

# **WHITE ROCK WIND FARM STAGE 2**

## **MODIFICATION APPLICATION No.6 IMPACTS ON BIRDS AND BATS**

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## 1. INTRODUCTION

The White Rock Wind Farm (WRWF) is located near Glen Innes in northern New South Wales and received planning approval in July 2012 (Minister for Planning and Infrastructure). The Project Approval details specifications for the construction and operation of up to 119 wind turbines with a maximum blade tip height of 150 metres above foundation level. The Project Approval did not specify blade lengths, hub heights or ground clearance for the operating turbines.

### 1.1. The proposed modification

In this report, RSA (rotor swept area) is defined as the zone encompassing the area of an operating wind turbine within which the blades rotate, defined in terms of an upper “maximum” and lower “minimum” RSA height, and a total circular swept area of the RSA.

This document has been prepared to inform an application for modification of the Project Approval. The proponent is seeking to make a variation from the turbines used for WRWF Stage 1 (GW-121) to a GW-170 turbine in line with Table 1 below. It assesses the change in potential impacts as a result of the proposed modification.

**Table 1: Proposed modifications to turbine specifications**

Turbine specification	Stage 2 using turbines consistent with Stage 1 (GW121)*	Stage 2 Modification Based on GW170	Total extent of change
Maximum RSA height (tip height)	150 m	Up to 200 m	Overall 50 m blade tip height
Minimum RSA height (above ground)	29 m	Minimum of 30 m	1-meter increase in minimum lower RSA
Rotor diameter	121 m	Up to 170 m	Up to 49 m rotor diameter increase
Total RSA m <sup>2</sup> / turbine	11,499 m <sup>2</sup>	22,698 m <sup>2</sup>	Up to 97% increase in RSA

\* - turbine dimensions were provided by the proponent as those similar to Stage 1 of WRWF (GW121).

### 1.2. Assessment process

Brett Lane and Associates Pty. Ltd. (BL&A) have been involved with the White Rock Wind Farm since 2015 and have undertaken several bird and avifauna field and desktop assessments, namely:

- BL&A (2015) White Rock Wind Farm: Bird and Bat Adaptive Management Program: Risk Assessment, Report 15009 (1.1).
- BL&A (2016a) White Rock Wind Farm Stage 1: Bird and Bat Adaptive Management Program, Report 15009 (2.6).
- BL&A (2016b) White Rock Wind Farm: Bat Pre-construction survey 2015, Report 15009 (3.3).
- BL&A (2017) White Rock Wind Farm: Bird Utilisation Survey, Report 15009 (4.0).

- BL&A (2018a) White Rock Wind Farm- Stage Two – Pre-construction Bat Survey – Autumn 2018 Report 15009 (9.0).
- BL&A (2018b) White Rock Wind Farm- Stage Two – Pre-construction Bird Utilisation Survey – Autumn 2018 Report 15009 (10.0).

This report considers information from previous investigations to assess the change in risk profile from the proposed modification as indicated in Table 1. The above-mentioned survey reports provides baseline information on bird species composition and utilisation at WRWF.

The impact on bats is considered, based on the detailed surveys completed from 2015, 2016, 2017 and 2018. In addition, publicly available data from other nearby developments including Sapphire Wind Farm and Glen Innes Wind Farm, ha been reviewed. In addition, pooled data from other comparable sites where data was collected at height is used to evaluate potential impacts on high-flying species.

## 2. IMPACTS OF MODIFICATION ON BIRDS

### 2.1. Previous Investigations

#### 2.1.1. 2016-2017 BUS at White Rock Wind Farm – Stage 1 and Stage 2

The pre-construction bird utilisation survey for the White Rock Wind Farm Stage 1 and Stage 2 was undertaken during two different seasons in Spring 2016 and Autumn 2017 to collect a range of data and include migratory birds that may only occur at certain times of the year.

Sixty-one bird species were recorded during the BUS (BL&A 2017). Species recorded were predominantly farmland and bushland species with some records of raptors and waterbirds. Bird abundance and diversity during the survey were similar to wind farms in other parts of New South Wales (BL&A, unpubl. data).

The most abundant species recorded at the proposed turbine sites were:

- Australian Magpie;
- Red Wattlebird;
- Crimson Rosella;
- Australian Wood Duck; and
- Yellow-faced Honeyeater.

These five species accounted for over 50 percent of the individual birds counted. These were followed by another five species namely Spotted Pardalote, Eastern Rosella, Australian Raven, Striated Pardalote and Superb Fairywren. These ten most abundant species recorded are common to rural landscapes and are widely distributed in wooded farmland habitats across south-eastern Australia.

The height of birds was recorded in ten metre intervals from 0 to 60 metres and 20 metre intervals from 60 to 180 metres. The most abundant species observed flying at RSA height (between 30-150m) were:

- Australian Magpie;
- Australian Raven;
- Australian Wood Duck;
- Wedge-tailed Eagle; and
- Silvereye.

