable nesting trees will be avoided, where practicable.
(e) <i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>	Not applicable.
(f) <i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>	Barking Owl recovery plan has the following objectives of relevance to this Project: • Objective 3: Undertake threat abatement and mitigation (NSW NPWS 2003). Specific Objective 3 relates to: loss and degradation of habitat through clearing removal of dead wood, competition from feral honey bees and predation by foxes and feral cats; and to the need to protect breeding pairs and individual nest sites. While 8.12 ha of potential Barking Owl habitat will be removed for the Project, this is a small area in the context of the Study Area (1.90%). No suitable nest hollows have been identified, and if suitable nest hollows or active nest sites are located during infrastructure micrositing, or at any other time, these will be protected. In consideration of these measures, the Project does not contravene the objectives of the Barking Owl Recovery Plan (NSW NPWS 2003). Powerful Owl recovery plan has the following objectives of relevance to this Project: • Objective 4: Ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment processes (NSW NPWS 2003). The Project does not contravene the actions or objectives of the recovery plan, and includes an adequate impact assessment as described in Objective 4.
(g) <i>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.</i>	

There are four Key Threatening Processes relevant to the Powerful Owl and Barking Owl:

- clearing of native vegetation;
- loss of hollow bearing trees;
- removal of dead wood and dead trees; and
- forest eucalypt dieback associated with over-abundant psyllids and Bell Miners.

The Project will involve the clearing of native vegetation; however infrastructure has been sited to avoid woodland areas, which has reduced the extent of clearing to less than 1.90% of sub-optimal Powerful Owl and Barking Owl habitat in the Study Area. No suitable nesting trees have been identified within 200 m of WTGs, or within the road corridor investigated for the 33 kV transmission line. Micrositing of access tracks and other areas not yet surveyed for HBTs will be undertaken with involvement from an ecologist, and if any suitable nesting trees are identified these will be avoided where practicable.

Canopy dieback associated with psyllids and Bell Miners generally occurs in landscapes disturbed by habitat fragmentation, logging, nutrient enrichment, altered fire regimes and/or weed invasion (NSW Scientific Committee 2008). The Project is not expected to significantly enhance these disturbances. The Project is unlikely to lead to nutrient enrichment or altered fire regimes, and weed management measures will be implemented. While some clearing of woodland will be unavoidable, vegetation in the PA currently exhibits a high level of fragmentation and infrastructure has been sited to minimise disturbance to large, intact areas of woodland.

Conclusion

The potential impacts of the Project on these owl species include habitat loss and WTG collision. Given the small proportion of habitat to be cleared habitat loss is unlikely to lead to a significant impact on these species. Furthermore neither owl species nor suitable nest hollows were recorded during field surveys, and the majority of the habitat within the Study Area is considered sub-optimal. If the threatened owl species occur within the Study Area it is likely to be limited to occasional foraging, rather than being resident or breeding within the Study.

The risk of WTG collision is uncertain however it is expected that while hunting the species are likely to fly below RSA height.

BROWN TREECREEPER (EASTERN SUBSPECIES) (*Climacteris picumnus victoriae*) – Vulnerable

The Brown Treecreeper (Eastern Subspecies) can be found in eucalypt woodlands and dry open forest of the inland slopes and plains inland of the Great Dividing Range. The species mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts and can also be found in box-gum woodland, mallee, and River Red Gum (*Eucalyptus camaldulensis*) forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses. Fallen timber is an important habitat component for foraging and hollows in standing dead or live trees and tree stumps are essential for nesting (OEH 2015). The species was not recorded during field surveys, and no database records have been identified within the locality, however the species is considered to have potential to occur due to the presence of suitable 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 species is known to nest in standing hollow dead or alive trees. The project is likely to impact 5% of HBTs (13 HBTs) identified in the Study Area therefore impacts from availability of nesting resources are not considered significant.

(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.

	<i>(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,</i>
	Not applicable.
	<i>(d) in relation to the habitat of a threatened species, population or ecological community:</i>
	<i>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>
	The Project will involve clearing of 8.12 ha of suitable woodland and open forest habitat within the Development Footprint, equivalent to 1.90% of available habitat within the Study Area. Further woodland and open forest areas are available to the east and south of the PA. Only 13 of the 249 HBTs recorded within the Study Area (5%) are within the Development Footprint, and any additional HBTs identified during infrastructure micro-siting will be avoided where possible.
	<i>(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</i>
	Where possible, infrastructure has been located in cleared areas, and linear infrastructure has been located to follow existing roads and access tracks. At some locations, smaller patches of woodland will be intersected by access tracks, which will require the clearing of approximately 8 m corridors. The transmission line linking the southern precinct to the substation in the northern precinct is aligned immediately adjacent to the existing main roads and will be no greater than 4 m wide. This width is not expected to inhibit the movement of the Brown Treecreeper, and therefore will not substantially isolate or fragment areas of habitat. Furthermore, the risk of habitat alienation from WTGs is considered unlikely as this species typically flies below RSA height, preferring to fly within forested area below canopy height
	<i>(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,</i>
	Infrastructure has been sited to avoid large and well-connected areas of woodland, and the quality of habitat to be retained is generally consistent with the quality of habitat to be removed. It is acknowledged that HBTs are of importance to the Brown Treecreeper. Only 13 of the 249 HBTs recorded within the Study Area (5%) are within the Development Footprint, and any additional HBTs identified during infrastructure micro-siting will be avoided where possible.
	<i>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
	<i>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
	<i>(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.</i>

There are five Key Threatening Processes relevant to the Brown Treecreeper that may result from the Project:

- clearing of native vegetation;
- loss of hollow bearing trees;
- removal of dead wood and dead trees;
- aggressive exclusion of birds by noisy miners (*Manorina melanocephala*); and
- forest eucalypt dieback associated with over-abundant psyllids and Bell Miners.

The Project will involve:

- minimal clearing of native vegetation that provides suitable habitat for the species;
- minimal loss of HBT;
- dead wood and dead trees will be retained and relocated to surrounding woodland.

The Noisy Miner often occurs in lightly timbered areas and habitat edges, and Noisy Miner colonies dominate many small (<20 ha) patches of woodland (NSW Scientific Committee 2013). Likewise, canopy dieback associated with psyllids and Bell Miners generally occurs in landscapes disturbed by habitat fragmentation and logging, as well as nutrient enrichment, altered fire regimes and/or weed invasion (NSW Scientific Committee 2008). While some clearing of woodland areas will be unavoidable, vegetation in the Study Area currently exhibits a high level of fragmentation and infrastructure has been sited to minimise disturbance to large, intact areas of woodland. The Project is unlikely to lead to nutrient enrichment or altered fire regimes, and weed management measures will be implemented.

Conclusion

The key potential impacts of the Project on the Brown Treecreeper are habitat loss and habitat alienation. Infrastructure has been sited to minimise clearing of Brown Treecreeper habitat and avoid habitat fragmentation. Less than 1.90% of woodland habitat within the Study Area will be removed, coarse woody debris and HBTs will be retained where possible, and corridors required to be cleared for access tracks or the 33 kV transmission line are not expected to inhibit movement of the species. This species was not recorded within the Study Area, although potential habitat exists. If the species does occur within the Study Area it is likely to occur in low abundances. It is unlikely that the proposal will lead to a significant impact on the species.

DIAMOND FIRETAIL (*Stagonopleura guttata*) - Vulnerable

The Diamond Firetail is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. 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 (OEH 2015). It is 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 green leaves, and insects (OEH 2015).

The species was recorded on five occasions during the field surveys, with sightings generally on roadsides in open areas with scattered trees.

(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 local Diamond Firetail population is unlikely to be placed at risk of extinction as a result of the Project. While clearing of a small area of woodland habitat will be required by the Project, the local population has been observed using partly cleared farmland around roads, and the proposed clearing areas following clearing will be consistent with currently utilised habitat. The risk of WTG collision for the species is considered low, as the species generally flies below RSA height. The main potential risk to the species is vehicle strike resulting from increased vehicle traffic during construction. Maximum vehicle speed limits will be introduced for Project activities to minimise the risk of vehicle strike.

(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)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
	<i>(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</i>
	Not applicable.
	<i>(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,</i>
	Not applicable.
(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
	<i>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>
	The Project will involve clearing of 22.03 ha or 2.90% of suitable habitat for the species in the Study Area. The configuration of clearing for the Development Footprint will result in small clearings and narrow (approximately 4 m - 8 m) corridors, which are consistent with the open habitats currently used by the species within the PA.
	<i>(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</i>
	The Diamond Firetail occurs in open areas with scattered trees, and was recorded on roadsides during field survey. The clearing of small areas required for Project infrastructure will not inhibit the movement of the Diamond Firetail.
	<i>(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,</i>
	The quality of habitat to be retained within the Study Area and PA is generally consistent with the quality of habitat to be removed. The Diamond Firetail occurs in both woodland and open areas with scattered trees, and was recorded on roadsides during field survey. This habitat type is extensive across the PA and Study Area and as such, the small area of habitat to be removed is not considered to be of importance.
(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
(f)	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
(g)	<i>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.</i>
	The listings for two Key Threatening Processes specifically acknowledge adverse impacts to the Diamond Firetail. These are: • clearing of native vegetation; and • aggressive exclusion of birds by noisy miners (<i>Manorina melanoccephala</i>). The Project will require removal of 22.03 ha (2.90%) of suitable habitat for the species; however a large proportion of suitable habitat will remain within the Study Area. As large areas of suitable habitat will be retained, and the species occurs in already fragmented landscapes, the scale and configuration of clearing is unlikely to adversely impact the Diamond Firetail. The Noisy Miner often occurs in lightly timbered areas and habitat edges, and Noisy Miner colonies dominate many small (<20 ha) patches of woodland (NSW Scientific Committee 2013). Infrastructure has been sited to avoid large patches of woodland, however at some locations, the creation of new edges to accommodate linear infrastructure, which may favour the Noisy Miner, will be unavoidable. This will occur at only a few locations, and will occur within an already fragmented landscape. As such, it is not expected to have a substantial impact on the dominance of the Noisy Miner.

<i>Conclusion</i>	
	The species is unlikely to be affected by clearing of small areas of vegetation proposed for the Project, and is considered to be at low risk of WTG collision, as the species generally flies below RSA height. The species was recorded in open habitats and the amount of vegetation clearance is likely to be negligible for this species. The risk of mortality due to vehicle strike will be managed through introducing speed limits for Project vehicles in and around the PA. Therefore, the Project is unlikely to have a significant impact on the species.
WHITE-FRONTED CHAT - <i>Epthianura albifrons</i> (Vulnerable)	
	In NSW, The White-fronted Chat occurs in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas. The species was observed at two grassland locations in the north of the PA. At one location the species was sighted on numerous occasions within a patch of Bracken Fern in a grassland area.
(a)	<i>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,</i>
	The species builds open-cup type nests in low vegetation. The Development Footprint will not remove isolated or unique occurrences of low vegetation with such vegetation occurring in the Development Footprint as contiguous parts of more widespread vegetation extending well beyond the Development Footprint. Therefore, the local-scale proportion of nesting habitat to be removed will be relatively small and the Project will not inhibit the species' life cycle such that it will place the species at risk of extinction.
(b)	<i>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,</i>
	Not applicable.
(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
	(i) <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</i>
	Not applicable.
	(ii) <i>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,</i>
	Not applicable.
(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
	(i) <i>the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>
	Within the Study Area, the species was recorded within open grassland areas. This habitat is widespread throughout the Study Area and wider PA. The majority of the infrastructure is sited in grassland habitats and the development Footprint contains 26.37 ha of native grassland habitat, equivalent to 3.91% of available habitat in the Study Area. Wetland areas within the PA will not be impacted, as development is not planned within wetlands or the margins around them.
	There is a potential risk of vehicle strike resulting from increased vehicle traffic during construction. Vehicle speed limits will be introduced to minimise the risk of vehicle strike. The local White-fronted Chat population is unlikely to be placed at risk of extinction as a result of the Project.
	(ii) <i>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</i>

	White-fronted Chats were recorded within fragmented open habitats within the Study Area. The narrow linear clearance for roads is not likely to significantly increase fragmentation within the already fragmented Study Area. The risk of WTG collision for the species is considered low. Over eight years of carcass monitoring at a 38-WTG wind farm in Tasmania, one fatality of White-fronted Chat was recorded (Hull et al. 2013). The minimum rotor height of the Tasmanian WTGs was 27 m (Hull et al. 2013), while the minimum rotor height of the Project WTGs is 51.5 m. This is expected to further reduce the risk to low-flying species, such as the White-fronted Chat, and therefore, WTG collision of the species is expected to be rare and the presence of WTGs is not likely to alienate or fragment habitat for this species.
	<i>(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,</i> The species was recorded in dry grassland with some low Bracken, which is not considered optimal for the species. This type of habitat is very common within the Study Area and the PA. Wetland margins and ephemeral watercourse provide higher quality habitat for the species and these habitats will not be impacted by the project.
(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i> Not applicable.
(f)	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i> Not applicable.
(g)	<i>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.</i> There are currently 38 Key Threatening Processes listed under the TSC Act. No listing for Key Threatening Processes specifically acknowledges adverse impacts to the White-fronted Chat.
	<i>Conclusion</i> Within the PA, the species was recorded within open dry grassland areas, of which there is an abundance of within the Study area and the wider PA. The risk of WTG collision for the species is considered low, as the species generally flies below RSA height for this Project. There is a potential risk of vehicle strike resulting from increased vehicle traffic during construction. Vehicle speed limits will be introduced to minimise the risk of vehicle strike. The Project is unlikely to have a significant impact on the species, especially as the species has been shown to occur within modified habitats on site.

RAPTORS

Spotted Harrier (*Circus assimilis*), Black Falcon (*Falco subniger*), Little Eagle (*Hieraaetus morphnoides*)

Spotted Harrier (Circus assimilis) - Vulnerable

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 (OEH 2015). The species has been recorded within the locality and one individual was recorded by ERM within the PA.

Black Falcon (Falco subniger) - Vulnerable

The Black Falcon inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. The Black Falcon is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. Habitat selection is generally influenced more by prey densities than by specific aspects of habitat floristics or condition, although in agricultural landscapes the Black Falcon tends to nest in healthy, riparian woodland remnants with a diverse avifauna (NSW Scientific Committee 2013). Database searches identified two records of the species from 1983 within the locality.

Little Eagle (Hieraaetus morphnoides) - Vulnerable

The Little Eagle is found throughout the Australian mainland except in 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 2015). Database searches did not identify any records of the species within the locality, however the PA is within the species' distribution and contains suitable habitat.

(a)	<i>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,</i>

No indication of any of these species breeding within the Study Area was recorded. There were no nests observed and no pairs of threatened raptors were recorded. Due to the lack of observations it is unlikely that any of these species were nesting within the Study Area, although this does not rule out any future nesting. The species may occur within the Study Area in low numbers intermittently. They all have large ranges or are nomadic species.

(b)	<i>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,</i>

Not applicable.

(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>

(i)	<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</i>

Not applicable.

(ii)	<i>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,</i>

Not applicable.

(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>

(i)	<i>the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>

Open forest, woodland and grassland with scattered trees may provide potential habitat for these species, within the Study Area. Small areas of each of these habitat types will be removed or modified as a result of the Project. This will total 22.03 ha of habitat to be removed within the development footprint (equivalent to 2.90% of habitat in the Study Area). In consideration of the extensive woodland habitats to the east and south of the PA, the loss or modification of this habitat is unlikely to adversely affect these species.

(ii)	<i>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</i>

WTGs have the potential to fragment or isolate habitat through rotor strike. WTGs have been located in clusters with at least a 2.5 km gap between each cluster, and approximately 350 m gaps between each WTG within clusters. This configuration is expected to allow adequate space between individual WTGs and clusters for raptors to move between WTGs. These raptor species are highly mobile and the Project is not expected to fragment any populations of raptor 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,

In the context of other available habitat within and outside the PA, the habitat to be removed is not of particular importance to the threatened raptors. The modified habitat within the Study Area is typical of the wider area with these species able to cover vast distances while foraging.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Not applicable.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Not applicable.

(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 38 Key Threatening Processes listed under the TSC Act. No listing for Key Threatening Processes specifically acknowledges adverse impacts for the Spotted Harrier, Black Falcon or Little Eagle.

Conclusion

Potential impacts to these species include habitat loss and WTG collision. In consideration of the small proportion of habitat within the PA to be removed and the availability of extensive grassland, woodland and forest habitats in the locality, the loss or modification of this habitat is unlikely to adversely affect these species.

These species are likely to fly at RSA for at least some of the time and are therefore at risk of rotor strike. The Study Areas are likely to only support very low densities of these species intermittently and resident birds were not recorded. This reduces the likelihood of strike and there is not likely to be a significant impact on the species populations.

DUCKS

Freckled Duck (Stictonetta naevosa) - Vulnerable

The Freckled Duck is found primarily in south-eastern and south-western Australia. The species occurs in permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. Generally rest in dense cover during the day, usually in deep water. Feed at dawn and dusk and at night on algae, seeds and vegetative parts of aquatic grasses and sedges and small invertebrates. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. Nests are usually located in dense vegetation at or near water level.

The Lake Bathurst Important Bird Area is recognised as an important drought refuge for the Freckled Duck and, at times, has supported more than 1% of the global population of the species (BirdLife International 2015a). There are four records of the species, from between 1983 and 1999, within the locality.

Blue-Billed Duck (Oxyura australis) - Vulnerable

The Blue-billed Duck is endemic to south-eastern and south-western Australia. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and overwintering lakes with some long-distance dispersal to breed during spring and early summer.

The Lake Bathurst Important Bird Area regularly supports large numbers of the Blue-billed Duck, and monitoring between 1980 and 2005 has recorded between 0 to 421 individuals at the lake (BirdLife International 2015a). This species was recorded within the PA during field surveys.

(a)	<i>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,</i>
	Neither of these species are likely to breed within the Study Area or PA with the dams on site expected to provide the only habitat for these species. A small proportion of individuals utilising the nearby Important Bird Area may enter the Study Area, however, as these species are typically found in large expanses of water, the available small dams within the PA are unlikely to provide high quality habitat nor any locally or regionally significant breeding habitat. Lake Bathurst, to the north of the PA, provides a much larger area of suitable breeding habitat. It is also recognised as an important drought refuge for the Freckled Duck, and regularly supports large numbers of the Blue-billed Duck. The Project is not likely to interfere with the life cycle of this species due to an absence of impacts on the species' breeding habitat.
(b)	<i>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,</i>
	Not applicable.
(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
(i)	<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</i>
	Not applicable.
(ii)	<i>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,</i>
	Not applicable.
(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
(i)	<i>the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>

	Direct impacts of habitat removal will be avoided as the Development Footprint will not remove a locally significant magnitude of farm dams. Habitat degradation may result from polluted run-off from construction areas entering watercourses or wetlands, or weed invasion in areas of suitable habitat. These risks will be managed through standard construction environmental management practices.
	<i>(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</i> Currently, there is limited research in Australia on the risk of WTG collision for Australian bird species. One study undertaken monitored bird and bat fatalities at two Tasmanian wind farms: Bluff Point Wind Farm, with 38 WTGs monitored over eight years; and the Studland Bay Wind Farm, with 25 WTGs monitored over three years (Hull <i>et al</i> 2013). The Freckled Duck and Blue-billed Duck were not recorded at these wind farms, however bird utilisation surveys recorded six other species from the family Anatidae. No fatalities of birds in this family were recorded during the eight year or three year monitoring programs. While the context of these wind farms differs from the Project, these results may suggest risk of collision for species of the family Anatidae may be low. The Freckled Duck and Blue-billed Duck are highly mobile species and the removal of vegetation required for the Project would not inhibit the movement of these species.
	<i>(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,</i> Habitat for these species within the PA consists of small farm dams which are typically too small to be optimal or provide habitat to significant numbers of either of these species. Lake Bathurst, to the north of the PA, provides a much larger area of suitable habitat, and is recognised as an important drought refuge for the species (BirdLife Australia 2015a). In this context, habitat within the PA is not considered to be of importance to the species.
	<i>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i> Not applicable.
	<i>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i> Not applicable.
	<i>(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.</i> There are two Key Threatening Processes that specifically acknowledge the Blue-billed Duck and Freckled Duck as adversely affected. These are: • alteration to the natural flow regimes of rivers, streams, floodplains and wetlands; and • clearing of native vegetation. The Project is unlikely to affect the natural flow regimes of watercourses in the PA. While watercourse crossings will be required for access tracks, these will be constructed in a way that maintains pre-development flows. Removal of native vegetation around will not include vegetation within or around dams and therefore no significantly impact is predicted.
	Conclusion The PA does not provide high quality habitat for these species, and the species are expected to occur within the Study Area intermittently and in low numbers. Habitat for these species will not be impacted by the Project. The nearby Lake Bathurst supports large numbers of the species and therefore the species may fly over the Study Area. This presents a risk of WTG collision however, as there is a lack of important habitat for these species within or immediately south of the PA, it is unlikely that large numbers of individuals would fly over the Study Area. In consideration of these factors, it is considered unlikely that the Project will have a significant impact on the Blue-billed Duck or Freckled Duck.

CURLEW SANDPIPER (*Calidris ferruginea*) – Endangered

The Curlew Sandpiper is distributed around most of the Australian coastline (including Tasmania). The Curlew Sandpiper breeds in Siberia and migrates to Australia (as well as Africa and Asia) for the non-breeding period (OEH 2015). It generally occurs in littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts, and in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. Inland records are probably mainly of birds pausing for a few days during migration (OEH 2015).

There is one record of the species, from 1988, within the locality, and the PA is within the species' distribution. The species has the potential to fly over the site, however habitat within the PA is sub-optimal.

(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 Curlew Sandpiper is a coastal species, and may utilise the nearby Lake Bathurst to rest and forage for short periods during migration. The species may fly over the PA, however habitat within the Study Area is sub-optimal. Given that the species does not breed in Australia and generally occurs in coastal areas, it is likely that only a small proportion of the population would travel through the locality, and therefore the proportion of the population exposed to risks of WTG collision would be very low. It is unlikely that the very low risk of mortality resulting from WTG collision at this location would interfere with the life cycle of the species such that the Project would place the population 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 Curlew Sandpiper is a coastal species, and may utilise the nearby Lake Bathurst to rest and forage for short periods during migration. The species may fly over the PA however habitat within the PA is sub-optimal. Therefore removal or modification of habitats within the PA is not expected to impact this species.

(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 potential impact to Curlew Sandpiper from the Project is mortality due to WTG collision. The estimated population size of the species in Australia is 118,000 (DoE 2015). Given that the species does not breed in Australia and generally occurs in coastal areas, it is likely that only a small proportion of the population would travel through the locality, and therefore the proportion of the population at risk of WTG collision would be very low. It is unlikely that the Project would place the population at risk of extinction. This species is a highly mobile migratory species and the Project will not isolate areas of the species' habitat.

(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 Curlew Sandpiper is a coastal species, and may utilise the nearby Lake Bathurst to rest and forage for short periods during migration. The PA provides sub-optimal habitat for the species and is not considered to be of importance for this species.

(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
(f)	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
(g)	<i>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.</i>
	There are currently 38 Key Threatening Processes listed under the TSC Act. No listing for Key Threatening Processes specifically acknowledges adverse impacts to the Curlew Sandpiper.
	<i>Conclusion</i>
	The Curlew Sandpiper may fly over the PA however habitat within the PA is sub-optimal. The impact of WTG collision on the viability of the Curlew Sandpiper population is considered low, as the species is expected to be only an occasional visitor to the PA. The Project is unlikely to have a significant impact on this species.
GANG-GANG COCKATOO (<i>Callocephalon fimbriatum</i>) - Vulnerable	
	The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales. In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas (OEH 2015). This species requires tree hollows for nesting and sometimes for roosting (OEH 2015). Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts (OEH 2015). The species was not recorded during the field survey and therefore it is unlikely that the Study Area includes important habitat for the species or is likely to support a high percentage of the population. Potential impacts to the Gang-gang Cockatoo include habitat loss and WTG collision.
(a)	<i>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,</i>
	No suitable nesting trees (ie hollows with an entrance diameter greater than 10 cm and at least 9 m above ground) have been identified within 200 m of WTGs or within the road corridor investigated for the 33 kV transmission line. Micrositing of access tracks and other areas not yet surveyed for HBTs will be undertaken with involvement from an ecologist, and if any suitable nesting trees are identified, these will be avoided where practicable. Given the small proportion of habitat to be cleared, and the absence of suitable hollow bearing trees, habitat loss is unlikely to adversely affect the life cycle such that the local population of Gang-gang Cockatoo is at risk of extinction.
(b)	<i>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,</i>
	Not applicable.
(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
	(i) <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</i>
	Not applicable.
	(ii) <i>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,</i>
	Not applicable.
(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
	(i) <i>the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>

	The Project will involve clearing of 8.12 ha of suitable woodland and forest habitats, equivalent to 1.90% of available habitat within the Study Area. Further woodland and forest areas are available to the east and south of the PA. No suitable nesting trees have been identified within 200 m of WTGs or within the road corridor investigated for the 33 kV transmission line. Micrositing of access tracks and other areas not yet surveyed for HBTs will be undertaken with involvement from an ecologist, and if any suitable nesting trees are identified, these will be avoided where practicable.
	(ii) <i>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</i> The Gang-gang Cockatoo is highly mobile (a partial or altitudinal migrant), and is unlikely to be affected by the small areas of clearing proposed for the Project. There is potential for the individuals to fly at RSA height while travelling between patches of foraging habitat within the PA. There is limited research in Australia on the risk of WTG collision for Australian bird species. One study undertaken monitored bird and bat fatalities at two Tasmanian wind farms: Bluff Point Wind Farm, with 38 WTGs monitored over eight years; and the SB Wind Farm, with 25 WTGs monitored over three years (Hull et al 2013). The Gang-gang Cockatoo was not recorded at these wind farms, however bird utilisation surveys recorded other cockatoo species (Sulphur-crested cockatoo <i>Cacatua galerita</i>, and Yellow-tailed black cockatoo <i>Calyptorhynchus funereus</i>). No fatalities of these cockatoo species were recorded over the three year and eight year monitoring periods. While the context of this Tasmanian study is different to the context of the Project, the findings suggest the scale of potential WTG collisions may be low.
	(iii) <i>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,</i> In the context of other available habitat within and outside the PA, the habitat to be removed is not of particular importance. Furthermore the species was not recorded within the Study Area.
	(e) <i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i> Not applicable.
	(f) <i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i> Not applicable.
	(g) <i>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.</i> There are two Key Threatening Processes relevant to the Gang-gang Cockatoo: • clearing of native vegetation; • loss of hollow bearing trees. The Project will involve the clearing of native vegetation however infrastructure has been sited to avoid woodland areas, which has reduced the extent of clearing to less than 1.90% of forest and woodland habitat in the Study Area. A survey of hollow bearing trees within 200 m of WTG and within the road reserve proposed to contain the 33 kV transmission line did not identify any suitable nesting hollows for this species.
	<i>Conclusion</i> Potential impacts to the Gang-gang Cockatoo include habitat loss and WTG collision. In consideration of the small proportion of habitat within the Study Area to be removed and the availability of extensive grassland, woodland and forest habitats in the locality, the loss or modification of this habitat is unlikely to adversely affect these species. This species was not recorded during field surveys and it is unlikely that large numbers of these species are likely to occur within the Study Area. There is limited research on collision risk for these species; however the low occurrence of this species within the Study Area indicates a low risk for the species. This species is not likely to be significantly impacted by the Project.
SWIFT PARROT – <i>Lathamus discolor</i> (Endangered)	

The Swift Parrot is endemic to south-eastern Australia. It breeds only in Tasmania, and migrates to mainland Australia in autumn (DoE 2015). On the mainland the species occurs in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark, and White Box. Commonly used lerp infested trees include Inland Grey Box, Grey Box and Blackbutt. The species returns to some foraging sites on a cyclic basis depending on food availability (OEH 2015). 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 (DoE 2015).

There is one database record in the locality from 2002. The species was not recorded during field surveys; however woodland within the PA may provide some foraging habitat for the species.

Potential impacts to the Swift Parrot include loss of foraging habitat and mortality due to WTG collision.

(a)	<i>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,</i>
	Infrastructure has been sited to minimise clearing of native habitats. The total area of Swift Parrot foraging habitat to be removed is 2.19 ha, equivalent to 2.45% of this habitat within the Study Area. Woodland within the PA would provide foraging habitat only, as the species does not breed in NSW. It is unlikely that the removal of this small area of foraging habitat would adversely impact the lifecycle of the Swift Parrot.
(b)	<i>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,</i>
	Not applicable.
(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
	<i>(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</i>
	Not applicable.
	<i>(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,</i>
	Not applicable.
(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
	<i>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>
	Infrastructure has been sited to minimise clearing of woodland areas. The total area of suitable foraging habitat to be removed 2.19 ha, equivalent to 2.45% of this habitat type within the Study Area. Extensive woodland habitats exist to the east and south of the PA and will not be adversely effected by the Project.
	<i>(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</i>

Infrastructure has been sited to avoid large patches of woodland. Linear infrastructure has been located to follow existing roads and access tracks where possible. At some locations, smaller patches of woodland will be intersected by access tracks, which will require the clearing of up to 8 m corridors. This is not expected to restrict the movement of the Swift Parrot.

Biosis Research Pty Ltd (2006) modelled the cumulative impact of WTG collision to the Swift Parrot as a result of 39 wind farms across the species distribution. The modelling suggested that the rate of fatalities across all wind farms modelled was approximately one bird every ten years (Biosis Research Pty Ltd 2006). This suggests that potential fatalities resulting from WTG collision in this Project will be very rare.

Further, while no Swift Parrots were recorded during the field surveys, flight heights of other medium-sized parrots (Crimson Rosella (*Platycercus elegans*), Eastern Rosella (*P. eximius*) and Red-rumped Parrot (*Psephotus haematonotus*)) were below RSA height, between 0 m and 10 m AGL. This suggests the Swift Parrot may also fly at these heights, reducing the risk of WTG collision.

In consideration of the small area of foraging habitat to be removed, and the expected rarity of WTG collision, and the low expected occurrence of this species within the Study Area, the Project is not expected to fragment or isolate areas of habitat.

(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,

Infrastructure has been sited to avoid large and well-connected areas of woodland. The quality of habitat to be retained is generally consistent with the quality of habitat to be removed. In consideration of the large proportion of habitat to be retained within the Study Area, the habitat to be removed is not considered to be of particular importance.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Not applicable.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Not applicable.

(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 three Key Threatening Processes that specifically acknowledge adverse impacts to the Swift Parrot:

- clearing of native vegetation;
- infection by Psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations; and
- aggressive exclusion of birds by noisy miners (*Manorina melanocephala*).

The Project will involve the clearing of native vegetation however infrastructure has been sited to avoid native vegetation, which has reduced the extent of clearing to 2.45% of suitable White Box-Yellow Box-Blakely's Red Gum EEC woodland habitat within the Study Area.

The epizootiology of beak and feather disease is not fully understood (TSSC 2001), however it is not expected that project activities would affect the prevalence of the disease.

The Noisy Miner often occurs in lightly timbered areas and habitat edges, and Noisy Miner colonies dominate many small (<20 ha) patches of woodland (NSW Scientific Committee 2013). Infrastructure has been sited to avoid large patches of woodland, however at some locations, the creation of new edges to accommodate linear infrastructure, which may favour the Noisy Miner, will be unavoidable. This will occur at only a few locations, and will occur within an already fragmented landscape. As such, it is not expected to have a substantial impact on the dominance of the Noisy Miner.

Conclusion

Potential impacts to the Swift Parrot include loss of foraging habitat and mortality due to WTG collision. Infrastructure has been sited to minimise clearing of native vegetation, with only 2.45% of suitable foraging habitat within the Study Area to be removed. While there is potential for the Swift Parrot to collide with WTGs, modelling of the cumulative collision risk of 39 wind farms has suggested the rate of collision across all wind farms would be low (approximately one bird every 10 years) (Biosis Research Pty Ltd 2006). Furthermore, observations of other medium sized parrot species within the PA suggest the Swift Parrot would typically fly below RSA height, reducing the risk of collision. The Swift Parrot was not recorded within the Study Area and it is likely to occur in low numbers and intermittently. The Project is considered unlikely to significantly impact the Swift Parrot.

E.2

VOLANT MAMMALS

Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis* - Vulnerable)

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 2015).

There are two key maternity caves known within the NSW Southern Tablelands, Bungonia Caves and Wee Jasper Caves. Bungonia Cave system is approximately 45 km to the north east of the PA and Wee Jasper is approximately 90 km to the east of the PA. The bats typically breed in these caves between November and February, with vast aggregation of the species occurring at one time, compromising a significant percentage of the total abundance for the subspecies. Males remain dispersed throughout suitable habitat, and females emerge following the breeding period, to disperse across the landscape.

A 'staging' cave exists at Mount Fairy, which is approximately 6 km west of the Study Area. The staging cave is used during the migration of the bats to the coast, during late summer/early autumn after leaving the maternity roost.

The species was recorded on multiple occasions and locations, within the PA during the targeted surveys. Records of the species in October correspond with the period when the species gravitates towards maternity caves within the region, however, the number of records were low (19 calls from September 2014 to February 2015). No evidence was detected in March to suggest the Study Area is within the migration path of species moving from maternity caves (via the nearby staging) cave to the coast after leaving the maternity roost. Calls recorded throughout the year indicate that the species forages within the Study Area, with activity levels likely to be dependent on the weather and abundance of insect prey. Potential impacts to the Eastern Bentwing Bat include loss of small areas of foraging habitat and mortality due to WTG collision and barotrauma.

- (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 local population is not likely to be concentrated within the Study Area and it does not provide any unique values (such as a maternity roost), that are important to the life cycle of the species. Any adverse impacts are likely to affect a small proportion of the total population, and are not considered to put the local population at the risk of extinction.

Infrastructure has been sited to avoid woodland areas where possible, restricting the amount of foraging habitat loss to 8.12 ha or 1.90% of woodland within the Study Area.. Roosting resources within the Study Area are very limited. A stone bridge and two disused mines were identified as potential roost site, although targeted surveys at these locations did not identify any bats at these sites. These potential roost sites will not be disturbed by the Project.

There is potential for this species to fly at RSA height, presenting a risk of WTG collision. However, a much higher number of calls were detected at ground-level detectors compared to mast-level detectors, when adjusted for survey effort. This indicates that the species may be less active at RSA height, and therefore has a lower potential for WTG collision.

It is expected that the species will not occur in dense aggregations as it will have dispersed in the distance between the maternity caves and the Study Area. It is expected that only a small proportion of population are likely to be at risk of WTG collision.

