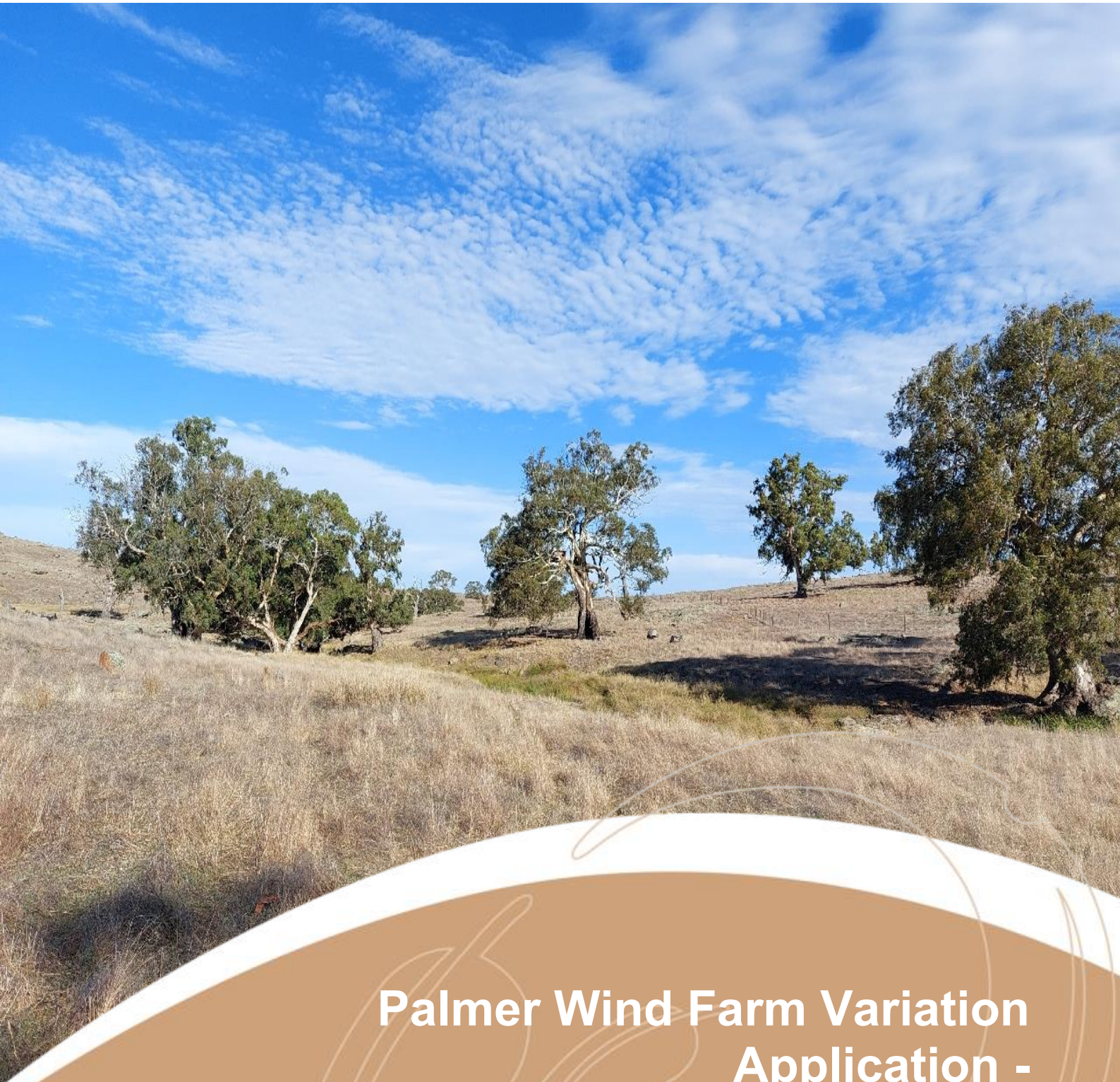

Palmer Wind Farm Variation Application -

Bird and Bat Risk Assessment

Palmer Wind Farm Variation Application - Bird and Bat Risk Assessment

26 February 2024

Version 4

Prepared by EBS Ecology for Tilt Renewables

Document Control					
Revision No.	Date issued	Authors	Reviewed by	Date Reviewed	Revision type
1	05/05/2023	H. Merigot and N. Piscioneri	Dr M. Louter	05/05/2023	Draft
2	19/05/2023	H. Merigot	A. Derry	18/05/2023	Final
2.1	28/06/2023	H. Merigot	A. Derry	27/06/2023	Final (updated)
3	25/08/2023	H. Merigot	A. Derry	24/08/2023	Final (updated)
4	26/02/2024	A. Derry	Dr M. Louter	26/02/2024	Final (updated)

Distribution of Copies			
Revision No.	Date issued	Media	Issued to
1	05/05/2023	Electronic	Natalie Taggert, Tilt Renewables
2	19/05/2023	Electronic	Natalie Taggert, Tilt Renewables
2.1	28/06/2023	Electronic	James Beckett, Tilt Renewables Natalie Taggert, Tilt Renewables
3	25/08/2023	Electronic	Natalie Taggert, Tilt Renewables James Beckett, Tilt Renewables
4	26/02/2024	Electronic	Natalie Taggert, Tilt Renewables James Beckett, Tilt Renewables

EBS Ecology Project Number: EX230107

CITATION: EBS Ecology (2024) Palmer Wind Farm Variation Application - Bird and Bat Risk Assessment. Report to Tilt Renewables. EBS Ecology, Adelaide.

Cover photograph: Scattered trees in a creek line within the Project Area.