These five species constituted 81 percent of the birds counted at RSA height, with Australian Magpies comprising 25 percent of flights at RSA height. All bird species flying at RSA height were common species.

No species were recorded flying above rotor swept area height (>150 m) during the bird utilisation surveys. This indicates that the frequency of RSA flights occur is low.

Two threatened listed species on the NSW Scientific Committee 2016 *Biodiversity Conservation Act* (BC Act) were recorded during the BUS, namely Dusky Woodswallow and Varied Sittella. Of these two species, the Varied Sittella is a tree dwelling species considered unlikely or rarely to fly at RSA height, whilst the Dusky

Woodswallow occurred at low frequency hence considered to be at low risk from adverse effects of turbine mortality.

No additional species listed as rare or threatened on the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was recorded, however one listed marine and migratory species, the White-throated Needletail, was recorded during the BUS. This species is known to fly at RSA height and may be at increased risk from the modification of turbine specifications.

### 2.1.2. 2018 BUS at White Rock Wind Farm- Stage 2

A pre-construction BUS for the Stage 2 of the White Rock Wind Farm was undertaken from 21st – 28th April 2018. The height of birds was recorded in ten metre intervals from 0 to 60 metres, and 20 metre intervals from 60 to 200 metres (BL&A 2018b). This report is attached in Appendix 1.

Forty-five bird species were recorded during the BUS, the majority of which were common farmland or open woodland birds (BL&A 2018b). Bird abundance and diversity during the bird utilisation survey were similar to previous surveys at White Rock WF (BL&A 2017).

The most abundant species recorded at the proposed turbine sites were:

- Australian Magpie;
- Noisy Miner;
- Red Wattlebird;
- Australian Raven; and
- Superb Fairy-wren.

These five species accounted for over 46% percent of the individual birds counted. Bird species that were recorded during this survey were predominantly common farmland and woodland species, including some records of raptor and waterbird species.

The most abundant species observed flying at RSA height (between 30-200m) were:

- Australian Raven;
- Wedge-tailed Eagle (WTE); and
- Nankeen Kestrel.

These three species constituted 93% percent of the birds recorded at RSA height, with the Australian Raven comprising over 50% percent of all flights at RSA height. All bird species flying at RSA height were common species of wooded farmland.

There was one record of Wedge-tailed Eagle flying above rotor swept area height (>200 m) during the survey. This indicates that the frequency these flights occur is low.

Three threatened listed species on the *NSW Biodiversity Conservation Act 2016* (BC Act) were recorded during the BUS, namely

- Little Eagle – recorded on one occasion during the survey;
- Scarlet Robin – recorded on two occasions during the survey; and

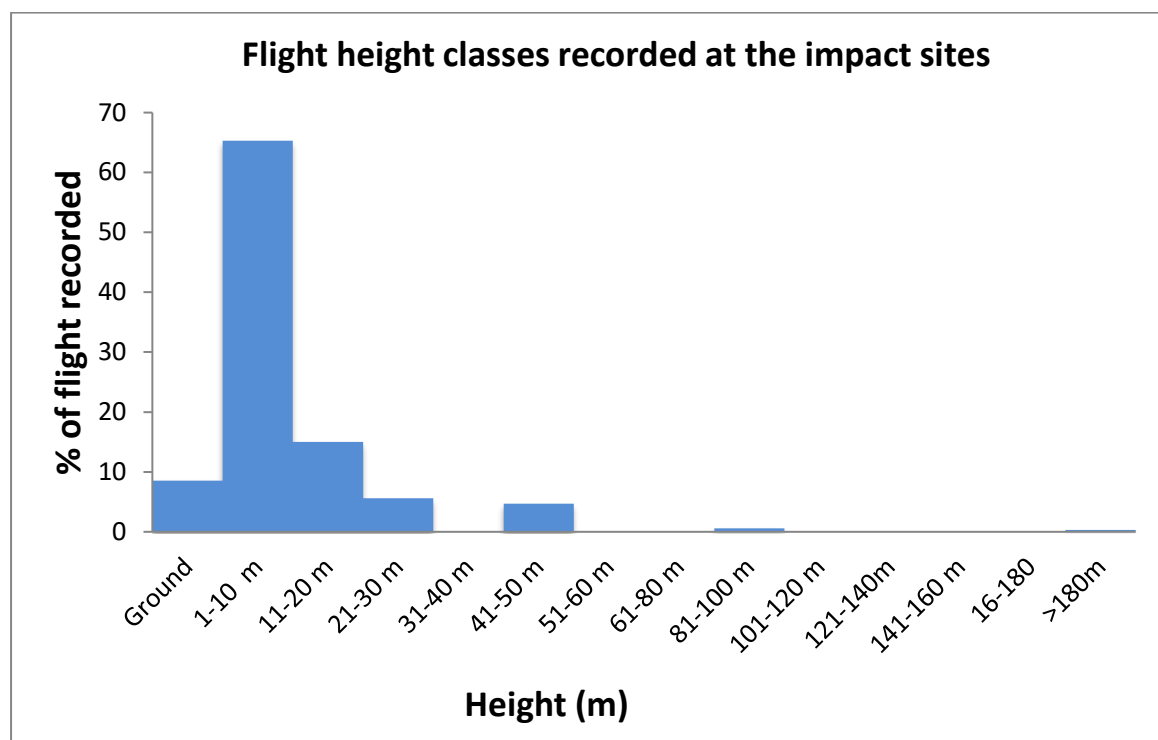
- Speckled Warbler – recorded once during the survey.