Considering the small area of habitat to be removed, and that a relatively small proportion of the population would be at risk of WTG collision, the proposed action is unlikely to place the local population 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

Infrastructure has been sited to avoid woodland areas where possible, restricting the amount of foraging habitat loss to 8.12 ha or 1.90% of woodland within the Study Area. The habitat within the Study Area is not unique, with large areas of similar habitat in the region. The potential roost sites identified will not be disturbed by the Project.

(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

Where possible, infrastructure has been located in cleared areas, and linear infrastructure has been located to follow existing roads and access tracks in order to reduce the effects of fragmentation. At some locations, smaller patches of woodland will be intersected by access tracks, which will require the clearing of up to approximately 8 m corridors. The Eastern Bentwing Bat is a highly mobile species and this clearing would not inhibit the Eastern Bentwing Bat.

Of the individuals moving through the PA, only a small portion would be expected to move through the RSA (as WTGs are spaced over 300 m apart), and therefore be at risk of WTG collision. Considering this, the effect of WTG collision on population fragmentation is considered negligible.

(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,

Infrastructure has been sited to largely avoid woodland habitat which provides foraging habitat for the species. Areas impacted are not unique, and much larger areas of similar habitat exist in the region. The habitat to be removed is not considered of high importance to the survival of the species.

(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
Not applicable.	
(f)	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
Not applicable.	
(g)	<i>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.</i>
The listing of the Key Threatening Processes 'Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners' specifically acknowledges adverse impacts to the Eastern Bentwing Bat. Canopy dieback associated with psyllids and Bell Miners generally occurs in landscapes disturbed by habitat fragmentation, logging, nutrient enrichment, altered fire regimes and/or weed invasion (NSW Scientific Committee 2008). The Project is not expected to significantly enhance these disturbances. The Project is unlikely to lead to nutrient enrichment or altered fire regimes, and appropriate weed management will aim to prevent weed invasion. While some clearing of woodland areas will be unavoidable, vegetation in the PA currently exhibits a high level of fragmentation and infrastructure has been sited to minimise disturbance to large, intact areas of woodland.	
<i>Conclusion</i>	
Potential impacts to the Eastern Bentwing Bat include loss of a small area of foraging habitat and potential mortality due to WTG collision and barotrauma. Infrastructure has been sited to minimise clearance of woodland, and as a result only 1.90% of woodland/forest habitat in the Study Area will be removed, which is considered insignificant and unlikely to affect the species. The species was recorded far more frequently at ground-level bat detectors, than mast-mounted bat detectors, suggesting the species is most active below RSA height. It is therefore unlikely that a significant proportion of the population would be at risk of WTG collision.	
EASTERN FALSE PIPISTRELLE (<i>Falsistrellus tasmaniensis</i> – Vulnerable)	
The Eastern False Pipistrelle is documented as preferring tall and wet sclerophyll forest, over 20 m in height, with a dense understory. The species hunts insects both above and below the canopy. Roosting is typically in eucalypt hollows, however loose bark and building are also utilised. This species was potentially recorded in the Study Area; however the majority of the potential calls were from open low dry sclerophyll woodland and cleared areas considered unsuitable for this species. This species calls cannot be distinguished from several other species and it is likely that this species was not present in the majority of cases. Nevertheless small areas of potential sub-optimal habitat exist in the southern part of the study area and the study area occurs within the species known range (although on the periphery). The species is considered as potentially occurring within the Study Area.	
(a)	<i>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.</i>
This habitat within the study area is considered marginal for this species, and typically lower, drier and more fragmented than optimal habitat for this species. If the species does occur it is likely to be restricted to discrete areas in the south of the Study Area and it is unlikely to occur in high abundances. Impacts are anticipated to be restricted to a small amount of habitat loss, potentially affecting a small number of individuals. Generally, as the species is tree roosting, a consideration of the relative amount of tree hollows to be removed by the Project at a local scale is important to consider. The Project will remove 5% of tree hollows in the Study Area. The large relative retention of hollows is likely to provide alternative roosting sites for the species, therefore not interfering with the species' breeding cycle. This will have no population wide effects on the breeding cycle of the species.	
(b)	<i>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,</i>
Not applicable.	

(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
	<i>(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</i>
	Not applicable.
	<i>(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,</i>
	Not applicable.
(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
	<i>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>
	Infrastructure has been sited to avoid woodland areas where possible, restricting the amount of suboptimal woodland habitat loss to 8.12 ha or 1.90% of woodland within the Study Area. The habitat within the study area is not considered optimal for this species and more suitable habitat is likely to occur south and east from the study area.
	<i>(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</i>
	This species is likely to be vulnerable to fragmentation however, the majority of the study area is already fragmented and not likely to provide habitat for this species. Where possible, infrastructure has been located in cleared areas, and linear infrastructure has been located to follow existing roads and access tracks in order to reduce the effects of fragmentation. At some locations, smaller patches of woodland will be intersected by access tracks, which will require the clearing of up to approximately 8 m corridors. Clearing of this width is not likely to inhibit movements of this species, if it occurs within the area. Of the individuals moving through the PA, only a small portion would be expected to move through the RSA (as WTGs are spaced over 300 m apart), and therefore be at risk of WTG collision. Considering this, the effect of WTG collision on population fragmentation is considered negligible.
	<i>(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,</i>
	Infrastructure has been sited to largely avoid woodland and residual impacts are largely restricted to woodland which is not considered habitat for this species being too dry and low with sparse midstory. Some potential but sub-optimal woodland exists in the south of the study area however the majority of this habitat will remain unaffected by the proposal habitat. Areas impacted are not unique, and much larger areas of similar habitat exist in the surrounding Study Area and wider region. The habitat to be removed is not considered of high importance to the survival of the species.
(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
(f)	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
(g)	<i>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.</i>
	There are two Key Threatening Processes which will occur as a result of the proposal action which are: - clearing of native vegetation, and - loss of hollow bearing trees (HBTs). The latter specifically acknowledges adverse impacts to the Eastern False Pipistrelle, as HBTs provide roosting habitat. Clearance of native vegetation has been avoided where possible, with the majority of clearance limited to grassland and dry sclerophyll forest which does not provide habitat for this species. Impacts to hollow bearing trees will be avoided where possible by micro-siting of infrastructure.
	<i>Conclusion</i>

This habitat within the study area is sub-optimal for this species and if the species occurs, it is only likely to occur in low abundances in discrete areas of the study area. Impacts are anticipated to be negligible, potentially affecting a small number of individuals. This species is unlikely to fly at RSA height in open areas and therefore is not considered highly susceptible to barotrauma or rotor strike.

SOUTHERN MYOTIS (*Myotis macropus*) – Vulnerable

The Southern Myotis is found up to 100 km from the coast between north west Australia and western Victoria (OEH 2015). The species often occurs in riparian habitats, and roost sites are located in caves, mine shafts, HBTs, storm water channels, buildings, under bridges and in dense vegetation close to slow-flowing or still water. The species forages over rivers, streams and dams in a variety of forest types (Environment Australia 1999).

The species was potentially recorded once during field surveys, from a ground-level detector, in the northern precinct of the Study Area. The call was noted as either the Southern Myotis or a Long-eared Bat species (*Nyctophilus* sp.). The PA is within the species' distribution (OEH 2015) however there is only sub-optimal habitat for this species within the Study Area with foraging resources restricted to farm dams which are largely in open areas. The potential record of this species was not close to water and in an area of dry sclerophyll forest. It is most likely that the calls were actually from a Long-eared Bat species (*Nyctophilus* sp.). This species has been considered as having potential to occur within the Study Area, although if it does occur it is likely to only occur in low abundances as the habitat is sub-optimal.

Potential impacts to the Southern Myotis include a loss of a small amount of sub-optimal woodland and forested habitat. Watercourses and farm dams will remain unaffected by the Project. Riparian areas are limited within the Study Area with suitable foraging habitat limited to Reedy Creek and farm dams.

(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,*

Infrastructure has been sited to avoid watercourses where possible. There is expected to be minimal impacts to riparian forest with the potential for widening of creek crossings to 8 m in the southern area of the Study Area. These are ephemeral watercourses which may provide corridors for movement and are likely to provide only sub-optimal foraging habitat. Dams within the PA will not be affected by the proposal.

Mine shafts and hollow-bearing trees in the PA may provide suitable roosting sites. Mine shafts will not be disturbed by the Project, and infrastructure micro-siting will avoid removal of hollow-bearing trees where possible.

This species flies at low heights over the water while foraging, and does not typically fly at height in open areas, therefore the risk of barotrauma and rotor strike is considered low. This is consistent with overseas research and one Australian study, which suggest that high-flying, open-air foraging bats are more at risk of fatality at WTGs than species with other foraging strategies (Hull *et al.* 2013).

Considering the small area of sub-optimal potential habitat to be removed, and that only a small proportion of the population would be at risk of WTG collision, the proposed action is unlikely to place the local population 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>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>
	Infrastructure has been sited to avoid watercourses and riparian vegetation where possible however disturbance to very small amounts of riparian habitat will be required. HBTs in the PA may provide suitable roosting sites and infrastructure micro-siting will aim to avoid removal of hollow-bearing trees where possible. Mine shafts were not found to offer suitable roosting habitat for this species.
	<i>(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</i>
	Infrastructure has been sited to avoid large patches of woodland. Linear infrastructure has been located to follow existing roads and access tracks where possible. At some locations, riparian vegetation will be intersected by linear infrastructure, which will require the clearing of up to 8 m corridors. This is not expected to restrict the movement of Southern Myotis and adjacent habitats will remain connected. This species flies at low heights over the water while foraging, and does not typically fly at height in open areas, therefore the risk of rotor strike fragmenting or isolating areas of suitable habitat is considered low.
	<i>(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,</i>
	Potential Southern Myotis habitat to be removed as part of the Project generally consists of narrow riparian corridors set within a modified agricultural landscape. Southern Myotis habitat to be retained within the PA includes riparian areas within large forested areas, which may provide higher quality habitat for the species.
	<i>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
	<i>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
	<i>(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.</i>
	No Key Threatening Processes listings include the Southern Myotis as a potentially adversely affected species.
	<i>Conclusion</i>
	Potential impacts to the Southern Myotis include loss of a small area of foraging habitat and mortality due to WTG collision. Infrastructure has been sited to avoid watercourses and riparian vegetation where possible, and as a result only a very small amount of riparian habitat in the Study Area will be disturbed. Potential roosting sites will be retained where possible. As this species is unlikely to fly at height in open areas the risk of mortality from rotor strike and barotrauma is low. It is considered unlikely that the Project would result in a significant impact to this species.

YELLOW-BELLIED SHEATHTAIL BAT (*Saccolaimus flaviventris*) – Vulnerable

	The Yellow-bellied Sheathtail-bat forages for insects in most habitats, including treed and treeless areas, across a very wide range. The species 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 2015).
	The species was frequently recorded within the Study Area; on both mast-mounted detectors and those at ground level. Potential impacts to the Yellow-bellied Sheathtail Bat include loss of a small area of roosting habitat and mortality due to WTG collision and barotrauma. This proposed action is not likely to affect a significant proportion of the species as it has a large range across a variety of habitats and is considered as a single population in NSW. Potential mortality of this species is unlikely to put the population at risk of extinction
	<i>(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</i>

	<i>risk of extinction,</i>
	As the species forages in most habitats, the impact of removal of woodland and forest habitats to accommodate Project infrastructure is considered negligible. A survey of hollow-bearing trees within 200 m of WTGs identified that only 5% of HBTs in the Study Area are located within the Development Footprint. Infrastructure micro-siting will aim to further avoid disturbance to HBTs. In consideration of the retention of hollow-bearing trees where possible and the relatively small removal of HBTs at a local scale, the Project is considered unlikely to interfere with the lifecycle of this species such that it would place the local population at risk of extinction.
(b)	<i>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,</i>
	Not applicable.
(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
	<i>(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</i>
	Not applicable.
	<i>(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,</i>
	Not applicable.
(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
	<i>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>
	As the species forages in most habitats, the impact of removal of woodland and forest habitats to accommodate Project infrastructure is considered negligible. Micro-siting of infrastructure will be undertaken to avoid removal of HBTs which may be used for roosting.
	<i>(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</i>
	The Yellow-bellied Sheathtail Bat is a wide-ranging species which occurs over most types of habitat. Clearing of native vegetation required for the Project is unlikely to inhibit the movement of the species given that it occurs in open areas. WTGs have the potential to alienate habitats. There is potential for this species to fly at RSA height, presenting a risk of WTG collision. The species is wide ranging and likely to occur at low densities within the Study Area, and as such only a small proportion of the population would be at risk of WTG collision.
	<i>(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,</i>
	The Yellow-bellied Sheathtail Bat is a wide-ranging species with generalist habitat requirements. Habitat within the PA is not considered to be of particular importance to the species.
(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
(f)	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
(g)	<i>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.</i>
	There are two Key Threatening Processes relevant to the Yellow-bellied Sheathtail Bat: • clearing of native vegetation; and • loss of hollow bearing trees. The Project will involve the clearing of native vegetation however in total the Development Footprint covers only 8.12 ha of Woodland/Forest, equivalent to 1.90% of native vegetation in the PA. A survey of hollow-bearing trees within 200 m of WTGs identified that only 5% of HBTs in the Study Area are located within the Development Footprint. Infrastructure

micrositing will aim to further avoid disturbance to HBTs.

Conclusion

Potential impacts to the Yellow-bellied Sheath-tail Bat include loss of a small area of potential roosting habitat and mortality due to WTG collision and barotrauma. As the species forages in most habitats, the impact of removal of a small area of native vegetation to accommodate Project infrastructure is considered negligible. Removal of hollow-bearing trees, which may be used as roost sites for the species, will be avoided where possible. There is a risk of WTG collision; however only a small proportion of the population is expected to enter the PA, the risk of WTG collision is considered low. The Project is unlikely to have a significant impact on the species.

GREY-HEADED FLYING-FOX (*Pteropus poliocephalus*) - Vulnerable

The Grey-headed Flying-fox feeds in the canopy of a range of vegetation communities, including rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands. It also feeds on commercial fruit crops and on introduced tree species in urban areas. The species roosts on exposed branches near water, generally in rainforest patches, *Melaleuca* patches, mangroves and riparian vegetation, but can also use modified vegetation in urban and suburban areas (DoE 2015).

Grey-headed Flying-foxes generally travel within 15 km of the roost site each night, but can travel up to 50 km per night as food resources change. The national population has been estimated at between 320,000 individuals in 2001 and 674,000 individuals in 2005 however these estimates are based on incomplete knowledge of camp location and use. The national population is considered to be a single interbreeding population (DoE 2015).

The species has not been recorded within the locality however this is a wide ranging species and the PA is within the species' distribution. Sub-optimal foraging resources within the Study Area are likely to be limited to occasional eucalypt flowering events. The Study Area does not support unique or important foraging habitat and if the species does occur within the Study Area it is likely to be occasionally as a fly over species. Potential impacts to the Grey-headed Flying-fox as a result of the Project are loss of sub-optimal foraging habitat and WTG collision.

(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 Project will involve clearing of 8.12 ha of woodland/forest which may provide sub-optimal foraging habitat. This is equivalent to 1.90% of woodland/forest habitat within the Study Area. Further woodland and forest to the east and south of the PA may provide suitable foraging habitat. The Study Area does not contain any breeding areas for this species and only occasional sub-optimal foraging resources. The Project is not likely to adversely affect the breeding cycle of the species such that it could 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 Project will involve clearing of 8.12 ha of woodland/forest which may provide sub-optimal foraging habitat. This is equivalent to 1.90% of woodland/forest habitat 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

This species is likely to fly at RSA height, presenting a risk of WTG collision. However the species was not identified during field surveys, and there are no database records of the species within the locality. This suggests that, although individuals of the species may enter the PA to forage, it is unlikely a substantial proportion of the population would be at risk of WTG collision within the PA.

The Grey-headed Flying-fox is a wide ranging species. Vegetation clearing and development of infrastructure associated with this Project is unlikely to inhibit the mobility of the 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 PA is typical of pastoral landscapes in the region. Larger, more intact areas of forest and woodland are located to the east and south of the PA. Habitat within the PA is not considered to be of importance to this species.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Not applicable.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Not applicable.

(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 two Key Threatening Processes that specifically acknowledge adverse impacts to the Grey-headed Flying-fox that are relevant to this Project:

- clearing of native vegetation; and
- forest eucalypt dieback associated with over-abundant psyllids and Bell Miners.

The Project will involve the clearing of native vegetation however infrastructure has been sited to avoid woodland areas, which has reduced the extent of clearing within the Study Area to less than 1.90% of forest/woodland habitat. The habitat within the Development Footprint is sub-optimal for the species.

Canopy dieback associated with psyllids and Bell Miners generally occurs in landscapes disturbed by habitat fragmentation, logging, nutrient enrichment, altered fire regimes and/or weed invasion (NSW Scientific Committee 2008). The Project is not expected to significantly enhance these disturbances. The Project is unlikely to lead to nutrient enrichment or altered fire regimes, and appropriate weed management will aim to prevent weed invasion. While some clearing of woodland areas will be unavoidable, vegetation in the PA currently exhibits a high level of fragmentation and infrastructure has been sited to minimise disturbance to large, intact areas of woodland.

Conclusion

Potential impacts to the Grey-headed Flying-fox as a result of the Project are habitat loss and WTG collision. The Project will involve the clearing of native vegetation; however infrastructure has been sited to avoid woodland areas, which has reduced the extent of clearing to less than 1.90% of forest/woodland habitat. This habitat is not of high importance to the species. While the Grey-headed Flying-Fox is likely to fly at RSA height, the lack of records in the locality suggest it is unlikely a substantial proportion of the population would be at risk of WTG collision within the PA. In consideration of the small area of potential habitat to be impacted, and the low likelihood of a substantial proportion of the population entering the PA, the Project is unlikely to have a significant impact on the Grey-headed Flying-fox.

KOALA (*Phascolarctos cinereus*) - Vulnerable

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 (OEH 2015). The PA is within the Central and Southern Tablelands Koala Management Area, which lists primary Koala feed trees as Ribbon Gum (*Eucalyptus viminalis*) and River Red Gum (*Eucalyptus camaldulensis*). Ribbon Gum was recorded in the PA predominately in the south of the Study Area associated with riparian vegetation. There are also 18 secondary feed trees listed for the Koala within this catchment management area. Eight of these species occur in the PA. One species of supplementary tree species, the Red Stringybark (*E. macrorhyncha*) was common within the PA.

The species was not recorded during field surveys and no Koala scats were recorded, however there are 14 records of the species within the locality from between 1978 and 2004 (NSW Atlas). It is expected that the Koala will occur within the Study Area in low densities, perhaps intermittently with transient individual moving through the Study Area.

(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 Koala has the potential to occur in low densities within the Study Area as is typical of populations on the southern tablelands. The habitat within the Study Area is fragmented with open areas interspersed with patches of forest and woodland. Infrastructure has been predominantly sited in open areas to avoid woodland areas, including Koala habitat where practicable, although some habitat loss will be unavoidable. The Project will result in impacts to approximately 8.12 ha of woodland/forest with secondary feed tree species. Habitat loss containing high densities of the primary feed tree species will be limited to 0.99 ha which is 1.44% of the habitat recorded within the Study Area.

As this is a very small amount of the overall habitat present within the PA and the locality, it is not anticipated that Koala will be impacted significantly by the loss of habitat and hence 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*

Infrastructure has been sited to avoid woodland areas, including Koala habitat where practicable. The Project will result in impacts to approximately 8.12 ha of woodland/forest, with secondary feed tree species, as well as some additional clearing of linear fragments of woodland habitats in the road reserve proposed to contain the 33 kV transmission line.

Habitat loss of forest containing high densities of the primary feed tree species was limited to 0.99 ha or 1.44% of the habitat recorded within the Study Area. Due to the small proportion of habitat within the Study Area to be disturbed, habitat loss/modification resulting from the Project is unlikely to significantly affect the species.

(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*

Where possible, infrastructure within the PA has been sited to avoid woodland. Fragmentation of woodland and forest habitat within the PA will be limited to the widening of existing linear impact areas (eg existing tracks and the road edge for the 33 kV transmission line), with clearing of vegetation for new tracks at only a few locations. This is unlikely to change the connectivity of the landscape significantly given the existing fragmentation of habitat within the PA.

(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 habitat to be removed is a small portion (approximately 1.90%) of forest containing secondary feed trees and 1.44% of forest containing primary feed trees in the Study Area, and infrastructure has been sited to avoid clearing within woodland and forest areas where possible. A large portion of similar habitat exists within the locality which won't be impacted. The habitat for the Koala is not considered important as it does not appear to support large number of Koala and the habitat is patchy and fragmented. The level of fragmentation and habitat loss for the Koala in the PA is not expected to threaten the long-term survival of a local population.

(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 declared under 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 relevant to this Project are:

- Objective 1: To conserve koalas in their existing habitat;
- Objective 2: To rehabilitate and restore koala habitat and populations.

The proposed action will remove a small portion of potential Koala habitat within the Study Area and infrastructure has been sited to avoid clearing within woodland and forest areas where possible. The proposed action is not anticipated to significantly impact the Koala within the region and is considered consistent with the approved recovery plan.

(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 four Key Threatening Processes relevant to the Koala:

- clearing of native vegetation;
- forest eucalypt dieback associated with over-abundant psyllids and Bell Miners;
- *Lantana camara*; and
- Predation and Hybridisation by Feral Dogs (*Canis lupus familiaris*).

The Project will involve the clearing of native vegetation; however infrastructure has been sited to avoid woodland and forest areas, which has reduced the extent of clearing to less than approximately 1.44% of Koala habitat containing primary feed trees within the Study Area. Avoidance and mitigation measures will be adopted to minimise this clearing wherever possible.

Conclusion

The main potential impact to the Koala resulting from the Project is habitat loss. The Koala was not recorded during the recent field surveys undertaken within the PA, with the majority of the Study Area considered sub-optimal habitat for this species due to fragmentation. Infrastructure has been sited to avoid native woodland and forest areas a very small proportion of habitat containing primary feed trees (1.44%) will be impacted. Fragmentation of woodland and forest habitat associated with the proposed action is likely to be limited to the widening of existing tracks and/or corridors for transmission lines. This is unlikely to significantly change the connectivity of Koala habitat given the existing fragmentation of habitat within the PA. There is not anticipated to be a significant impact on Koala as a result of the Project. It is recommended that micro-siting of infrastructure should be undertaken to avoid *Eucalyptus viminalis* where possible as this will further reduce impacts to the species.

*SPOT-TAILED QUOLL (*Dasyurus maculatus maculatus*) - Vulnerable*

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 2015).

The species was not recorded during field surveys and no Spot-tailed Quoll latrine sites or scats were recorded, however there are six records of the species within the locality from between 2002 and 2010. Woodland areas with fallen logs and a gully in the south of the PA containing large boulders may provide suitable habitat for this species. Potential impacts to the Spot-tailed Quoll resulting from the Project are the loss of habitat and direct mortality due to vehicle strike.

(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,*

This species, if currently present within the PA, is expected to occur at relatively low densities. This species is expected to utilise larger tracts of connected woodland and forest areas within the PA. Infrastructure has been sited to avoid woodland and forest areas where possible. Although some small areas of habitat loss will be unavoidable. The Development Footprint will result in impacts to approximately 8.12 ha of potential Spot-tailed Quoll habitat. This is approximately 1.90% of the total potential Spot-tailed Quoll habitat within the Study Area.

The majority of project vehicle movements will occur during daylight hours and, as the species is nocturnal, the risk of vehicle strike is considered low. The introduction of vehicle speed limits will further reduce the risk of vehicle strike.

While it is considered unlikely that a Spot-tailed Quoll den site would be located within the Development Footprint, fauna spotters will be present during clearing to identify any active Spot-tailed Quoll dens. If Spot-tailed Quoll are located within the clearing area the individuals will be encouraged to move away from the area or relocated.

In consideration of the small proportion of habitat to be removed, and the implementation of measures to minimise the risk of mortality, the Project is unlikely to impact the life cycle of the Spot-tailed Quoll, 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*

Infrastructure has been sited to avoid woodland and forest areas where possible. Although some small areas of habitat loss will be unavoidable. The Project will result in impacts to approximately 8.12 ha of potential Spot-tailed Quoll habitat. This is approximately 1.90% of the total potential Spot-tailed Quoll habitat within the Study Area. Due to the small proportion of habitat within the PA to be cleared, habitat loss/modification resulting from the Project is unlikely to significantly affect this species.

(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*

Where possible, infrastructure has been sited to avoid woodland. The Project is unlikely to change the existing connectivity of Spot-tailed Quoll habitat significantly given the existing fragmentation of habitats within the PA and the narrow, linear nature of the majority of the Development Footprint.

(iii)	<i>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,</i>
	The area of habitat that may be impacted as part of the Project is not considered to represent an area of optimal habitat for the Spot-tailed Quoll. The habitat within the Study Area to be impacted is a small portion (approximately 1.90%) of the available habitat in the Study Area, and infrastructure has been sited to avoid clearing within woodland and forest areas where possible. Therefore the level of fragmentation and habitat loss for the Spot-tailed Quoll resulting from the Project is not expected to threaten the long-term survival of a local population.
(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
(f)	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
(g)	<i>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.</i>
	There are seven Key Threatening Processes that are relevant to the Spot-tailed Quoll: • clearing of native vegetation; • bushrock removal; • cane toad; • ecological consequences of high frequency fires; • loss of hollow-bearing trees; • predation and hybridisation by Feral Dogs (<i>Canis lupus familiaris</i>); and • Removal of dead wood and dead trees The Project will involve minimal clearance of native vegetation that may provide habitat for this species. Avoidance and mitigation measures will be adopted to minimise this clearing wherever possible. Infrastructure has been sited to avoid woodland and forest areas where possible, as such, impacts to areas of bushrock, loss of HBTs, removal of dead wood and dead trees are considered to be minimal. Only 13 of the 249 HBTs recorded within the Study Area (5%) are within the Development Footprint, and any HBTs identified in previously unsurveyed areas during infrastructure micro-siting will be avoided where possible. Where avoidance is not possible, hollows will be relocated in areas adjacent to the impact area. Similarly, bushrock, dead wood and dead trees will also be relocated outside of impact areas if avoidance is not possible. Therefore there will be no loss of these habitat features.
	<i>Conclusion</i>
	The potential impact to the Spot-tailed Quoll resulting from the Project is habitat loss. The Spot-tailed Quoll was not recorded during the recent field surveys undertaken within the PA, with the vast majority of the Study Area is considered sub-optimal habitat for this species. Infrastructure has been sited to avoid native woodland and forest areas, and less than 1.90% of potential Spot-tailed Quoll habitat will be cleared as a result of the Project. Fragmentation of woodland and forest habitat associated with the proposed action is likely to be limited to the widening of existing tracks and/or corridors for transmission lines. This is unlikely to significantly change the connectivity of Spot-tailed Quoll habitat given the existing fragmentation of habitat within the PA. There is not anticipated to be a significant impact on Spot-tailed Quoll as a result of the Project.

E.4

REPTILES

ROSENBERG'S GOANNA (*Varanus rosenbergi*) - Vulnerable

Found in heath, open forest and woodland. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component. 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 (OEH 2015).

The species was not recorded during field surveys, however the PA is within the species distribution and woodland with termite mounds has been identified within the PA which may provide suitable habitat for this species. Potential impacts to the Rosenberg's Goanna resulting from the Project would be loss of habitat.

(a)	<i>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,</i>
	Although not recorded during recent surveys, this species has been identified to have the potential to occur within the PA. This species is expected to utilise intact woodland and forest areas with scattered termite mounds present that were recorded within the PA. Infrastructure has been sited to avoid woodland and forest areas where possible. Although some small areas of habitat loss will be unavoidable. The Project will result in impacts to approximately 8.12 ha of potential Rosenberg's Goanna habitat within the Study Area. This is approximately 1.90% of the total potential habitat within the Study Area.
	As only a very small amount of the overall habitat present within the PA and the locality is proposed to be cleared, it is not anticipated that Rosenberg's Goanna will be significantly impacted by the loss of habitat and hence the proposed action is unlikely to impact the life cycle of the Rosenberg's Goanna, such that a viable local population of this species will be placed at risk of extinction.
(b)	<i>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,</i>
	Not applicable.
(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
	<i>(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</i>
	Not applicable.
	<i>(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,</i>
	Not applicable.
(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
	<i>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>
	Infrastructure has been sited to avoid woodland and forest areas where possible. Although some small areas of habitat loss will be unavoidable. The Project will involve clearing of 8.12 ha of suitable habitat for the Rosenberg's Goanna within the Study Area, equivalent to 1.90% of available habitat within the Study Area. Due to the small proportion of habitat within the PA to be cleared, habitat loss/modification resulting from the Project is unlikely to significantly affect this species.
	<i>(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</i>
	Where possible, infrastructure has been sited to avoid wooded areas and has been located within existing cleared areas. Fragmentation of woodland and forest habitat associated with the proposed action is likely to be limited to the widening of existing tracks and/or corridors for transmission lines and other linear infrastructure. This is unlikely to change the connectivity of the habitat significantly given the extent of impact and existing fragmentation of existing habitat within the PA.
	<i>(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,</i>

The area of habitat that may be impacted as part of the Project is not considered to represent an area of important habitat for the Rosenberg's Goanna. The habitat recorded within the PA is considered relatively common throughout the Study Area and wider PA. The habitat to be impacted is a small portion (approximately 1.90%) of the available habitat in the Study Area, and infrastructure has been sited to avoid clearing within woodland and forest areas where possible. The level of fragmentation and habitat loss for the Rosenberg's Goanna in the PA is not expected to threaten the long-term survival of a local population.

(e) *whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

Not applicable.

(f) *whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*

Not applicable.

(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 two Key Threatening Processes that are relevant to the Rosenberg's Goanna:

- alteration of habitat following subsidence due to longwall mining; and
- removal of dead wood and dead trees.

The Project will involve the clearing of native vegetation; however infrastructure has been sited to avoid woodland and forest areas, which have reduced the extent of clearing to less than approximately 1.90% of potential Rosenberg's Goanna habitat in the PA. Avoidance and mitigation measures will be adopted to minimise this clearing wherever possible.

Clearing of woodland and forest areas may involve impacts to dead wood and dead trees although these impacts are considered to be minimal. Where impacts to these habitat features may occur, dead wood and dead trees will be relocated outside of impact areas where avoidance is not possible. Therefore there will be no loss of these habitat features.

Conclusion

Potential impacts to the Rosenberg's Goanna resulting from the Project include habitat loss. This species was not recorded during the recent field surveys undertaken within the PA and therefore, if the species does occur, it is expected to occur in low numbers only. Infrastructure has been sited to avoid native woodland and forest areas, which contain areas with termite mounds, considered to be potential habitat for the Rosenberg's Goanna. Less than 1.90% of potential habitat within the PA for this species will be cleared as a result of the Project. Fragmentation of habitat associated with the proposed action is likely to be limited to the widening of existing tracks and other linear corridors (such as the road edge along one side of the Gouburn-Braidwood Road and the Kings Highway. The potential habitat within the Study Area is not unique and is widespread within the PA and locality. The level of clearance is considered unlikely to significantly change the connectivity of Rosenberg's Goanna habitat given the existing fragmentation of habitat within the PA. There is not anticipated to be a significant impact on this species as a result of the Project.

LITTLE WHIP SNAKE (Suta flagellum) – Vulnerable

Occurs in Natural Temperate Grasslands and grassy woodlands, including those dominated by Snow Gum *Eucalyptus pauciflora* or Yellow Box *E. melliodora*. Also occurs in secondary grasslands derived from clearing of woodlands. Found on well drained hillsides, mostly associated with scattered loose rocks (OEH 2015).

The species was not recorded during field surveys; however there are three records of the species within the locality from between 1996 and 1998. Areas of suitable habitat including grassy woodland and derived native grasslands were recorded within the PA, although areas of optimal habitat with loose rock within these habitats were uncommon. The potential impact to the Little Whip Snake resulting from the Project would be loss of habitat. Although not recorded during recent surveys, this species has been identified to have the potential to occur within the PA.

(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,*

If present within the PA this species is expected to utilise habitat such as grassy woodland and derived native grasslands although optimal habitat for this species which includes areas of scattered loose rock were uncommon within the PA, limited to discrete areas. The Project will result in impacts to approximately 48.40 ha (3.38%) of suitable habitats in the PA. The majority of this habitat is likely to be sub-optimal for the species and therefore this assessment is conservative. It is not anticipated that the Little Whip Snake will be significantly impacted by the loss of habitat as it represents a small proportion of the habitat present in the Study Area. The proposed action is unlikely to impact the life cycle of this species, such that a viable local population of this species will be placed at risk of extinction.

(b)	<i>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,</i>
Not applicable.	
(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
(i)	<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</i>
Not applicable.	
(ii)	<i>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,</i>
Not applicable.	
(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
(i)	<i>the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>
Potential habitat within the Study Area includes grassy woodland and derived native grasslands although optimal habitat for this species which includes areas of scattered loose rock were uncommon. The Project will result in impacts to approximately 48.40 ha (3.38%) of suitable habitats in the PA. The majority of this habitat is likely to be sub-optimal for the species.	
(ii)	<i>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</i>
Infrastructure has been largely located in cleared areas, and linear infrastructure has been located to follow existing roads and access tracks. Open grassland areas of the PA are widespread. The Little Whip Snake utilises a range of habitat types and as such it is considered unlikely that the project will result in the fragmentation or isolation of habitat for this species, especially considering the existing widespread fragmentation of habitat throughout the PA.	
(iii)	<i>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,</i>
Due to the limited areas of loose rock, the areas of habitat that may be impacted as part of the Project are not considered to provide optimal habitat for the Little Whip Snake. The habitat to be impacted within the Study Area is a small portion of the available habitat in the Study Area and further habitat exists within the PA. Given the abundance of similar habitat throughout the locality, the habitat within the PA is not considered important to the long term survival of the species.	
(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
Not applicable.	
(f)	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
Not applicable.	
(g)	<i>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.</i>

There are two Key Threatening Processes that are relevant to the Little Whip Snake:

- clearing of native vegetation; and
- bushrock removal.

The Project will involve the clearing of native vegetation, however infrastructure has been sited to avoid woodland areas and grassland areas of the PA are often dominated by non-native species. Areas of bushrock within the PA are limited and impacts to these areas are considered to be insignificant. First preference will be avoidance of areas of bushrock, where avoidance is not possible bushrock will be relocated outside of impact areas.