EBS Ecology
112 Hayward Avenue
Torrensville, South Australia 5031
t: 08 7127 5607
http://www.ebsecology.com.au
email: info@ebsecology.com.au

GLOSSARY AND ABBREVIATION OF TERMS

DRMF	Australian Defence Risk Management Framework
BDBSA	Biological Databases of South Australia database search
EBS	Environmental and Biodiversity Services Pty Ltd, trading as EBS Ecology
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
MNES	Matters of National Environmental Significance, as defined under the EPBC Act
NPW Act	*National Parks and Wildlife Act 1972*
PMST	Protected Matters Search tool
sp.	Species (singular)
spp.	Species (plural)
ssp.	Subspecies
the Varied Project	Palmer Wind Farm (as proposed to be varied, by the reduction of the number of WTG to 40 and the increase of the maximum tip height to 220m)
the Project Area	Several blocks of farming and cropping land located 70 km east of Adelaide, South Australia on which the Varied Project will be located.
Tilt	Tilt Renewables (the Proponent)
TrustPower	Former name of Tilt
WTG	Wind turbine generator

EXECUTIVE SUMMARY

Tilt Renewables (Tilt) has development plan consent for the Palmer Wind Farm Project, comprising up to 103 wind turbines with a maximum tip height of 165m. Tilt Renewables is seeking approval to vary the Project to reduce the number of turbines to 40 and to increase the maximum tip height to 220m.

EBS Ecology (EBS) has been engaged by Tilt to undertake an Avian and Bat Risk Assessment using past EBS collected data and results from the bird utilisation surveys undertaken in October 2022 and January 2023 to inform the assessment of the Variation Application. A risk assessment was undertaken in 2014 (EBS 2014) regarding the potential impact on birds of 114 turbines with a 165 m maximum blade tip height. The 2014 risk assessment considered the risk to birds of turbines with similar turbine parameters and dimensions as the turbine design approved in 2019. As such, EBS has taken into consideration the 2014 risk assessment as well as previous data collected at Palmer Wind Farm and combined this information with more recent 2022/2023 data, to update the risk assessment.

The proposed Palmer Wind Farm is located approximately 50 kilometres (km) east of Adelaide and is situated within the eastern hills of the Mount Lofty Ranges. The proposed varied Project Area extends approximately 15 km in a north to south direction, centred on ridgelines, and is split into Area B (the central area) and Area C (southern area).

As of information supplied to EBS on 14 February 2024, Tilt have selected the locations of 40 wind turbine generator (WTG) proposed to be installed at Palmer Wind Farm. As Tilt have not finalised the designs, EBS understands that variations to the WTG locations within the defined micro-siting areas may occur in subsequent design iterations.

Advice is being sought on the potential impact of the proposed Project to birds and bats on:

- The reduction in the number of WTG from 103 to 40 (reduction of 63 WTG); and
- The selected WTG size increasing from a rotor diameter of 130 metres (m) to 180 m (increase of 50 m).

A risk assessment matrix was used to qualitatively define the risk of the proposed Project on threatened bird species observed in the Project Area and threatened bird species defined as “possibly” or “likely” to occur within the Project Area (based on the database searches). Bird species identified as having performed at-risk-movements within the Project Area (such as raptors) were also assessed. A risk assessment matrix was also used to define the risk to all bat species identified during previous surveys as occurring within the Project Area, threatened bats identified and potentially in the region and other bat species determined as “likely” to occur in the Project Area (based on database searches). The assessment is an adaptation of the qualitative measures of likelihood and consequence used in the Australian Defence Risk Management Framework.

Risk Assessment – Birds

The maximum rotor diameter Tilt is considering as part of the WTG update is 180 m, with a 220 m tip height, resulting in a 40 m ground clearance.

Raptors

The assessment of the risk of raptor collisions with WTG identified the following:

- **Medium** risk: Wedge-tailed Eagle, Brown Falcon, Nankeen Kestrel and Peregrine Falcon
- **Low** risk: Black-shouldered Kite, Black Kite, Collared Sparrowhawk and Little Eagle.

Of the above listed raptor species, only the Peregrine Falcon (*Falco peregrinus*) has a formal conservation status, with it being listed as Rare under the NPW Act.

Woodland birds

Compared to the minimum blade tip height of the approved Project (2019), the risk to woodland birds being impacted by the turbines is reduced by the increase in blade tip height by 5 m as woodland birds typically utilise a low air space to fly between woodland habitats.

The assessment of the risk of woodland bird collisions with WTG identified the following:

- **Medium** risk:
    - Two threatened bird species observed in the Project Area were assessed as having a medium level of risk: the EPBC Act listed species Diamond Firetail (*Stagonopleura guttata*), and the NPW Act listed Elegant Parrot (*Neophema elegans*); and
    - Two common bird species observed within the Project Area, Australian Pelican (*Pelecanus occidentalis*) and Rainbow Bee-eater (*Merops ornatus*), were assessed as having a medium risk level.
- **Low** risk:
    - Three threatened bird species observed in the Project Area were assessed as having a low level of risk;
    - Four species assessed as “likely to occur in the Project Area” were assessed as having a low level of risk; and
    - Seven common bird species identified as having performed at-risk movements within the Project Area were assessed as having a low level of risk.

Risk Assessment – Bats

The likelihood of collision causing mortality was determined as likely for all bat species, except the South-eastern Long-eared Bat (*Nyctophilus corbeni*) which was unlikely. As such the overall level of risk for all bat species was determined as medium, except for the Nationally threatened South-eastern Long-eared Bat which was assessed as low. For those species considered to have a risk level of medium, all efforts should be made to mitigate against potential impact on the species.