The Little Eagle was recorded only once during the surveys and thus may be an occasional visitor to the site. It has only been observed once during the regular vantage point monitoring as part of the regular BBAMP implementation. During the surveys there was no evidence of current or old eagle nests.

No species listed as rare or threatened on the EPBC Act was recorded.

**Review of flight height data**

Bird utilisation surveys from White Rock Wind Farm collected data in 10 metre height increments in the 2018 survey from 0 to 60 metres and 20 metre intervals from 60 to 200 metres, enabling a more precise calculation of changes in impact from adjustments to turbine specifications as technology changes. This data is presented in Figure 1 below.



**Figure 1: Distribution of flight heights across proposed turbine locations during 2018 BUS (BL&A 2018a)**

The majority of flights recorded largely encompassed heights of less than 30 metres. The distribution of birds flying at RSA heights at each of the survey points was varied. Birds were not observed flying at RSA heights at one point more than others.

## 2.2. Assessment of impacts from modified turbine specification

The approved and modified turbines are provided in Table 1 above. The change in the area of RSA at various height bands is analysed and presented in Table 2 below.

**Table 2: Change in RSA at each height range**

Height range (m)	% bird flights at height interval	RSA of 121 m diameter blades (m <sup>2</sup> )	RSA of 170 m diameter blades (m <sup>2</sup> )	Change in area of exposure /turbine (m <sup>2</sup> )	Incremental % change in RSA area
Ground	8.5				
0-10	65.3				
11-20	15.0				
21-30	5.6	15		- 15	-100%
31-40	0.0	506	540	34	7%
41-50	4.7	815	959	144	18%
51-60	0.0	991	1,201	210	21%
61-80	0.0	2,278	2,872	594	26%
81-100	0.6	2,409	3,241	832	35%
101-120	0	2,264	3,386	1,123	50%
121-140	0	1,770	3,338	1,569	89%
141-160	0	452	3,088	2,636	583%
161-180	0	-	2,574	2,574	
181-200	0	-	1,499	1,499	
200+	0.3				
<b>Total</b>		<b>11,499</b>	<b>22,698</b>	<b>11,199</b>	<b>97%</b>

As a result of the proposed modifications to wind turbines, the following is noted:

- The total area of RSA between 10-40m will increase from 521 m<sup>2</sup> to 540 m<sup>2</sup>, a 3.5% increase due to the proposed modification. This will potentially have a corresponding increase in risk to the few birds that may fly between 30 and 40 metres;
- The incremental RSA area change at each 10-metre height range from 30-40m, 40-50m and 50-60m are 7%, 18% and 21% respectively. This is a small increase in risk to the 4.7 % of birds recorded flying between 30-60 metres; and
- Above 60 metres there is an increase in the total area of RSA in 20 metre bands up to 200 metres. However, this is also the height range where the fewest bird flights were recorded. In total, only 0.9% of flights were recorded above 60 metres and only one flight was recorded at heights over 100 metres during the 2018 BUS (Stage 2).

It is noteworthy that this potential increased collision risk may affect birds common to agricultural landscapes. This analysis demonstrates that the increase in RSA area at heights above 80 metres is more likely to impact on higher flying species such as raptors (e.g. Wedge-tailed Eagle) and the EPBC Act listed migratory species the White-throated Needletail.

### 2.2.1. *Potential Impacts on listed species*

Three NSW BC Act listed species of species were recorded and are discussed below.

The Little Eagle is listed as vulnerable in New South Wales under the BC Act (NSW Scientific Committee 2016). The main reason for listing Little Eagle as a 'vulnerable' species is a degradation in the foraging and breeding habitat and secondary poisoning, as well as loss of genetic diversity. The migration and movement patterns of this species are varied in that adult breeding birds are resident but juveniles are dispersive, sometimes over long distances of up to c. 2,900 km (Marchant and Higgins 1993, Debus 1998, 2017). Little Eagles nest in eucalypt trees and usually select nest sites in canopy trees located in sheltered sites, often with a southerly aspect (Debus 2017). The Little Eagle was recorded once during the 2018 surveys and thus may be an irregular visitor to the site. It has only been observed once during the regular vantage point monitoring as part of the regular BBAMP implementation. During the surveys, no evidence of old eagle nests have been found. Given its infrequent occurrence at the site, it is highly unlikely that the change in turbine size will impact on this species.