Conclusion

Potential impacts to the Little Whip Snake resulting from the Project include habitat loss. This species was not recorded during the recent field surveys undertaken within the PA. Infrastructure has been largely sited outside of areas of potential habitat for this species. The Project will result in impacts to approximately 48.40 ha (3.38%) of suitable habitats in the PA. The majority of this habitat is likely to be sub-optimal for the species. Optimal habitat for the Little Whip Snake, including areas of loose scattered rock, was an uncommon feature within the PA. It is considered unlikely that impacts to this species from the Project will significantly change the extent or connectivity of Little Whip Snake habitat given the extent of fragmentation of existing habitat within the PA and locality. There is not anticipated to be a significant impact on this species as a result of the Project.

BUTTERCUP DOUBLETAIL (*Diuris aequalis*) – Endangered

The Buttercup Doubletail 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 2015).

This species was recorded within the PA during recent field surveys. According to the NSW Wildlife Atlas there are an additional 10 records in the locality, dated between 1976 and 2011.

(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 known Buttercup Doubletail individuals will not be disturbed as part of the Project, and the nearest infrastructure (WTG 38) is located approximately 250 m from the known Buttercup Doubletail individuals. No clearing of known Buttercup Doubletail individuals will occur.

Potential impacts on the species' life cycle could result from indirect impacts, due to dust pollution, sediment runoff, weed invasion or pest invasion. Indirect impacts to known and potential habitat will be managed by:

- Installing signage around the known Buttercup Doubletail habitat to discourage unnecessary entry of personnel to the habitat;
- Implementing dust suppression measures (refer to Section 7.4.1); and
- Implementing weed management measures (refer to Section 7.4.1).

Pre-clearance surveys will be undertaken to identify any further individuals prior to clearing. If additional individuals are identified, these will be avoided where possible.

(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*

No clearing of known Buttercup Doubletail habitat is proposed. A small area of potential Doubletail Buttercup habitat (0.41 ha) is within the Development Footprint however this equates to only 0.65% of potential habitat in the Study Area.

Indirect impacts to known and potential habitat will be managed by:

- Installing signage around the known Buttercup Doubletail habitat to discourage unnecessary entry of personnel to the habitat;
- Implementing dust suppression measures (refer to Section 7.4.1); and
- Implementing weed management measures (refer to Section 7.4.1).

(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 known habitat for the species will not be disturbed by the Project. The Project will not fragment the known population, and fragmentation of potential habitat will be limited to clearing of access roads with a maximum width of 8 m. This is unlikely to affect seed dispersal or vegetative reproduction in plants.

	<i>(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,</i>
	There is 6.11 ha of known habitat for this species and 62.62 ha of potential habitat for this species in the Study Area. The Project will not remove any known habitat for the species, and only 0.41 ha (0.65%) of potential habitat for the species in the Study Area.
<i>(e)</i>	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	At the time of writing, critical habitat had not been listed for any of the threatened plants under Part 3 of the TSC Act.
<i>(f)</i>	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
<i>(g)</i>	<i>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.</i>
	There are no listings of Key Threatening Processes specifically acknowledge impacts to Buttercup Doubletail.
	<i>Conclusion</i>
	In consideration of the retention of known Buttercup Doubletail habitat, the removal of only 0.65% of potential Buttercup Doubletail habitat in the Study Area, and the management of indirect impacts to known and potential habitat, the Project is considered unlikely to significantly impact the Buttercup Doubletail.
BLACK GUM (<i>Eucalyptus aggregata</i>) - Vulnerable	
	Grows on alluvial soils, on cold, poorly-drained flats and hollows adjacent to creeks and small rivers. Often grows with other cold-adapted eucalypts, such as Snow Gum (<i>Eucalyptus pauciflora</i>), Ribbon Gum (<i>E. viminalis</i>), Candlebark (<i>E. rubida</i>), Black Sallee (<i>E. stellulata</i>) and Swamp Gum (<i>E. ovata</i>). Black Gum usually occurs in an open woodland formation with a grassy groundlayer dominated either by River Tussock (<i>Poa labillardierei</i>) or Kangaroo Grass (<i>Themeda australis</i>), but with few shrubs. Also occurs as isolated paddock trees in modified native or exotic pastures (OEH 2015). The species was not recorded during field surveys however there are six records of the species within the locality from between 1971 and 2010. Areas of potential habitat including open grassy woodland were recorded within the Study Area, although areas of optimal habitat along creek lines and poorly drained flats were not common within the Study Area. A comprehensive tree survey within the road reserve proposed to contain the 33 kV transmission line did not identify the species at this location.
<i>(a)</i>	<i>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,</i>
	The project is unlikely to adversely affect the life cycle of the species, as pre-clearance surveys will be conducted for all clearing activities and if this species is recorded it will be avoided where possible. The construction and operational impacts of the Project will not affect pollination or seed dispersal vectors for this species.
<i>(b)</i>	<i>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,</i>
	Not applicable.
<i>(c)</i>	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
	<i>(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</i>
	Not applicable.
	<i>(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,</i>
	Not applicable.

(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
(i)	<i>the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>
	Infrastructure has been sited to avoid woodland areas however some habitat loss will be unavoidable. The Project will result in impacts to approximately 4.55 ha of potential habitat for this species within the Study Area, equivalent to 5.02% of potential habitat in the Study Area. Due to the small proportion of habitat within the Study Area to be cleared, habitat loss/modification resulting from the Project is unlikely to significantly affect this species.
(ii)	<i>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</i>
	The Project will not fragment the known population, and fragmentation of potential habitat will be limited to clearing of access roads with a maximum width of 8 m. This is unlikely to affect seed dispersal or vegetative reproduction in plants.
(iii)	<i>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,</i>
	Due to the lack of habitat along watercourses and poorly drained flats, habitat for the Black Gum within the Study Area is considered sub-optimal. Field observations indicate that the quality of habitat to be retained within the Study Area is generally consistent with the quality of habitat to be removed from the Development Footprint. The habitat to be impacted is a small portion (approximately 5.02%) of the available habitat in the Study Area, therefore the potential habitat in the Development Footprint is not considered important to the long term survival of the species.
(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
(f)	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
(g)	<i>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.</i>
	There is one Key Threatening Process relevant to the Black Gum: • Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae. Washdown procedures will be undertaken to avoid potential introduction of exotic rust fungi.
	<i>Conclusion</i>
	In consideration of avoidance of any identified individuals through pre-clearance surveys, and the small area of potential habitat to be removed, the Project is considered unlikely to significantly impact this species.
BASALT PEPPER-CRESS (<i>Lepidium hyssopifolium</i>) – Endangered	
	Generally, the Basalt Pepper-cress is known to establish on open, bare ground with limited competition from other plants. The Basalt Pepper-cress has been recorded from Eucalypt woodland with a grassy ground cover, low open Casuarina woodland with a grassy ground cover, tussock grassland and exotic pasture. The species has been recorded in areas of high soil disturbance. Establishment of the species is thought to be disturbance-driven, as opposed to habitat specific. Soils at known sites are light to heavy clay loams that are often friable and the species is known to tolerate a range of environmental conditions (DoE 2015). The species has not been recorded within the PA, however the PA is within the species' distribution (DoE 2015), and areas of open, bare ground within the Study Area and around the proposed 33 kV transmission line alignment may provide suitable habitat
(a)	<i>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,</i>

	Basalt Pepper-cress, if occurring within the Study Area, could be affected by direct clearing. The Project will result in impacts to approximately 6.81 ha of potential habitat for this species within the Study Area, equivalent to 3.17% of the potential habitat within the Study Area. As the species is known to occur in areas of high soil disturbance (DoE 2015), the species may be able to persist in areas disturbed during construction. The species' presence in highly disturbed areas also directs that its life cycle is not significantly negatively affected by disturbance; therefore it could be reasonably asserted that a narrow, linear development such as this one would not negatively affect this species' lifecycle. It is unlikely that, if a local population exists, the population would be placed at risk of extinction by the Project activities.
(b)	<i>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,</i> Not applicable.
(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i> (i) <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</i> Not applicable. (ii) <i>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,</i> Not applicable.
(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i> (i) <i>the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i> The species occurs in open, bare ground within a range of habitat types. Therefore, clearing and ground disturbance resulting from the Project are unlikely to adversely affect potential habitat for the species. (ii) <i>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</i> The species occurs in open, bare ground within a range of habitat types. Therefore, clearing and ground disturbance resulting from the Project are unlikely to adversely affect potential habitat for the species. (iii) <i>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,</i> The species occurs in open, bare ground within a range of habitat types. The areas of land to be disturbed (including forest, woodland, shrubland and grassland) are not considered to be of importance to the species.
(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i> Not applicable.
(f)	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i> Not applicable.
(g)	<i>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.</i> There are two Key Threatening Processes that specifically acknowledge adverse impacts to the Basalt Peppercress. These are: • clearing of native vegetation; and • competition and grazing by the feral European Rabbit. The species may be affected by clearing of large areas of habitat. The Development Footprint covers a total area of 6.81 ha representing 3.17% of the potential habitat within the Study Area. The Study Area currently has a high abundance of the European Rabbit. The Project is unlikely to affect the European Rabbit population.

Conclusion

The Basalt Pepper-cress has not been recorded within the locality, however the Study Area may provide suitable habitat. As the species is known to occur in areas of high soil disturbance (DoE 2015), the species may be able to persist in areas disturbed during construction. The species' presence in highly disturbed areas also directs that its life cycle is not significantly negatively affected by disturbance; therefore it could be reasonably asserted that a narrow, linear development such as this one would negatively affect this species' lifecycle. It is unlikely that, if a local population exists, the population would be placed at risk of extinction by the Project activities.

AUSTRAL TOADFLAX (*Thesium australe*) - Vulnerable

In NSW, the Austral Toadflax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. The species is a root parasite that is often associated with Kangaroo Grass (*Themeda triandra*). In areas away from the coast the species occurs in grassland and grassy woodland (OEH 2015).

The species has not been recorded in the locality, however the Study Area is within the species' distribution and contains suitable habitat for the species.

(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 project is unlikely to adversely affect the life cycle of the species, as pre-clearance surveys will be conducted for all clearing activities and if this species is recorded it will be avoided where possible. The construction and operational impacts of the Project will not affect pollination or seed dispersal vectors for this species.

(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*

Impacts to potential habitat as a result of the Project include:

- removal of 6.07 ha of potential habitat (representing 5.25% of the potential habitat for this species in the Study Area); and
- Indirect impacts, due to dust pollution, sediment runoff, weed invasion or pest invasion.

Indirect impacts will be managed by implementing the dust suppression, erosion and sediment control, and weed and pest management measures outlined in Section 7.4.1.

(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. The proposed Project activities comprise linear infrastructure and as the Development Footprint has been designed to avoid areas of woodland, the proposed Project will not greatly exacerbate the fragmentation of habitat in the Study Area, PA or locality.

(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,*

As the species has not been recorded in the Study Area, despite targeted surveys, it is considered unlikely that the habitat is of high importance for the long-term survival of the species. Field surveys indicate that mapped habitat is uniform within each Vegetation Zone within the Development Footprint and in the Study Area surrounding. Therefore, it is not likely that the habitat for this species in the Development Footprint is important habitat in the context of the wider Study Area.

(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
(f)	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
(g)	<i>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.</i>
	There are four Key Threatening Processes specifically acknowledge impacts to Austral Toadflax: • clearing of native vegetation; • competition and grazing by the feral European rabbit; • invasion of native plant communities by exotic perennial grasses; and • loss and degradation of native plant and animal habitat by invasion of escaped garden plants. Infrastructure has been sited to minimise clearing of native vegetation. The PA currently has a high abundance of the European Rabbit, and the Project is unlikely to affect the European Rabbit population. Weed management practices will be implemented to avoid the invasion of non-native species. Additionally, regeneration of native flora in areas required to be temporarily cleared will be encouraged.
	<i>Conclusion</i>
	Due to the lack of records of the species, despite targeted surveys, the proposal to undertake pre-clearance surveys and avoid any threatened flora identified, and the large area of similar potential habitat to be retained, the Project is not likely to have a significant impact on this species.

WOODLAND FLORA

Few-seeded Bossiaea (*Bossiaea oligosperma*), Pale Pomaderris (*Pomaderris pallida*), Matted Bush-pea (*Pultenaea pedunculata*)

Few-Seeded Bossiaea (Bossiaea oligosperma) – Vulnerable

The Few-seeded Bossiaea occurs on stony slopes or ridges on sandstone in the Yerranderie area (Warragamba) and on loamy soil in low woodland in the Windellama area (TSSC 2008). It is locally abundant in the Windellama area (OEH 2015).

The species has not been recorded within the locality, however the Study Area is within the species' distribution and eucalypt woodland within the Study Area may provide suitable habitat.

Pale Pomaderris (Pomaderris pallida) – Endangered

The Pale Pomaderris occurs in 15 known populations across the ACT, Victoria and southern NSW (TSSC 2008). This species is found in dry open forest and shrub communities, associated with Brittle Gum (*Eucalyptus mannifera*) and Red Stringybark (*E. macrorhyncha*) or *Callitris* spp. Woodland (TSSC 2008). The species generally occurs on granite slopes, river slopes and hillsides.

The species has not been recorded within the Study Area, however there is one record, from 2008, within the locality.

Matted Bush-Pea (Pultenaea pedunculata) – Endangered

The Matted Bush-pea occurs in a range of habitats. NSW populations are generally among woodland vegetation but plants have also been found on road batters and coastal cliffs. Southern Tablelands populations are at 560-620 m ASL and on friable loam soils underlain by Tertiary basalt and Quaternary sediments. In the Windellama area on the Southern Tablelands, *P. pedunculata* generally grows in creek lines within grassy woodland dominated by Brittle Gum (*Eucalyptus mannifera*). Broad-leaved Peppermint (*E. dives*) and *E. gregsoniana* are also often present. A few populations occur within Scribbly Gum (*E. rossii*) – Red Stringybark (*E. macrorhyncha*) woodland (OEH 2015).

The species has not been recorded within the Study Area; however there are three records of the species, from the year 2000, within the locality.

(a)	<i>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,</i>
	Potential impacts to these woodland flora species include loss of potential habitat and direct mortality during clearing although none of the species were identified in field surveys. The project is unlikely to adversely affect the life cycle of the species, as pre-clearance surveys will be conducted for all clearing activities and if this species is recorded it will be avoided where possible. The construction and operational impacts of the Project will not affect pollination or seed dispersal vectors for this species.
(b)	<i>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,</i>
	Not applicable.
(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
	<i>(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</i>
	Not applicable.
	<i>(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,</i>
	Not applicable.
(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
	<i>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>

	Infrastructure has been sited to avoid clearing of native vegetation where possible, especially woodland patches. There is 223.64 ha of potential habitat for these species in the Study Area. The Project will require the removal of 1.86 ha of potential habitat for the species, representing 0.83% of potential habitat for this species in the Study Area. Due to the small proportion of habitat within the Study Area to be cleared, habitat loss/modification resulting from the Project is unlikely to significantly affect this species.
	<i>(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</i>
	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. The proposed Project activities comprise linear infrastructure and as the Development Footprint has been designed to avoid areas of woodland, the proposed Project will not greatly exacerbate the fragmentation in the Study Area, PA or locality. The Project comprises small and narrow linear elements spread across a wide area and as such, and as such, the scale and configuration of proposed clearing is unlikely to inhibit the dispersal of these woodland flora species, if present in the Study Area.
	<i>(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,</i>
	Field surveys indicate that mapped habitat is uniform within each Vegetation Zone within the Development Footprint and in the Study Area surrounding. Therefore, it is not likely that the habitat for this species in the Development Footprint is important habitat in the context of the Study Area and broader PA.
(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
(f)	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
(g)	<i>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.</i>
	There are two Key Threatening Processes that specifically acknowledge impacts to the Matted Bush-pea. These are: • clearing of native vegetation; and • infection of native plants by <i>Phytophthora cinnamomi</i>. The other threatened woodland flora species are not specifically identified although may also be adversely affected by these processes. The NSW Scientific Committee acknowledge that the Matted Bush-pea may be affected either by direct infestation of <i>P. cinnamomi</i> infestation, or associated degradation of habitat (NSW Scientific Committee 2002). Field surveys did not identify any locations suspected of being infested by <i>P. cinnamomi</i> within the PA. Measures will be implemented to prevent the introduction of <i>P. cinnamomi</i> and other soil borne diseases. These include: the use of clean fill materials and implementation of vehicle and machinery hygiene procedures.
	<i>Conclusion</i>
	Potential impacts to these woodland flora species include loss of potential habitat and direct mortality during clearing. Infrastructure has been sited to minimise clearing of habitat for these species, with only 0.83% of potential habitat for these species within the Study Area to be removed. These species have not been recorded within the Study Area, however pre-clearance vegetation surveys will be undertaken within the Development Footprint prior to clearing, and threatened species avoided where possible. In consideration of these factors, it is considered unlikely that the Project would have a significant impact on the Matted Bush-pea, Pale Pomaderris, or Few-seeded Bossiaea.

Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion (Endangered Ecological Community (EEC))

This EEC, commonly referred to as Tablelands Snow Gum Grassy Woodland, is an open-forest, woodland or open woodland. The main tree species are *Eucalyptus pauciflora* (Snow Gum), *E. rubida* (Candlebark), *E. stellulata* (Black Sallee) and *E. viminalis* (Ribbon Gum), either alone or in various combinations.

This EEC occurs in the Study Area as Snow Gum (*E. pauciflora*) and Ribbon Gum (*E. viminalis*) woodland along creeklines and adjacent floodplains. It is located along: Boro Creek, Reedy Creek (northern section of Study Area); and Manar Creek system (southern section of Study Area). The EEC occurs at numerous locations within the Goulburn-Braidwood Road and Kings Highway road reserves proposed to contain the 33 kV transmission line.

(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*

Project infrastructure has been sited to avoid native vegetation where possible. However, clearing of 4.70 ha (5.60%) of this EEC within the Study Area will be required. The impacts are generally linear in nature and where the EEC occurs in the Development Footprint, the linear clearing will remove an edge of the EEC rather than a large polygon. There will be EEC retained immediately adjacent to the clearing.

(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 areas of the EEC to be retained will not be modified. Clearing areas will be clearly delineated on the ground during construction to avoid disturbance to surrounding vegetation. Weed management measures and erosion and sediment controls measures will be applied to avoid impacts to surrounding vegetation. In consideration of these measures, the Project is unlikely to adversely modify the composition of the community to an extent that the occurrence of the EEC would 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*

Project infrastructure has been sited to avoid native vegetation where possible. However, clearing of 3.88 ha (5.09%) of this EEC within the Study Area will be required.

(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*

Clearing of up to 8 m corridors within the EEC will be required to accommodate access roads, and the 33 kV transmission line in the Goulburn-Braidwood Road and Kings Highway road reserves. This clearing will not ecologically fragment the EEC remnants. To manage the impacts of this clearing, the following measures will be undertaken:

- clearing areas will be clearly delineated to avoid disturbance to surrounding vegetation; and
- weed management measures and erosion and sediment controls measures will be applied to avoid impacts to surrounding vegetation.

(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 this EEC vegetation to be cleared is not thought to be higher than the large majority of this EEC that will remain in the adjacent Study Area. The ecological processes of the EEC will continue to operate following development and the Project is not likely to impede the long-term survival of the EEC in the locality.

(e)	<i>whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),</i>
	Not applicable.
(f)	<i>whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,</i>
	Not applicable.
(g)	<i>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.</i>
	The listings of Key Threatening Processes do not specifically acknowledge adverse impacts to this EEC.
	<i>Conclusion</i>
	The removal of 4.70 ha of this communities within the Study Area (5.60%) is unlikely to significantly impact this EEC.

White Box Yellow Box Blakely's Red Gum Woodland (Endangered Ecological Community)

The TSC Act listing for the EEC is characterised by areas currently or formerly dominated by White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) and/or Blakely's Red Gum (*E. blakelyi*). This EEC occurs throughout the Study Area in broad valley floors.

(a)	<i>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,</i>
	Not applicable.
(b)	<i>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,</i>
	Not applicable.
(c)	<i>in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</i>
	<i>(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</i>
	Project infrastructure has been sited to avoid native vegetation where possible. However, clearing of 2.19 ha of this community will be required. This is equivalent to 2.45% of the extent of the community in the Study Area and removal of this small proportion is unlikely to place the local occurrence at risk of extinction.
	<i>(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,</i>
	The construction of access roads and WTGs within this EEC has potential to alter the composition of the community through weed invasion. To minimise the risk of weed invasion, clearing areas will be clearly delineated to avoid disturbance to surrounding vegetation, and weed management and erosion and sediment controls measures will be applied to avoid impacts to surrounding vegetation. In consideration of these measures, the Project is unlikely to adversely modify the composition of the community to an extent that the occurrence of the EEC would be placed at risk of extinction.
(d)	<i>in relation to the habitat of a threatened species, population or ecological community:</i>
	<i>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and</i>
	Clearing of 2.19 ha of this community will be required. This is equivalent to 2.45% of the extent of the community in the Study Area and removal of this small proportion is unlikely to place the local occurrence at risk of extinction.
	<i>(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</i>

This EEC occurs in fragmented patches in the north and south of the PA, with one large area in the central part of the PA. Clearing for an access track (approximately 8 m wide) and WTGs will be required in the larger patch. This area currently contains narrow (approximately 4 m wide) access tracks. The clearing of additional access tracks is considered unlikely to inhibit the dispersal of plants throughout this patch of the EEC.

(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 this EEC vegetation to be cleared is not thought to be higher than the large majority of this EEC that will remain in the adjacent Study Area. The ecological processes of the EEC will continue to operate following development and the Project is not likely to impede the long-term survival of the EEC in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Not applicable.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Not applicable.

(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 listing of the Key Threatening Processes 'Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)' specifically acknowledges adverse impacts to this EEC. Feral pigs do occur within the PA, and signs of the Feral Pig were abundant in the south of the PA. The Project is unlikely affect the abundance of the Feral Pig in the PA.

Conclusion

Clearing of 2.19 ha of this community will be required. This is equivalent 2.45% of the extent of the community in the Study Area and is not considered to significantly impact this EEC. Mitigation measures are proposed to manage the risk of weed invasion or disturbance to vegetation to be retained.

Annex F

Seasonal Interim Ecology Report



Jupiter Wind Farm

Seasonal Interim Ecology Report

For EPYC Pty Ltd

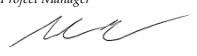
January 2014

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Jupiter Wind Farm

Seasonal Interim Ecology Report

Approved by:	Adam Coburn
Position:	Project Manager
Signed:	
Date:	20 January 2014
Approved by:	Steve Laister
Position:	Partner
Signed:	
Date:	20 January 2014

EPYC Pty Ltd

January 2014

Environmental Resources Management Australia Pty Ltd Quality System

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<i>TABLE 3.3</i>	<i>TOTAL AREA OF VEGETATION TYPES WITHIN STUDY AREA</i>	<i>11</i>

Environmental Resources Management Pty Ltd (ERM) undertook ecological field surveys in December 2013 within the Study Area for the proposed Jupiter Wind Farm (the Project). The field surveys focussed on identifying individuals and suitable habitat for the Golden Sun Moth (GSM) (*Synemon plana*). Within the areas surveyed for GSM, broad scale vegetation mapping was also undertaken.

1.1 BACKGROUND

1.1.1 Project Area

The Project Area (PA) comprises the areas within the boundaries of the properties that are involved with the Project (refer *Figure 1.1*). This area was assessed during the initial desktop investigations to identify candidate GSM habitat areas in accordance with the method described in *Section 2.1*.

1.1.2 Study Area

The Study Area comprises the areas that were considered to be candidate GSM habitat areas within the PA, which are identified within *Figure 3.1*. Areas of grassland within this boundary were targeted, along with native vegetation stands adjacent to and in the vicinity of such grasslands.

1.1.3 Purpose

The purpose of the surveys was to identify areas of potential habitat for the GSM in the Study Area. Where potential habitat was identified, and when weather conditions were suitable, targeted surveys for the GSM were undertaken to establish whether the species occurs in the Study Area.

A supplementary purpose of the surveys was to stratify the vegetation in the Study Area as part of initial vegetation mapping to identify preliminary vegetation types present and identify the potential presence of Endangered Ecological Communities (EECs) listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Threatened Ecological Communities (TECs) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.1.4 GSM

The GSM is listed as 'critically endangered' under the EPBC Act and 'endangered' under the TSC Act.

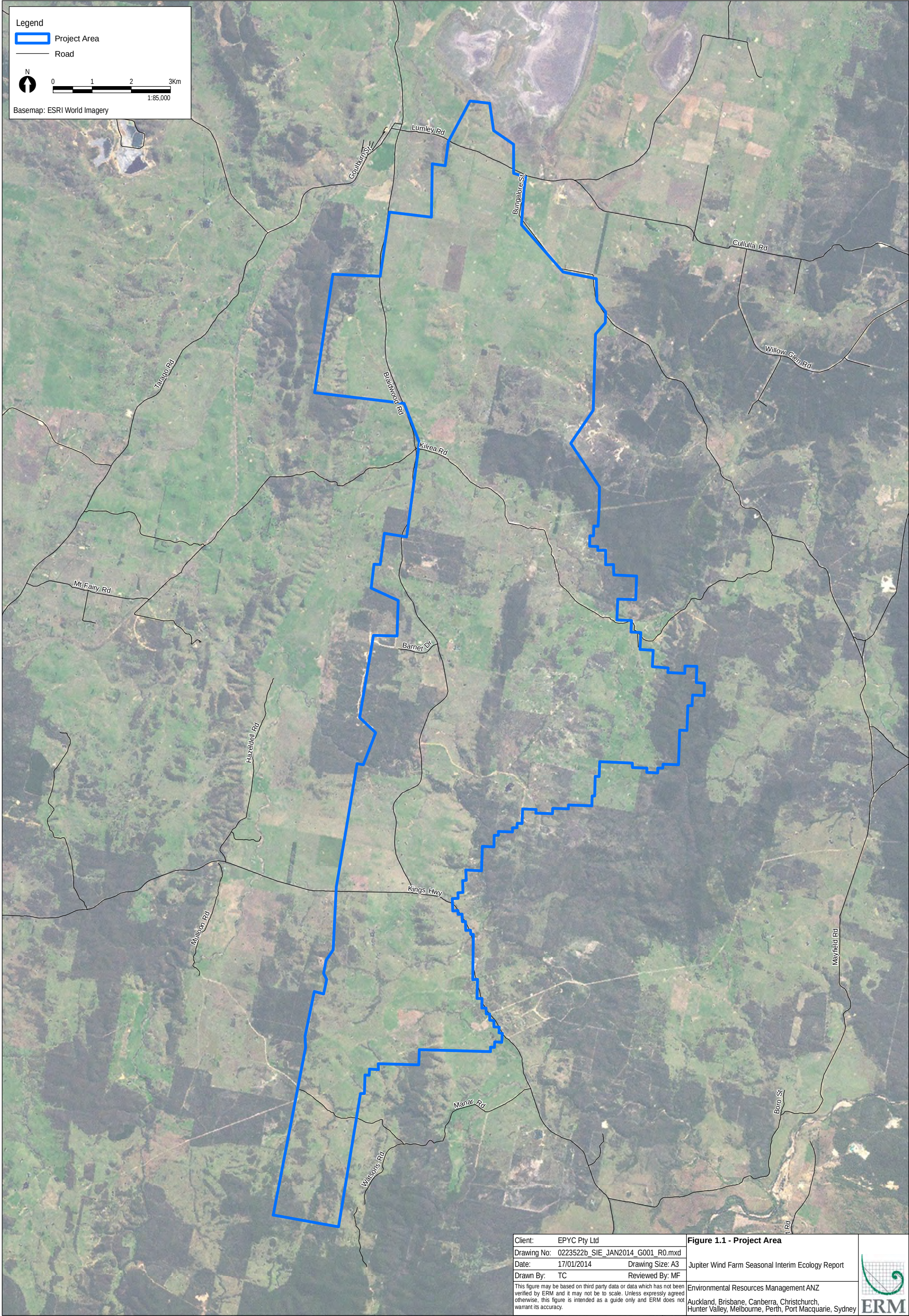
The GSM is found in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which the ground layer is dominated by Wallaby Grasses (*Rytidosperma* spp.). Other grasses that are typically associated with the species' habitat include Speargrasses (*Austrostipa* spp.) and Kangaroo Grass (*Themeda australis*). These grasslands are typically low and open with bare ground between the tussocks (OEH 2012a).

Optimal Survey Conditions

GSM surveys should coincide with the peak breeding period for the species, which is signalled by flying adult males and usually occurs between late October and early January (DEWHA 2009). However, GSM activity is also weather dependent and therefore, the weather conditions must be favourable to the species' activity and surveys should be undertaken during the hottest part of the day (ie between 10:00 and 14:00), when the following conditions occur at the site (DEWHA 2009):

- warm to hot day (above 20°C by 10:00);
- clear or mostly cloudless sky;
- still or relatively still wind conditions; and
- at least two days since rain.

Due to the variability of the timing of the flight season from year to year, known reference sites should be monitored for flying males to guide the survey timing at the site (DEWHA 2009).



2.1 GSM

The GSM habitat assessment was undertaken between 11 December 2013 and 13 December 2013. The field team comprised GSM and grasslands specialist: Tom O'Sullivan, and ERM ecologist: Tom Cotter.

A search of the NSW Wildlife Atlas was undertaken to identify previous records of GSM in the region.

Areas of grassland in the Study Area were initially identified and mapped through analysis of aerial photography. These areas were visited and assessed for their potential to provide habitat for the GSM. This involved identification of the following features:

- grassland species composition and diversity, particularly the presence of suitable host plants such as Wallaby Grasses and Speargrasses;
- site history and level of disturbance, eg whether the area has been ploughed;
- extent of bare ground between grass tussocks; and
- composition of adjacent vegetation.

GSM habitat was categorised according to the following definitions:

- **Optimal:** areas that comprise abundant host plants, spaces between grass tussocks and that are likely to be natural grasslands or derived from Box Gum Woodland;
- **Suitable:** areas that provide potential habitat for the species due to the presence of habitat features, such as abundant Wallaby Grasses;
- **Low Possibility:** areas that have limited habitat features. Factors such as historical land use and the limited extent of preferred grass species mean the potential for the species to occur in these areas is low; and
- **Unsuitable:** areas in which habitat features do not occur, such as exotic pasture or cropped areas.

The weather conditions during the field survey were suitable for GSM survey and within GSM flying season. Therefore, targeted surveys were conducted in areas that comprised native grassland and that were considered to provide potential habitat for the species. This comprised meandering transects through the area of potential habitat, with the aim of detecting flying males or flushing them out of the grass. This method also aims to detect females, eggs and pupal cases opportunistically by observing the areas between grass tussocks.

2.2

VEGETATION

Areas of native vegetation were visited and the dominant species in each stratum were recorded (ie the canopy, mid-storey and ground layer). The purpose was to provide a broad initial stratification of the vegetation in the Study Area to inform further vegetation surveys and therefore, vegetation plots were not sampled.

The species composition was used to determine the equivalent Biometric Vegetation Types (BVTs) in accordance with the Biometric Vegetation Types Database (OEH 2012b). The species composition was also used to determine if any of the vegetation in the Study Area comprises an EEC.

3 RESULTS

3.1 WEATHER CONDITIONS

The prevailing weather conditions during the survey period were obtained from the Bureau of Meteorology and are provided in *Table 3.1*. Temperature, wind and rainfall observations are from Goulburn Airport AWS (station 070330). Cloud and evaporation observations are from Goulburn TAFE (station 070263).

Table 3.1 *Weather Conditions*

Date	Temperature (°C)		Rain (mm)	Evaporation (mm)	Maximum Wind Gust		Cloud Cover (oktas*)	
	Min.	Max.			Direction	Speed	9am	3pm
11/12/2013	1.4	23.6	0	8	WNW	67	0	1
12/12/2013	3.6	26.5	0	8.2	W	44	1	1
13/12/2013	4.3	28.6	0	8	WSW	44	1	1

Source: Bureau of Meteorology

* note: 'oktas' are a measure of cloud cover where 0 = clear skies and 8 = completely overcast

Specific details of weather conditions in the Study Area at the time of the survey are provided in *Annex A*.

3.2 GSM

There are no previous records of GSM in the vicinity of the Study Area. All previous records in the Wildlife Atlas occur to the west of the Study Area, in and around Canberra. The closest records are approximately 50 km west of the Study Area.

GSMs were not observed in the Study Area, despite the weather conditions being suitable for flying males. No other evidence of the species presence was observed (ie females, eggs and pupal cases).

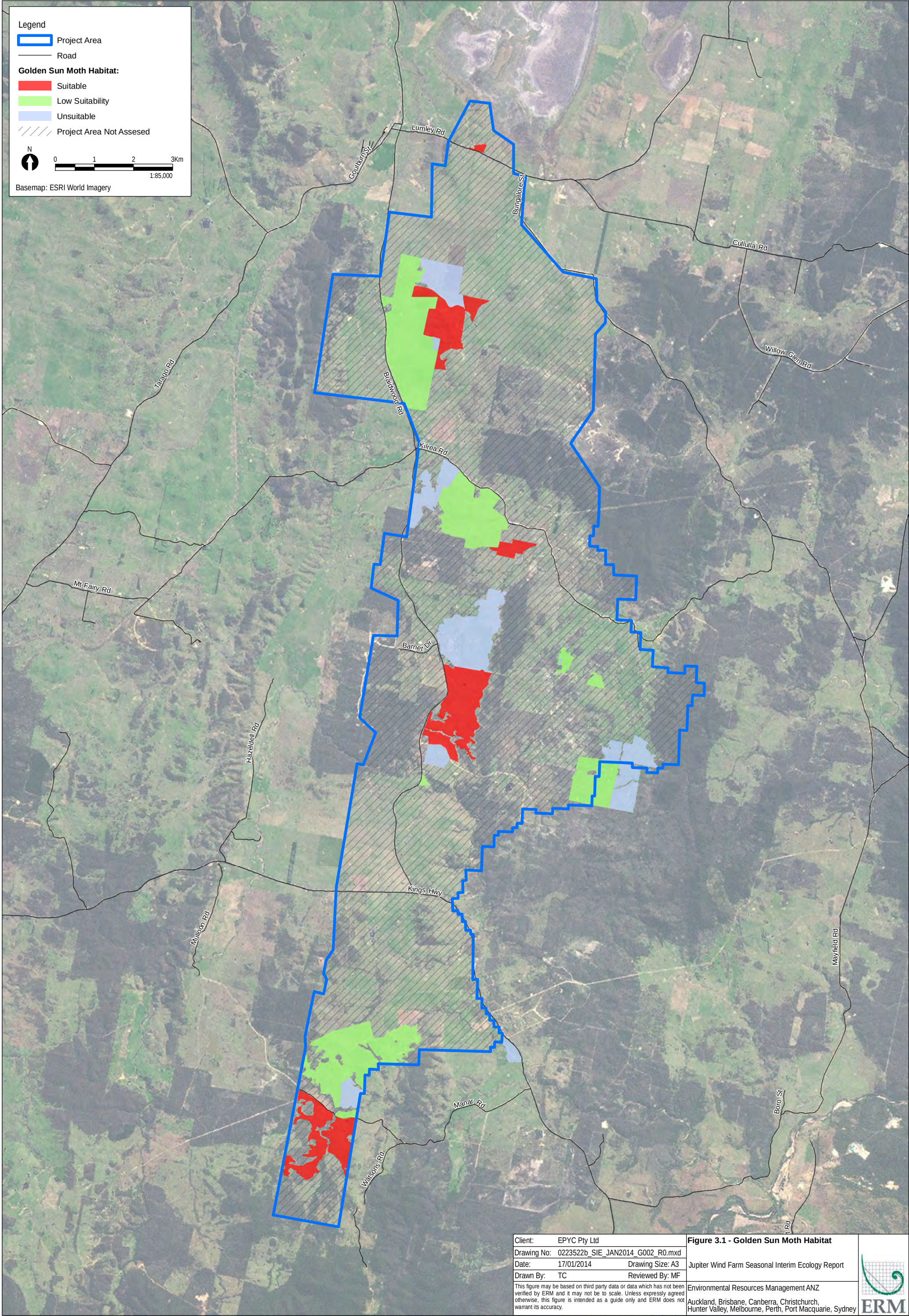
While there are no reference sites close to the Study Area, GSMs were observed flying at sites in and around Canberra throughout December (T. O'Sullivan and A. Rowell, *pers. comm.*, January 2014). These data are currently being collated.