Discussion

If the level of risk for a species is determined as **high** to **extreme**, then resulting impact on an individual species and local population would be unacceptable. If the level of risk for a species is categorised as **medium**, then all efforts should be made to mitigate against potential impact on the species. If the level of risk for a species is determined to be **low**, then impact would be limited to the level of individuals only, and impact at a species level would be low, and is therefore considered to be unlikely to affect the viability of a local population.

The level of risk was categorised as medium for 8 out of 25 bird species and for 11 of 12 bat species. The species with medium risk level assessments were generally also defined as having a minor consequence at a species / population level. This implies that there may be an impact on the local population of this species in the event of collision with a WTG. As such all efforts should be made by Tilt Renewables to mitigate against potential impact on bird and bat species, in particular placing WTG away from woodland areas as much as possible and away from sensitive areas, such as raptor nest locations.

However, compared to previous designs, the number of turbines proposed for construction within the Varied Project is fewer and the overall rotor swept area for all turbines combined is 26% less than the approved Project design and as such may promote fewer collision events for both birds and bats compared to previous designs. In addition, 4 fewer turbines have been located in or near woodlands than the approved Project designs, reducing the potential risks for woodland birds and bats.

The location of the proposed wind farm relative to bird species that may be present, the layout of the turbines, particular landscape features and the behaviour of bird species, influence the likelihood that a bird flying through a wind farm will collide with a WTG. As such, where possible, features that increase the risk of birds colliding with WTG (such as placement of turbines near Wedge-tailed Eagle nest and Peregrine Falcon nest, or placement of turbines near woodlands) should be considered and mitigated against.

Recommendations

Based on the risk assessment, EBS recommends adopting exclusion buffers between turbines and avoiding identified bat habitat (such as woodlands) to minimise potential impacts on bat species using the Project Area.

Given the increase in WTG size, EBS would advise on incorporating a bird and bat strike monitoring program, including scavenger and detectability trials as this would assist with understanding the potential impact of the Varied Project on birds and bats. This information can then be used to determine the adequacy of mitigation measures.

If the tower height and/or blade length (and ultimately the lowest extent of the rotating tip and the rotor swept area) of proposed WTGs change, this risk assessment will need to be re-evaluated and updated accordingly.

EPBC Act listed threatened species

The following EPBC Act listed threatened species have been identified in this risk assessment:

- Hooded Robin (*Melanodryas cucullata cucullata*) (EPBC Act: Endangered);
- Diamond Firetail (*Stagonopleura guttata*) (EPBC Act: Vulnerable);
- Southern Whiteface (*Aphelocephala leucopsis*) (EPBC Act: Vulnerable);
- Blue-winged Parrot (*Neophema chrysostoma*) (EPBC Act: Vulnerable); and
- South-eastern Long-eared Bat (*Nyctophilus corbeni*) (EPBC Act: Vulnerable)

Four of the bird species, listed above, are species that have been recently listed as being of national conservation significance under the EPBC Act. These include the Hooded Robin, Diamond Firetail,

Southern Whiteface and Blue-winged Parrot. For all of the species mentioned above, an EPBC self-assessment should be undertaken to determine the potential impact the construction and operation of the proposed windfarm may have on these species. This risk assessment and information from the two-year bird utilisation survey monitoring can be used to inform impacts to these species. If a significant impact is identified as potentially occurring, an EPBC referral is required.

If additional EPBC Act listed threatened species are detected during additional bird utilisation surveys, then these species should also be included in a self-assessment to determine impacts.

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1 INTRODUCTION

Tilt Renewables (Tilt) has development plan consent for the Palmer Wind Farm Project, comprising up to 103 wind turbines with a maximum tip height of 165m. Tilt Renewables is seeking approval to vary the Project to reduce the number of turbines to 40 and to increase the maximum tip height to 220m. The Project Area is located near Palmer, approximately 50 kilometres (km) east of Adelaide (**the Project Area**), in South Australia (Figure 1). The Varied Project will incorporate wind turbine generators (herein referred to as WTGs or turbines) along with associated infrastructure, including access tracks, transmission lines and underground cabling.

EBS Ecology (EBS) has been engaged by Tilt to undertake a Bat and Avian Risk Assessment using previously collected data as well as results from the bird utilisation surveys undertaken thus far in October 2022 and January 2023, to inform the assessment of the variation application. A risk assessment was undertaken in 2014 (EBS 2014) regarding the potential impact on birds of 114 turbines with a 165 m maximum blade tip height. The 2014 risk assessment assessed the risk to birds of turbines with similar turbine parameters and dimensions as the turbine design approved in 2019. As such, EBS has taken into consideration the 2014 risk assessment as well as previous data collected at Palmer Wind Farm and combined this information with recent data, to update the risk assessment.

1.1 Project Area

The Project Area is located approximately 50 km east of Adelaide and is situated within the eastern hills of the Mount Lofty Ranges. Land use within the area is predominantly agricultural (e.g., grazing for sheep and cattle). Native vegetation in the area has been extensively cleared, with most of the Varied Project's footprint containing grasslands with large outcrops of rocks and boulders. Woodland vegetation is generally restricted within small patches and within creek lines.

The Project Area extends approximately 15 km in a north to south direction, centred on ridgelines, and is split into Area B (the central area) and Area C (southern area) (Figure 2).

Previously, there were three areas comprising the Project Area. Area A, which was located further north, will be excluded from the Project Area as a result of the variation (EBS 2014).

The Varied Project layout will be finalised pending this report and the finalisation of the flora and fauna ecological report (EBS 2024).