The Scarlet Robin is listed as vulnerable in NSW under the BC Act. It occurs in a wide distribution from southeast Queensland to South Australia as well as in Tasmania and Western Australia. This species is considered to be partly migratory and inhabits dry eucalypt forest and woodlands, occasionally wet forests and wetlands (Higgins and Peter 2002). During the 2018 BUS, it was recorded on two occasions at Site number 1. In both instances, the bird was a female flying at a height of below four meters. This species is considered unlikely to fly at RSA height regularly and is not expected to be at risk from colliding with operating wind turbines at the proposed wind farm.

The Speckled Warbler is listed as vulnerable in New South Wales under the BC Act. This species is found from central Queensland to western Victoria in dry sclerophyll forest and eucalypt-dominated woodlands with an open grassy or shrubby ground layer, often with high quantities of coarse woody debris. The Speckled Warbler is a ground forager that also nests close to, or on the ground (Higgins and Peter 2002). This species is considered very unlikely to fly at RSA height and therefore is at minimal risk of collision with operating wind turbines.

#### **Wedge tailed Eagles**

Wedge tailed Eagles (WTE) were recorded at WRWF. The 2018 Stage 2 BUS did not record any nest sites in Stage 2. However, there is one nest located in Stage 1 which was recorded during the regular post-monitoring surveys that commenced in November 2017.

The increase in both the total RSA and height of the turbines will increase the number of eagle flights potentially at risk of collision. However, this species is considered secure at the state and national level, and is not listed by the EPBC Act and BC Act as threatened or endangered, the potential for a significantly greater population impact from the proposed modification compared with the currently permitted turbine envelope is considered unlikely. Collision risk to the WTE will further be reduced through the implementation of mitigation recommendations in the Bird and Bat Adaptive Management Program (BL&A 2016a).

## White-throated Needletail

White-throated Needletails (WTNT) were recorded at WRWF during the 2016-2017 Stage 1 BUS, at low frequency (seen twice, total of four birds). It is listed as 'migratory' under the EPBC Act. It is a common species that ranges over much of eastern Australia during its non-breeding season and migrates from its breeding grounds in north-east Asia (Higgins 1999). The Needletail is an aerial insect eater that forages over all habitat types with a preference for wooded areas, including open forest and rainforest (Higgins 1999). Their occurrence in Australia often coincides with low-pressure systems as winds stimulate the abundance of invertebrates lifted into the air. Therefore, they are considered to pass through occasionally on migration in search of food. Their use of the site is transitory and brief when moving these long distances in summer and early autumn. Due to the species sometimes flying at RSA heights occasional casualties are known from wind farms in south-eastern Australia (BL&A, unpublished data).

The increase in both the total RSA and height of the turbines will increase the number of WTNT flights potentially at risk of collision. However, as this species is considered secure at the state, national and international level, and is not listed by the EPBC Act and TSC Act as threatened or endangered, the potential for a significant impact at the population level from the proposed modification is considered unlikely.

### 2.2.2. *Potential for alteration to bird movement*

The locations of turbines for Stage 2 are elevated on the ridgelines areas of the wind farm. They are not located in heavily treed areas. In a number of locations, turbines are located on ridges higher than contiguous woodland habitat which occurs on steep valleys, e.g. chain of turbines 105-108 and the chain of turbines 126-129. It is unlikely for the turbines chains alter the movements of forest birds.

### 2.2.3. *Interaction with roost and nesting sites*

The BUS conducted in 2018 (BL&Ab) did not record any additional roosting or nesting sites of any aerial species, including the Wedge-tailed Eagle. In addition, regular raptor monitoring has been occurring over a period of 5-7 days per month since November 2017 as part of the implementation of the BBAMP for WRWF Stage 1. which includes specific vantage point surveys for raptors. This assessment has noted a single WTE nest located approximately 500 metres to the west of Turbine 29. There has been no other raptor nest recorded to-date. Thus, the location of turbines indicated in the current modification are not likely to impact on roosting and nesting sites.

### 2.2.4. *Results from Stage 1 monitoring*

Stage 1 of White Rock Wind Farm has been monitored on a monthly basis since November 2017 with 18 turbines searched twice per month (regular search to 100 metres and pulse searches to 60 metres, 2-3 days after regular search). These formal searches have recorded seven carcasses and/or featherspots. In addition, at least eight additional carcasses have been recorded as incidental finds outside the formal carcass searches.

The 15 carcasses and featherspots represent species that are considered common with secure conservation status. The finds include:

- 4 Wood Ducks
- 2 Australian Magpies
- 1 Brown Goshawk
- 1 Grey Fantail
- 3 Nankeen Kestrels
- 3 Wedge tailed Eagles
- 1 Whistling Kite

The results of the bird mortality monitoring to-date have not recorded mortality of any species that are listed on the EPBC Act or NSW BC Act.