3.2.1 Habitat Assessment

Investigation of the aerial imagery revealed patches of grassland throughout the Study Area, along with areas that have been cropped. These areas were mapped prior to the field surveys and the grassland areas targeted.

A total of 40 sites were assessed for their suitability for GSM habitat (refer *Figure 3.1*). While there were no areas that are considered 'Optimal' habitat

for the species, 13 of the sites are considered to comprise 'Suitable' habitat, 17 are considered to have a 'Low Possibility' of providing habitat and 10 are 'Unsuitable' for GSM. These areas are described in *Table 3.2* and are mapped in *Figure 3.1*.



Client:	EPYC Pty Ltd	Figure 3.1 - Golden Sun Moth Habitat
Drawing No:	0223522b_SIE_JAN2014_G002_R0.mxd	Jupiter Wind Farm Seasonal Interim Ecology Report
Date:	17/01/2014	Reviewed By: MF
Drawn By:	TC	Environmental Resources Management ANZ
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.		Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

Table 3.2 GSM Habitat Classification within Study Area

Habitat Type	Area in hectares (ha)	Description of Vegetation	Notes on Suitability for GSM
Suitable	560 ha		
Derived native grassland. The majority is derived from dry Eucalypt forest / woodland communities such as Brittle Gum (<i>Eucalyptus mannifera</i>) / Broad-leaved Peppermint (<i>E. dives</i>), or Snow Gum (<i>E. pauciflora</i>) Grassy Woodland. One site may be derived from Box Gum Woodland.		Moderate to high diversity of native species including grasses and forbs. Wallaby Grasses, Speargrasses, Weeping Grass (<i>Microlaena stipoides</i>), Wheat Grass (<i>Elymus scaber</i>), Lovegrass (<i>Eragrostis</i> sp.) <i>Poa</i> sp., Kangaroo Grass (<i>Themeda australis</i>), Chocolate Lily (<i>Dichopogon</i> sp.), Common Everlasting (<i>Chrysocephalum apiculatum</i>), Blue Devil (<i>Eryngium ovinum</i>), Blushing Bindweed (<i>Convolvulus erubescens</i>), Golden Weather-grass (<i>Hypoxis hygrometrica</i>), Yellow Autumn-lily (<i>Tricoryne elatior</i>) and Scaly Buttons (<i>Leptorhynchus squamatus</i>). Exotic species include Brome (<i>Bromus</i> spp.), Fescue (<i>Vulpia</i> sp.), Phalaris (<i>Phalaris aquatica</i>), Cocksfoot (<i>Dactylis glomerata</i>), Serrated Tussock (<i>Nassella trichotoma</i>) and Oats (<i>Avena</i> sp.).	High diversity of native species, however, the preferred habitat of GSM is grasslands derived from Box Gum Woodland. As such, while the native grass component would indicate this habitat is suitable for the species, the majority of these areas are not optimal habitat.
Native pasture. Likely derived from cleared Brittle Gum / Broad-leaved Peppermint Woodland or Snow Gum Grassy Woodland.		Low diversity of native species, dominated by grass species including Wallaby Grasses, Speargrasses and Weeping Grass. Catsear (<i>Hypochaeris radicata</i>) is an exotic species that commonly occurs throughout these areas.	The native grass component would indicate this habitat is suitable for the species, however, the majority of these areas are not optimal habitat as they may have been ploughed in the past. The grassland at the majority of sites are likely to be derived from areas previously vegetated with Brittle Gum / Broad-leaved Peppermint Woodland or Snow Gum Grassy Woodland.

Habitat Type	Area in hectares (ha)	Description of Vegetation	Notes on Suitability for GSM
Low Possibility	1037 ha		
Mixed native and exotic pasture		Low diversity of native species dominated by grasses including Wallaby Grasses and Speargrasses. Exotic pasture species include Brome, Fescue, Phalaris and Cocksfoot.	There is a low possibility that these areas could support GSM due to the presence of native grasses that are typically associated with the species’ habitat. However, these areas also comprise exotic species and are likely to have been sown with exotic pasture species for pasture improvement.
Sown and improved pasture with some Chilean Needlegrass (<i>Nassella neesiana</i>) present.		Dominated by exotic pasture species such as Phalaris, Cocksfoot, Brome, Fescue, Chilean Needle Grass, Barley (<i>Hordeum</i> sp.). Native grasses occur rarely.	This area is unlikely to support GSM, however, GSM have been recorded in areas where Chilean Needle Grass occur (DEWHA 2009).
Unsuitable	600 ha		
Sown and improved pasture with Chilean Needlegrass absent.		Dominated by exotic pasture species such as Phalaris, Cocksfoot, Brome, Fescue, Barley, Yorkshire Fog (<i>Holcus lanatus</i>).	These areas do not provide suitable habitat for GSM.
Cropped		Canola crop.	These areas do not provide suitable habitat for GSM.

3.3

VEGETATION

The vegetation in the Study Area has been stratified into six vegetation types. These are:

- cropping;
- native and exotic pasture mosaic;
- derived native grassland;
- Box Gum Woodland;
- Snow Gum Grassy Woodland; and
- Dry Eucalypt Woodland / Forest.

These are described in further detail below and are shown in *Figure 3.2*. *Table 3.3* identifies the total area of each vegetation type recorded within the Study Area.

Table 3.3 *Total area of vegetation types within Study Area*

Vegetation Type	Total hectares within study area
Derived Native Grassland	560 ha
Dry Eucalypt Forest	45 ha
Snow Gum Grassy Woodland	1485 ha
Native and Exotic Pasture Mosaic	152 ha
Crop	152 ha
Unidentified	17 ha

3.3.1

Cropping

Cropping refers to areas that have previously or are currently undergoing ploughing and cultivation of crops. The cropping observed in the Study Area was canola. Whilst predominantly given over to cultivation of crops, these areas can also 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. Cropping occurs as discrete scattered patches in the Study Area.

This vegetation community does not constitute an EEC under the TSC Act or the EPBC Act.

3.3.2 *Native and Exotic Pasture Mosaic*

These areas comprise a mix of native and exotic pasture in which the extent and dominance of native species varies in the patches of these mosaics throughout the Study Area. The diversity of native species is low and dominated by grasses. Native herbs are limited both in diversity and distribution. Common native species include Wallaby Grasses, Speargrasses, Poa and Weeping Grass. Exotic pasture species include Barley Grass, Phalaris, Brome, Cocksfoot and Yorkshire Fog.

The majority of the survey sites comprise this vegetation community and it occurs throughout the Study Area.

This vegetation community does not constitute an EEC under the TSC Act or the EPBC Act.

3.3.3 *Derived Native Grassland*

Derived native grasslands are areas where the majority of woody vegetation has been cleared, however, greater than 50% of the ground cover comprises indigenous grasses and herbs. The grasslands are derived from either Dry Eucalypt Woodland / Forest, Snow Gum Grassy Woodland or Box Gum Woodland. These areas have moderate to high diversity of native grasses and herbs. Common grasses include Wallaby Grasses, Speargrasses, Weeping Grass, Wheat Grass, Poa sp., Kangaroo Grass. Other native species that occur include Chocolate Lily, Common Everlasting, Blue Devil, Blushing Bindweed, Golden Weather-grass, Yellow Autumn-lily and Scaly Buttons. Derived native grassland occurs as scattered patches throughout the Study Area.

This vegetation community does not constitute an EEC under the TSC Act or the EPBC Act.

3.3.4 *Box Gum Woodland*

Areas mapped as Box Gum Woodland have a canopy dominated by Yellow Box (*Eucalyptus melliodora*). This vegetation community was only recorded as stands of scattered trees over a groundcover of native grasses and herbs. Its occurrence is highly restricted in the Study Area and it was only recorded at one location.

This vegetation community is likely to constitute an EEC listed under the TSC Act: White Box Yellow Box Blakely's Red Gum Woodland. Native grasslands derived from this community are considered to also constitute the EEC. It may also constitute TEC: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (listed as Critically Endangered).

3.3.5

Snow Gum Grassy Woodland

Areas mapped as Snow Gum Grassy Woodland have a canopy dominated by Snow Gum (*Eucalyptus pauciflora*). The Snow Gum Grassy Woodland stands are reduced to scattered small stands of Snow Gums over a groundcover comprised of native grasses, native herbs and exotic pasture species.

The occurrence of this vegetation community is restricted to small scattered patches and narrow corridors along creeklines. However, some of the native grasslands in the Study Area are likely to be derived from this community.

This vegetation community may constitute an EEC listed under the TSC Act: Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions. It is noted that native grasslands derived from this community are considered to also constitute the EEC.

3.3.6

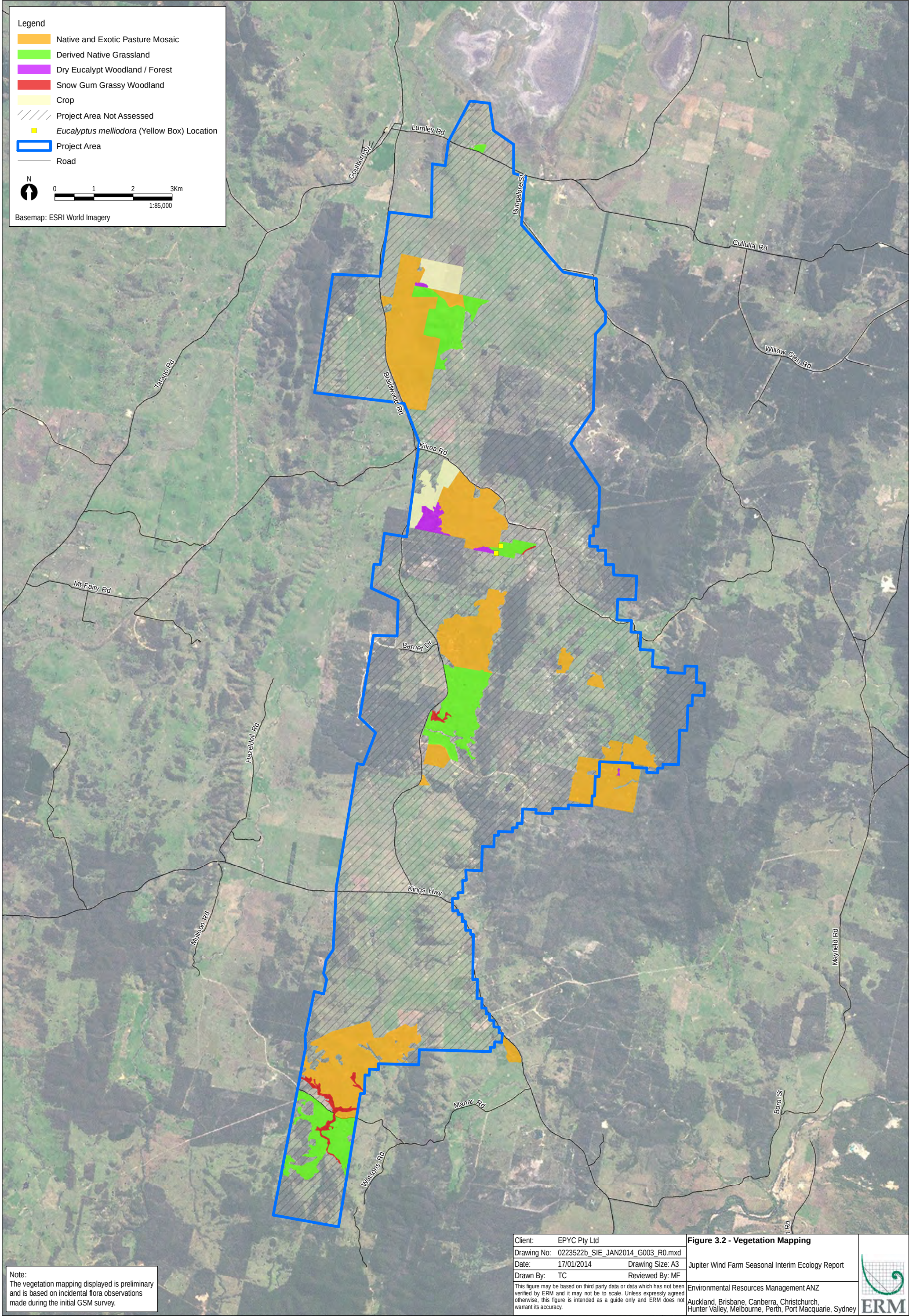
Dry Eucalypt Forest / Woodland

Areas mapped as Dry Eucalypt Forest / Woodland have a canopy dominated by Brittle Gum and Broad-leaved Peppermint. Other canopy species include Red Stringybark (*Eucalyptus macrorhynca*) and Scribbly Gum (*Eucalyptus rossii*).

This vegetation community was observed in the northern half of the Study Area. Prior to clearing, it is likely that this community was once widespread throughout the Study Area and that the majority of native grasslands are likely to be derived from it. This has been determined through identifying the remaining paddock trees and the landscape characteristics of these areas.

It is likely that when detailed vegetation mapping is undertaken for the Study Area, this vegetation community will be determined as the equivalent of more than one BVT.

This vegetation community does not constitute an EEC under the TSC Act or the EPBC Act.



4.1

GSM

Sections of the Study Area comprise groundcover that would normally be considered suitable for GSM. However, most of the original woody vegetation is likely to have been Snow Gum Grassy Woodland or Dry Eucalypt Forest / Woodland. Grasslands derived from these vegetation communities do not typically support GSM (T. O'Sullivan pers. comm. December 2013). This may be a result of the environmental and landscape characteristics of these vegetation types being unfavourable for GSM, eg areas prone to frost or areas where water and nutrients are scarce.

There are no previous records of GSM in the vicinity of the Study Area and the Study Area is not within the mapped known or predicted distribution area (OEI 2012a).

It is not possible to conclude that the GSM is absent from the Study Area based on one site visit. It is however considered that the likelihood of the species occurring in the Study Area is reduced due to the Study Area consisting of grasslands that are likely derived from unsuitable vegetation types, and is further supported by the lack of any GSM observations under suitable conditions during the flight season.

4.2

VEGETATION

The results of the preliminary vegetation mapping indicate that the majority of the woody native vegetation in the Study Area comprises dry Eucalypt forest and /or woodland and that large sections of the grasslands are derived native grasslands in areas that would have once supported this vegetation community. This vegetation does not comprise an EEC. More detailed vegetation mapping will be required to accurately define this vegetation community and determine the equivalent BVT.

The Snow Gum Grassy Woodland and Box Gum Woodland are likely to comprise EECs, as described in *Sections 3.3.4 and 3.3.5*. Areas of native grassland derived from these communities may also comprise the EEC. Further detailed vegetation mapping will be required to accurately define these communities in accordance with the Biometric Vegetation Types Database and also to confirm the legislative status of the vegetation communities.

RECOMMENDATIONS

A number of recommendations have been developed, aimed at adequately addressing the ecological impact assessment requirements associated with the Project, particularly the Director General's Requirements (once received for the Project):

- Meet with and provide a copy of this report to OEHL to discuss its findings and the merits of undertaking further targeted GSM surveys in the next flying seasons;
- Depending on the outcome of a meeting with OEHL, an additional survey of the areas of 'Suitable' GSM habitat may be required at the peak of the GSM season. The exact timing for this varies from year to year, however, it is usually late October or November;
- obtain GSM observation data from other surveys in the region when it is collated. If other surveys detected GSM activity on the days surveyed for this report, it provides further evidence that the species is unlikely to occur in the Study Area;
- refine the vegetation mapping of the Study Area through detailed surveys, including sampling of vegetation plots to confirm the BVTs that occur and confirmation whether any vegetation constitutes EECs or TECs and the areas concerned; and
- the evolution of the Project layout take account of the location of the 'Suitable' GSM habitat and vegetation that is likely to constitute EECs or TECs and apply the first principle of the mitigation hierarchy, ie avoidance.

The results of the December 2013 field surveys indicate that parts of the Study Area may provide habitat for the GSM. However, it is considered unlikely that GSMs occur within the Study Area as the area largely lacks the vegetation associations in which GSMs are typically recorded. Furthermore, the species was not observed during field surveys and there are no previous records in the vicinity of the Study Area. Further surveys during the peak of the 2014 season will help confirm whether the species is present in the Study Area. In this regard we would recommend that OEHL be consulted to discuss the merits of undertaking additional targeted surveys in light of the most recent habitat assessment and surveys in December 2013.

Areas of Snow Gum Grassy Woodland and Box Gum Woodland are likely to comprise EECs listed under the TSC Act and the evolution of the project layout should seek to avoid these areas or minimise intrusion into them.

Further vegetation surveys will be required to refine the vegetation mapping of the Study Area.

REFERENCES

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<http://www.bom.gov.au/nsw/observations/map.shtml>

Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009) **Significant Impact Guidelines for the Critically Endangered GSM (*Synemon plana*)**. Available online:
<http://www.environment.gov.au/system/files/resources/b945f32e-3f75-4739-a793-9f672893f3bb/files/golden-sun-moth.pdf>

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<http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10791>

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<http://www.environment.nsw.gov.au/biobanking/vegtypedatabase.htm>

Annex A

Survey Data

Location	Turbine Site ID	Waypoint	Property	Date	Time Start	Time Finish	Site Description	Altitude	Easting	Northing	No. of GSM	Vegetation	Veg description	Veg Description No	Conditions	Photo	Notes
590 Manar Rd. Sth side of Manar Rd.				11/12/2013	10:50	12:20	Rolling hills & riparian edges		658286	6150107	-	Suitable	Mixed pasture - ranging from low diversity native pasture (<i>Rytidosperma</i> spp., <i>Microlaena stipoides</i> , <i>Elymus scaber</i> , <i>Austrostipa</i> spp., <i>Eragrostis</i> sp. <i>Poa</i> sp., <i>Bromus</i> spp., <i>Vulpia</i> sp., <i>Phalaris aquatica</i> , <i>Dactylis glomerata</i> , <i>Nassella trichotoma</i>) Avena sp. and moderate to high diversity secondary grassland including the native grasses and <i>Themeda australis</i> , <i>Dichopogon</i> sp., <i>Chryscephalum apiculatum</i> , <i>Eryngium ovinum</i> .	1	22 C; wind 10-20 km/hr; full sun; cloud 0/8	83-85	Remaining woodland comprises dry forest/woodland community and Snow Gum Grassy Woodland. Not typical GSM habitat
590 Manar Rd. Nth side of Manar Rd. to creekline (WP 070)				11/12/2013	12:30	12:50	Rolling hills, riparian edges				-	Possible but low	Native pasture low diversity - <i>Microlaena stipoides</i> , <i>Vulpia</i> sp., <i>Elymus scaber</i> , <i>Rytidosperma</i> spp., <i>Austrostipa</i> spp., <i>Bromus</i> sp., <i>Chloris truncata</i> , <i>Carex breviculmis</i> , <i>Carex</i> sp., <i>Juncus</i> sp., <i>Cynodon dactylon</i>	2	24 C; wind 30 km/hr; full sun; cloud 1/8	82	Paddock heavily grassed more so than paddocks south of Manar Rd.
	J 169		Kate's Property	11/12/2013	14:30						-	Possible but low	Mixed pasture low diversity - <i>Rytidosperma</i> spp. <i>Austrostipa densiflora</i> , <i>Austrostipa</i> sp., <i>Elymus scaber</i> , <i>Microlaena stipoides</i> , <i>Poa</i> sp., <i>Hypochaeris radicata</i> , <i>Tricoryne elatior</i> , <i>Dichopogon</i> sp., <i>Lachnagrostis</i> sp.,		24-25 C; wind 30-40 km/hr; full sun; cloud 1/8	85	
	J 171			11/12/2013	15:20						-	Suitable	Poor groundcover - <i>Hordeum</i> sp., <i>Marrubium vulgare</i> , <i>Microlaena stipoides</i> , <i>Modiola caroliniana</i> , <i>Bromus</i> sp.,		24 C; wind 30-40 km/hr; full sun; cloud 28	86	very degraded, sheep camp
	J 171											Possible but low			24 C; wind 30-40 km/hr; full sun; cloud 28	87*	*Photo 87 looking Sth to 86
	J 171			11/12/2013		16:45			746290	6102681	-	Mixed	*Photo 88 - Foreground (see co-ordinates) potential habitat <i>Austrostipa</i> spp., <i>Rytidosperma</i> sp., <i>Microlaena stipoides</i> , <i>Themeda australis</i> , <i>Elymus scaber</i> , <i>Bromus</i> sp., <i>Hypochaeris radicata</i> Background not typical habitat <i>Microlaena stipoides</i> dominant, <i>Hordeum</i> sp., <i>Elymus scaber</i> , <i>Vulpia</i> sp., <i>Poa</i> sp., <i>Bromus</i> sp., <i>Lolium perenne</i> .		24 C; wind 30-40 km/hr; full sun; cloud 28	88*	
Goulburn Road				12/12/2013	8:30												Accessed wrong property situated Nth of 1644 Goulburn Rd (Winston's Property). Owner became quite agitated.
1644 Goulburn Rd.	J 124 & J 123	WP 035	Winston's Property	12/12/2013	10:30							Possible but low	Mixed pasture - <i>Bromus</i> sp., <i>Phalaris aquatica</i> , <i>Dactylis glomerata</i> , <i>Rytidosperma</i> spp., <i>Poa</i> sp., <i>Austrostipa</i> spp., <i>Hypochaeris radicata</i> , <i>Carthamus lanatus</i>		19 C; light wind; full sun; cloud 1/8		
1644 Goulburn Rd.		WP 036		12/12/2013	10:35							Possible but low	Mixed pasture - <i>Rytidosperma</i> spp., <i>Austrostipa</i> spp., <i>Vulpia</i> sp., <i>Phalaris aquatica</i> , <i>Bromus</i> sp., <i>Dactylis glomerata</i>		21-22 C; wind 10-15 km/hr; full sun; cloud 1/8		
1644 Goulburn Rd.		WP 037		12/12/2013	10:40								Mixed pasture <i>Vulpia</i> sp., <i>Hypochaeris radicata</i> , <i>Bromus</i> sp., <i>Dactylis glomerata</i> . Low abundance of <i>Rytidosperma</i> sp. and <i>Austrostipa</i> sp.		23 C; wind 10 km/hr; full sun; cloud 1/8		
1644 Goulburn Rd.		WP 038		12/12/2013	10:45							Possible but low	Mixed pasture - <i>Holcus</i> sp., <i>Bromus</i> sp., <i>Phalaris aquatica</i> , <i>Hypochaeris radicata</i> , <i>Cynosurus echinatus</i> , <i>Carthamus lanatus</i> , <i>Rytidosperma</i> spp., <i>Austrostipa</i> spp.		24-25 C; wind 10 km/hr; full sun; cloud 1/8	89	
1644 Goulburn Rd.		WP 039		12/12/2013			Hill top				-	Not suitable	Sown pasture - <i>Phalaris aquatica</i> , <i>Dactylis glomerata</i>		24-25 C; wind 10 km/hr; full sun; cloud 1/8		
Paddock E. of WP 039		(WP 039)		12/12/2013							-	Suitable	Native pasture - <i>Rytidosperma</i> spp., <i>Austrostipa</i> spp., <i>Austrostipa densiflora</i> , <i>Vulpia</i> sp., <i>Hordeum</i> sp., <i>Hypochaeris radicata</i> .		24 C; light wind; full sun; cloud 1/8	90	Paddock to W. (R. of frame 90) not suitable. Paddock to E. (L. or frame 90) suitable.
		WP 041		12/12/2013							-	Suitable	Native pasture - <i>Rytidosperma</i> spp., <i>Austrostipa</i> spp., <i>Austrostipa densiflora</i> , <i>Hypochaeris radicata</i> .		24 C; light wind; full sun; cloud 1/8		
Paddock E. of WP 042		(WP 042)		12/12/2013							-	Suitable	Native pasture - <i>Rytidosperma</i> spp., <i>Austrostipa</i> spp.,		24 C; light wind; full sun; cloud 1/8		
N. of drainage gully		WP 043		12/12/2013							-	Not suitable	Sown pasture - <i>Dactylis glomerata</i> , <i>Phalaris aquatica</i>		24 C; light wind; full sun; cloud 1/8		
Paddock N. of WP 044		WP 044		12/12/2013	11:35						-	Not suitable	Non-native pasture - <i>Lolium perenne</i> + other non-native pasture grasses		24 C; wind 10 km/hr; full sun; cloud 1/8		Formerly Brittle Gum / Broad-leaf Peppermint woodland
N & S of WP 045		(WP 045)		12/12/2013							-	Possible but low	Mixed pasture - <i>Phalaris aquatica</i> , <i>Holcus</i> sp., <i>Rytidosperma</i> spp., <i>Austrostipa</i> sp., <i>Poa</i> sp., <i>Juncus</i> sp.		25 C; wind 10 km/hr; full sun; cloud 1/8		
	J 77			12/12/2013							-	Suitable	*Native pasture - <i>Rytidosperma</i> spp., <i>Austrostipa</i> sp., <i>Microlaena stipoides</i> , <i>Hordeum</i> sp., <i>Bromus</i> sp.		26 C; wind 10-20 km/hr; full sun; cloud 1/8	91	* Paddock immediately N. of Lumley Rd. No access to paddocks further N. nearer to Lake Bathurst.
Peter Brooke - Property 1108				12/12/2013	14:10						-	Not suitable	*Cropped - canola		26 C; wind 10-20 km/hr; full sun; cloud 1/8		*Not suitable from Goulburn Rd. to farm shed - all cropped.
Peter Brooke - Property 1108				12/12/2013							-	Possible but low			26 C; wind 10-20 km/hr; full sun; cloud 1/8		Paddocks E. of shed contain native pasture derived from Brittle Gum Woodland.
Chris Cremer	J 140	WP 049		12/12/2013	15:15						-	Suitable	Moderate to high diversity native pasture secondary grassland - <i>Themeda australis</i> , <i>Rytidosperma</i> spp., <i>Austrostipa</i> spp., <i>Microlaena stipoides</i> , <i>Chryscephalum apiculatum</i> , <i>Convolvulus erubescens</i> , <i>Poa</i> sp., <i>Hypoxis hygometrica</i> , <i>Leptorhynchus squamatus</i> , <i>Vulpia</i> sp., <i>Hypochaeris radicata</i>		26 C; wind 10-15 km/hr; full sun; cloud 1/8	92	

Location	Turbine Site ID	Waypoint	Property	Date	Time Start	Time Finish	Site Description	Altitude	Easting	Northing	No. of GSM	Vegetation	Veg description	Veg Description No	Conditions	Photo	Notes
		WP 052		12/12/2013	15:40						-	Suitable	*Mixed grassland moderate diversity - <i>Austrostipa</i> sp., <i>Themeda australis</i> , <i>Rytidosperma</i> spp., <i>Chrysocephalum apiculatum</i> , <i>Vulpia</i> sp., <i>Poa</i> sp., <i>Juncus</i> sp., <i>Hypochaeris radicata</i> .		25 C; wind 10-20 km/hr; full sun; cloud 1/8		* Secondary grassland derieved from Snow Gum Grassy Woodland
Ian ?	J 49			12/12/2013	17:00						-	Suitable	*Moderate to high diversity native pasture secondary grassland - <i>Themeda australis</i> , <i>Rytidosperma</i> spp., <i>Austrostipa</i> spp., <i>Chrysocephalum apiculatum</i> , <i>Chloris truncata</i> , <i>Microlaena stipoides</i> , <i>Elymus scaber</i> , <i>Vulpia</i> sp.		26 C; wind 10-20 km/hr; full sun; cloud 0/8	94 & 95	* Probably secondary grassland derived from Snow Gum Grassy Woodland along drainage channel and Brittle Gum Woodland on elevated areas
Brooke	J 44	WP 057		12/12/2013	17:30						-	Possible but low	Mix of sown pasture and native pasture - <i>Rytidosperma</i> spp., <i>Austrostipa densiflora</i> , <i>Austrostipa</i> spp., <i>Microlaena stipoides</i> , <i>Hypochaeris radicata</i> .		24 C; wind 10-20 km/hr; full sun; cloud 0/8		Variable range from sown to native pasture probably improved.
Brooke	J 44	(WP 057)		12/12/2013		18:30					-	Suitable	* Native pasture secondary grassland <i>Themeda australis</i> , <i>Rytidosperma</i> sp., <i>Chrysocephalum apiculatum</i>		24 C; wind 10-20 km/hr; full sun; cloud 0/8		*Secondary grassland possibly derived from Box Gum Grassy Woodland
350 Goulburn Rd, Sth Paddock	J 79	WP 061		13/12/2013	9:00						-	Possible but low*	Pasture improved and sown - <i>Nassella nessiana</i> , <i>Phalaris aquatica</i> , <i>Dactylis glomerata</i> , <i>Bromus</i> sp., <i>Vulpia</i> sp., <i>Hypochaeris radicata</i> , <i>Avena</i> sp., <i>Acetosella vulgaris</i> , <i>Hordeum</i> sp. <i>Nassella trichotoma</i> . Some areas contain native pasture but generally limited - <i>Rytidosperma</i> sp., <i>Austrostipa</i> spp., <i>Poa</i> sp., <i>Microlaena stipoides</i> , <i>Themeda australis</i> .		18 C; wind light; full sun; cloud 0/8	96**	* Possible due to presence of N. nessiana otherwise limited habitat. **Photo 96 looking Nth. highly modified vegetation
Chris Cremer, Paddock to Sth off Duckfield Rd.	J 140			13/12/2013	9:45						-	Suitable	Native pasture - <i>Rytidosperma</i> spp., <i>Austrostipa bigeniculata</i> , <i>Austrostipa densiflora</i> , <i>Nassella nessiana</i> (low), <i>Microlaena stipoides</i> , <i>Hypochaeris radicata</i> , <i>Poa</i> sp., <i>Themeda australis</i> , <i>Briza maxima</i> , <i>Elymus scaber</i>		20 C; wind light; full sun; cloud 0/8	97	
Nth paddock along Duckfield Rd.	J 79	WP 063		13/12/2013	10:00						-	Not suitable	Pasture improved and probably sown - <i>Phalaris aquatica</i> , <i>Holcus lanatus</i> , <i>Vulpia</i> sp., <i>Bromus</i> sp.		20 C; wind light; full sun; cloud 0/8		
Branxton Park, W. paddocks				13/12/2013	11:00		Low lying				-	Not suitable	Sown & pasture improved		21 C; wind 10-15 km/hr; full sun; cloud 1/8		
Branxton Park, Sth paddocks		WP 064		13/12/2013	11:10		Rocky rises & low slopes				-	Suitable (in part)	Native pasture moderate diversity - <i>Rytidosperma</i> spp., <i>Austrostipa bigeniculata</i> , <i>Austrostipa densiflora</i> , <i>Nassella nessiana</i> (low), <i>Microlaena stipoides</i> , <i>Hypochaeris radicata</i> , <i>Poa</i> sp., <i>Themeda australis</i> , <i>Briza maxima</i> , <i>Elymus scaber</i>		21 C; wind 10-15 km/hr; full sun; cloud 1/8		
Branxton Park, Nth paddocks		WP 066		13/12/2013	11:20		Low rolling hills				-	Not suitable	Paddocks non-native pasture. Rock areas contain native grassy cover including <i>Rytidosperma</i> sp., <i>Austrostipa</i> sp., <i>Elymus scaber</i> , <i>Hordeum</i> sp., <i>Vulpia</i> sp., <i>Convolvulus erubescens</i> , <i>Microlaena stipoides</i> , <i>Eragrostis curvula</i> , <i>Circum vulgare</i> , <i>Echium</i> sp., <i>Chrysocephalum apiculatum</i> , <i>Bothriochloa macra</i> .		21 C; wind 10-15 km/hr; full sun; cloud 1/8	98	Rocky areas are small and do not constitute a large area of habitat.
	J 175			13/12/2013	12:25						-	Possible but low	Native pasture - <i>Elymus scaber</i> , <i>Rytidosperma</i> sp., <i>Tricoryne elatior</i> , <i>Vulpia</i> sp., <i>Hypochaeris radicata</i>		28 C; wind light; full sun; cloud 0/8	99	
	J 177	WP 067		13/12/2013	12:30						-	Possible but low	Native pasture low diversity - <i>Elymus scaber</i> , <i>Microlaena stipoides</i> , <i>Austrostipa densiflora</i> , <i>Austrostipa</i> sp., <i>Vulpia</i> sp., <i>Acetosella vulgaris</i> , <i>Hypochaeris radicata</i> , <i>Bromus</i> sp., <i>Juncus</i> sp., <i>Rytidosperma</i> sp.		28 C; wind light; full sun; cloud 0/8	100	
	J 175	WP 068		13/12/2013	13:00						-	Possible but low	Paddock to E. possible <i>Rytidosperma</i> sp., <i>Themeda</i> , <i>Vulpia</i> sp., <i>Hypochaeris radicata</i> (yellow in frame), <i>Dichopogon</i> sp.		28 C; wind light; full sun; cloud 0/8	101*	* Photo - view to E from Lower Boro Road
				13/12/2013								Not suitable	Paddock to W. not suitable sown <i>Dactylis glomerata</i> and <i>Phalaris aquatica</i>		28 C; wind light; full sun; cloud 0/8	102*	* Photo - view to W from Lower Boro Road
S. of WP 068	J 166			13/12/2013	13:10						-	Possible but low	Native pasture low diversity - <i>Rytidosperma</i> spp., <i>Austrostipa</i> spp.		28 C; wind light; full sun; cloud 0/8		Previously Brittle Gum Dry Forest
Sth of Kings Hwy	J 129	WP 069		13/12/2013	13:35						-	Not suitable	Paddock immediately S. of Kings Hwy sown - <i>Phalaris</i> ? and some <i>Austrostipa</i> sp. and <i>Rytidosperma</i> sp. Valley further S. also appears to have been sown.		28 C; wind 10-20 km/hr; full sun; cloud 0/8	103	NO ACCESS
	J 119	WP 073		13/12/2013	14:30						-	Possible but low	Native pasture low diversity - <i>Rytidosperma</i> spp., <i>Austrostipa</i> spp., <i>Juncus</i> sp., <i>Lolium perenne</i> , <i>Hordeum</i> sp.			104	
	J 119	WP 075		13/12/2013							-	Not suitable	Mixed pasture, mostly non-native				
Area between WP 073 & WP 075	J 119			13/12/2013							-	Possible but low	Mixed pasture				
WP 075 to WP 070 (Creek line)	J 119			13/12/2013		16:00					-	Not suitable	Non-native pasture - <i>Phalaris aquatica</i> , <i>Dactylis glomerata</i> , <i>Bromus</i> sp., <i>Austrostipa</i> spp., <i>Holcus lanatus</i>				
Total GSM												0					

Summary: some areas contained groundcover that would normally be considered suitable for GSM. However, most of the former vegetation appears to have been either SGGW or Dry Sclerophyll woodland (i.e. Brittle Gum/Broad-leaf Peppermint) with smaller components of BGGW in the north. While it is not possible to conclude an absence of GSM on the basis of a once off site visit, the former vegetation types and lack of any GSM observation under suitable conditions and during the current flight season suggest a low probability of occurrence.