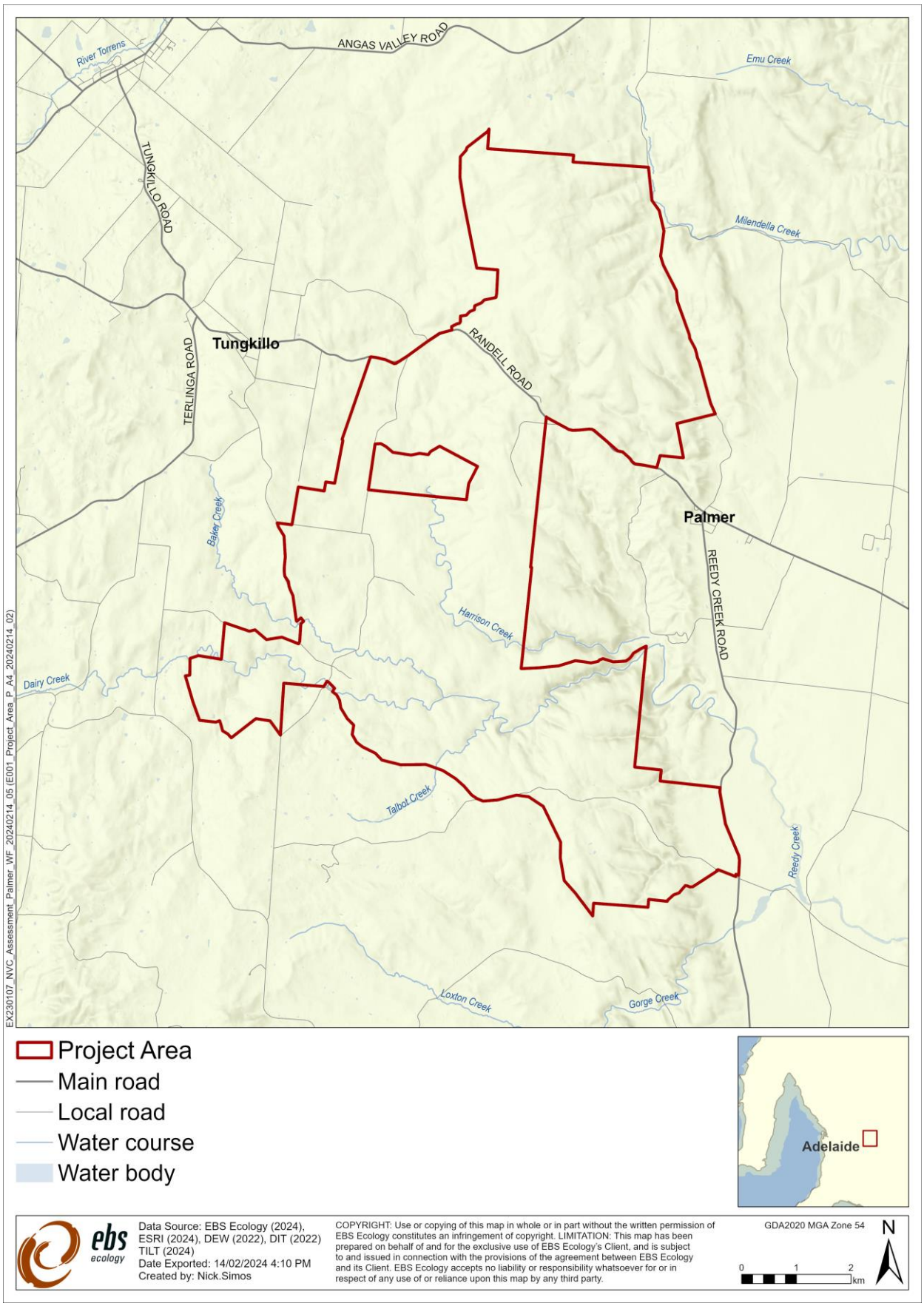

Figure 1. Location of the Varied Palmer Wind Farm Project Area.

2 BACKGROUND

2.1 Project details

As of information supplied to EBS on 14 February 2024, Tilt have selected the locations of 40 turbines proposed to be installed at Palmer Wind Farm, which is a reduction of 63 turbines from the approved designs of 103 turbines (Table 1). Tilt have not finalised the designs, thus EBS understands that variations to the turbine design and locations within the defined micro-siting areas may occur in future design iterations.

Advice is being sought on the potential impact to birds and bats as a result of:

- The reduction in the number of WTG from 103 to 40 (reduction of 63 WTG); and
- The selected WTG size increasing from a rotor diameter of 130 m to 180 m (increase of 50 m).

Figure 2 shows the number and location of WTG, distributed across the two areas remaining in the Varied Project layout, following the variation:

- Area B (central area) – 19 WTG; and
- Area C (southern area) – 21 WTG.

The Project commenced in 2009, with a Development Application lodged with the Mid-Murray Council pursuant to the Development Act 1993 in February 2014 for a layout of 114 turbines. The Development Application was approved in December 2015, then appealed and approved at the Supreme Court in 2019 subject to conditions (the approved Project). WTG designs for early planning, the approved Project and the Varied Project are provided in Table 1.

2.2 Previous risk assessments

The following report was prepared by EBS:

- A risk assessment was undertaken by EBS in 2014 as part of the Flora and Fauna Ecological Assessment for bird species at risk of potential impacts from wind turbines at the proposed Palmer Wind Farm (EBS 2014).

2.3 Current design plans

The maximum rotor diameter Tilt is considering as part of the update is 180 m, with a 220 m tip height resulting in a 40 m ground clearance (Table 1). This is an increase from the previously approved turbine design of 25 m to the blade length, 50 m to the rotor diameter, 55 m to the maximum tip height and 5 m to the minimum tip height.