### 2.3. Summary of potential impact on birds from modification

The species of birds recorded at WRWF involved common, widespread species in wooded agricultural landscapes in south-eastern Australia. No species listed as rare or threatened under the EPBC Act were recorded. Two woodland species listed under the BC Act were considered unlikely to be negatively impacted. The BC Act listed species Little Eagle was recorded only once during the surveys and thus considered to be an irregular visitor to the site. Given its infrequent occurrence at the site, it is highly unlikely that the change in turbine size will impact on this species.

Therefore, the majority of bird species at WRWF are considered at minimal risk of being significantly impacted from turbine collision. Given that total area of rotor-swept area (RSA) will increase substantially above 60 metres, (99% of birds were flying at under 50 metres height during BUS), the impacts of the modified turbines are unlikely to lead to effects on the populations of birds of conservation concern.

The modification may increase the risk of collision by Wedge-tailed Eagles, other high-flying raptors and White-throated Needletails. Overall, the risk to the WTE and WTNT from collision with turbines was considered to be low given the low number of birds utilising the site, the low frequency with which these flights occur and the non-threatened status of these species in mainland Australia (WTNT is non-threatened throughout Australia).

### 3. IMPACTS OF MODIFICATION ON BATS

#### 3.1. Previous Investigations

The bat surveys undertaken in spring of 2015 (BL&A 2016b), 2017 and 2018 (BL&A 2018a) used ultrasonic bat detectors deployed at or near ground level at White Rock Wind Farm Stage 1 and Stage 2. Recording of bat activity was distributed evenly across representative habitats near planned wind turbine locations. Bat surveys conducted at White Rock Wind Farm since 2015 have recorded for a total 352 detector nights. The results are outlined in the following reports:

- BL&A (2016b) White Rock Wind Farm: Bat Pre-construction survey 2015, Report 15009 (3.3).
- BL&A (2018a) White Rock Wind Farm- Stage Two – Pre-construction Bat Survey – Autumn 2018 Report 15009 (9.0) (see Appendix 2).

Over 36,000 bat calls were recorded in the 2015 survey at the wind farm site. The call detection rate of 160 calls per recording site per night is relatively high and may be due to the higher proportion of treed habitat at this wind farm site and also the recording targeting the spring season when bat activity increases on the tablelands. The vast majority (>99%) of calls were from widespread, common and secure species.

Of those listed as threatened species under the BC Act, four species (Eastern Bent-wing Bat, Eastern Cave Bat, Eastern False Pipistrelle and possibly Little Pied Bat) were all recorded at very low frequencies (totalling 30 calls combined out of over 36,000 calls identified, i.e. less than 0.1% of all bat calls recorded at WRWF). No species listed on the EPBC Act were recorded.

The 2018 targeted survey took place from 21<sup>st</sup> February to 31<sup>st</sup> March at four sites at WRWF to include the migration period of Eastern Bent-wing Bat (*Miniopterus orianae oceanensis*). The survey was seeking to identify listed threatened bat species that may be affected by the wind farm including:

- Eastern Bent-wing Bat (Vulnerable - BC Act 2016 [NSW]); and
- Yellow-bellied Sheath-tail-Bat (Vulnerable - BC Act 2016 [NSW]).

These two species are known casualties from wind farms across Australia (albeit in very low numbers) and are known to fly above the tree canopy at heights which places them at risk of collision with wind turbines.

It is considered that the low number of records of these above-mentioned species in the vicinity of WRWF makes it unlikely that potential mortality levels would significantly affect the regional, state or national populations of these threatened species.

All the possible 2018 Eastern Bent-wing Bat (EBWB) calls were identified as part of a species complex and could equally belong to forest bat species (*Vespadalus* spp.). No confirmed calls of the EBWB was recorded. The activity patterns (e.g. changes in numbers of calls recorded within and between nights) paralleled that of forest bats whose calls could be identified with certainty. Compared with confirmed forest bats, no exceptional occurrences of calls belonging to the species complex were found at any time during the survey. On this basis, it was concluded that it was

highly unlikely that large numbers of EBWB occurred at WRWF during the February-March migration season.

There has been one fatality of the Yellow-bellied Sheathtail-Bat (*Saccolaimus flaviventris*) at WRWF Stage 1. Further analysis indicated two records in the NSW BioNET Atlas database (OEH 2018) (BL&A 2018a). This species has been recorded from the region at Glen Innes and Sapphire Wind Farms. One specimen was collected at WRWF after a collision with a turbine (BL&A, unpublished data). According to GR&A (2007), this species requires a minimum of 150 to 200 hectares of remnant forest habitat to sustain a local population. The infrequency of its occurrence in the region suggests that it may traverse with WRWF occasionally when passing through the area. This species typically flies above the forest canopy (Churchill 2008) making it susceptible to turbine collision. Flights are lower over open spaces and along the forest edge (Churchill 2008). It is a wide-ranging species distributed throughout northern and eastern mainland Australia and in New Guinea. It migrates in summer to southern Australia (Churchill 2008).