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Annex G

Biodiversity Offset Report



Jupiter Wind Farm Ecology Assessment

Offsets Report

For EPHYC Pty Ltd

June 2016

0223522_Annex G_v03

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Jupiter Wind Farm Ecology Assessment

Offsets Report

EPYC Pty Ltd

June 2016

0223522_Annex G_v03

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Approved by:	Matthew Flower
Position:	Senior Ecologist
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Date:	24 June 2016
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Environmental Resources Management Australia Pty Ltd Quality System

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BACKGROUND

EPYC Pty. Ltd (EPYC), hereafter referred to as the Proponent, is seeking approval to construct and operate the Jupiter Wind Farm near the township of Tarago in the Southern Tablelands Region of New South Wales (NSW) (the Project).

The Ecological Assessment has identified threatened matters, as well as general ecological values of the Study Area within the Project Area, and through iterative design process with the Proponent avoided impacts where possible and identified management measures to minimise potential impacts. In consideration of the implementation of mitigation measures, the Project is considered unlikely to have a significant impact on the majority of threatened matters known, or considered to have potential to occur on within the PA. The final step in the assessment is to identify have the residual impacts of the Project can be offset through the state based mechanisms.

This report is an Annexure to the Ecological Impact Assessment (EIA) prepared by Environmental Resources Management Australia Pty Limited (ERM) for the Project.

PURPOSE OF THE REPORT

This offsets report is to address the Director General's Requirements (DGRs) and Secretary's Environmental Assessment Requirements (SEARs) that relate to biodiversity offsets specifically:

Scenario 2 – Where a proposal is assessed outside the BioBanking Assessment Methodology:

- 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 OEH's Principles for the use of biodiversity offsets in NSW;*
 - 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.*

This report contains a calculation of the Project's impacts, presents the requirements to achieve a biodiversity outcome consistent with the NSW Biodiversity Offsets Policy for Major Projects (OEH 2014a), and outlines the options available for offsetting impacts. The policy document referred to in the DGRs/SEARs (OEH's *Principles for the use of Biodiversity Offsets in NSW*)

has been revised and updated and a new policy document is being applied by the Office of Environment and Heritage (OEH) to major projects: the NSW *Biodiversity Offsets Policy for Major Projects* (OEH 2014a). ERM have assumed that the latter document will apply to biodiversity offset assessment of this Project as it is the most current and applicable and has prepared this offsets report accordingly. The application of the NSW *Biodiversity Offsets Policy for Major Projects* to the Project is outlined below.

Calculations of the Project's impacts on the BioBanking Credit Calculator (BBCC) and 'credit to hectare converter' have been provided using the best estimate of impact areas that are equivalent to the proposed area of impact, rather than being the actual exact footprint. This is because the exact footprint will not be available until after the detailed design of the Project is finalised. A preliminary offset calculation is presented here with the offset calculation to be finalised at a later stage during the Project assessment process in consultation with the Department of Planning and Environment (DP&E) and the OEH. Potential offset options and land areas will also be identified at a later stage in consultation with the DP&E and the OEH.

Consideration has also been given to the consistency between the NSW *Biodiversity Offsets Policy for Major Projects* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DoE 2012).

The details of the NSW *Biodiversity Offsets Policy for Major Projects* are outlined below (hereafter referred to as ‘the policy’).

There are six principles underpinning the policy for application to ‘major projects’:

- Principle 1: Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts;
- Principle 2: Offset requirements should be based on a reliable and transparent assessment of losses and gains;
- Principle 3: Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities;
- Principle 4: Offsets must be additional to other legal requirements;
- Principle 5: Offsets must be enduring, enforceable and auditable; and
- Principle 6: Supplementary measures can be used in lieu of offsets.

These six principles form the basis under which this offset discussion has been completed. The principles address similar themes to the principles contained in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DoE 2012) and as such, the NSW policy is followed as the more locally applicable policy (unless where impacts cannot be accounted for in the NSW policy such as where a threatened matters is listed under Commonwealth but not State Legislation).

2.1 PRINCIPLE 1: AVOIDANCE

The main document of the Ecology Impact Assessment contains detailed discussion of the Project’s avoidance of ecological values during an iterative design process.

2.2 PRINCIPLE 2: RELIABLE CALCULATION OF PROJECT IMPACTS

A detailed description of the Project impacts is provided in the main body of the Ecology Impact Assessment. Calculation of the impacts and the offset requirements has been completed based on the Development Footprint (hereafter referred to as the ‘footprint’) (refer Ecology Impact Assessment for detailed definition and description of the footprint area). The total native vegetation in the footprint is 49.09 ha (which includes 0.15 ha planted native vegetation no longer considered in the offsets discussion). The breakdown of these areas by Vegetation Zone and other land cover types are provided in *Table 2.1*.

Table 2.1 Areas of Each Native Vegetation Zone in the Study Area and Development Footprint

PCT	Vegetation Zone ID	Equivalent EEC	Equivalent TEC	Study Area (ha)	Development Footprint (ha)	Percentage of area in Study Area that is within Development Footprint
Apple Box - Candlebark - Snow Gum shrubby open forest on valley floors, southern South Eastern Highlands Bioregion	650_M-G_L	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		2.08	0.00	0.00
	650_M-G_M	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		19.05	0.32	1.70
	650_M-G_P	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		0.08	0.00	0.00
	650_M-G_S	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		0.55	0.00	0.00
	650_M-G_W	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion.		1.22	0.06	5.23

PCT	Vegetation Zone ID	Equivalent EEC	Equivalent TEC	Study Area (ha)	Development Footprint (ha)	Percentage of area in Study Area that is within Development Footprint
Black Sallee - Tussock Grass open woodland of the South Eastern Highlands Bioregion	680_M-G_L	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		0.09	0.00	0.00
	680_M-G_M	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		5.69	3.39	59.55
	680_M-G_P	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		0.18	0.05	29.71
	680_M-G_S	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		1.66	0.12	7.38
	680_M-G_W	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		4.99	0.15	2.94

PCT	Vegetation Zone ID	Equivalent EEC	Equivalent TEC	Study Area (ha)	Development Footprint (ha)	Percentage of area in Study Area that is within Development Footprint
Burgan - Pink Kunzea derived tall shrubland, South Eastern Highlands Bioregion and South East Corner Bioregion	757_M-G_M			5.18	0.29	5.54
Derived grasslands of the South Eastern Highlands Bioregion and South East Corner Bioregion	797_M-G_L			158.45	4.59	2.90
Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion	888_M-G_G			6.31	0.00	0.00
	888_M-G_L			104.27	5.47	5.25
	888_M-G_M			81.20	0.67	0.83
	888_M-G_P			4.91	0.36	7.26
Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	1093_L			515.86	21.78	4.22
	1093_M-G_G			56.31	0.41	0.73
	1093_M-G_L			38.86	1.84	4.74
	1093_M-G_M			79.82	0.78	0.97
	1093_M-G_P			136.52	5.06	3.71
	1093_M-G_S			0.93	0.11	12.41
	1093_M-G_W			0.18	0.03	16.96
Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion	1100_M-G_G	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		0.61	0.00	0.00
	1100_M-G_M	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		47.61	0.58	1.22

PCT	Vegetation Zone ID	Equivalent EEC	Equivalent TEC	Study Area (ha)	Development Footprint (ha)	Percentage of area in Study Area that is within Development Footprint
	1100_M-G_W	Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion		0.14	0.02	14.31
River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion	1110_M-G_L			15.78	0.08	0.48
Silvertop Ash - Blue-leaved	1150_M-G_G			46.68	0.07	0.16
Stringybark shrubby open forest on ridges, north east South Eastern Highlands Bioregion	1150_M-G_M			1.04	0.00	0.00
Silvertop Ash - Narrow-leaved	1155_M-G_G			0.34	0.00	0.00
Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion	1155_M-G_L			12.59	0.48	3.80
	1155_M-G_M			0.96	0.00	0.00
	1155_M-G_P			3.01	0.03	0.99

PCT	Vegetation Zone ID	Equivalent EEC	Equivalent TEC	Study Area (ha)	Development Footprint (ha)	Percentage of area in Study Area that is within Development Footprint
Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion	1334_M-G_G	White Box Yellow Box Blakely's Red Gum Woodland	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	31.57	0.91	2.89
	1334_M-G_L	White Box Yellow Box Blakely's Red Gum Woodland		0.16	0.00	0.00
	1334_M-G_M	White Box Yellow Box Blakely's Red Gum Woodland	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	43.37	0.72	1.66
	1334_M-G_P	White Box Yellow Box Blakely's Red Gum Woodland		13.78	0.55	3.97
	1334_M-G_W	White Box Yellow Box Blakely's Red Gum Woodland		0.33	0.01	2.63
Planted Native Vegetation	NA			1.98	0.15	7.51
Total EPBC Act Listed EEC				74.94	1.63	2.18
Total TSC Act Listed TEC				173.15	6.89	3.98
Total Native Vegetation				1444.33	49.09	3.40

Calculation of the Project's impacts has been completed using the *BioBanking Assessment Methodology* (BBAM) (hereafter referred to as the BBAM 2009 or 2014) as this is a reliable and transparent metric method to quantify impacts. Note that the BBAM was updated and the new one brought into force during the period of fieldwork and analysis for the Project. This section contains descriptions of details inserted into the BBCC where they require description and explanation.

Limitations

Data were collected in 33 transect/plots in the field. During the fieldwork period the Project layout was iteratively refined based on a number of factors, one of which was to avoid areas of ecological importance. Therefore some transects/plots are located outside of the Development Footprint, but are in Vegetation Zones consistent with those inside the Development Footprint. Due to the alterations in Project design throughout the fieldwork process, four Vegetation Zones are now calculated as having an area in the Development Footprint that requires a greater number of transect/plots than have been completed. The shortfall in plot/transect data in those four Vegetation Zones has been covered using benchmark data.

The field data were collected using both the BBAM (DECC 2009 and OEHL 2014b) as transition occurred during the Project investigations.

The results of this report can only be considered preliminary until:

- the BBCC is updated to reflect the updated BBAM;
- the detailed design is completed;
- final offset calculations are undertaken; and
- further consultation with DP&E and OEHL is undertaken.

This calculation is a preliminary calculation of the biodiversity offsets required for the potential impacts of the Project. A final calculation should be completed following detailed design when the exact location of all Project infrastructure is known.

Data Entered Into The BBCC

The Project is a multiple fragmentation impact development, as such; the 'linear-based development' module was selected in the BBCC. As the Development Footprint covers a large spatial spread of land, it crosses a number of boundaries of various spatial datasets. In the case where a selection was required, the option covering the majority area was selected. This included Major Catchment Area, Local Government Area and Interim Biogeographic Regionalisation for Australia (IBRA) Sub-region.

a. Landscape Value Section

Native Vegetation Cover in Landscape

The area of native vegetation was measured using a GIS pre- and post-development in the Development Footprint plus a 550 metre (m) buffer area.

Connectivity Value

The Project Development Footprint is a linear network of tracks <10 m wide with 'nodes' being each wind turbine generator (WTG) and other infrastructure. None of the Project infrastructure will reduce the connectivity of the landscape and the Project will not impact on any of the listed connectivity links in the BBCC.

Buffer Area

'Buffer Area' has been created by delineating an area extending 550 m around the Development Footprint.

Patch Size

The largest 'Patch Size' in each Mitchell Landscape was calculated using a GIS (refer *Table 2.2*).

Table 2.2 *Patch Size Areas by Mitchell Landscape and Percent Cleared Status*

Mitchell Landscape	Area (ha) ¹	Percent Cleared
Gundary Plains	12450.47	72
Lake George Complex	834.80	91
Molonglo Ranges	3285.18	45
Shoalhaven Gorge	26.55	23
Shoalhaven Tertiary Sands	2652.09	40

1. In liaison with OEH regarding the BBCC entry it was agreed to enter the patch size as 1,001 ha for any patch larger than 1,000 ha to prevent BBCC errors when entering data >9,999 ha.

2. Mitchell Landscape percent cleared value from the NSW VIS

Area to Perimeter Ratio

The area and perimeter of all patches 'pre' and 'post' development was calculated using a GIS (refer *Table 2.3*).

Table 2.3 *Area to Perimeter Calculations*

Status	Area (m ²)	Perimeter (m)	Area/Perimeter
Pre-development	192653960.16	400041.99	481.58
Post-development	192163109.19	471777.11	407.32

b. Vegetation Zones

Nomenclatural Rules

The Plant Community Types (PCTs) of the Development Footprint have been classified according to the condition in which they were observed and nomenclatural rules. *Table 2.4* shows those used in the BBCC.

Table 2.4 *Condition Class Definitions*

Primary_Secondary Condition Class	Detail	Equivalent Selectable Condition Class in BBCC
Woody Vegetation Types		
Mod-Good_Good	Nil disturbance - upper, mid and lower intact	MG-High
Mod-Good_Mod	Mostly intact upper, some clearance, lower storey disturbed	MG-Medium
Mod-Good_Poor	Sparse - mostly cleared vegetation (although still >25% of the upper storey lower benchmark cover value; & >50% native understorey cover)	MG-Poor
Mod-Good_Low	Derived native grassland - very cleared (<25% of the upper storey lower benchmark cover value; but still >50% native understorey cover)	MG-Derived Grassland
Low	Derived grassland - <25% of the upper storey lower benchmark cover value & <50% native understorey cover (but still >5% native grass cover)	Low
Derived Grassland (specific 'derived' PCT)		
Mod-Good_Low	>50% native ground cover but ubiquitous pasture species only	MG-Derived Grassland

Vegetation Zones

The BBCC 2009 states that: a Vegetation Zone smaller than 0.25 ha must be merged into the nearest (or most similar) Vegetation Zone. The Vegetation Zones entered into the BBCC are shown in *Table 2.5*. The vegetation types were not selectable as PCTs in the BBCC; therefore the best matching Biometric Vegetation Types (BVTs) were selected.

Table 2.5 Vegetation Zones Entered into the BBCC

Project Identified Vegetation Zone Data			Data Entered into BBCC			Vegetation Zone Number in BBCC
PCT ID ¹	Component Vegetation Zones	Area (ha)	PCT ID ¹	Vegetation Zone	Area (ha)	
650_M-G_M	Apple Box - Candlebark - Snow Gum shrubby open forest on valley floors, southern South Eastern Highlands Bioregion_Mod-Good_Mod	0.32	650_M-G_M	Apple Box - Candlebark - Snow Gum shrubby open forest on valley floors, southern South Eastern Highlands Bioregion_Mod-Good_Mod	0.39	1
650_M-G_W ²	Apple Box - Candlebark - Snow Gum shrubby open forest on valley floors, southern South Eastern Highlands Bioregion_Mod-Good_Mod	0.06				
757_M-G_M	Burgan - Pink Kunzea derived tall shrubland, South Eastern Highlands Bioregion and South East Corner Bioregion_Mod-Good_Mod	0.29	757_M-G_M	Burgan - Pink Kunzea derived tall shrubland, South Eastern Highlands Bioregion and South East Corner Bioregion_Mod-Good_Mod	0.29	2
797_M-G_L	Derived grasslands of the South Eastern Highlands Bioregion and South East Corner Bioregion_Mod-Good_Low	4.59	797_M-G_L	Derived grasslands of the South Eastern Highlands Bioregion and South East Corner Bioregion_Mod-Good_Low	4.67	3
1110_M-G_L	River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion_Mod-Good_Low	0.08				
888_M-G_L	Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion_Mod-Good_Low	5.47	888_M-G_L	Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion_Mod-Good_Low	5.47	4
888_M-G_M	Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion_Mod-Good_Mod	0.67	888_M-G_M	Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion_Mod-Good_Mod	0.67	5
888_M-G_P	Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion_Mod-Good_Poor	0.36	888_M-G_P	Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion_Mod-Good_Poor	0.36	6

Project Identified Vegetation Zone Data			Data Entered into BBCC			Vegetation Zone Number in BBCC
PCT ID ¹	Component Vegetation Zones	Area (ha)	PCT ID ¹	Vegetation Zone	Area (ha)	
1093_L	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Low	21.78	1093_L	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Low	21.78	7
1093_M-G_G	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Mod-Good_Good	0.41	1093_M-G_G	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Mod-Good_Good	0.41	8
1093_M-G_L	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Mod-Good_Low	1.84	1093_M-G_L	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Mod-Good_Low	1.84	9
1093_M-G_M	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Mod-Good_Mod	0.78	1093_M-G_M	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Mod-Good_Mod	0.92	10
1093_M-G_S	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Mod-Good_Shrubby	0.11				
1093_M-G_W	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Mod-Good_Weedy	0.03				
1093_M-G_P	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Mod-Good_Poor	5.06	1093_M-G_P	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion_Mod-Good_Poor	5.06	11
1100_M-G_M	Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion_Mod- Good_Mod	0.58	1100_M-G_M	Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion_Mod- Good_Mod	4.31	12

Project Identified Vegetation Zone Data			Data Entered into BBCC			Vegetation Zone Number in BBCC
PCT ID ¹	Component Vegetation Zones	Area (ha)	PCT ID ¹	Vegetation Zone	Area (ha)	
1100_M-G_W	Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion_Mod-Good_Weedy	0.02				
680_M-G_M ²	Black Sallee - Tussock Grass open woodland of the South Eastern Highlands Bioregion_Mod-Good_Mod	3.39				
680_M-G_P ²	Black Sallee - Tussock Grass open woodland of the South Eastern Highlands Bioregion_Mod-Good_Poor	0.05				
680_M-G_S ²	Black Sallee - Tussock Grass open woodland of the South Eastern Highlands Bioregion_Mod-Good_Shrubby	0.12				
680_M-G_W ²	Black Sallee - Tussock Grass open woodland of the South Eastern Highlands Bioregion_Mod-Good_Weedy	0.15				
1155_M-G_L	Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion_Mod-Good_Low	0.48	1155_M-G_L	Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion_Mod-Good_Low	0.58	13
1150_M-G_G	Silvertop Ash - Blue-leaved Stringybark shrubby open forest on ridges, north east South Eastern Highlands Bioregion_Mod-Good_Good	0.07				
1155_M-G_P	Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion_Mod-Good_Poor	0.03				
1334_M-G_G	Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Good	0.91	1334_M-G_G	Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Good	0.91	14

Project Identified Vegetation Zone Data			Data Entered into BBCC			Vegetation Zone Number in BBCC
PCT ID ¹	Component Vegetation Zones	Area (ha)	PCT ID ¹	Vegetation Zone	Area (ha)	
1334_M-G_M	Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Mod	0.72	1334_M-G_M	Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Mod	0.72	15
1334_M-G_P	Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Poor	0.55	1334_M-G_P	Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Poor	0.56	16
1334_M-G_W	Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion_Mod-Good_Weedy	0.01				
				Total Input into BBCC	48.94³	

1. PCT ID is an abbreviated representation of the Vegetation Zone combining the PCT, the primary and the secondary condition classes.

2. A PCT thought originally to be PCT 680 via diagnostic species assemblage was not selectable in the BBCC (possibly due to not being scored as being present in the ‘major catchment area’ of Southern Rivers). An equivalent was searched via the VIS and through considering choosing an alternative PCT from the observed PCTs from the Development Footprint. The best resolution was to select a suitable alternative from the other Vegetation Zones in the Development Footprint and that selected was Vegetation Zone 1100 (relevant condition class: M-G_M).

3. The total native vegetation clearance for the Development Footprint is 49.09 ha however this includes 0.15 ha planted native vegetation that is not considered in the offsets calculations.

A single Vegetation Zone is comprised of many patches (some discontinuous or unconnected). The area of all patches of the same Vegetation Zone across the Development Footprint was combined to make a total area sum for each Vegetation Zone. To best (and most conservatively) represent the patch size for each Vegetation Zone, they all were scored as the largest for the Mitchell Landscape in which the majority of the Development Footprint occurs (Gundary Plains); that being 1,001 ha (based on advice used in the Landscape Values tab).

A number of mismatches occurred in selecting the BVT and equivalent PCT in the BBCC:

- In selecting the PCT 888 as the BVT SR558, the BBCC says the equivalent PCT is 1526 however PCT 1526 is a different community restricted to the Hunter-Central Rivers Major Catchment Area. Regardless, SR558 is named correctly as Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion and was selected;
- In selecting the PCT 1093 as the BVT SR600, the BBCC says the equivalent PCT is 1567 however PCT 1567 is a different community restricted to the Hunter-Central Rivers Major Catchment Area. This advice was not applied as the selected BVT SR600 matches the PCT 1093 ie Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion and was selected;
- In selecting the PCT 1100 as the BVT SR602, the BBCC says the equivalent PCT is 1569 however PCT 1569 is a different community restricted to the Hunter-Central Rivers Major Catchment Area. Regardless, SR602 is named correctly as Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion and was selected;
- In selecting the PCT 1155 as the BVT SR628, the BBCC says the equivalent PCT is 1595 however PCT 1595 is a different community restricted to the Hunter-Central Rivers Major Catchment Area. Regardless, SR628 is named correctly as Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion and was selected; and
- In selecting the PCT 1334 as the BVT SR670, the BBCC says the equivalent PCT is 1637 however PCT 1637 is a different community restricted to the Hunter-Central Rivers Major Catchment Area. Regardless, SR670 is named correctly as Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion was selected.

It is unclear if these mismatches are driving an erroneous credit calculation.

c. Site Values

In two cases the selection of EECs was erroneous:

- SR510 (PCT 650) was not selectable as an EEC although the EIA identified it as an EEC: Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion.
- SR602 (PCT 1100) was only selectable as the EEC: Tablelands Basalt Forest although the EIA identified it as an EEC: Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion.

These four Vegetation Zones have had the corresponding number of plot/transects entered at benchmark data due to shortfalls in plot/transect numbers:

- PCT 650/BVT SR510_M-G_Medium: one plot;
- PCT 757/BVT SR539_M-G_Medium: one plot;
- PCT 797/BVT SR540_M-G_Derived Grassland: one plot; and
- PCT 1093/BVT SR600_M-G_Poor: two plots.

d. Threatened species survey and results

Data detailing threatened species not included as 'predicted' threatened species that were identified through surveys was entered at this tab. These species are the fauna species: Speckled Warbler (*Chthonicola sagittata*) and the Eastern Bentwing Bat (*Miniopterus schreibersii* subsp. *oceanensis*); and the flora species: Hoary Sunray (*Leucochrysum albicans* subsp. *albicans* var. *tricolor*). Note that although the Hoary Sunray is not listed under State legislation (only Commonwealth legislation) it is included in the BBCC.

A habitat area in the Development Footprint was entered for the two fauna species. For the flora species, the Hoary Sunray, a total number of individuals that will be lost was required. The density was estimated at 200 individuals per hectare (based on a count of 20 in a transect/plot). The area of known habitat to be impacted is 1.71 ha therefore the total of 342 individuals was entered. The Threatened Species offset multiplier was set at default 0.6 in the BBCC although when attempting to save the BBCC, an error was identified that the input must be greater than, or equal to, '1' so the Threatened Species offset multiplier was manually reset to 1.

Credit Profile

The BBCC credit report identifies the requirement for ecosystem credits as shown in *Table 2.6* for the Vegetation Zones entered into BBCC (refer *Annex A*).

Table 2.6 *Summary of Ecosystem Credits Required for Development*

PCT/BVT Code	Plant Community Type	Area (ha)	Credits Created
650/SR510	Apple Box - Candlebark - Snow Gum shrubby open forest on valley floors, southern South Eastern Highlands Bioregion	0.39	26.00
757/SR539	Burgan - Pink Kunzea derived tall shrubland, South Eastern Highlands Bioregion and South East Corner Bioregion	0.29	20.00
797/SR540	Derived grassland of the South Eastern Highlands Bioregion and South East Corner Bioregion	4.67	89.00
888/SR558	Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion	6.50	214.00
1093/SR600	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	30.01	670.52
1100/SR602	Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion	4.31	280.68
1155/SR628	Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion	0.58	24.00
1334/SR670	Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion	2.19	106.06
	Total	48.94	1430.00
1. The total native vegetation clearance for the Development Footprint is 49.09 ha however this includes 0.15 ha planted native vegetation that is not considered in the offsets calculations.			

The BBCC credit report states that these credits can be sourced from the BVTs/PCTs in the Monaro (Part B) IBRA subregion or any adjoining IBRA subregion according to the offset options shown in *Table 2.7* (refer *Annex A*).

Table 2.7 Ecosystem Credit Offset Options from BBCC Output

PCT in Development Footprint	Credits Required	PCT Offset Options
Apple Box - Candlebark - Snow Gum shrubby open forest on valley floors, southern South Eastern Highlands Bioregion, (SR510)	26	• Apple Box - Candlebark - Snow Gum shrubby open forest on valley floors, southern South Eastern Highlands Bioregion, (SR510) • Black Gum grassy woodland of damp flats and drainage lines of the eastern Southern Tablelands, South Eastern Highlands Bioregion, (SR514) • Mountain Gum Narrow leaved Peppermint Snow Gum dry shrubby open forest on undulating tablelands, southern South Eastern Highlands Bioregion, (SR584) • Snow Gum Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion, (SR637)
Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion, (SR602)	281	• Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion, (SR602) • Ribbon Gum - Snow Gum grassy open forest on flats and undulating hills of the eastern tableland, South Eastern Highlands Bioregion, (SR603)
Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion, (SR670)	106	• Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion, (SR670)
Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion, (SR558)	214	• Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion, (SR558) • Broad-leaved Peppermint - Brittle Gum shrubby open forest on the eastern tablelands, South Eastern Highlands Bioregion, (SR522) • Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, (SR600)
Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, (SR600)	395	• Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, (SR600) • Broad-leaved Peppermint - Brittle Gum shrubby open forest on the eastern tablelands, South Eastern Highlands Bioregion, (SR522)

PCT in Development Footprint	Credits Required	PCT Offset Options
Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, (SR600)	276	- Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion, (SR558) - Broad-leaved Peppermint - Brittle Gum shrubby open forest on the eastern tablelands, South Eastern Highlands Bioregion, (SR522) - Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion, (SR558) - Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, (SR600)
Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion, (SR628)	24	- Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion, (SR628) - Ironbark - Woollybutt - White Stringybark open forest on coastal hills, South East Corner Bioregion, (SR559) - Messmate dry shrubby forest on sandstone, far southern South East Corner Bioregion, (SR577) - Red Bloodwood - Hard-leaved Scribbly Gum - Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion, (SR594) - Red Bloodwood - Silvertop Ash - White Stringybark heathy open forest on coastal foothills, southern South East Corner Bioregion, (SR596) - Silvertop Ash - Blue-leaved Stringybark - Red Bloodwood dry shrubby open forest on ridges of the hinterland foothills, northern South East Corner Bioregion, (SR621) - Silvertop Ash - Blue-leaved Stringybark shrubby open forest on ridges, north east South Eastern Highlands Bioregion, (SR624) - Silvertop Ash - White Stringybark shrubby open forest of the escarpment ranges, southern South East Corner Bioregion, (SR631) - White Stringybark - Narrow-leaved Peppermint dry open forest on hinterland hills, far south of the South East Corner Bioregion, (SR668)

PCT in Development Footprint	Credits Required	PCT Offset Options
Burgan Pink Kunzea derived tall shrubland, South Eastern Highlands Bioregion and South East Corner Bioregion, (SR539)	20	- Burgan Pink Kunzea derived tall shrubland, South Eastern Highlands Bioregion and South East Corner Bioregion, (SR539) - Bracelet Honey myrtle Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion, (SR520) - Coast Boobialla Wallaby Bush shrubland on monzonite outcrops near Tilba Tilba, South East Corner Bioregion, (SR532) - Dwarf She oak closed heathland of escarpment ranges, South Eastern Highlands Bioregion, (SR541) - Kunzea ambigua Bracelet Honey myrtle shrubland on rhyolite outcrops, southern South East Corner Bioregion, (SR564) - Kunzea ambigua Correa reflexa shrubland on skeletal granitic substrates, southern South East Corner Bioregion, (SR565)
Derived grassland of the South Eastern Highlands Bioregion and South East Corner Bioregion, (SR540)	89	- Derived grassland of the South Eastern Highlands Bioregion and South East Corner Bioregion, (SR540) - River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion, (SR610) - Snow Grass - Kangaroo Grass - Sheep's Burr grassland on undulating basalt plateaux, South Eastern Highlands Bioregion, (SR636) - Speargrass grassland of the South Eastern Highlands Bioregion, (SR639) - Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion, (SR644) - Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion, (SR645) - Wallaby Grass - Red-grass - Tall Speargrass - Kangaroo Grass dry tussock grassland of the North-western and Eastern Southern Tablelands in the South Eastern Highlands Bioregion, (SR684) - Kangaroo Grass - Purple Wire-grass - Mat-rush - Wallaby Grass - Common Buttons dry tussock grassland on steep sites in the north-western and Eastern parts of the Southern Tablelands of the South Eastern Highlands Bioregion, (SR687)

The species credits required are shown in *Table 2.8*.

Table 2.8 ***Species Credits Required***

Common Name	Species Name	Extent of Impact ¹	Number of Species Credits Created
Speckled Warbler	<i>Chthonicola sagittata</i>	8.12	211
Eastern Bentwing Bat	<i>Miniopterus schreibersii</i> subsp. <i>oceanensis</i>	8.12	106
Hoary Sunray	<i>Leucochrysum albicans</i> subsp. <i>tricolor</i>	342	3420
1. Extent of impact shown as an area (ha) for fauna species (Speckled Warbler and Eastern Bentwing Bat) and as an estimated number of individuals for flora species (Hoary Sunray).			

The full and final credit reports accompany this Biodiversity Offsets Report (refer *Annex A*).

Credit to Hectare Converter

OEH has created a tool that converts a credit profile into an equivalent hectare area for use to assist in identifying land areas required where the BioBanking system is not being used. The tool also provides indicative land purchase and management costs. It is recommended that the final credit profile be inserted into the credit to hectare converter when detailed design is complete.

2.3 ***PRINCIPLE 3: CONSERVATION VALUES GUIDING OFFSETS***

The credit report identifies that the ecosystem credits for offsetting can be sourced from a wide variety of vegetation types in the IBRA subregion and also in any adjoining subregion. There is no guidance on where the species credits are required to be sourced from.

Full investigations of appropriate offset sites needs to be undertaken to identify if they possess the biodiversity values required to meet the offset requirements. This can only be completed following negotiations with landholders and managers who may be interested in hosting a biodiversity offset site. These negotiations will also need to cover the conservation mechanisms and funding arrangements (discussed below).

2.4 ***PRINCIPLE 4: ADDITIONALITY***

When securing the offset, the land secured and actions to improve the biodiversity must be in addition to existing legal management requirements on any land. This can be explored further during the process of land selection.

A number of conservation mechanisms are available to secure the land required for the offset. OEHL have listed those they support in their contribution to the DGRs as:

- the establishment of biobanking sites with biobanking agreements under the *Threatened Species Conservation Act 1995* (TSC Act);
- the dedication of land under the *National Parks and Wildlife Act 1974* (NPW Act);
- a Conservation Agreement under the NPW Act;
- a Trust Agreement under the *Nature Conservation Trust Act 2001*; or
- a Planning Agreement under Section 93F of the *Environmental Planning and Assessment Act 1979*.

Each of these options have unique responsibilities and of key importance to securing the offset is that they are funded appropriately, that ecological management tasks occur to maintain and improve the ecological values and that these are audited/monitored. Management actions will typically be more onerous at the instigation of the offset site and reduce over time however, it is important to note that they will be required in perpetuity.

Such management actions may include:

- fencing to exclude stock;
- fencing to exclude feral animals;
- feral animal removal;
- weed removal;
- controlled burning;
- revegetation; and
- erosion control.

A management action plan would detail the specific actions required and their timing/frequency, and would also include a recommended monitoring and auditing program to measure the improvements in biodiversity values at the site and provide an opportunity to make improvements to the management actions.

The policy defines supplementary measures and their application as *“proponents can provide funds for supplementary measures when offsets are not available. These are other measures that benefit biodiversity but do not specifically involve protecting and managing a site”* (OEH 2014a). These can only be applied, *“If appropriate offset sites cannot be found, proponents can provide funds for supplementary measures. Reasonable steps must be undertaken to locate appropriate like-for-like offset sites before supplementary measures can be considered”* (OEH 2014a). Some processes have to be followed prior to coming to the list of reasonable steps, which include the application of a variation to allow relaxation of like-for-like vegetation types. The reasonable steps that must be taken to locate like-for-like offsets (in addition to consideration of any feasible sites that are known to the proponent) include:

- checking the biobanking public register and having an expression of interest for credits on it for at least six months;
- liaising with an OEH Office and relevant local councils to obtain a list of potential sites that meet the requirements for offsetting;
- considering properties for sale in the required area; and
- providing evidence of why offset sites are not feasible – suitable evidence may include:
 - the unwillingness of a landowner to sell or establish a biobank site; and
 - the cost of an offset site itself should not be a factor unless it can be demonstrated the landowner is charging significantly above market rates. (OEH 2014a).