While the rotor swept area for each turbine has increased by 92%, overall the number of WTG's has decreased by 63 (61% reduction) and the total rotor swept area of all turbines proposed for Palmer Wind Farm has decreased by 26% when compared to the approved Project (Table 1).

Table 1. Changes in WTG layout and parameters for Palmer Wind Farm.

Parameter	Early Planning (2014)	Approved Project (2019)	Varied Project (2024)	Change from Early Planning (2014) to Approved Project (2019)	Change from Approved Project (2019) to Varied Project (2024)
Number of turbines	114	103	40	Decrease by 11 WTG (10% reduction)	Decrease by 63 WTG (61% reduction)
Blade length (m)	65	65	90	No Change	Increase by 25m (38% increase)
Rotor diameter (m)	130	130	180	No Change	Increase by 50m (38% increase)
Maximum tip height (m)	165	165	220	No Change	Increase by 55m (33% increase)
Minimum tip height / ground clearance (m)	35	35	40	No Change	Increase by 5m (14% increase)
Rotor swept area per turbine (m^2)	13,273	13,273	25,447	No Change	Increase by 12,173m^2 (92% increase)
Rotor swept area all turbines (m^2)	1,513,122	1,367,119	1,017,880	Decrease by 146,003m^2 (10% reduction)	Decrease by 349,239m^2 (26% reduction)

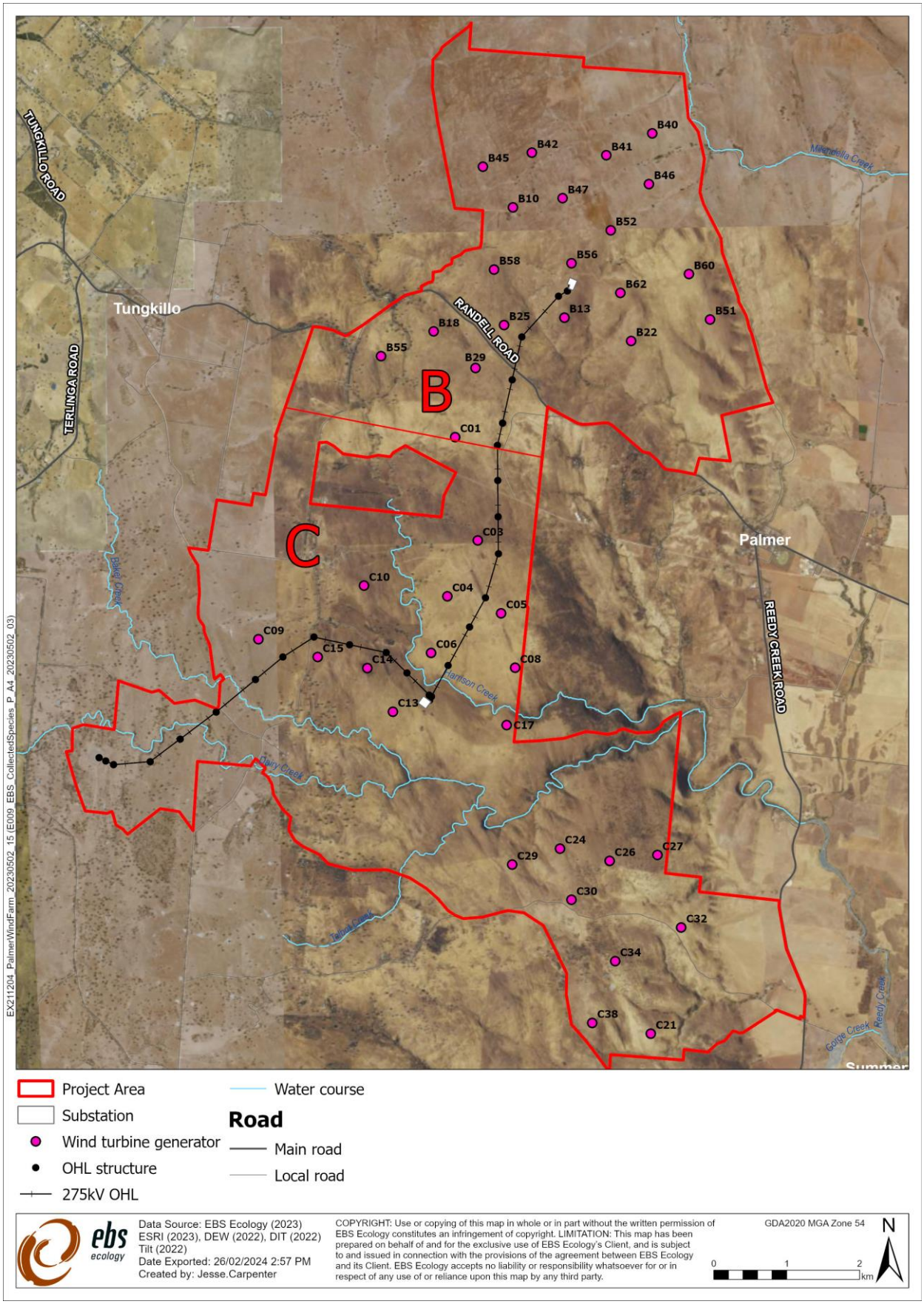

Figure 2. Location of the Wind Turbine Generators at Varied Project. Area B is located to the north and Area C is located to the south.

2.4 Wind farm impacts on avifauna

The potential impacts of wind farms on avifauna include:

- Rotor strikes (bird mortality);
- Barotrauma (bat mortality);
- Clearance and degradation of habitat;
- Acoustic masking; and
- Behavioural avoidance.