Habitats at WRWF comprised mostly cleared agricultural land with scattered remnant trees. Forested habitat occurs in gullies and amount to patches greater than 150 hectares. Most of the wind farm site does not provide suitable habitat for a resident population of Yellow-bellied Sheathtail-Bat. The mortality of this species is not expected to occur at levels that would significantly impact the population due to the paucity of records nearby the site, lack of large forest remnants close to the turbine locations in Stage 2 and extensive habitat availability in the wider region.

In addition, the following listed threatened bat species are known to occur in the region of WRWF at low activity levels:

- Eastern Cave Bat *Vespadelus troughtoni* (possible recording);
- Eastern Falsistrelle *Falsistrellus tasmaniensis*; and
- Little Pied Bat *Chalinolobus picatus* (possible recording).

These species are considered low risk from turbine collision due to their tendency to fly within or just above tree canopy height (BL&A 2018a).

The following listed threatened species are not known to occur at WRWF, but may occasionally occur in small numbers:

- Corben's Long-eared Bat *Nyctophilus corbeni*;
- Greater Broad-nosed Bat *Scoteanax rueppellii*;
- Grey-headed Flying-fox *Pteropus poliocephalus*; and
- Large-eared Pied Bat *Chalinolobus dwyeri*.

It is unlikely that the proposed modification would significantly impact on these species, as the site does not represent key habitat and therefore considered at low risk from turbine mortality (BL&A, 2018a).

As bat detectors generally do not record bat calls beyond about 25 metres (for some species, less) a 25-metre height separation can be assumed to be sampling different height zones. Bat activity recording at WRWF does not extend beyond 25 metres above ground level. Accordingly, impacts of turbine design alteration was assessed based on pooled bat detector data from recorded heights of 25 and 50

metres above ground collated from other wind farm sites in similar landscapes in south-eastern Australia (BL&A unpubl. data).

This combined data showed that at 50 metres above the ground, bat call numbers were approximately 15% of the total number recorded from ground level. At 25 metres above ground, numbers were approximately 25% of the total number recorded from ground level. The proposed change in turbine height and RSA occurs in the recording zone sampled at 25 metres and above.

### 3.2. Assessment of impacts from modified turbine specification

Recent data from OEH provides additional insights into the flight heights of bats in southern NSW (Mills and Pennay 2017). This included the following findings:

- At Parsons Creek, a mixed woodland agricultural setting, overall bat activity was 1.3 times greater close to the ground (1,319 passes) than at 100 metres above ground (1,008 passes);
- However, the relative proportion of bat species activity varied with elevation. For example, the White-striped Freetail Bat dominated activity at 100 metres (making up 81% of all balloon calls and only 20% of ground-based calls); and
- If White-striped Freetail Bat is excluded from the analysis, activity levels for all other species were over 7 times greater at ground level (1,034 passes) than at 100 metres above the ground (187 passes) [i.e. activity at height was less than 19% less than activity on the ground].

The information related to a higher flight profile by the White-striped Freetail Bat activity is consistent with the findings of the mortality searches to-date at WRWF, which has only recorded two species, namely the White-striped Freetail Bat and Gould's Wattled Bat, in addition to the single carcass of the Yellow-bellied Sheath-tail-Bat.

Recent data from OEH provides additional insights in relation to flight height of Eastern Bent-wing Bat (Mills & Pennay 2017) and includes the following:

- Near the exit of the maternity cave at Wee Jasper in southern NSW, the EBWB were recorded flying around 100m elevation on 3 out of 6 nights (0.26 passes per hour) and was 9.3 times more likely to be recorded closer to ground level where they were recorded on 6 out of 6 nights (2.46 passes per hour);
- At Parsons Creek, a site approximately 20 km from the Wee Jasper cave, no EBWB were recorded at heights of 100 m elevation during the 19 sampling nights. They were, however, recorded at ground level up to 30 metres on 6 out of 19 nights;
- The OEH report states it is not known whether the lack of records at 100 m at Parsons Creek is the result of very low activity at this altitude or whether it is the result of the calls being masked out by high winds and associated noise; and
- It is noteworthy that there are records of bats flying higher at the exits of roost caves of Bent-winged Bat from the Naracoorte Caves in SA (BL&A unpublished obs).

In summary, whilst EBWB was recorded flying at 100 metres at its roost cave exit, flights distant from the cave exit may be lower.

### Increase in lower minimum RSA height

The proposed modified turbine (GW170) increases the lower minimum RSA height from the intended turbines by one metre. This change will lift the lower minimum RSA by one metre which may lead to a slight decrease in risk profile for flights below 30 metres.