The Policy states that supplementary measures can be used in lieu of offsets if offsets are not feasible.

CONCLUSION

The final footprint and impact areas of the Project will be available following the detailed design phase for the Project. The credit profile should be identified at that point in time building on the data used in this assessment. The NSW policy is consistent with the principles of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DoE 2012) and currently all Commonwealth threatened matters of relevance to the offset calculation for the Project are covered by the BBCC. As a result, no additional offset calculation is required using Commonwealth processes.

Department of Environment and Climate Change (DECC) (2009). *BioBanking Assessment Methodology and Credit Calculator Operational Manual*. NSW DECC.

Office of Environment and Heritage (OEH) (2014a). *NSW biodiversity offsets policy for major projects*. NSW OEH. Accessed on 31 August 2015 from: <http://www.environment.nsw.gov.au/resources/biodiversity/140672biopolicy.pdf>.

Office of Environment and Heritage (OEH) (2014b). *BioBanking Assessment Methodology 2014*. NSW OEH. Accessed on 31 August 2015 from: <http://www.environment.nsw.gov.au/resources/biobanking/140661BBAM.pdf>.

Office of Environment and Heritage (OEH) (2015). *NSW Biodiversity Offsets Policy for Major Projects: Practice Note; Offset Threshold for Vegetation Below a Certain Condition Level*. NSW OEH. Accessed on 31 August 2015 from: <http://www.environment.nsw.gov.au/resources/biodiversity/150420-FBA-offset-threshold.pdf>.

Annex A

Biobanking Credit Calculator Reports

BioBanking Credit Calculator

Ecosystem credits

Proposal ID : 128/2015/2049MP

Proposal name : Jupiter Wind Farm

Assessor name : Matthew Flower

Assessor accreditation number : 128

Tool version : v4.0

Report created : 03/09/2015 15:21

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	10.00	SR540_Moderate/Good_Derived grassland	Derived grassland of the South Eastern Highlands Bioregion and South East Corner Bioregion	Moderate/Good_Derived grassland	Yes	2A	4.58	28.57	0.00	28.57	0	87	Little Whip Snake	0.00	2.30	87
AC1	10.00	SR558_Moderate/Good_Derived grassland	Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion	Moderate/Good_Derived grassland	Yes	3A	5.47	45.31	0.00	45.31	0	175	Spotted-tailed Quoll	16.67	2.60	175
AC1	10.00	SR600_Low	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	Low	Yes	6A	20.72	40.10	0.00	40.10	0	0		0.00	0.00	260
AC1	10.00	SR602_Moderate/Good_Medium	Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion	Moderate/Good_Medium	Yes	9A	3.88	83.33	0.00	83.33	252	220	Spotted-tailed Quoll	66.67	2.60	252
AC1	10.00	SR628_Moderate/Good_Derived grassland	Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion	Moderate/Good_Derived grassland	Yes	10A	0.58	58.85	0.00	58.85	0	24	Spotted-tailed Quoll	38.10	2.60	24
AC1	10.00	SR670_Moderate/Good_High	Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion	Moderate/Good_High	Yes	11A	0.91	71.88	0.00	71.88	51	45	Spotted-tailed Quoll	55.56	2.60	51
AC1	10.00	SR558_Moderate/Good_Medium	Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion	Moderate/Good_Medium	Yes	4A	0.67	59.90	0.00	59.90	0	28	Spotted-tailed Quoll	38.89	2.60	28

Assessment circle name	Landsc pe score	Vegetation zone name	Vegetation type name	Condition	Red flag status	Management zone name	Manage ment 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	10.00	SR558_Moderate/Good_Poor	Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion	Moderate/Good_Poor	Yes	5A	0.36	41.15	0.00	41.15	0	11	Spotted-tailed Quoll	5.56	2.60	11
AC1	10.00	SR600_Moderate/Good_Derived grassland	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	Moderate/Good_Derived grassland	Yes	7A	2.71	55.73	0.00	55.73	0	105	Spotted-tailed Quoll	22.22	2.60	105
AC1	10.00	SR600_Moderate/Good_Poor	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	Moderate/Good_Poor	Yes	8A	5.09	89.58	0.00	89.58	0	309	Spotted-tailed Quoll	88.89	2.60	309
AC1	10.00	SR670_Moderate/Good_Medium	Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion	Moderate/Good_Medium	Yes	12A	0.72	69.79	0.00	69.79	39	34	Spotted-tailed Quoll	50.00	2.60	39
AC1	10.00	SR670_Moderate/Good_Poor	Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion	Moderate/Good_Poor	No	13A	0.56	32.29	0.00	32.29	15	13	Spotted-tailed Quoll	38.89	2.60	15

BioBanking Credit Calculator

Species credits

Proposal ID : 128/2015/2049MP
Proposal name : Jupiter Wind Farm
Assessor name : Matthew Flower
Assessor accreditation number : 128
Tool version : v4.0
Report created : 03/09/2015 15:21

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
Leucochrysum albicans subsp. tricolor	Hoary Sunray	1.00	No		340.00	0.00	No	3,400
Chthonicola sagittata	Speckled Warbler	2.60	No		7.16	0.00	No	186
Miniopterus schreibersii subsp. oceanensis	Eastern Bentwing-bat	1.30	No		7.16	0.00	No	93

Biodiversity credit report



This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 3/09/2015

Time: 3:22:39PM

Calculator version: v4.0

Major Project details

Proposal ID:	128/2015/2049MP
Proposal name:	Jupiter Wind Farm
Proposal address:	Boro Road Tarago NSW 2580
Proponent name:	EPYC Pty Ltd
Proponent address:	PO Box 1681 North Sydney NSW 2059
Proponent phone:	1300896189
Assessor name:	Matthew Flower
Assessor address:	53 Bonville Avenue THORNTON NSW 2322
Assessor phone:	02 4964 2150
Assessor accreditation:	128

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Derived grassland of the South Eastern Highlands Bioregion and South East Corner Bioregion	4.58	87.00
Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion	6.50	214.00
Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	28.52	673.52
Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion	3.88	252.19
Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion	0.58	24.00
Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion	2.19	105.78
Total	46.25	1,356

Credit profiles

1. Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion, (SR602)

Number of ecosystem credits created	252
IBRA sub-region	Monaro (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion, (SR602) Ribbon Gum - Snow Gum grassy open forest on flats and undulating hills of the eastern tableland, South Eastern Highlands Bioregion, (SR603)	Monaro (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion, (SR670)

Number of ecosystem credits created	106
IBRA sub-region	Monaro (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion, (SR670)	Monaro (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion, (SR558)

Number of ecosystem credits created	214
IBRA sub-region	Monaro (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion, (SR558) Broad-leaved Peppermint - Brittle Gum shrubby open forest on the eastern tablelands, South Eastern Highlands Bioregion, (SR522) Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, (SR600)	Monaro (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, (SR600)

Number of ecosystem credits created	414
IBRA sub-region	Monaro (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, (SR600) Broad-leaved Peppermint - Brittle Gum shrubby open forest on the eastern tablelands, South Eastern Highlands Bioregion, (SR522) Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion, (SR558)	Monaro (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

5. Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, (SR600)

Number of ecosystem credits created	260
IBRA sub-region	Monaro (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Broad-leaved Peppermint - Brittle Gum shrubby open forest on the eastern tablelands, South Eastern Highlands Bioregion, (SR522) Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion, (SR558) Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, (SR600)	Monaro (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

6. Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion, (SR628)

Number of ecosystem credits created

24

IBRA sub-region

Monaro (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Silvertop Ash - Narrow-leaved Peppermint open forest on ridges of the eastern tableland, South Eastern Highlands Bioregion and South East Corner Bioregion, (SR628) Ironbark - Woollybutt - White Stringybark open forest on coastal hills, South East Corner Bioregion, (SR559) Messmate dry shrubby forest on sandstone, far southern South East Corner Bioregion, (SR577) Red Bloodwood - Hard-leaved Scribbly Gum - Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion, (SR594) Red Bloodwood - Silvertop Ash - White Stringybark heathy open forest on coastal foothills, southern South East Corner Bioregion, (SR596) Silvertop Ash - Blue-leaved Stringybark - Red Bloodwood dry shrubby open forest on ridges of the hinterland foothills, northern South East Corner Bioregion, (SR621) Silvertop Ash - Blue-leaved Stringybark shrubby open forest on ridges, north east South Eastern Highlands Bioregion, (SR624) Silvertop Ash - White Stringybark shrubby open forest of the escarpment ranges, southern South East Corner Bioregion, (SR631) White Stringybark - Narrow-leaved Peppermint dry open forest on hinterland hills, far south of the South East Corner Bioregion, (SR668)	Monaro (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

7. Derived grassland of the South Eastern Highlands Bioregion and South East Corner Bioregion, (SR540)

Number of ecosystem credits created

87

IBRA sub-region

Monaro (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Derived grassland of the South Eastern Highlands Bioregion and South East Corner Bioregion, (SR540) River Tussock - Tall Sedge - Kangaroo Grass moist grasslands of the South Eastern Highlands Bioregion, (SR610) Snow Grass - Kangaroo Grass - Sheep's Burr grassland on undulating basalt plateaux, South Eastern Highlands Bioregion, (SR636) Speargrass grassland of the South Eastern Highlands Bioregion, (SR639) Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion, (SR644) Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion, (SR645) Wallaby Grass - Red-grass - Tall Speargrass - Kangaroo Grass dry tussock grassland of the North-western and Eastern Southern Tablelands in the South Eastern Highlands Bioregion, (SR684) Kangaroo Grass - Purple Wire-grass - Mat-rush - Wallaby Grass - Common Buttons dry tussock grassland on steep sites in the north-western and Eastern parts of the Southern Tablelands of the South East, (SR687)	Monaro (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Hoary Sunray	Leucochrysum albicans subsp. tricolor	340.00	3,400
Speckled Warbler	Chthonicola sagittata	7.16	186
Eastern Bentwing-bat	Miniopterus schreibersii subsp. oceanensis	7.16	93

Annex H

Project-specific Impact Assessment and Mitigation

Non-threatened Matters Especially Susceptible to Wind Turbine Impacts

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude of Effects	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Migratory birds	Individual mortality (WTG collision); Habitat alienation	Medium	Negligible	Not Significant	- A Bird and Bat Monitoring Plan will be developed, which includes: - species to be monitored; - techniques for monitoring; - frequency of monitoring; - adaptive management provisions; and - reporting requirements. - HBTs will be avoided through infrastructure micro-siting with involvement from a qualified ecologist. - Pre-clearance surveys will be undertaken to determine if roosts, nests or dens are present or in use in any trees proposed for clearing. When identified a qualified ecologist experienced in tree clearance should be present when HBTs are being removed to mitigate any impacts to fauna. - A tree hollow replacement ratio will be identified and implemented as part of the CEMP. - Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of fauna habitat. - All site staff will be inducted on the procedures of the CEMP in relation to flora and fauna. - 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).	Small	Not Significant
Birds (non-threatened)	Individual mortality (WTG collision); Habitat alienation	Negligible	Large	Not Significant		Small	Not Significant
Bats (non-threatened)	Individual mortality (WTG collision/ Barotrauma); Habitat alienation	Negligible	Large	Not Significant		Small	Not Significant

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude of Effects	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Common Flora Species	Individual mortality; Habitat alienation; Habitat fragmentation	Negligible	Medium	Not Significant	- An appropriate offset package will be secured within 12 months of commencing construction to compensate for the loss of habitat within the Study Area. Final calculation of the offset area will be carried out during the pre-construction phase once WTG selection has taken place and the final Development Footprint is confirmed. - Micrositing of infrastructure will avoid disturbance to native vegetation, where possible. - Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of native vegetation and habitat. - During construction and operation, vehicles will remain on formed roads or tracks designed specifically for the purposes of the wind farm construction. - All site staff will 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.	Small	Not Significant

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude of Effects	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Common Fauna Species	Individual mortality; Habitat alienation; Habitat fragmentation	Negligible	Medium	Not Significant	- A pre-clearance protocol will be established and will define survey and management requirements for fauna during clearing. - An Environmental Compliance Manager or field officer qualified in the handling of fauna will be present on-site during clearing to capture and re-release fauna (where appropriate). - Where Trenches are to remain open overnight, an escape ramp (1 in 4) will be constructed to allow for fauna escape. - Trenches will be regularly checked during construction by the Environmental Compliance Manager to ensure any captured fauna are released according to the CEMP.	Small	Not Significant

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude of Effects	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Habitats (excluding threatened species habitat)	Direct clearance	Low	Medium	Minor	- An appropriate offset package will be secured within 12 months of commencing construction to compensate for the loss of habitat within the Study Area. Final calculation of the offset area will be carried out during the pre-construction phase once WTG selection has taken place and the final Development Footprint is confirmed. - Micrositing of infrastructure will avoid disturbance to native vegetation, where possible. - Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of native vegetation and habitat. - During construction and operation, vehicles will remain on formed roads or tracks designed specifically for the purposes of the wind farm construction. - All site staff will 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.	Small	Not Significant

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude of Effects	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Habitats (excluding threatened species habitat)	Remaining habitat degradation	Low	Medium	Minor	- Tree Protection Zones will be established to prevent damage to trees to be retained close to the Development Footprint. - Trenches will be excavated at least 15 m away from the base of trees where possible to prevent root damage. - A Weed Management Plan will be developed and implemented which includes the following measures: - importing only weed-free gravel, sand and other materials; - importing machinery only when clean; and - regular weed checks in and around construction zones.	Small	Not Significant
	Fauna refugia loss	Low	Medium	Minor	- Pre-clearance surveys will be undertaken to determine if roosts, nests or dens are present in any trees proposed for clearing. - 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. - Hollows removed will be replaced with artificial hollows within adjacent suitable habitat at a suitable replacement ratio to be calculated.	Small	Not Significant
	Retarded regeneration	Low	Medium	Minor	- Areas will be rehabilitated as soon as no longer required for construction (eg laydown areas following construction). - Where native grasslands are impacted, spread locally sourced grass seeds over impacted areas no longer required for construction. - Native vegetation that is removed will be chipped and mulched for on-site use where practical, minimising large stockpiling of cleared vegetation in woodland areas.	Small	Not Significant

Threatened Matters

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
TECs and EECs Known to Occur in the Study Area							
White Box, Yellow Box, Blakely's Red Gum Woodland and Derived Native Grassland	Direct clearance; Habitat degradation	High	Medium	Major	Current slashing practices within this community in the central precinct should be continued. Slashing should occur at heights greater than 10 cm (DECC 2010). A Weed Management Plan will be prepared and implemented that details control measures such as:	Small	Moderate
White Box Yellow Box Blakely's Red Gum Woodland	Direct clearance; Habitat degradation	High	Small	Moderate	- importing only weed-free gravel, sand and other materials; - regular weed checks in and around construction zones; and - only import machinery when clean. A CEMP will be prepared and implemented that details activities including: - 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; - all site staff are to be inducted on the procedures of the CEMP in relation to flora and fauna; and - 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.	Small	Moderate

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregion	Direct clearance; Habitat degradation	High	Medium	Major	A Weed Management Plan will be prepared and implemented that details control measures such as: - importing only weed-free gravel, sand and other materials; - regular weed checks in and around construction zones; and - only import machinery when clean. A CEMP will be prepared and implemented that details activities including: - 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; - all site staff are to be inducted on the procedures of the CEMP in relation to flora and fauna; and - 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.	Small	Moderate

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Threatened Flora Known to Occur in the Study Area							
Buttercup Doubletail (<i>Diuris aequalis</i>)	Direct clearance; Habitat degradation	High	Small	Moderate	- 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. - Pre-clearance surveys will be undertaken in areas of potential habitat and a chance-finds procedure will be developed to outline the appropriate actions if a new population is identified. - 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 - The use of exclusion fencing at the known Buttercup Doubletail location will be considered, to avoid trampling, browsing or grazing from domestic and/or feral animals.	Negligible	Not significant
Hoary Sunray (<i>Leucochrysum albicans</i> <i>subsp. albicans var. tricolor</i>)	Direct clearance; Habitat degradation	High	Medium	Major		Small	Moderate

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Threatened Flora with Potential to Occur in the Study Area							
Few-seeded Bossiaea (<i>Bossiaea oligosperma</i>)	Direct clearance; Habitat degradation	High	Small	Moderate	- 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. - Pre-clearance surveys will be undertaken in areas of potential habitat and a chance-finds procedure will be developed to outline the appropriate actions if a new population is identified. - 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. - The Weed Management Plan to be implemented will consider the risks of adverse effects of chemicals or other mechanisms used to eradicate weeds on potentially occurring threatened species.	Negligible	Not Significant
Black Gum (<i>Eucalyptus aggregata</i>)	Direct clearance; Habitat degradation	Medium	Small	Minor		Negligible	Not Significant
Basalt Pepper-cress (<i>Lepidium hyssopifolium</i>)	Direct clearance; Habitat degradation	High	Small	Moderate		Negligible	Not Significant
Pale Pomaderris (<i>Pomaderris pallida</i>)	Direct clearance; Habitat degradation	High	Small	Moderate		Negligible	Not Significant
Matted Bush-pea (<i>Pultenaea pedunculata</i>)	Direct clearance; Habitat degradation	High	Small	Moderate		Negligible	Not Significant
Austral Toadflax (<i>Thesium australe</i>)	Direct clearance; Habitat degradation	High	Small	Moderate		Negligible	Not Significant

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Threatened Fauna Known to Occur in the Study Area							
<i>Birds</i>							
Glossy Black-Cockatoo (<i>Calyptorhynchus lathami</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Medium	Moderate	- HBTs will be avoided through infrastructure micro-siting with involvement from a qualified ecologist. - A Bird and Bat Monitoring Plan will be developed and implemented. - Pre-clearance surveys will be undertaken to determine if roosts, nests or dens are present or in use in any trees proposed for clearing. When identified a qualified ecologist experienced in tree clearance should be present when HBT are being removed to mitigate any impacts to fauna. - A tree hollow replacement ratio will be identified and implemented as part of the CEMP. - Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of fauna habitat. - 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). - Measures to reduce fauna mortality on access roads will be developed and implemented, including speed limits and appropriate signage.	Medium	Moderate

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Speckled Warbler (<i>Chthonicola sagittata</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Negligible	Not Significant	- A Bird and Bat Monitoring Plan will be developed and implemented. - Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of fauna habitat. - Pre-clearance surveys will be undertaken to determine if roosts, nests or dens are present or in use in any trees proposed for clearing. - Large woody debris in the clearing area will be relocated to adjacent habitat. - 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). - Measures to reduce fauna mortality on access roads will be developed and implemented, including speed limits and appropriate signage.	Negligible	Not Significant
Spotted Harrier (<i>Circus assimilis</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Small	Minor		Small	Minor
Varied Sittella (<i>Daphoenositta chrysoptera</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Negligible	Not Significant		Negligible	Not Significant
White-fronted Chat (<i>Epthianura albifrons</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Negligible	Not Significant		Negligible	Not Significant
Blue-billed Duck (<i>Oxyura australis</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Small	Minor		Small	Minor

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Scarlet Robin (<i>Petroica boodang</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Negligible	Not Significant		Negligible	Not Significant
Diamond Firetail (<i>Stagonopleura guttata</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Negligible	Not Significant		Negligible	Not Significant
Mammals							
Eastern Bentwing-bat (<i>Miniopterus schreibersii oceanensis</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Small	Minor	- Infrastructure micrositing will be undertaken with involvement from a qualified ecologist, with an aim to avoid suitable HBTs. - A pre-clearance protocol will be designed to identify how fauna (particularly hollow-nesting or roosting fauna) will be surveyed for and managed during clearing.	Moderate	Moderate

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Yellow-bellied Sheathtail Bat (<i>Saccolaimus flaviventris</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Small	Minor	- A qualified ecologist experienced in tree clearance should be present when HBT are being removed to mitigate any impacts to fauna. - A hollow replacement ratio will be defined in the CEMP and implemented. - Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of fauna habitat. - An Environmental Compliance Manager or field officer qualified in the handling of fauna will be present on-site during clearing to capture and re-release fauna (where appropriate). - The CEMP will include measures to reduce fauna mortality on roads and access tracks including speed limits and appropriate signage. - An Operational Bird and Bat monitoring plan will be developed.	Moderate	Moderate

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Koala (<i>Phascolarctos cinereus</i>)	Individual mortality; Habitat degradation; Habitat alienation	High	Small	Moderate	- Micrositing of infrastructure will be undertaken to avoid feed trees, with priority given to avoiding primary feed trees followed by secondary feed trees. - A qualified fauna spotter will be present during clearing of potential habitat to identify any Koalas in the area. - If a Koala is identified during clearing or construction, works will cease until the Koala has left the area. - Excavation monitoring will be undertaken to rescue trapped fauna and the frequency and details of monitoring will be outlined in the CEMP. - Maximum vehicle speed limits of 60 km/hour will be introduced on Project access roads. - Appropriate sanitation procedures will be implemented to reduce the risk of introduction of <i>Phytophthora cinnamomi</i>.	Not Significant	Minor
Threatened Fauna with Potential to Occur in the Study Area							
<i>Birds</i>							
Brown Treecreeper (eastern subspecies) (<i>Climacteris picumnus victoriae</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Negligible	Not Significant	- HBTs will be avoided through infrastructure micrositing with involvement from a qualified ecologist. - A Bird and Bat Monitoring Plan will be developed and implemented. - Pre-clearance surveys will be undertaken to determine if roosts, nests or dens are present or in use in any trees proposed for clearing. When identified a qualified ecologist experienced in tree clearance should be present when HBT are being removed to mitigate any impacts to fauna. - A tree hollow replacement ratio will be identified and implemented as part of the CEMP.	Negligible	Not Significant
Gang-gang Cockatoo (<i>Callocephalon fimbriatum</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Negligible	Not Significant		Negligible	Not Significant

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Barking Owl (<i>Ninox connivens</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Small	Minor	- Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of fauna habitat. - All site staff will be inducted on the procedures of the CEMP in relation to flora and fauna. - 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). - Measures to reduce fauna mortality on access roads will be developed and implemented, including speed limits and appropriate signage.	Small	Minor
Powerful Owl (<i>Ninox strenua</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Small	Minor	- Pre-clearance surveys will be undertaken to determine if roosts, nests or dens are present or in use in any trees proposed for clearing. When identified a qualified ecologist experienced in tree clearance should be present during clearing to advise on methods to avoid impacts to fauna. - Large woody debris within clearing habitat will be relocated to adjacent habitats. - Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of fauna habitat. - 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). - Measures to reduce fauna mortality on access roads will be developed and implemented, including speed limits and appropriate signage.	Small	Minor
Flame Robin (<i>Petroica phoenicea</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Negligible	Not Significant	- Pre-clearance surveys will be undertaken to determine if roosts, nests or dens are present or in use in any trees proposed for clearing. When identified a qualified ecologist experienced in tree clearance should be present during clearing to advise on methods to avoid impacts to fauna. - Large woody debris within clearing habitat will be relocated to adjacent habitats. - Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of fauna habitat. - 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). - Measures to reduce fauna mortality on access roads will be developed and implemented, including speed limits and appropriate signage.	Negligible	Not Significant
Pink Robin (<i>Petroica rodinogaster</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Negligible	Not Significant	- Large woody debris within clearing habitat will be relocated to adjacent habitats. - Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of fauna habitat. - 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). - Measures to reduce fauna mortality on access roads will be developed and implemented, including speed limits and appropriate signage.	Negligible	Not Significant
Hooded Robin (<i>Melanodryas cucullata cucullata</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Negligible	Not Significant	- Large woody debris within clearing habitat will be relocated to adjacent habitats. - Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of fauna habitat. - 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). - Measures to reduce fauna mortality on access roads will be developed and implemented, including speed limits and appropriate signage.	Negligible	Not Significant

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Black Falcon (<i>Falco subniger</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Negligible	Not Significant	- A Bird and Bat Monitoring Plan will be developed and implemented. - Pre-clearance surveys will be undertaken to determine if roosts, nests or dens are present or in use in any trees proposed for clearing. When identified a qualified ecologist experienced in tree clearance should be present during clearing to advise on methods to avoid impacts to fauna. - Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of fauna habitat. - 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). - Measures to reduce fauna mortality on access roads will be developed and implemented, including speed limits and appropriate signage.	Negligible	Not Significant
Little Eagle (<i>Hieraaetus morphnoides</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Small	Minor		Small	Minor
Swift parrot (<i>Lathamus discolor</i>)	Individual mortality; Habitat degradation; Habitat alienation	High	Small	Moderate		Small	Moderate
Freckled Duck (<i>Stictonetta naevosa</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Small	Minor		Small	Minor
Curlew Sandpiper (<i>Calidris ferruginea</i>)	Individual mortality; Habitat degradation; Habitat alienation	High	Negligible	Not Significant		Negligible	Not Significant

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
<i>Mammals</i>							
Spotted-tail Quoll (<i>Dasyurus maculatus maculatus</i>)	Individual mortality; Habitat degradation; Habitat alienation	High	Negligible	Not Significant	- Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of native vegetation and habitat. - Pre-clearance surveys will be undertaken to determine if dens are present in the proposed clearing area. - Where trenches are to remain open overnight, an escape ramp will be constructed (at 1 in 4) to allow fauna escape. - Trenches will be regularly checked during construction by the Environmental Compliance Manager to ensure any captured fauna are released according to the CEMP. - Measures to reduce fauna mortality on access roads will be developed and implemented, including speed limits and appropriate signage.	Negligible	Not Significant

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
Eastern False Pipistrelle (<i>Falsistrellus tasmaniensis</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Negligible	Not Significant	- A Bird and Bat Monitoring Plan will be developed and implemented. - Measures to reduce fauna mortality on access roads will be developed and implemented, including speed limits and appropriate signage. - Pre-clearance surveys will be undertaken to determine if roosts, nests or dens are present or in use in any trees proposed for clearing. When identified a qualified ecologist experienced in tree clearance should be present during clearing to advise on methods to avoid impacts to fauna. - Laydown or temporary disturbance areas will be located in already disturbed areas to avoid any unnecessary clearing of fauna habitat. - 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).	Negligible	Not Significant
Southern Myotis (<i>Myotis macropus</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Negligible	Not Significant		Negligible	Not Significant
Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>)	Individual mortality; Habitat degradation; Habitat alienation	High	Negligible	Not Significant		Negligible	Not Significant

Ecological Feature/Value	Potential Impact	Sensitivity	Magnitude	Initial Significance Rating	Proposed Mitigation Measures	Residual Magnitude	Residual Significance Rating
<i>Reptiles</i>							
Little Whip Snake (<i>Suta flagellum</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Small	Minor	- Infrastructure will be micrositied to avoid microhabitat features, such as surface rock, in native grassland or grassy woodlands. - Vehicles will remain on formed roads or tracks designed specifically for the purposes of the wind farm construction where possible. - Where trenches are to remain open overnight, an escape ramp will be constructed (at 1 in 4) to allow fauna escape. - Trenches will be regularly checked during construction by the Environmental Compliance Manager to ensure any captured fauna are released according to the CEMP - Measures to reduce fauna mortality on access roads will be developed and implemented, including speed limits and appropriate signage.	Small	Minor
Rosenberg's Goanna (<i>Varanus rosenbergi</i>)	Individual mortality; Habitat degradation; Habitat alienation	Medium	Small	Minor	- Pre-clearance surveys will involve inspection of termite mounds for nests. - Vehicles will remain on formed roads or tracks designed specifically for the purposes of the wind farm construction where possible. - Where trenches are to remain open overnight, an escape ramp will be constructed (at 1 in 4) to allow fauna escape. - Trenches will be regularly checked during construction by the Environmental Compliance Manager to ensure any captured fauna are released according to the CEMP. - Measures to reduce fauna mortality on access roads will be developed and implemented, including speed limits and appropriate signage.	Small	Minor

KEY DOCUMENTS REVIEWED TO INFORM THIS ASSESSMENT

Department of Environment and Heritage (2006) *Wildlife Conservation Plan for Migratory Shorebirds*.

Department of Environment Water Heritage and the Arts (DEWHA) (2009). *Draft EPBC Act Policy Statement 3.21 – Significant Impact Guidelines for 36 Migratory Shorebird Species*. Barton, ACT.

Department of Environment, Climate Change and Water NSW (2009). *Draft National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus*. Prepared by Dr Peggy Eby. Department of Environment, Climate Change and Water NSW, Sydney.

Department of Environment, Climate Change and Water NSW (2010). *National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*. Department of Environment, Climate Change and Water NSW, Sydney.

Department of Environment, Climate Change NSW (DECC) (2008). *Best Practice Guidelines for the Grey-headed Flying Fox*. Sydney.

Department of Environment, Climate Change NSW (DECC) (2008). *Recovery Plan for the Koala (Phascolarctos cinereus)*. Sydney.

Natural Resource Management Ministerial Council (2009). *National Koala Conservation and Management Strategy 2009–2014*. Department of the Environment, Water, Heritage and the Arts, Canberra.

Saunders, D.L. and Tzaros, C.L. (2011). *National Recovery Plan for the Swift Parrot Lathamus discolor*, Birds Australia, Melbourne.

Sinclair, S.J. (2010). *National Recovery Plan for the Hoary Sunray Leucochrysum albicans var. tricolor*. Department of Sustainability and Environment, Melbourne.

Threatened Species Scientific Commission (TSSC) (2008). *Approved Conservation Advice for Few-seeded Bossiaea (Bossiaea oligosperma)*.

Threatened Species Scientific Commission (TSSC) (2008). *Approved Conservation Advice for Pomaderris pallida*.

Threatened Species Scientific Commission (TSSC) (2012). *Approved Conservation Advice for Phascolarctos cinereus (Combined Populations of Queensland, New South Wales and the Australian Capital Territory) (koala Northern Designable Unit)*.

Threatened Species Scientific Commission (TSSC) (2013). *Approved Conservation Advice for Thesium australe (austral toadflax)*.

Threatened Species Scientific Commission (TSSC) (2015). *Conservation Advice Calidris ferruginea Curlew Sandpiper*.

TSSC (2008). *Approved Conservation Advice for Diuris aequalis (Buttercup Doubletail)*.

Tumino, M. (2010). *National Recovery Plan for the Basalt Peppercreese Lepidium hyssopifolium*. Department of Sustainability and Environment, Melbourne.

Annex I

MNES Significant Impact Assessment

ANNEX I MNES SIGNIFICANT IMPACT ASSESSMENT

This Annex presents the assessments of significance undertaken in accordance with the Significant Impact Guidelines 1.1 for threatened species and ecological communities and migratory species that are known, or have potential to occur, within the PA.

I.1 THREATENED ECOLOGICAL COMMUNITIES

White Box - Yellow Box - Blakely's Red Gum Grassy Woodland And Derived Native Grasslands (Critically Endangered Ecological Community)

This TEC is a grassy woodland dominated by White Box, Yellow Box or Blakely's Red Gum with a ground layer dominated by tussock grasses and a sparse or patchy shrub layer. The tree cover is discontinuous and consists of widely-spaced trees ie the canopies are clearly separated. In some areas there may be co-dominant trees including (but not limited to) Grey Box, Red Box, Red Stringybark, White and Black Cypress Pine, Long-leaved Box, Kurrajong and Drooping She-Oak. The TEC occurs on areas where the soil is of moderate to high fertility and it generally occurs on areas most sought-after for agriculture. Remnants generally occur on fertile lower parts of the landscape where resources such as water and nutrients are abundant (DECCW 2010).

The Study Area contains 74.94 ha of this TEC, mostly configured in small patches, with one larger patch in the central portion of the PA. The patches of this TEC with the highest ecological quality are located in the centre and far south of the PA. The TEC does not occur in the road reserve proposed to contain the 33 kV transmission line alignment.

This assessment takes into account the guidance on threats and management actions provided in the National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland (DECCW 2010).

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

reduce the extent of an ecological community

Clearing of 1.63 ha of this community will be required. This is equivalent to 2.18% of the extent of the community in the Study Area. This clearing will be configured in small patches and linear fragments.

fragment or increase fragmentation of an ecological community

This TEC occurs in fragmented patches in the north and south of the PA, with one larger patch in the southern part of the northern precinct. Clearing for an access track (approximately 8 m wide) and WTGs will be required in the larger patch. This area currently contains narrow (approximately 4 m wide) access tracks. The clearing of additional access tracks is considered unlikely to inhibit genetic exchange or the dispersal of plants throughout this patch of the TEC, and is therefore not considered to fragment the TEC.

adversely affect habitat critical to the survival of an ecological community

The National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland (DECCW 2010) states that '*given the currently highly fragmented and degraded state of this ecological community, all areas of Box-Gum Grassy Woodland which meet the minimum condition criteria...should be considered critical to the survival of this ecological community*'. Therefore, this TEC within the PA is considered habitat critical to the survival of the TEC, and the clearing of 1.63 ha of this TEC could adversely affect this habitat.

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 creation of access tracks and WTGs within the TEC is unlikely to modify or destroy the soil, surface water or groundwater on which this TEC relies.

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 through regular burning or flora or fauna harvesting

Areas of this TEC outside the Development Footprint will not be modified. Impacts to areas of the TEC to be retained will be managed by:

- Clearly delineating clearing areas to avoid disturbance to surrounding vegetation;
- Restricting vehicle movements to designated access tracks; and
- Implementing dust suppression, erosion and sediment control, and weed and pest management measures, as described in *Section 7.4.1*.

In consideration of these measures, it is unlikely the Project would cause a substantial change in the composition of the TEC to be retained.

cause a substantial reduction in the quality or integrity of an occurrence of an ecological community

Impacts to areas of the TEC outside the Development Footprint will be managed by:

- Clearly delineating clearing areas to avoid disturbance to surrounding vegetation;
- Restricting vehicle movements to designated access tracks; and
- Implementing dust suppression, erosion and sediment control, and weed and pest management measures, as described in *Section 7.4.1*.

In consideration of these measures, it is unlikely the Project would cause a substantial reduction in the quality of the TEC outside the Development Footprint.

interfere with the recovery of an ecological community.

Clearing associated with land use change is a recognised threat to the conservation and recovery of this TEC. Current estimates indicate that 250,729 ha of this TEC remain in NSW (TSSC 2006). The proposed clearing associated with the Project will equate to less than 0.01% of the remaining TEC and this is not considered to substantially interfere with the recovery of the TEC.