2.4.1 Rotor strikes

Bird species that regularly fly at heights swept by turbine rotors are prone to rotor strike. This includes raptors, which are one of the most at-risk groups of bird from wind farms due to their flight height, low fecundity and long lifespans (Beston *et al.* 2016), which means that the replacement of struck individuals within the population takes considerable time and energy, and population declines may occur (Dahl *et al*. 2012).

Worldwide, raptors and birds of prey have been extensively documented as a high-risk species for WTG collision (Thaxter *et al.* 2017), and in Australia collisions of raptors with WTG have been documented for Tasmania Wedge-tailed Eagle (*Aquila audax fleayi*) (Hull *et al.* 2015), Wedge-tailed Eagle (*Aquila audax*), White-bellied Sea Eagle (*Haliaeetus leucogaster*), Swamp Harrier (*Circus approximans*), Brown Falcon (*Falco berigora*), Black-shouldered Kite (*Elanus axillaris*), Australian Hobby (*Falco longipennis*), Brown Goshawk (*Accipiter fasciatus*), Collared Sparrowhawk (*Accipiter cirrocephalus*), Little Eagle (*Hieraaetus morphnoides*), Nankeen Kestrel (*Falco cenchroides*), Peregrine Falcon (*Falco peregrinus*), Whistling Kite (*Haliastur sphenurus*) and Black Falcon (*Falco subniger*) (Hull *et al* 2013; Maloney *et al.* 2019).

EBS has undertaken bird strike monitoring at Hornsdale Wind Farm. From the results analysed thus far (from either evidence of a carcass or feather spot), it has been determined that 4 raptor species (Wedge-tailed Eagle, Brown Falcon, Nankeen Kestrel and Peregrine Falcon) have collided with turbines at Hornsdale Wind Farm (EBS 2019). Additionally, EBS conducted raptor survey / monitoring at Snowtown Wind Farm over a six-year period (EBS 2013), whereby three Wedge-tailed Eagles were known to have collided with wind turbines. This number may be an underestimation of strike rates, as detectability and scavenging of the carcases may contribute to underrating collisions.

Bird collisions with seemingly slow-moving turbine blades occur as a result of the following possible reasons:

- Due to the optics of bird vision, as the bird approaches the spinning blades, the rate the image is transmitted to the bird's brain speeds up until the retina cannot keep up with it, creating a blur (called motion blur) that the bird likely translates as being safe air space (Hodos 2003). Birds could therefore assess this area as safe and risk colliding with the turbine blades.

- Due to birds narrow frontal field of view and expected high use of their lateral field of view for detecting prey, predators and other conspecifics, birds may not observe turbines while undertaking other activities, increasing their risk of collision (May *et al.* 2020).

2.4.2 Barotrauma

Bats succumb to barotrauma at wind farm turbines whereby the rapid air-pressure reduction near moving turbines causes tissue damage to air-containing structures (Baerwald *et al*. 2008). The number of bat mortalities at wind farms is expected to be substantial, with 44 bat carcasses identified within one year of monthly monitoring over 25 turbines at Ararat Wind Farm, Victoria (BL&A 2018). The true number of bat mortalities across these 25 turbines would be significantly higher than 44 deaths, as scavenging rates and surveyor error (failed detection during searches) was not accounted for. Bat monitoring at McArthur Wind Farm in south-western Victoria found annual bat mortality per turbine to be 1.41 ± 0.65 and 3.08 ± 1.68 in 2013 and 2014, respectively (AERS 2015).

2.4.3 Clearance and degradation of habitat

The proposed Project will result in the direct clearance of habitat for hardstands, access tracks, transmission lines and substations. For the construction of wind farms, clearance of remnant native vegetation is expected to be required and can contribute to habitat loss, fragmentation and degradation of habitat. In particular, habitat loss is expected to be unfavourable to small passerine species with specific habitat preferences and favourable to large generalist species (Szabo *et al*. 2011). If any hollow bearing trees, are to be cleared, this contributes to the loss of roosting and nesting habitat for bird and bat species with those specific habitat requirements. Furthermore, where native vegetation borders the infrastructure footprint, habitat is at a higher risk of to becoming degraded from weed invasion, erosion and other edge effects.

2.4.4 Acoustic masking

The noise associated with a wind farm may have adverse impacts on songbirds (Zwart *et al*. 2016). Acoustic masking caused by wind farm noise may affect the ability of individuals with established territories to deter a rival (Zwart *et al*. 2016). As such, increased time and energy would need be spent for maintaining territories, which could result in reduced breeding success of sedentary territorial bird species (Zwart *et al*. 2016). In South Australia, acoustic masking is thought to be one of the key drivers of reduced songbird abundance in areas within 500 m of mining activity (Read *et al*. 2015).

2.4.5 Behavioural avoidance

Raptors are known to substantially reduce their presence within an area following the construction of a wind farm. While this reduces the number of individuals that succumb to rotor strike, it may displace pairs from their established territories, which can reduce breeding success. The impact of rotor strike and displacement of individuals is considered to have reduced the breeding success of White-tailed Eagles (*Haliaeetus albicilla*) within occupied territories from 48% before wind farm construction to 22% post construction (Dahl *et al*. 2012). Displacement of raptors at a wind farm also occurred in Wisconsin, United States of America, where a 47% reduction in raptor abundance was recorded following wind farm construction (Garvin *et al*. 2011). At two wind farms in Tasmania, flight tracks and behaviour of Wedge-

tailed Eagles were recorded over two years, which demonstrated that Wedge-tailed Eagles had avoidance rates of 81% to 97% higher compared to pre-construction, although this varied between sites and in different weather conditions (Hull & Muir 2013).