### Change in extent of RSA at various heights

As a result of the proposed modifications:

- The incremental RSA area change at each 10-metre height range from 30-40m, 40-50m and 50-60m are 7%, 18% and 21% respectively. This is an increase in risk to the bats that may fly between 30-60 metres. The pooled bat data outlined above (BL&A unpubl. data) indicates that the number of bats flying above 50 metres is 15% of those recorded at ground level and that species diversity at 50 metres is lower, with recorded bats dominated by higher-flying species such as White-striped Freetail Bat and Gould's Wattled Bat which are not listed as species of conservation concern. and
- Above 100 metres, the difference between the proposed larger turbine design, places blades into an additional zone likely to have less bat activity (i.e. between 100 and 180 metres). If any bats were recorded above 100 metres, the species diversity is likely to be lower and include higher-flying bat species, such as White-striped Freetail Bat and Gould's Wattled Bat which are common species.

### 3.3. Summary of potential impact on bats from modification

The proposed modification involving larger and higher turbines, is unlikely to cause significant adverse impacts to bat populations in the local area, both threatened and non-threatened, for the following reasons:

- The species of bats recorded during surveys in spring 2015 and the autumn 2017 and 2018 overwhelmingly (>99%) comprised common, widespread species of wooded agricultural landscapes in south-eastern Australia;
- Five bat species listed under BC Act (Eastern Bent-wing Bat, Eastern Cave Bat, Little Pied Bat, Yellow-bellied Sheath-tail bat, and Eastern False Pipistrelle) are confirmed to occur, mostly likely at very low numbers. They are unlikely to be adversely affected at regional level if at all because they are likely to fly mostly at or below the adjusted RSA height minimum;
- No bat species listed on the EPBC Act was recorded at White Rock Wind Farm; and
- There has been a small amount of change in RSA area up to 40 metres and between 18-21% RSA change between 40-60 metres (up to 60 metres). Beyond 60 metres there is a large change in RSA. Any added impacts of the larger turbines above 60 metres are unlikely to lead to effects on bat populations of conservation concern as any impacts are likely to be on species that are not listed as being of conservation concern.

## 4. ADDITIONAL COMPARISON 140 VS 170 DIAMETER ROTORS

WRWF requested an additional assessment of change in risk between the proposed 170 metre diameter rotor and a 140-metre diameter rotor. This was to inform a comparison in risk to birds and bats from the two options.

These two options are compared in Table 3 below. In summary, the comparison considers both options with the same lower minimum blade height of 30 metres and the blades rotating above this height. The 70-metre blade would have a tip height of 170 metres (30 minimum height + 140 metres (2x70 m radius blades)) and the 85 metre blade a tip height of 200 metres (30 minimum height + 170 metres (2x85m radius blades)). The overall increase in RSA between the two options is 47%.

### 4.1. Summary of additional comparison

Table 3: Comparison between 140 and 170 diameter blade specifications

Turbine specification	Stage 2 using 140 meter diameter rotor	Stage 2 using 170 meter diameter rotor	Total extent of change
Maximum RSA height (tip height)	170 m	200 m	Overall 30 m increase blade tip height
Minimum lower RSA height (above ground)	30 m	30 m	nil
Rotor diameter (metres)	140 m	170 m	30 m rotor diameter increase
Total RSA m <sup>2</sup> / turbine	15,394 m <sup>2</sup>	22,698 m <sup>2</sup>	Up to 47% increase in RSA

### 4.2. Change in RSA in height bands

Table 4 below compares the change in the area of RSA at each of the heights in bands from 30 metres to 200 metres and above. Up to 60 metres in height the change in RSA is considered in 10 metre bands. Above 60 metres the change is considered in 20 metre bands to 200 metres in height.

Table 4: Change in RSA at each height range - comparing 140m to 170 metre diameters

Height range (m)	% bird flights at height interval	RSA of 140 m diameter blades (m <sup>2</sup> )	RSA of 170 m diameter blades (m <sup>2</sup> )	Change in area of exposure /turbine (m <sup>2</sup> )	Incremental % change in RSA area
Ground	8.5				
0-10	65.3				
10-20	15.0				
20-30	5.6				
30-40	0.0	488	540	52	11%
40-50	4.7	861	959	98	11%
50-60	0.0	1,070	1,201	131	12%
60-80	0.0	2,517	2,872	355	14%
80-100	0.6	2,761	3,241	480	17%
100-120	0.0	2,761	3,386	625	23%

Height range (m)	% bird flights at height interval	RSA of 140 m diameter blades (m <sup>2</sup> )	RSA of 170 m diameter blades (m <sup>2</sup> )	Change in area of exposure /turbine (m <sup>2</sup> )	Incremental % change in RSA area
120-140	0.0	2,517	3,338	821	33%
140-160	0.0	1,931	3,088	1,157	60%
160-180	0.0	488	2,574	2,086	427%
180-200	0.0	-	1,499	1,499	0%
Above 200	0.3				
<b>Overall total change</b>		<b>15,394</b>	<b>22,698</b>	<b>7,305</b>	<b>47%</b>