Conclusion

Clearing of 1.63 ha of this community will be required. This is equivalent to less than 3% of the extent of the community in the Study Area, and <0.01% of the estimated area of the community in NSW (TSSC 2006). While this is a relatively small area, all areas of this TEC are considered habitat critical to the survival of the TEC, and the proposed clearing will adversely affect habitat critical to the survival of the TEC. Therefore the Project is likely to significantly impact this TEC.

I.2

CRITICALLY ENDANGERED SPECIES

Curlew Sandpiper (Calidris ferruginea) – Critically Endangered

Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. The species is occasionally recorded in the Tablelands (DoE 2015).

Database records of the species exist within the locality from the late 1990s, and BirdLife International (2015) report that 450 Curlew Sandpiper have been recorded at Lake Bathurst, although no date is provided for that record. Sites of international importance for the species are identified in Bamford *et al.* (2008). The nearest site of international importance for the species is located over 300 km from the Study Area, at the Hunter Wetlands National Park (Bamford *et al.* 2008).

The species is considered to have potential to use habitat at Lake Bathurst and Lake George and may fly over the Study Area. Habitat within the Study Area is restricted to sub-optimal farm dams, drainage lines and small damp depressions.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

lead to a long-term decrease in the size of a population,

The Project has potential to lead to mortality of individuals due to WTG collision, as the species is likely to fly at RSA height when travelling between areas of suitable habitat. However, WTG collision is expected to be a rare event as the species has not been recorded in the locality in the last 25 years and the PA is not located within the direct line of flight

between Lake Bathurst and Lake George. It is considered unlikely that a significant proportion of the individuals occurring within Lake Bathurst or Lake George would fly over the PA and of the small proportion of the population which may fly over the PA, only a subset would fly within the RSA of a WTG. It is considered unlikely that the Project would lead to a long-term decrease in the size of the population.

reduce the area of occupancy of the species,

The Project will not reduce the area of occupancy of the species, as the species is highly mobile, and the PA does not provide high quality habitat for the species.

fragment an existing population into two or more populations,

The species is highly mobile and the presence of WTGs is unlikely to affect the movement of the species at a landscape scale. WTGs have been located in clusters with at least a 2.5 km gap between each cluster, and approximately 350 m gaps between each WTG within clusters. This configuration is expected to allow adequate space between individual WTGs and clusters for birds to move between WTGs. This species is highly mobile and the Project is not expected to fragment the population of the species.

adversely affect habitat critical to the survival of a species,

The PA contains only sub-optimal habitat for the species, and is not considered to provide habitat critical to the survival of the species.

disrupt the breeding cycle of a population,

The species does not breed in Australia; however impacts to the species during the non-breeding season could affect the species' breeding success in subsequent years. The Project will not impact important habitat for the species and, while there is potential for the species to fly at RSA height, the occurrence of WTG collision is expected to be rare.

modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,

Habitat within the Study Area is restricted to sub-optimal farm dams, drainage lines and small damp depressions. Farm dams will not be disturbed by the Project, and the removal of some small areas of other sub-optimal habitat is unlikely to lead to a decline in the species.

result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat,

Weed and pest management measures will be undertaken to avoid the introduction of invasive species. In consideration of the implementation of these measures, it is unlikely that the Project would result in the establishment of invasive species in the suboptimal habitat for the species within the PA, or within the Lake Bathurst Important Bird Area (IBA) to the north of the PA.

introduce disease that may cause the species to decline, or

The Project is not expected to introduce any diseases that may cause the species to decline.

interfere with the recovery of the species.

The species may be impacted by WTG collision, however, WTG collision is expected to be a rare event as the species has not been recorded in the locality in the last 25 years and the PA is not located within the direct line of flight between Lake Bathurst and Lake George.

Conclusion

In consideration of the lack of recent records of the species in the locality, the position of the PA south of any direct line of flight between areas of suitable habitat for the species (ie coastal areas, Lake Bathurst IBA or Lake George), and the presence of only sub-optimal habitat within the PA, the Project is considered unlikely to have a significant impact on the species.

Basalt Peppercress (Lepidium hyssopifolium) – Endangered

Generally, the Basalt Peppercress is known to establish on open, bare ground with limited competition from other plants. The Basalt Peppercress has been recorded from Eucalypt woodland with a grassy ground cover, low open Casuarina woodland with a grassy ground cover, tussock grassland and exotic pasture. The species has been recorded in areas of high soil disturbance. Establishment of the species is thought to be disturbance-driven, as opposed to habitat specific. Soils at known sites are light to heavy clay loams that are often friable and the species is known to tolerate a range of environmental conditions (DoE 2015).

The species has not been recorded within the PA, however the PA is within the species' distribution (DoE 2015), and areas of open, bare ground within the PA may provide suitable habitat.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

lead to a long-term decrease in the size of a population,

Despite extensive searches, this species has not been recorded within the PA. If the species does occur in the PA, it could be affected by direct clearing or indirect impacts. To manage impacts to any potentially occurring Basalt Peppercress, the following measures will be taken:

- Pre-clearance vegetation surveys will be undertaken within areas of proposed disturbance that may provide threatened species habitat prior to clearing. If the species is recorded it will be avoided where possible;
- During construction, vehicle movements will be restricted to designated access tracks to avoid disturbance to any potentially occurring individuals outside the Development Footprint; and
- Indirect impacts will be managed by implementing the dust suppression, erosion and sediment control, and weed and pest management measures outlined in Section 7.4.1.

In consideration of these measures, it is unlikely that the size of a potentially occurring population would decrease as a result of the Project.

reduce the area of occupancy of the species,

This species was not identified during targeted field surveys. Pre-clearance surveys will be undertaken prior to construction and, if any individuals are identified, these will be avoided where possible. If individuals can be avoided the Project would not reduce the area of occupancy of the population.

fragment an existing population into two or more populations,

This species was not identified during targeted field surveys, and the Project will therefore not fragment any known populations. Some areas of potential habitat will be fragmented due to the clearing of up to 8 m wide corridors for the access roads. These corridors are unlikely to affect the dispersal of this species.

adversely affect habitat critical to the survival of a species,

The National Recovery Plan for the Basalt Peppercress *Lepidium hyssopifolium* (Tumino 2010) does not define habitat critical for the survival of Basalt Peppercress. Due to the absence of records of the species in the PA, the potential habitat within the PA is unlikely to constitute habitat critical to the survival of the species.

Impacts to potential habitat as a result of the Project include:

- Removal of 6.81 ha of potential habitat within the Study Area, equivalent to 3.17% of potential habitat in the Study Area; and
- Indirect impacts, due to dust pollution, sediment runoff, weed invasion or pest invasion.

Indirect impacts will be managed by implementing the dust suppression, erosion and sediment control, and weed and pest management measures outlined in Section 7.4.1.

disrupt the breeding cycle of a population,

Potential impacts to the breeding cycle of the species, if it does occur in the PA, include

- Damage to flowering individuals during clearing or vehicle movement;
- Removal of, or damage to, seedlings during clearing or vehicle movement; and

- Modification of habitat to prevent successful growth and flowering of individuals.

A pre-clearance survey will be undertaken prior to clearing, and identified individuals will be avoided where possible. In addition, modification of the potential habitat to be retained will be avoided by managing indirect impacts, as described in *Section 7.4.1*.

In consideration of this, the Project would be unlikely to disrupt the breeding cycle of an important population if an important population occurs in the PA.

modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,

This species was not identified during targeted field surveys, however areas of potential habitat for the species have been mapped, and the Project will require the removal of 6.81 ha of potential habitat with the Study Area. Modification of the potential habitat to be retained will be avoided by implementing the dust suppression, erosion and sediment control, and weed and pest management measures outlined in *Section 7.4.1*. It is unlikely that the removal of 6.81 ha of potential habitat (3.17% of potential habitat in the Study Area) will lead to a decline of a potentially occurring local population.

result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat,

Weed and pest management measures will be undertaken to avoid the introduction of invasive species (refer to *Section 7.4.1*). In consideration of the implementation of these measures, it is unlikely that the Project would result in the establishment of invasive species in potential habitat for the Basalt Peppercreep.

introduce disease that may cause the species to decline, or

The Project is not expected to introduce any diseases that may cause the species to decline. Where a specific weed risk has been identified, all machinery, equipment and vehicles are to be washed down before entry and egress of the PA, and any imported soil and rubble will be certified as free of weeds and weed seeds.

interfere with the recovery of the species.

This species was not identified during targeted field surveys. If individuals of the species are identified in pre-clearance surveys, these will be avoided where possible. The Project will involve the removal of 6.81 ha of potential habitat, equivalent to 3.17% of potential habitat in the Study Area. Indirect impacts to habitat will be managed through dust suppression, erosion and sediment control and pest and weed management. Considering the lack of records of the species and the small area of potential habitat to be removed, the Project is unlikely to interfere substantially with the recovery of the species.

Conclusion

In consideration of the lack of records of the species, the small area of potential habitat to be removed, and the management of indirect impacts to potential habitat, the Project is unlikely to significantly impact the Basalt Peppercreep.

Hoary Sunray, Grassland Paper-Daisy (Leucochrysum albicans var. tricolor) – Endangered

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 (DoE 2015).

The Hoary Sunray was recorded within the PA during field surveys and there are three records of the species, from 2010, within the locality.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

lead to a long-term decrease in the size of a population,

Removal of an estimated 342 Hoary Sunray individuals that occur in the 1.71 ha of known habitat will be required for the construction of three WTGs and access tracks. This is from an estimated population of 25,000 individuals and represents approximately 1.37% of the population.

This will, temporarily, reduce the size of the population present in the PA by 1.4%. Hoary Sunray in the PA are particularly abundant in and around existing unsealed access tracks. It is possible that, following the construction phase, the species will regenerate in and around Project access roads and within rehabilitated laydown areas surrounding WTGs. While removal of Hoary Sunray will be required during the construction phase, this may not result in a substantial long-term decrease in the size of the population.

reduce the area of occupancy of the species,

The proposed clearing is not of a scale that would be considered to reduce the area of occupancy of the Hoary Sunray.

fragment an existing population into two or more populations,

Clearing for the Project will result in the clearing of narrow (up to 8 m wide) corridors. Hoary Sunray seed is thought to be able to disperse over many kilometres and can remain viable in the soil for at least a few months (Sinclair 2010). Therefore the clearing associated with the Project will not result in fragmentation of the existing population. Further, the Hoary Sunray is currently abundant in and around existing access tracks, which suggests these small scale disturbances in the PA have not adversely impacted the species.

adversely affect habitat critical to the survival of a species,

The National Recovery Plan for the Hoary Sunray *Leucochrysum albicans* var. *tricolor* (Sinclair 2010) does not identify habitat critical to the survival of the species.

Potential adverse effects to known Hoary Sunray habitat include:

- Removal of 1.71 ha of known habitat, equivalent to 3.98% of known habitat in the Study Area;
- Removal of 19.96 ha of potential habitat within the Development Footprint, equivalent to 4.14% of potential habitat in the Study Area; and
- Indirect impacts, due to dust pollution, sediment runoff, weed invasion or pest invasion.

Indirect impacts will be managed by implementing the dust suppression, erosion and sediment control, and weed and pest management measures outlined in Section 7.4.1.

Further Hoary Sunray individuals and known habitat occur within the PA, outside the Study Area.

disrupt the breeding cycle of a population,

The Hoary Sunray is dependent on pollen transfer by insects, including bees (Apidae) and flies (Tephritidae) (Sinclair 2010). The Project is not expected to affect the transfer of pollen by these invertebrates. Further, Hoary Sunray seed is thought to be able to disperse over many kilometres and can remain viable in the soil for at least a few months (Sinclair 2010) and the Project is unlikely to inhibit the dispersal of seed.

The Project could potentially affect the breeding cycle by removing some Hoary Sunray individuals in the PA, however retained Hoary Sunray will be protected from disturbance by:

- Clearly delineating clearing areas to avoid disturbance to surrounding vegetation;
- Restricting vehicle movements to designated access tracks; and
- Implementing dust suppression, erosion and sediment control, and weed and pest management measures, as described in Section 7.4.1.

In consideration of these measures, the Project is unlikely to impact the reproduction of retained Hoary Sunray.

modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,

The Project will involve removal of 1.71 ha of known Hoary Sunray, equivalent to 3.98% of known habitat within the Study Area. Additional Hoary Sunray individuals are present within the PA, outside the Study Area.

Further potential habitat will also be removed, including 19.96 ha of potential Hoary Sunray habitat within the Study Area (equivalent to 4.14% of potential habitat present in the Study Area).

Retained habitat will not be modified, and the following measures will be implemented to avoid impacts to retained habitat:

- Clearly delineating clearing areas to avoid disturbance to surrounding vegetation;
- Restricting vehicle movements to designated access tracks; and
- Implementing dust suppression, erosion and sediment control, and weed and pest management measures, as described in Section 7.4.1.

In addition, Hoary Sunray in the PA are particularly abundant in and around existing unsealed access tracks and it is possible that, following the construction phase, the species will regenerate in and around unsealed access roads and rehabilitated laydown areas surrounding WTGs

In consideration of the mitigation measures to be implemented, and the potential for regeneration of Hoary Sunray within the Development Footprint, the Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent

that the species would be likely to decline.

result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat,

Weed and pest management measures will be undertaken to avoid the introduction of invasive species (refer to Section 7.4.1.).

In consideration of the implementation of these measures, it is unlikely that the Project would result in the establishment of invasive species in potential habitat for the Hoary Sunray.

introduce disease that may cause the species to decline, or

The Project is not expected to introduce any diseases that may cause the species to decline. Where a specific weed risk has been identified, all machinery, equipment and vehicles are to be washed down before entry and egress of the PA, and any imported soil and rubble will be certified as free of weeds and weed seeds.

interfere with the recovery of the species.

The National Recovery Plan for the Hoary Sunray *Leucochrysum albicans* var. *tricolor* (Sinclair 2010) states that there is no data on population and location size for most of the NSW and ACT populations, and that collection of baseline data is an important action of the recovery plan to assist in identifying important populations. The data provided on this newly identified Hoary Sunray population can assist in meeting a specific objective of the Recovery Plan to determine distribution, abundance and population structure of the species.

Conclusion

In consideration of the estimated remaining 24,658 individuals from the population, the remaining 41.26 ha of known Hoary Sunray habitat in the Study Area, and 123.29 ha of further known habitat within the PA, management of indirect impacts to retained Hoary Sunray, and the observed resilience potential for the species to recolonise in unsealed access roads and laydown areas, the Project is unlikely to significantly impact the Hoary Sunray.

Swift Parrot – Lathamus discolor (Endangered)

The Swift Parrot is endemic to south-eastern Australia. It breeds only in Tasmania, and migrates to mainland Australia in autumn (DoE 2015). On the mainland the species occurs in areas where eucalypts are flowering profusely or where there are abundant lerp infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark, and White Box. Commonly used lerp infested trees include Inland Grey Box, Grey Box and Blackbutt. The species returns to some foraging sites on a cyclic basis depending on food availability (OEH 2015). 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 (DoE 2015).

There is one database record in the locality from 2002 however the species was not recorded within the PA. As the Swift Parrot is a wide ranging species it has been conservatively estimated that this species has the potential to occur within the PA, however the PA provides only limited foraging resources for the species. If the species does occur within the PA it is likely to occur only intermittently or to fly over the PA.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

lead to a long-term decrease in the size of a population,

Potential impacts to the Swift Parrot include loss of foraging habitat and mortality due to WTG collision.

Infrastructure has been sited to minimise clearing of woodland areas. The total area of Swift Parrot foraging habitat to be removed is 2.19 ha, equivalent to 2.45% of this habitat within the Study Area. In addition, extensive woodland habitats exist to the east and south of the PA. Woodland within the PA would provide foraging habitat only, as the species does not breed in NSW.

The National Recovery Plan for the Swift Parrot (*Lathamus discolor*) (Saunders and Tzaros 2011) acknowledges that the construction of WTGs in south-eastern Australia may have implications for the conservation of the Swift Parrot where they are poorly sited. The Study Area is not adjacent to areas known to support high numbers of this species and does not occur within a distinct known migratory pathway for the species. The species is likely to be dispersed over a wide area of NSW by the time they reach the southern tablelands of NSW (on their migration from their Tasmanian breeding grounds), therefore any risk of collision is not likely to affect a high number of individuals.

Biosis Research Pty Ltd (2006) modelled the cumulative impact of WTG collision to the Swift

Parrot as a result of 39 wind farms across the species distribution. The modelling suggested that the rate of fatalities across all wind farms modelled was approximately one bird every ten years (Biosis Research Pty Ltd 2006). This suggests that potential fatalities resulting from WTG collision in this Project will be very rare.

Further, while no Swift Parrots were recorded during the field surveys, flight heights of other medium-sized parrots (Crimson Rosella (*Platycercus elegans*), Eastern Rosella (*P. eximius*) and Red-rumped Parrot (*Psephotus haematonotus*)) were below RSA height, between 0 m and 10 m AGL. The Swift Parrot is also likely to fly at these heights, reducing the risk of WTG collision.

In consideration of the small area of foraging habitat to be removed, and the expected rarity of WTG collision, the Project is unlikely to lead to a long-term decrease in the size of the population.

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 Swift Parrot is a highly mobile migratory species, and part of a single population. The project would not fragment the population as it disperses widely on the mainland.

adversely affect habitat critical to the survival of a species,

The National Recovery Plan for the Swift Parrot (*Lathamus discolor*) (Saunders and Tzaros 2011) identifies habitat critical to the survival of the Swift Parrot as "areas of priority habitat for which the Swift Parrot has a level of site fidelity or possess phenological characteristics likely to be of importance to the Swift Parrot, or are otherwise identified by the recovery team." Actions of the recovery plan are intended to further define the ecological characteristics and distribution of habitat critical to the survival of the species.

The potential habitat within the PA is unlikely to constitute habitat critical to the survival of the species, as there are no records of the species within the PA to suggest site fidelity, and there are limited autumn or winter flowering eucalypt species to be used for foraging.

disrupt the breeding cycle of a population,

This species breeds only in Tasmania and, therefore, breeding is unlikely to be affected by the Project.

modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,

Infrastructure has been sited to minimise clearing of woodland areas. In addition, further woodland habitats exist in the PA and extensive tracts east and south of the PA. In consideration of the relatively small area of potential foraging habitat to be removed, loss of habitat associated with the Project is unlikely to lead to a decline of the species.

result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat,

Weed and pest management measures will be undertaken to avoid the introduction of invasive species (refer to Section 7.4.1.).

In consideration of the implementation of these measures, it is unlikely that the Project would result in the establishment of invasive species in the identified potential foraging habitat for the Swift Parrot.

introduce disease that may cause the species to decline, or

The Project is not expected to introduce any diseases that may cause the species to decline. It is recognised that Psittacine circoviral (beak and feather) disease presents a risk to the Swift Parrot. While the epizootiology of beak and feather disease is not fully understood (TSSC 2001), it is not expected that project activities would affect the prevalence of the disease.

interfere with the recovery of the species.

The Swift Parrot has not been recorded within the PA and the PA provides only limited winter foraging resources for the species. Therefore impacts from the removal of 2.19 ha of potential foraging habitat are unlikely to interfere with the recovery of the species.

Additionally, while the Project presents a risk of WTG collision, modelling of the cumulative impacts of WTG collision across the country and observation of flight heights of other medium-sized parrots within the locality suggest that WTG collision of the Swift Parrot would be rare. Therefore potential WTG collision associated with the Project is considered unlikely to interfere with the recovery of the species.

Conclusion

The Swift Parrot has not been recorded within the PA, however as the species is wide ranging it has been conservatively estimated that this species has the potential to occur within the PA. In consideration of the small proportion of potential foraging habitat to be removed and the expected rarity of WTG collision, the Project is considered unlikely to significantly impact the Swift Parrot.

Spot-Tailed Quoll (Dasyurus maculatus maculatus) - Endangered

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 2015).

The species was not recorded during field surveys and no Spot-tailed Quoll scats were recorded, however there are six records of the species within the locality from between 2002 and 2010. Woodland areas with fallen logs and a gully in the south of the PA containing large boulders may provide suitable habitat for this species.

An action is likely to have a significant impact on a critically endangered or endangered 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, if currently present within the PA, is expected to occur at relatively low densities. This species is expected to utilise larger tracts of connected woodland and forest areas within the PA. Infrastructure has been sited to avoid woodland and forest areas where possible. Although some small areas of habitat loss will be unavoidable. The Development Footprint will result in impacts to approximately 8.12 ha of potential Spot-tailed Quoll habitat. This is approximately 1.90% of the total potential Spot-tailed Quoll habitat within the Study Area.

The majority of project vehicle movements will occur during daylight hours and, as the species is nocturnal, the risk of vehicle strike is considered low. The enforcement of vehicle speed limits will further reduce the risk of vehicle strike.

In consideration of the small proportion of habitat to be removed, and the implementation of measures to minimise the risk of mortality, the Project is unlikely to lead to a long-term decrease in the size of a Spot-tailed Quoll population.

reduce the area of occupancy of the species,

Although some small areas of habitat loss will be unavoidable. The Development Footprint will result in impacts to approximately 8.12 ha of potential Spot-tailed Quoll habitat. This is approximately 1.90% of the total potential Spot-tailed Quoll habitat within the Study Area. The proposed clearing is not of a scale that would be considered to reduce the area of occupancy of the Spot-tailed Quoll.

fragment an existing population into two or more populations,

Where possible, infrastructure has been located in cleared areas, and linear infrastructure has been located to follow existing roads and access tracks. However at some locations, smaller patches of woodland will be intersected by access tracks, which will require the clearing of up to approximately 8 m wide corridors. Existing forest/woodland habitat within the PA is highly fragmented and clearing associated with the Project will not substantially change the configuration of habitat in the PA.

adversely affect habitat critical to the survival of a species,

The majority of woodland and forest habitat in the PA does not contain the habitat features (rocky outcrops, dense understorey and connectivity to large extents of habitat) required for the species. Therefore, the majority of woodland and forest habitat in the PA is not likely to be of high value for the species.

Discrete areas of suitable habitat exist in the north and south of the PA and these areas are not proposed as locations for Project infrastructure.

disrupt the breeding cycle of a population,

No breeding dens were detected within the PA and it is considered that the habitat is suboptimal for the species. It is unlikely that a breeding population occurs within the PA and therefore disruption to breeding is anticipated. More optimal breeding habitat is likely to exist outside of the PA in areas of continuous forest.

While it is considered unlikely that a Spot-tailed Quoll den site would be located within the Development Footprint, fauna spotters will be present during clearing to identify any active Spot-tailed Quoll Dens. If Spot-tailed Quoll are located within the clearing area the individuals will be encouraged to move away from the area or relocated.

modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,

While the species has not been recorded within the PA, there is potential for the species to occur at low densities or transient individuals to occur within forest habitat in the PA. A small proportion of woodland and forest habitats within the Study Area (8.12 ha, equivalent to 1.90% of this habitat type within the Study Area) will be cleared to accommodate Project infrastructure. A larger extent of forest habitat exists to the east and south of the PA. It is unlikely that the proposed habitat removal would lead to a decline in the species.

result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat,

Weed and pest management measures will be undertaken to avoid the introduction of invasive species (refer to Section 7.4.1).

In consideration of the implementation of these measures, it is unlikely that the Project would result in the establishment of invasive species in potential habitat for Spot-tailed Quoll.

introduce disease that may cause the species to decline, or

The Project is not expected to introduce any diseases that may cause the species to decline. Where a specific soil-borne disease risk has been identified, all machinery, equipment and vehicles are to be washed down before entry and egress of the PA.

interfere with the recovery of the species.

The species has not been recorded during targeted surveys and the majority of woodland and forest habitats in the PA is not suitable for the Spot-tailed Quoll. The removal of a small area of potential habitat is considered unlikely to interfere with the recovery of the species.

Conclusion

The species has not been recorded during targeted surveys and the majority of woodland and forest habitat in the PA is not suitable for the Spot-tailed Quoll. Measures will be implemented to avoid direct mortality of Spot-tailed Quoll if the species is found to occur within the PA. The Project is considered unlikely to significantly impact the species.

I.4

VULNERABLE SPECIES

Grey-Headed Flying-Fox (Pteropus poliocephalus) - Vulnerable

The Grey-headed Flying-fox feeds in the canopy of a range of vegetation communities, including rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands. It also feeds on commercial fruit crops and on introduced tree species in urban areas. The species roosts on exposed branches near water, generally in rainforest patches, melaleuca patches, mangroves and riparian vegetation, but can also use modified vegetation in urban and suburban areas (DoE 2015).

Grey-headed Flying-foxes generally travel within 15 km of the roost site each night, but can travel up to 50 km per night as food resources change. The national population has been estimated at between 320,000 individuals in 2001 and 674,000 individuals in 2005; however these estimates are based on incomplete knowledge of camp location and use. The national population is considered to be a single interbreeding population (DoE 2015).

The species has not been recorded within the locality however this is a wide ranging species and the PA is within the species' distribution.

The Significant Impact Guidelines 1.1 (DoE 2013) relate to 'important populations' of vulnerable species. The Significant Impact Guidelines 1.1 define an important population as:

"a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintain genetic diversity and or
- Populations that are near the limit of the species' range."

The Draft National Recovery Plan for the Grey-headed Flying-fox *Pteropus poliocephalus* (DECCW 2009b) does not identify important populations of the Grey-headed Flying-fox; however the SPRAT profile of the species considers all Grey-headed Flying-foxes to be part of a single inter-breeding population (DoE 2015). Therefore any individuals with potential to enter the PA are considered to be part of an important population.

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 the species,

This species is likely to fly at RSA height, presenting a risk of WTG collision. However the species was not identified during field surveys, and there are no database records of the species within the locality. This suggests that, although individuals of the species may enter the PA to forage, it is unlikely a substantial proportion of the population would be at risk of WTG collision within the PA.

In consideration of the small area of potential habitat to be impacted, and the low likelihood of a substantial proportion of the population entering the PA, the Project is unlikely to lead to a long-term decrease in the size of the population.

reduce the area of occupancy of an important population,

The Grey-headed Flying-fox is a highly mobile species and the removal of 8.12 ha of potential foraging habitat is unlikely to reduce the area of occupancy of the species.

fragment an existing important population into two or more populations,

The Grey-headed Flying-fox is a highly mobile species and the clearing of small patches and narrow linear corridors of woodland will not fragment the Grey-headed Flying-fox population.

adversely affect habitat critical to the survival of a species,

The SPRAT profile for the species lists spring foraging resources as critical to the survival of the species. No spring foraging resources were observed within the PA. Foraging resources within the PA were limited to flowering eucalypts of which none were recorded flower profusely during spring. The habitat within the PA is typical of the wider landscape which does not offer the species important foraging resources. The Project will not significantly impact habitat critical to the survival of this species.

disrupt the breeding cycle of an important population,

The Project could potentially impact the breeding cycle of Grey-headed Flying-foxes in the region by removing foraging resources used by pregnant or lactating females, or WTG collision of pregnant or lactating females. As discussed above, the foraging habitat to be removed is sub-optimal and small in comparison to remaining habitat within the PA and locality, and the risk of WTG collision is considered negligible. Therefore the Project is unlikely to disrupt the breeding cycle of the Grey-headed Flying-fox population.

modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,

The Project will involve clearing of 8.12 ha of sub-optimal foraging habitat for this species within the Study Area. This is equivalent to 1.90% of this habitat type within the Study Area. Further woodland and forest to the east and south of the PA may provide suitable foraging habitat. This extent of clearing is unlikely to lead to a decline in the species.

result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat,

Weed and pest management measures will be undertaken to avoid the introduction of invasive species (refer to Section 7.4.1).

In consideration of the implementation of these measures, it is unlikely that the Project would result in the establishment of invasive species in potential Grey-headed Flying-fox foraging habitat.

introduce disease that may cause the species to decline, or

The effects of the pathogens Australian bat Lyssavirus, Bat Paramyxovirus and Menangle Pig virus, on the Grey-headed Flying-fox are unknown (DoE 2015). It is considered unlikely that the Project would affect the prevalence of these diseases in the Grey-headed Flying-fox population.

interfere substantially with the recovery of the species.

Potential impacts to the Grey-headed Flying-fox as a result of the Project are habitat loss and WTG collision. The area of potential habitat to be removed is small (8.12 ha, equivalent to 1.90% of this habitat type within the PA) and this is unlikely to substantially impact the species. This species is at risk of WTG collision, however due to the lack of records of the species in the locality, the occurrence of a Grey-headed Flying-fox entering the PA, flying through the RSA and colliding with a rotor blade is expected to be a rare event.

In consideration of the small area of potential habitat to be impacted, and the anticipated rarity of WTG collision, the Project is unlikely to interfere substantially with the recovery of the species.

Conclusion

In consideration of the small area of sub-optimal habitat to be removed, and the expected rarity of WTG collision, the Project is unlikely to have a significant impact on the Grey-headed Flying-fox.

Koala (Phascolarctos cinereus) - Vulnerable

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 (OEH 2015). The PA is within the Central and Southern Tablelands Koala Management Area, which lists primary Koala feed trees as Ribbon Gum (*Eucalyptus viminalis*) and River Red Gum (*Eucalyptus camaldulensis*). Ribbon Gum was recorded in the PA. There are also 18 secondary feed trees listed for the Koala. Eight of these species occur in the PA. One species of supplementary tree species, the Red Stringybark (*E. macrorhyncha*) was common within the PA.

The species was not recorded during field surveys and no Koala scats were recorded, however there are 14 records of the species within the locality from between 1978 and 2004 (NSW Atlas). The Koala has been considered as having the potential to occur within the PA.

It is acknowledged that, due to deficiency of data on sub-populations throughout the range of the Koala, it is difficult to specify important populations. Therefore the Significant Impact Criteria below are addressed as for an important population.

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 the species,

Potential impacts to the Koala include habitat loss and direct mortality due to vehicle or machinery strike. The Project will clear approximately 8.12 ha of woodland/forest with secondary feed tree species. Habitat loss containing high densities of the primary feed tree species will be limited to 0.99 ha which is 1.44% of the habitat recorded within the Study Area. A larger extent of this forest habitat exists to the east and south of the PA.

Measures to reduce the risk of Koala mortality include:

- the enforcement of vehicle speed limits within the wind farm; and
- use of fauna spotters during clearing to identify any Koalas present in the clearing area. If Koalas are observed clearing will be paused until the Koala leaves or is removed from the clearing area.

In consideration of the small amount of more optimal habitat to be removed, and the implementation of measures to minimise the risk of mortality, the Project is unlikely to lead to a long-term decrease in the size of a Koala population.

reduce the area of occupancy of an important population,

The Project proposes the clearing of small areas and linear strips. The proposed clearing of potential foraging habitat as noted above, is not of a scale that would be considered to reduce the area of occupancy of the Koala.

fragment an existing important population into two or more populations,

Where possible, infrastructure has been located in cleared areas, and linear infrastructure has been located to follow existing roads and access tracks. However at some locations, smaller patches of woodland will be intersected by access tracks, which will require the clearing of up to approximately 8 m corridors. Existing forest/woodland habitat within the PA is highly fragmented and clearing associated with the Project is considered unlikely to restrict Koala movement to the extent that it would fragment a potentially existing population.

adversely affect habitat critical to the survival of a species,

The Referral Guideline for the Vulnerable Koala (DoE 2014) contains a habitat assessment tool to identify habitat critical to the survival of the Koala. An assessment of potential koala habitat using the assessment tool identified that the PA contains habitat critical to the survival of the species. A breakdown of the score is provided in the table below.

Attribute	Score	Description
Koala occurrence	0	The species has not been recorded during field surveys or database searches within the PA.
Vegetation composition	2	One primary feed tree (Ribbon Gum - <i>Eucalyptus viminalis</i>) and several secondary feed tree species exists within the PA.
Habitat connectivity	2	Woodland containing primary Koala habitat food trees occurs in linear strips along creeklines. Although this habitat is not considered to be well connected, the Referral Guidelines consider a contiguous landscape as lacking treeless areas more than 2 km wide. Due to the presence of scattered trees in pasture, the PA is considered a contiguous landscape as defined in the referral guidelines.
Recovery value	2	Riparian woodland in the PA is likely to contribute to achievement of the recovery objective to 'protect and conserve the quality and extent of habitat refuges for the persistence of the species during droughts and periods of extreme heat, especially in riparian environments and other areas with reliable soil moisture and fertility'.
Total score	7	

The Referral Guideline states that Projects resulting in the clearing of more than 2 ha of habitat with a score greater than five, but less than 20 ha of habitat with a score of eight or more, depend on consideration of a range of aspects to determine if a Project may have a significant impact on the Koala.

The above table that indicates habitat critical to the survival of the Koala occurs within the PA, some of which will be impacted.

disrupt the breeding cycle of an important population,

No Koalas were identified during field surveys, and there is not likely to be a resident breeding population within the Development Footprint. Only a small proportion of Koala habitat (1.90% of Koala habitat in the Study Area) is proposed to be cleared, and measures will be implemented to reduce the risk of Koala mortality, including enforcement of vehicle speed limits and use of fauna spotters during clearing. In consideration of the small proportion of habitat to be removed, and the implementation of measures to minimise the risk of mortality, the Project is unlikely to disrupt the breeding cycle of the Koala.

modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,

The Project will result in impacts to approximately 8.12 ha of woodland/forest, including some areas with secondary feed tree species. Habitat loss of forest containing high densities of the primary feed tree species was limited to 0.99 ha which 1.44% of the habitat recorded within the Study Area. Further habitat exists in the PA, and large tracts of forest and woodland exist to the east and south of the PA. In consideration of the extent of alternative habitat in the locality, loss of habitat due to the Project is unlikely to lead to a decline in the species.

result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat,

Weed and pest management measures will be undertaken to avoid the introduction of invasive species (refer to Section 7.4.1).

In consideration of the implementation of these measures, it is unlikely that the Project would result in the establishment of invasive species in potential Koala habitat.

introduce disease that may cause the species to decline, or

Diseases that may cause the Koala to decline are Chlamydiosis and Koala Retrovirus. Chlamydia is present throughout the species range outside of South Australia and French Island, Victoria, and up to 100% of Koalas in QLD and NSW have Koala Retrovirus, however

the proportions may be lower in southern populations. It is unlikely that the Project would introduce a new disease that may cause the species to decline.

interfere substantially with the recovery of the species.

The Project may impact the Koala through habitat loss and direct mortality due to vehicle or machinery strike. Due to the small percentage of habitat to be removed within the Study Area (1.90%), the lack of recent records of the species in the PA, and management of the risk of mortality due to vehicle or machinery strike, the Project is unlikely to interfere substantially with the recovery of the species.