3 METHODS

3.1 Risk assessment

3.1.1 Assessment of the likelihood of species utilising Project Area

A likelihood of occurrence rating (i.e., likelihood of that species occurring on or near the Project Area) was assigned to each threatened species identified in the Protected Matters Search Tool (PMST (DCCEEW 2023) and Biological Databases of South Australia (BDBSA) database search (DEW 2023 Recordset number: DEWNRBDBSA230614-1) with a 10 km search area around the Varied Project. The PMST identifies nationally threatened flora, fauna, migratory fauna and threatened ecological communities relevant to the search area. The BDBSA database search is comprised of an integrated collection of species records from the South Australian Museum, conservation organisations, private consultancies, Birds SA, Birdlife Australia and the Australasian Wader Study Group. As EBS records are submitted to the BDBSA databased, records from surveys conducted in 2014 are also included in the BDBSA database that are used to inform the likelihood of species using the Project Area.

This likelihood of occurrence rating, 'Highly Likely', 'Likely', 'Possible' and 'Unlikely' takes the following criteria into consideration:

- proximity of the records (distance to the Project Area);
- date of the records;
- landscape features, vegetation remnancy and vegetation type at the location of the record (taking into consideration similarities within the Project Area); and
- knowledge of species' habitat preferences, causes of decline, and local population trends.

Bird and bat species observed in the Project Area during field surveys undertaken at Palmer Wind Farm were assigned as "known" to occur within the Project Area. Threatened species assessed as potentially occurring in the area (i.e., "possible", "likely", "highly likely", or "known") were included in the risk assessment. Common bird and bat species that are known to occur in the Project Area and that were assessed as at risk of flying within the rotor swept height of WTG were included in the assessment.

A detailed description of the criteria for likelihood assessments is provided in the ecological assessment report (EBS 2024).

3.1.2 Level of risk

A risk assessment matrix was used to qualitatively define the risk of the Varied Project on threatened bird species observed in the Project Area and threatened bird species defined as "possibly" or "likely" to occur within the Project Area (based on the PMST search and BDBSA search). Bird species identified as having performed at-risk movements within the Project Area (such as raptors) were also assessed.

A risk assessment matrix was used to define the risk to all bat species identified during previous surveys as occurring in the Project Area, threatened bats identified and potentially in the region and other bat species determined as "likely" to occur in the Project Area (based on the BDBSA search).

The assessment is an adaptation of the qualitative measures of likelihood and consequence used in the Australian Defence Risk Management Framework (Gaidow and Boey 2005). The Australian Defence Risk Management Framework provides generic guidance on the introduction and ongoing implementation of a risk management process; it may be applied to different activities or operations of any corporate, community or public sector organisation (Gaidow and Boey 2005). The risk assessment matrix considered the risk consequences (impact or magnitude of effect) and likelihood (measured by frequency or probability) of risk occurrence to combine both into the overall level of risk.

The risk assessment methodology used within the Australian Defence Risk Management Framework was adapted to include likelihood and consequence of an event on a species or local population. EBS used the matrix to qualitatively define the risk of a proposed wind monitoring mast on birds within numerous proposed wind farms located in the mid-north of South Australia and has been accepted (when previously used by EBS) by the Environment, Resources and Development Court. State threatened bird species, raptors and migratory species were targeted in the assessment.

Likelihood was defined as how likely mortality from collision is to occur, and consequence was defined by significance of associated impact on species viability (Table 2):

- Categories A to E were used to define likelihood, ranging from chronic (the event is expected to occur in most circumstances) to rarely (where the event may occur only in exceptional circumstances).
- Categories 1-5 were used to define consequence, where one equated to nil/insignificant (individuals may be affected, but viability of local population was not impacted) and five equated to catastrophic disaster (potential to lead to collapse of a species) (Table 2).

Table 3 outlines the qualitative risk analysis matrix, which summarises four levels of impact: low, medium, high and extreme.

If the level of risk was determined to be high to extreme, then resulting impact on an individual species and local population may be unacceptable when considered through regulatory approval processes. If the level of risk was categorised as medium, then all efforts should be made to mitigate against potential impact on the species. If the level of risk was low, then impact would be restricted to an individual level and impact on a species would be unlikely to affect the viability of a local population.

3.2 Limitations

The findings and conclusions expressed by EBS are based solely upon information available at the time of the assessment.

Existing flora and fauna records were sourced from the BDBSA. The BDBSA only includes verified flora and fauna records submitted to the Department for Environment and Water or partner organisations. Although much of the BDBSA data has been through a variety of validation processes, the lists may contain errors and should be used with caution.

There is limitation in determining the resulting impact of acceptability and significance with regard to the risk assessment matrix. The risk assessment matrix provides a guide to risk consequences and likelihood

of risk occurrences, based on the bird species that were identified as performing flights considered as ‘at-risk’ movements.

Table 2. Qualitative measures of likelihood and consequence (adopted from AS/NZS 4360:1999, now superseded by AS ISO 31000:2018).

Likelihood (how likely is mortality from collision to occur)		Consequence (Significance of associated impact on species viability)	
Rating	**Definition**	**Rating**	**Definition**
Chronic	The event is expected to occur in most circumstances.	**Catastrophic/ Disaster**	Potential to lead to collapse of species.
Frequent	The event probably will occur in most circumstances (e.g., weekly to monthly).	**Major**	Critical event, very likely to have significant impact on species.
Likely	The event should occur at some time (i.e., once in a while).	**Moderate**	Likely to have impact on population, potential to impact on long-term viability under some scenarios.
Unlikely	The event could occur at some time.	**Minor**	May have impact on local population, no impact on species.
Rarely	The event may occur only in exceptional circumstances.	**Insignificant**	Individuals may be affected, but viability of local population not impacted.