In comparing the impacts of the 140-meter diameter rotor and the 170-meter diameter rotor, the implications of the comparison are outlined below:

- The total area of RSA between 30-40m will increase from 488 m<sup>2</sup> to 540 m<sup>2</sup>, a 52m<sup>2</sup> increase due to the proposed comparison. This will potentially have a corresponding increase in risk to the few birds and bats that may fly between 30 and 40 metres;
- The incremental RSA area change at each 10-metre height range from 30-40m, 40-50m and 50-60m are 11%, 11% and 12% respectively. This is a small increase in risk to the 4.7 % of birds recorded flying between 30-60 metres; and
- Above 60 metres there is an increase in the total area of RSA in 20 metre bands up to 100 metres, between 60-80 metres and 80-100 metres this is 14% and 17% respectively. However, this is also the height range where the very few bird flights were recorded and the area where few bat flights are typically recorded.
  - For birds only 0.9% of flights were recorded above 60 metres and only one flight was recorded at heights over 100 metres during the 2018 BUS (Stage 2); and
  - For bats there are fewer flights at these heights and the high-flying species recorded at these heights, namely Gould’s Wattled Bat and White Striped Freetail Bat (Mills & Pennay 2017).
- The largest change in RSA in extent and percentage terms occurs above 100 meters. This is the area where there are fewer birds and bats typically recorded.
  - For birds only 0.3% of flights were recorded above 100 metres during the 2018 BUS (Stage 2). This is the area where high-flying species such as raptors and the White-throated Needletail are record; and
  - For bats there are fewer flights at these heights and the high-flying species recorded at these heights, namely Gould’s Wattled Bat and White Striped Freetail Bat (Mills & Pennay 2017).

### 4.3. Summary of change in potential impacts from this comparison

Firstly, it is noteworthy that the potential increased collision risk may affect species common to agricultural landscapes. In summary, the changes are similar to the changes referred to in Section 2 – Impacts of modification on birds and Section 3 – Impacts of modification of modification on bats although the smaller change modelled results in a lesser impact.

#### 4.3.1. Summary of potential impact on birds from the comparison

The species of birds recorded at WRWF involved common, widespread species in wooded agricultural landscapes in south-eastern Australia. No species listed as rare or threatened by the EPBC Act were recorded. Two woodland species listed under the BC Act were considered unlikely to be negatively impacted. The BC Act listed Little Eagle was recorded only once during the surveys and thus considered to be an irregular visitor to the site. Given its infrequent occurrence at the site, it is highly unlikely that the change in turbine size will impact on this species.

Therefore, the majority of bird species at WRWF are considered at minimal risk of being significantly impacted from turbine collision. Given that total area of rotor-swept area (RSA) will increase substantially above 100 metres in this comparison and 99% of birds were recorded as flying at under 50 metres height during BUS, the impacts of the larger 170 metre turbine rotors are unlikely to lead to effects on the populations of birds of conservation concern.

The above comparison may increase the risk of collision by Wedge-tailed Eagles, other high-flying raptors and White-throated Needletails. Overall, the risk to the WTE and WTNT from collision with turbines was considered to be low given the low number of birds utilising the site, the low frequency with which these flights occur and the non-threatened status of these species in mainland Australia (WTNT is non-threatened throughout Australia).

### 4.4. Summary of potential impact on bats from the comparison

The proposed comparison involves larger and higher turbines, is unlikely to cause significant adverse impacts to bat populations in the local area, both threatened and non-threatened, for the following reasons:

- The species of bats recorded during surveys in spring 2015 and the autumn 2017 and 2018 overwhelmingly (>99%) comprised common, widespread species of wooded agricultural landscapes in south-eastern Australia;
- Five bat species listed under BC Act (Eastern Bent-wing Bat, Eastern Cave Bat, Little Pied Bat, Yellow-bellied Sheath-tail bat, and Eastern False Pipistrelle) are confirmed to occur, mostly likely at very low numbers. They are unlikely to be adversely affected at regional level if at all because they are likely to fly mostly at or below the adjusted RSA height minimum;
- No bat species listed on the EPBC Act was recorded at WRWF; and
- There has been a small amount of change in RSA area up to 40 metres and between 11-12% RSA change between 40-60 metres (up to 60 metres). Beyond 80 metres there is a large change in RSA. Any added impacts of the larger turbines above 60 metres are unlikely to lead to effects on bat populations of

conservation concern as any impacts are likely to be on species that are not listed as being of conservation concern.

## 5. REFERENCES

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**Appendix 1: White Rock WF - Stage 2: Pre-construction Bird Utilisation Survey (BL&A 2018b)**

**Appendix 2: White Rock WF - Stage 2: Pre-construction Bat Survey (BL&A 2018a)**