Conclusion

No Koalas were recorded within the PA during field surveys, although some habitat for the species occurs. The project will result in clearance of approximately 8.12 ha of woodland/forest, with secondary feed tree species. Much of this area is considered sub-optimal for Koala owing to the highly fragmented landscape and the low densities of feed trees in some areas. Some clearance will however include habitat defined as habitat critical to the survival of the Koala (as defined by the referral guidelines). Efforts will be made where possible to microsite infrastructure to reduce the amount of feed trees cleared, in particular habitat containing the Primary Feed Tree species, *Eucalyptus viminalis*. The majority of the Koala habitat within the PA will remain unaffected by the Project with negligible changes to the already fragmented habitat. Furthermore the populations of Koala are likely to be low within the PA and perhaps only occurring as transient individuals. The habitat for Koala is more optimal outside of the PA where large tracts of continuous forest occur. In consideration of the small area of habitat to be removed, the low densities of Koala likely to occur and the implementation of measures to minimise the risk of mortality (such as vehicle strike), the Project is unlikely to significantly impact the Koala.

Buttercup Doubletail (Diuris aequalis) - Vulnerable

The Buttercup Doubletail orchid 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 2015).

This species was recorded at one location within the PA during recent field surveys. There are an additional 10 records in the locality, dated between 1976 and 2011 (NSW Atlas).

The Significant Impact Guidelines 1.1 (DoE 2013) relate to 'important populations' of vulnerable species. The Significant Impact Guidelines 1.1 define an important population as:

"a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintain genetic diversity and or
- Populations that are near the limit of the species' range."

Based on this definition, the Buttercup Doubletail population within the PA is not considered an important population. The population is unlikely to be a key source population for dispersal or necessary for the maintenance of genetic diversity, as the known population consists of only three individuals; and, based on records in the Atlas of Living Australia, the population is not near the limit of the species' range. There is no recovery plan for the Buttercup Doubletail, however the approved conservation advice for the species provides information on the species ecology, and threats to the species (TSSC 2008).

Notwithstanding that avoidance, there is potential for an additional population to occur in areas of potential habitat that were not surveyed during the October – December growth period for the species. Therefore, potential impacts to the known population and any potentially occurring individuals are discussed below.

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 the species,

Potential impacts to the Buttercup Doubletail include:

- indirect impacts to individuals, due to dust pollution, sediment runoff, weed invasion or pest invasion; and
- removal of potential Buttercup Doubletail habitat.

No known Doubletail Buttercup habitat will be disturbed by the Project. The nearest infrastructure (WTG 38) is located approximately 250 m from the known Buttercup Doubletail individuals. To manage indirect impacts to these individuals, the following measures will be implemented during construction:

- signage will be installed around the known Buttercup Doubletail habitat discouraging unnecessary entry of personnel to the habitat;
- dust suppression measures will be implemented (refer to *Section 7.4.1*); and
- weed management measures will be implemented (refer to *Section 7.4.1*).

Access roads have been sited to limit access to known habitat, as recommended in the Approved Conservation Advice for the species (TSSC 2008). Sediment runoff is not expected to affect the individuals due to the elevated location, and the Project is unlikely to exacerbate the prevalence of existing pest animals.

The Vegetation Zones that match the species' habitat description are considered 'potential' habitat and cover 62.62 ha of the Study Area. The Development Footprint contains 0.41 ha of potential habitat, equivalent to 0.65% of that present in the Study Area. Pre-clearance surveys will be undertaken in areas of potential habitat prior to clearing. If the species is identified during these surveys it will be avoided where possible.

In consideration of this, the Project is unlikely to lead to a decrease in the size of the known population, or any potentially occurring populations detected during pre-clearance surveys.

reduce the area of occupancy of an important population,

The known Buttercup Doubletail population within the PA is not considered to be an important population. However, there is potential for additional individuals to occur in areas of potential habitat that were not surveyed during the October – December growth period for the species. Therefore, it is not possible to conclusively determine if the PA contains an important population of the species.

Regardless of this, the known population and known habitat will not be disturbed by the Project, and any additional individuals identified during pre-clearance surveys will be avoided where possible. Therefore, the Project is unlikely to reduce the area of occupancy of the population within the PA.

fragment an existing important population into two or more populations,

While it is not possible to conclusively determine if the PA contains an important population of the species, the Project will not fragment the known population, and fragmentation of potential habitat will be limited to clearing of access roads with a maximum width of 8 m. This is unlikely to fragment a population of the species.

adversely affect habitat critical to the survival of a species,

While it is not possible to conclusively determine if the PA contains an important population of the species, the Project is unlikely to affect known habitat of the species, and will have minor impacts to potential habitat for the species.

The nearest infrastructure (WTG 38) is located approximately 250 m from the known Buttercup Doubletail individuals. A small area of potential Doubletail Buttercup habitat (0.41 ha) is within the Development Footprint; however this equates to only 0.65% of potential habitat in the Study Area.

Indirect impacts to known and potential habitat will be managed by:

- Installing signage around the known Buttercup Doubletail habitat to discourage unnecessary entry of personnel to the habitat;
- Implementing dust suppression measures (refer to *Section 7.4.1*); and
- Implementing weed management measures (refer to *Section 7.4.1*).

In consideration of these measures, the Project is not expected to adversely affect known habitat, and will have only minor impacts to potential habitat for the species.

disrupt the breeding cycle of an important population,

While it is not possible to conclusively determine if the PA contains an important population of the species, the Project is unlikely to disrupt pollination of the species, and is unlikely to substantially affect the species' known or potential habitat within the PA.

modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,

The Project will not involve clearing of known Buttercup Doubletail habitat. Indirect impacts will be managed by:

- Installing signage around the known Buttercup Doubletail habitat to discourage unnecessary entry of personnel to the habitat;
- Implementing dust suppression measures (refer to *Section 7.4.1*); and
- Implementing weed management measures (refer to *Section 7.4.1*).

In consideration of the management of indirect impacts, the retention of known habitat and the removal of only 0.65% of known habitat in the Study Area, the Project is unlikely to

modify, remove or isolate habitat to the extent 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,

While this species occurs in a landscape with established weed species, weed management measures will be undertaken to avoid the introduction of invasive species that may be harmful to the species. These include:

- 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.

In consideration of the implementation of these measures, it is unlikely that the Project would result in the establishment of invasive species in Buttercup Doubletail habitat.

introduce disease that may cause the species to decline, or

The Project is not expected to introduce any diseases that may cause the species to decline. Any imported fill or materials will be certified weed and pest free, and vehicles and machinery will be regularly cleaned to avoid spread of soil borne pathogens. In addition, works will not occur within the known Buttercup Doubletail habitat.

interfere substantially with the recovery of the species.

Considering the information provided above, impacts to the Buttercup Doubletail are expected to be minimal. No known habitat for the species will be removed, as any individuals occurring in the habitat may be sources for the species' recovery.

Conclusion

In consideration of the retention of known Buttercup Doubletail habitat, the removal of only 0.65% of potential Buttercup Doubletail habitat in the Study Area, and the management of indirect impacts to known and potential habitat, the Project is considered unlikely to significantly impact the Buttercup Doubletail.

Few-Seeded Bossiaea (Bossiaea oligosperma) - Vulnerable

The Few-seeded Bossiaea occurs on stony slopes or ridges on sandstone in the Yerranderie area (Warragamba) and on loamy soil in low woodland in the Windellama area (TSSC 2008). It is locally abundant in the Windellama area (OEI 2015). A recovery plan has not been developed for this species, however this assessment takes into account the guidance on threats to the species presented in the species' conservation advice (TSSC 2008).

The species was not identified in the PA despite extensive searches within the Study Area, and although its presence is suspected unlikely, the possibility of it being present could not be completely ruled out.

The Significant Impact Guidelines 1.1 (DoE 2013) relate to 'important populations' of vulnerable species. The Significant Impact Guidelines 1.1 define an important population as:

"a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintain genetic diversity and or
- Populations that are near the limit of the species' range."

While a population of the species has not been recorded during field surveys, there is potential for a population to occur in unsurveyed areas of potential habitat. Therefore it is not possible to conclusively determine if an important population occurs within the PA.

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 the species,

This species was not identified during targeted field surveys. Pre-clearance surveys will be undertaken prior to construction and, if any individuals are identified, these will be avoided where possible. Given that no WTG pads require clearing of woodland, the only impacts to potential habitat for this species are the clearing of up to approximately 8 m wide corridors through woodland, it is extremely unlikely that this clearing will remove a population proportion significant enough to cause a long-term decrease of an important population.

reduce the area of occupancy of an important population,

This species was not identified during targeted field surveys. Pre-clearance surveys will be undertaken prior to construction and, if any individuals are identified, these will be avoided where possible. Given that no WTG pads require clearing of woodland, the only impacts to potential habitat for this species are the clearing of up to approximately 8 m wide corridors through woodland, it is extremely unlikely that this clearing will remove a population proportion significant enough to significantly reduce the occupancy area of an important population.

fragment an existing important population into two or more populations,

This species was not identified during targeted field surveys, therefore the Project will not fragment any known populations. Some areas of potential habitat will be traversed by access roads up to approximately 8 m wide. This clearing will not fragment any population as the development will not inhibit genetic exchange and seed dispersal.

adversely affect habitat critical to the survival of a species,

Due to the absence of records of the species in the PA, the potential habitat within the PA is unlikely to constitute habitat critical to the survival of the species.

Impacts to potential habitat as a result of the Project include:

- Removal of 1.86 ha of potential habitat (representing 0.83% of potential habitat for this species in the Study Area); and
- Indirect impacts, due to dust pollution, sediment runoff, weed invasion or pest invasion.

Indirect impacts will be managed by implementing the dust suppression, erosion and sediment control, and weed and pest management measures outlined in *Section 7.4.1*.

disrupt the breeding cycle of an important population,

Potential impacts to the breeding cycle of the species, if it does occur in the PA, include:

- damage to flowering individuals during clearing or vehicle movement;
- removal of or damage to seedlings during clearing or vehicle movement; and
- modification of habitat to prevent successful growth and flowering of individuals.

A pre-clearance survey will be undertaken prior to clearing, and identified individuals will be avoided where possible. In addition, modification of potential habitat retained will be avoided by managing indirect impacts, as described in *Section 7.4.1*.

In consideration of this, the Project would be unlikely to disrupt the breeding cycle of an important population if an important population occurs in the PA.

modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,

This species was not identified during targeted field surveys, however areas of potential habitat for the species have been mapped, and the Project will require the removal of 1.86 ha of potential habitat within the Study Area. Modification of the potential habitat to be retained will be avoided by implementing the dust suppression, erosion and sediment control, and weed and pest management measures outlined in *Section 7.4.1*. It is unlikely that the removal of the 1.86 ha of potential habitat within the Study Area would lead to a decline of a potentially occurring local population.

result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat,

Weed and pest management measures will be undertaken to avoid the introduction of invasive species. These include:

- 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.

In consideration of the implementation of these measures, it is unlikely that the Project would result in the establishment of invasive species in potential habitat for Few-seeded Bossiaea.

introduce disease that may cause the species to decline, or

Few-seeded Bossiaea may be affected either by direct infestation of *Phytophthora cinnamomi* infestation, or associated degradation of habitat. Field surveys did not identify any locations suspected of being infested by *P. cinnamomi* within the PA. Measures will be implemented to prevent the introduction of *P. cinnamomi* and other soil borne diseases. These include: the use of clean fill materials and implementation of vehicle and machinery hygiene procedures.

interfere substantially with the recovery of the species.

This species was not identified during targeted field surveys. The Project will require the removal of small areas of potential habitat for the species, however pre-clearance surveys will be undertaken in areas of potential habitat, and if individuals of the species are identified, these will be avoided where possible. Impacts to indirect habitat will be managed through dust suppression, erosion and sediment control and pest and weed management. Considering the lack of records of the species and the small area of potential habitat to be removed, the Project is unlikely to interfere substantially with the recovery of the species.

Conclusion

In consideration of the lack of records of the species, the small area of potential habitat to be removed, and the management of indirect impacts to potential habitat, the Project is unlikely to significantly impact the Few-seeded Bossiaea.

Pale Pomaderris (Pomaderris pallida) - Vulnerable

The Pale Pomaderris occurs in 15 known populations across the ACT, Victoria and southern NSW (TSSC 2008). This species is found in dry open forest and shrub communities, associated with Brittle Gum (*Eucalyptus mannifera*) and Red Stringybark (*E. macrorhyncha*) or *Callitris* spp. woodland (TSSC 2008). The species generally occurs on granite slopes, river slopes and hillsides. The species has not been recorded within the PA, however there is one record, from 2008, within the locality.

The Significant Impact Guidelines 1.1 (DoE 2013) relate to 'important populations' of vulnerable species. The Significant Impact Guidelines 1.1 define an important population as:

"a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintain genetic diversity and or
- Populations that are near the limit of the species' range."

While a population of the species has not been recorded during field surveys, there is potential for a population to occur in unsurveyed areas of potential habitat. Therefore it is not possible to conclusively determine if an important population occurs within the PA.

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 the species,

This species was not identified during targeted field surveys. Pre-clearance surveys will be undertaken prior to construction and, if any individuals are identified, these will be avoided where possible. Given that no WTG pads require clearing of woodland, the only impacts to potential habitat for this species are the clearing of up to approximately 8 m wide corridors through woodland, it is extremely unlikely that this clearing will remove a population proportion significant enough to cause a long-term decrease of an important population.

reduce the area of occupancy of an important population,

This species was not identified during targeted field surveys. Pre-clearance surveys will be undertaken prior to construction and, if any individuals are identified, these will be avoided where possible. Given that no WTG pads require clearing of woodland, the only impacts to potential habitat for this species are the clearing of up to approximately 8 m wide corridors through woodland, it is extremely unlikely that this clearing will remove a population proportion significant enough to significantly reduce the occupancy area of an important population.

fragment an existing important population into two or more populations,

This species was not identified during targeted field surveys, therefore the Project will not fragment any known populations. Some areas of potential habitat will be traversed by access roads up to approximately 8 m wide. This clearing will not fragment any population as the development will not inhibit genetic exchange and seed dispersal.

adversely affect habitat critical to the survival of a species,

Due to the absence of records of the species in the PA, the potential habitat within the PA is unlikely to constitute habitat critical to the survival of the species. Impacts to potential habitat as a result of the Project include:

- 1.86 ha of potential habitat (representing 0.83% of potential habitat for this species in the Study Area); and
- indirect impacts, due to dust pollution, sediment runoff, weed invasion or pest invasion.

Indirect impacts will be managed by implementing the dust suppression, erosion and sediment control, and weed and pest management measures outlined in Section 7.4.1.

disrupt the breeding cycle of an important population,

Potential impacts to the breeding cycle of the species, if it does occur in the PA, include:

- damage to flowering individuals during clearing or vehicle movement;
- removal of or damage to seedlings during clearing or vehicle movement; and
- modification of habitat to prevent successful growth and flowering of individuals.

A pre-clearance survey will be undertaken prior to clearing, and identified individuals will be avoided where possible. In addition, modification of the potential habitat to be retained will be avoided by managing indirect impacts, as described in Section 7.4.1.

In consideration of this, the Project would be unlikely to disrupt the breeding cycle of an important population if an important population occurs in the PA.

modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,

This species was not identified during targeted field surveys, however areas of potential habitat for the species have been mapped and the Project will require the removal of a small area of potential habitat. Modification of the potential habitat to be retained will be avoided by implementing the dust suppression, erosion and sediment control, and weed and pest management measures outlined in Section 7.4.1. It is unlikely that the removal of the small area proposed would lead to a decline of a potentially occurring local population.

result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat,

Weed management measures will be undertaken to avoid the introduction of invasive species (refer to Section 7.4.1.). In consideration of the implementation of these measures, it is unlikely that the Project would result in the establishment of invasive species in potential habitat for the Pale Pomaderris.

introduce disease that may cause the species to decline, or

Pale Pomaderris may be affected either by direct infestation of *Phytophthora cinnamomi* infestation, or associated degradation of habitat. Field surveys did not identify any locations suspected of being infested by *P. cinnamomi* within the PA. Measures will be implemented to prevent the introduction of *P. cinnamomi* and other soil borne diseases. These include: the use of clean fill materials and implementation of vehicle and machinery hygiene procedures.

interfere substantially with the recovery of the species.

This species was not identified during targeted field surveys. If individuals of the species are identified in pre-clearance surveys, these will be avoided where possible. The Project will involve the removal of 1.86 ha of potential habitat within the Study Area, equivalent to 0.83% of potential habitat in the Study Area. Indirect impacts to habitat will be managed through dust suppression, erosion and sediment control and pest and weed management. Considering the lack of records of the species and the small area of potential habitat to be removed, the Project is unlikely to interfere substantially with the recovery of the species.

Conclusion

In consideration of the lack of records of the species, the small area of potential habitat to be removed, and the management of indirect impacts to potential habitat, the Project is unlikely to significantly impact the Pale Pomaderris.

Austral Toadflax (Thesium australe) - Vulnerable

In NSW, the Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. The species is a root parasite that is often associated with Kangaroo Grass (*Themeda triandra*). In areas away from the coast the species occurs in grassland and grassy woodland (OEH 2015).

The species has not been recorded in the locality, however the PA and proposed transmission line alignment is within the species' distribution and contains suitable habitat for the species.

The Significant Impact Guidelines 1.1 (DoE 2013) relate to 'important populations' of vulnerable species. The Significant Impact Guidelines 1.1 define an important population as:

"a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintain genetic diversity and or
- Populations that are near the limit of the species' range."

While a population of the species has not been recorded during field surveys, there is potential for a population to occur in unsurveyed areas of potential habitat. Therefore it is not possible to conclusively determine if an important population occurs within the PA.

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 the species,

This species was not identified during targeted field surveys. Pre-clearance surveys will be undertaken prior to construction and, if any individuals are identified, these will be avoided where possible. If individuals can be avoided the Project would not lead to a long-term decrease in the size of the population.

reduce the area of occupancy of an important population,

This species was not identified during targeted field surveys. Pre-clearance surveys will be undertaken prior to construction and, if any individuals are identified, these will be avoided where possible. If individuals can be avoided the Project would not reduce the area of occupancy of the population.

fragment an existing important population into two or more populations,

This species was not identified during targeted field surveys, and the Project will therefore not fragment any known populations. Some areas of potential habitat will be traversed by up to approximately 8 m wide access roads. Corridors of this width area unlikely ecologically fragment any population.

adversely affect habitat critical to the survival of a species,

Due to the absence of records of the species in the PA, the potential habitat within the PA is unlikely to constitute habitat critical to the survival of the species.

Impacts to potential habitat as a result of the Project include:

- removal of 6.07 ha of potential habitat (representing 5.25% of the potential habitat for this species in the Study Area); and
- indirect impacts, due to dust pollution, sediment runoff, weed invasion or pest invasion.

Indirect impacts will be managed by implementing the dust suppression, erosion and sediment control, and weed and pest management measures outlined in Section 7.4.1.

disrupt the breeding cycle of an important population,

Potential impacts to the breeding cycle of the species, if it does occur in the PA, include:

- damage to flowering individuals during clearing or vehicle movement;
- removal of or damage to seedlings during clearing or vehicle movement; and
- modification of habitat to prevent successful growth and flowering of individuals.

A pre-clearance survey will be undertaken prior to clearing, and identified individuals will be avoided where possible. In addition, modification of potential habitat to be retained will be avoided by managing indirect impacts, as described in Section 7.4.1.

In consideration of this, the Project would be unlikely to disrupt the breeding cycle of an

important population if an important population occurs in the PA.

modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,

This species was not identified during targeted field surveys, however areas of potential habitat for the species have been mapped, and the Project will require the removal of small areas of potential habitat. Modification of the potential habitat to be retained will be avoided by implementing the dust suppression, erosion and sediment control, and weed and pest management measures outlined in Section 7.4.1. It is unlikely that the removal of the small areas of potential habitat proposed would lead to a decline of a potentially occurring local population.

result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat,

Weed and pest management measures will be undertaken to avoid the introduction of invasive species (refer to Section 7.4.1.). In consideration of the implementation of these measures, it is unlikely that the Project would result in the establishment of invasive species in potential habitat for the Austral Toadflax.

introduce disease that may cause the species to decline, or

Austral Toadflax may be affected either by direct infestation of *Phytophthora cinnamomi* infestation, or associated degradation of habitat. Field surveys did not identify any locations suspected of being infested by *P. cinnamomi* within the PA. Measures will be implemented to prevent the introduction of *P. cinnamomi* and other soil borne diseases. These include: the use of clean fill materials and implementation of vehicle and machinery hygiene procedures.

interfere substantially with the recovery of the species.

This species was not identified during targeted field surveys. If individuals of the species are identified in pre-clearance surveys, these will be avoided where possible. The Project will involve the removal of 6.07 ha of potential habitat within the Study Area, equivalent to 5.25% of potential habitat in the Study Area. Indirect impacts to habitat will be managed through dust suppression, erosion and sediment control and pest and weed management. Considering the lack of records of the species and the small area of potential habitat to be removed, the Project is unlikely to interfere substantially with the recovery of the species.

Conclusion

In consideration of the lack of records of the species, the small area of potential habitat to be removed, and the management of indirect impacts to potential habitat, the Project is unlikely to significantly impact the Austral Toadflax.

COASTAL WETLAND SPECIES

Common Sandpiper (*Actitis hypoleucos*), Red-necked Stint (*Calidris ruficollis*), Pacific Golden Plover (*Pluvialis fulva*), Pectoral Sandpiper (*Calidris melanotos*), Common Greenshank (*Tringa nebularia*), Curlew Sandpiper (*Calidris ferruginea*)

The Significant Impact Guidelines 1.1 (DoE 2013) require assessment of impacts to migratory species in terms of important habitat. The Significant Impact Guidelines 1.1 defines important habitat for a migratory species as:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- habitat that is of critical importance to the species at particular life-cycle stages, and/or
- habitat utilised by a migratory species which is at the limit of the species range, and/or
- habitat within an area where the species is declining.

These species generally occur in coastal areas but also, less commonly, can occur in inland wetlands. The Pacific Golden Plover, Pectoral Sandpiper, Common Greenshank and Curlew Sandpiper have been recorded in the locality in the late 1980s and early 1990s. BirdLife International (2015) report that 450 Curlew Sandpiper have been recorded at Lake Bathurst. During field surveys.

It is expected that these species have potential to use habitat at Lake Bathurst and Lake George. However, habitat within the PA is restricted to sub-optimal farm dams, drainage lines and small damp depressions and these species are only considered to have potential to occur in the PA as they may fly over the site. None of these species were recorded within the Study Area during bird surveys. The PA is not considered to contain important habitat for these species.

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

The PA does not contain important habitat for these 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 PA does not contain important habitat for these species.

seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

These species are likely to fly at RSA height when travelling between areas of suitable habitat. While individuals of these species may be at risk of WTG collision, WTG collision is expected to be a rare event. The PA is not located within the direct line of flight between Lake Bathurst and Lake George and it is considered unlikely that a significant proportion of the individuals occurring within Lake Bathurst or Lake George would fly over the PA. Of the small proportion of the population which may fly over the PA, only a subset would fly within the RSA of a WTG.

In consideration of the expected small numbers of individuals of these species to fly over the PA, it is considered unlikely that the Project would seriously disrupt the lifecycle of an ecologically significant proportion of the population of these species.

Conclusion

These species generally occur in coastal areas and may, less commonly, visit the nearby Lake Bathurst IBA. The PA does not provide important habitat for these species, and the species are only considered to have potential to occur in the PA as they may fly over the site. As the PA is not located in the direct line of flight between more substantial areas of habitat (Lake Bathurst IBA and Lake George), it is unlikely that significant proportions of the populations would fly over the site or be affected by the Project. Therefore, the Project is unlikely to have a significant impact on these migratory coastal wetland species.

WETLAND SPECIES

Great Egret (*Ardea alba*), Cattle Egret (*Ardea ibis*), Double-banded Plover (*Charadrius bicinctus*), Little Curlew (*Numenius minutus*), Glossy Ibis (*Plegadis falcinellus*), Marsh Sandpiper (*Tringa stagnatilis*)

The Significant Impact Guidelines 1.1 (DoE 2013) require assessment of impacts to migratory species in terms of important habitat. The Significant Impact Guidelines 1.1 defines important habitat for a migratory species as:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- habitat that is of critical importance to the species at particular life-cycle stages, and/or
- habitat utilised by a migratory species which is at the limit of the species range, and/or
- habitat within an area where the species is declining.

The Little Curlew, Glossy Ibis and Marsh Sandpiper have been recorded within the locality between the late 1970s and 1980s. The nearby Lake Bathurst IBA is recognised as an important drought refuge (BirdLife International 2015).

It is expected that each of the wetland species have potential to use habitat at the nearby Lake Bathurst IBA. However, habitat within the PA is restricted to sub-optimal farm dams, drainage lines and small areas of temporarily damp grassland. The wetland species are considered to have potential to occur in the PA as they may fly over the site. None of these species were recorded within the Study Area during bird surveys. The PA is not considered to contain important habitat for these species.

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

The PA does not contain important habitat for these 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 PA does not contain important habitat for these species.

seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

These species are likely to fly at RSA height when travelling between areas of suitable habitat. While individuals of these species may be at risk of WTG collision, WTG collision is expected to be a rare event. The PA is not located within the direct line of flight between Lake Bathurst and Lake George and it is considered unlikely that a significant proportion of the individuals occurring within Lake Bathurst or Lake George would fly over the PA. Of the small proportion of the population which may fly over the PA, only a subset would fly within the RSA of a WTG.

In consideration of the expected small numbers of individuals of these species to fly over the PA, it is considered unlikely that the Project would seriously disrupt the lifecycle of an ecologically significant proportion of the population of these species.

Conclusion

The PA does not provide important habitat for these species, and the species are only considered to have potential to occur in the PA as they may fly over the site. As the PA is not located in the direct line of flight between more substantial areas of habitat (Lake Bathurst IBA and Lake George), it is unlikely that significant proportions of the populations would fly over the site or be affected by the Project. Therefore, the Project is unlikely to have a significant impact on these migratory wetland species.

MIGRATORY SPECIES WITH GENERALIST HABITAT REQUIREMENTS

Rainbow Bee-eater (*Merops ornatus*), Fork-tailed Swift (*Apus pacificus*), White-throated Needletail (*Hirundapus caudacutus*)

The Significant Impact Guidelines 1.1 (DoE 2013) require assessment of impacts to migratory species in terms of important habitat. The Significant Impact Guidelines 1.1 defines important habitat for a migratory species as:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- habitat that is of critical importance to the species at particular life-cycle stages, and/or
- habitat utilised by a migratory species which is at the limit of the species range, and/or
- habitat within an area where the species is declining.

The Rainbow Bee-eater, White-throated Needletail and Fork-tailed Swift have generalist habitat requirements, occurring in a range of landscapes including cleared farmland. The Fork-tailed Swift and White-throated Needletail are aerial species which rarely alight while in Australia. Due to these generalist habitat requirements, habitat within the PA is not of critical importance to the species. The PA is not at the edge of the range of these species, and there is no evidence to suggest these species are declining in this region.

The Rainbow Bee-eater and Fork-tailed Swift have not been recorded within the locality; however have potential to occur in the PA due to their wide range and generalist habitat requirements. Due to the generalist habitat requirements and lack of records of these species, habitat within the PA is not considered to be important habitat for these species.

The White-throated Needletail was recorded on two occasions within the locality during field surveys and on one occasion up to 100 individuals were observed. There is no published estimate of the world population of the White-throated Needletail, however the species is often observed in large flocks of hundreds or thousands of individuals, and the individuals recorded in the PA would not constitute an ecologically significant proportion of the species. Therefore the PA is not considered to provide important habitat for this species.

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

The PA does not contain important habitat for these 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 PA does not contain important habitat for these species.

seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

These species may fly at RSA height while foraging and travelling between areas of suitable habitat. While individuals of these species may be at risk of WTG collision, WTG collision is expected to be a rare event. These species are wide-ranging and have generalist habitat requirements and it is highly unlikely that an ecologically significant proportion of the populations would fly within the PA. Of the small proportion of the population which may fly over the PA, only a subset would fly within the RSA of a WTG. In consideration of the expected small numbers of individuals of these species to fly over the PA, it is considered unlikely that the Project would seriously disrupt the lifecycle of an ecologically significant proportion of the population of these species.

Conclusion

These species are wide-ranging and have generalist habitat requirements. The PA is not considered to provide important habitat for these species and it is unlikely that an ecologically significant proportion of the population would enter the PA to be at risk of impacts from the Project. The Project is unlikely to have a significant impact on these species.

Satin Flycatcher (Myiagra cyanoleuca)

The Significant Impact Guidelines 1.1 (DoE 2013) require assessment of impacts to migratory species in terms of important habitat. The Significant Impact Guidelines 1.1 defines important habitat for a migratory species as:

- a. habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- b. habitat that is of critical importance to the species at particular life-cycle stages, and/or
- c. habitat utilised by a migratory species which is at the limit of the species range, and/or
- d. habitat within an area where the species is declining.

The species has not been recorded in the locality, and the PA does not contain heavily vegetated gullies in eucalypt forest in which the species generally occurs. However the species is known to use drier woodlands when on migration and the species may pass through the PA during migration. As the species has not been recorded in the locality, the PA does not contain preferred habitat for the species and the PA is not near the edge of the species range, the PA is not considered to contain important habitat for the species.

An action is likely to have a significant impact on a vulnerable 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

The PA does not contain important habitat for the Satin Flycatcher.

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 PA does not contain important habitat for the Satin Flycatcher.

seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The Project is unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of the population. The lack of records of the species within the locality suggests that an ecologically significant proportion of the population does not regularly occur in the locality.

This species forages among the canopy of trees and are thought to move singly, in pairs or in small loose groups through the canopy while on passage (DoE 2015). This behaviour is unlikely to cause the species to fly within the RSA of WTGs.

While the Project will involve clearing of some woodland which could provide foraging habitat and shelter during passage, the total area of potential habitat to be removed within the Study Area is 8.12 ha, equivalent to only 1.90% of these habitat types within the Study Area.

Conclusion

As the species has not been recorded in the locality, the PA does not contain preferred habitat for the species and the PA is not near the edge of the species range, the PA is not considered to contain important habitat for the species. Further, it is unlikely that an ecologically significant proportion of the population would enter the PA and be at risk of impacts from the Project.

Common Sandpiper (*Actitis hypoleucos*),

The Significant Impact Guidelines 1.1 (DoE 2013) requires assessment of impacts to migratory species in terms of important habitat. The Significant Impact Guidelines 1.1 defines important habitat for a migratory species as:

- a. habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- b. habitat that is of critical importance to the species at particular life-cycle stages, and/or
- c. habitat utilised by a migratory species which is at the limit of the species range, and/or
- d. habitat within an area where the species is declining.

These species generally occur in coastal area, less commonly, occurring at inland wetlands. Whilst in Australia the species is typically widespread in small number, with the highest concentrations in Northern and Western Australia (DoE, 2015). It is expected that these species have potential to use habitat at Lake Bathurst and Lake George. BirdLife International (2015) reports that 70 Common Sandpiper were recorded on one occasion at Lake Bathurst.

Habitat within the PA is not considered to contain suitable foraging resources for the species and this species is only considered to have potential to occur in the PA as they may fly over the site. The PA is therefore, not considered to contain important habitat for these species.

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

The PA does not contain important habitat for this 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 PA does not contain important habitat for this species.

seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The Study Area is not considered import for the lifecycle of the species given that there is no suitable foraging habitat and that it is not on a known migratory route for the species.

The species is likely to fly at RSA height or above when travelling between areas of suitable habitat. Occasionally the species may utilise Lake Bathurst and Lake George, however the PA is not located within the direct line of flight between Lake Bathurst and Lake George.

There is potential for a small number of individuals to fly over the Study Area and of possible mortality due to rotor strike. While individuals or small groups of the species may be at risk of WTG collision, the species is widespread whilst in Australia, therefore there is little risk of a significant proportion of the population to be impacted by rotor strike. WTG collision is expected to be a rare event affecting a small number of individuals and owing to this, it is considered unlikely that the Project would seriously disrupt the lifecycle of an ecologically significant proportion of the population of these species.

Conclusion

The Project will not impact a significant proportion of population for this species, and no significant impact is anticipated for the Common Sandpiper.

Sharp-tailed Sandpiper (*Calidris acuminata*),

The Significant Impact Guidelines 1.1 (DoE 2013) require assessment of impacts to migratory species in terms of important habitat. The Significant Impact Guidelines 1.1 defines important habitat for a migratory species as:

- a. habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- b. habitat that is of critical importance to the species at particular life-cycle stages, and/or
- c. habitat utilised by a migratory species which is at the limit of the species range, and/or
- d. habitat within an area where the species is declining.

The Sharp-tailed Sandpiper is a summer migrant from Arctic Siberia, being found on wetlands throughout Australia. The species prefers the grassy edges of shallow inland freshwater wetlands. It is also found around sewage farms, flooded fields, mudflats, mangroves, rocky shores and beaches. The Sharp-tailed Sandpiper, has been recorded within the locality between the late 1970s and 1980s. The nearby Lake Bathurst IBA is recognised as an important drought refuge which has, at times, supported more than 1% of the world population Sharp-tailed Sandpiper (BirdLife International 2015).

Habitat within the PA is not considered to contain suitable foraging resources for the species and this species is only considered to have potential to occur in the PA as they fly over the site. The PA is therefore, not considered to contain important habitat for these species.

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

The PA does not contain important habitat for these 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 PA does not contain important habitat for these species.

seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The Study Area is not considered import for the lifecycle of the species given that there is no suitable foraging habitat and that it is not on a known migratory route for the species.

The species is likely to fly at RSA height or above when travelling between areas of suitable habitat. Lake Bathurst IBA is a known drought refuge for the species, with their occurrence likely to be intermittent, reflecting climatic conditions. The PA is not located within the direct line of flight between Lake Bathurst and other potential foraging habitat such as Lake George.

There is potential for groups of the species to occasionally fly over the Study Area and therefore the possibility exists for mortality due to rotor strike. As the Study Area is not within a known migratory route for the species and it has not been recorded during field surveys, it is anticipated that there is only an intermittent risk and likely affecting a relatively a small number of individuals. WTG collision is expected to be a rare event it is considered unlikely that the Project would seriously disrupt the lifecycle of an ecologically significant proportion of the population of these species. The species was not observed during field survey within the Study Area.

Conclusion

The PA does not provide important habitat for these species, and the species are only considered to have potential to occur in the PA as they may fly over the site. As the PA is not located in the direct line of flight between more substantial areas of habitat (Lake Bathurst IBA and Lake George), it is unlikely that significant proportions of the populations would fly over the site or be affected by the Project. Therefore, the Project is unlikely to have a significant impact on these migratory wetland species.

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