Table 3. Qualitative Risk Analysis Matrix – Level of Risk (adopted from AS/NZS 4360:1999 [superseded by AS ISO 31000:2018] and HB 143:1999 [superseded by SA SNZ HB 436-2013]).

Likelihood	Consequences				
	Insignificant 1	**Minor 2**	**Moderate 3**	**Major 4**	**Catastrophic 5**
A (Chronic)	High	High	Extreme	Extreme	Extreme
B (Frequent)	Medium	High	High	Extreme	Extreme
C (Likely)	Low	Medium	High	Extreme	Extreme
D (Unlikely)	Low	Low	Medium	High	Extreme
E (Rarely)	Low	Low	Medium	High	High

4 AVIAN RISK ASSESSMENT

4.1 Results from previous risk assessments (EBS 2014)

The risk assessment completed by EBS in 2014 was based on proposed turbines with a maximum tip of blade height of 165 m. The dimensions of the WTG tower and blade were yet to be decided by TrustPower. Indicative dimensions were 100 m for the tower height and 65 m for the blade lengths. The 2014 risk assessment was based on the lowest extent of a rotating blade tip being 35 m from the ground.

Flight height and movement details were specifically recorded for 'at-risk' bird species; meaning those species with the potential to fly at heights within the rotor-swept area, making them at risk of collision with WTG. Flight height and movement details were used to assess the potential collision risk of avian species. In 2014 flights that were performed above 35 m over the top of a ridge were considered at-risk movements.

The overall level of risk for all bird and bat species was determined as **low** in the 2014 assessment (Table 4). The likelihood of collision causing mortality was determined as unlikely for six raptor species (including the Peregrine Falcon (*Falco peregrinus*)) and five threatened bird species. Two State threatened bird species known to occupy woodland habitats were assessed in the likelihood of a collision event causing mortality as rare. The consequence of mortality at a species/population level was determined as **minor** for four species: the Peregrine Falcon, Hooded Robin (*Melanodryas cucullata cucullata*), Elegant Parrot (*Neophema elegans*) and Diamond Firetail (*Stagonopleura guttata*).

4.2 Updated avian risk assessment 2024

The updated risk assessment was undertaken to determine the potential impact of the proposed Project on bird species, where the risk element of concern remain unchanged, as collision. The maximum rotor diameter of proposed WTGs is 180 m, with a 220 m tip height, resulting in a 40 m ground clearance.

The updated risk assessment is based on the lowest extent of the rotating blade tip and the rotor swept area being 40 m from the ground, which is a difference of 5 m from the 2014 risk assessment. For the purposes of the updated risk assessment, flights that would be performed above 40 m over the top of the ridge would be considered at-risk movements, as this air-space would correspond with the rotor-swept area of turbines.

It is anticipated that with the varied WTG design, with the updated blade tip height, reduces the risk of woodland birds being impacted by turbines by 5 m compared to the approved Project, as woodland birds typically utilise a low air space to fly between woodland habitats. In addition, 4 fewer turbines have been located in or near woodlands than the approved Project designs, further reducing the potential risks for woodland birds.

New assessments were performed for additional raptor species (two species) and threatened bird species known to the Project Area since 2014 (three species), and any common bird species assessed in field surveys as flying within the rotor swept height of the turbines (eight species). The Collared Sparrowhawk and Nankeen Kestrel were additional raptor species to be included in the risk assessment as they were observed in the Project Area and have been identified as colliding with turbines in a study of Victorian Wind Farms (Maloney *et al.* 2019).

One bird species listed as vulnerable under the EPBC Act and four species listed under the *National Parks and Wildlife Act 1974* (NPW Act), were observed during surveys at the proposed Palmer Wind Farm Project Area. Of the species recorded in the Project Area, eight raptors and nine common bird species were considered at risk, as determined by flight heights and / or flight behaviours (Table 4). One species not observed in the Project Area but assessed as possibly occurring in the Project Area (Blue-winged Parrot, *Neophema chrysostoma*) was also considered at risk due to the potential to fly in the rotor swept zone.

Raptors

As a result of bird strike monitoring data at other wind farms, as well as the larger rotor-swept area of the proposed wind turbines compared to the approved design, EBS has increased the risk assessment levels for four raptor species (Table 4). However, it is noted that the reduction in the number of turbines has decreased the total rotor-swept area of the Varied Project by 26% and the potential impact of this is discussed in section 6. As such Wedge-tailed Eagle, Brown Falcon, Nankeen Kestrel and Peregrine Falcon have been assessed as having a **medium** risk level, and Black-shouldered Kite, Black Kite, Collared Sparrowhawk and Little Eagle have been assessed as having a **low** risk level of impact due to collision with turbines.

The risk assessment levels for raptors changed from the 2014 assessment as listed below:

- Wedge-tailed Eagle, Brown Falcon, Peregrine Falcon and Little Eagle
    - Change in likelihood of an event causing mortality increased from unlikely to likely.

  - Change in their consequence at a species / population level changed from nil / insignificant to minor;
  - Risk level increased from low to medium.

- Collared Sparrowhawk was assessed as being unlikely to have an event causing mortality and nil / insignificant consequences at a species / population level resulting in a low level of risk.
- Nankeen Kestrel was assessed as being likely to have an event causing mortality and minor consequences at a species / population level, resulting in a medium level of risk.

All species assessed as having a medium level of risk were identified as potentially being affected at the local population level, but not at the overall species level. For the species of which risk was determined as low, individuals may be affected, but the viability of local populations will not be impacted upon.

Woodland birds

The risk of collision for woodland birds listed in Table 4 has been increased for two species, due to the larger rotor-swept area of the proposed larger wind turbines. In general, the potential effects of a wind farm on woodland bird species are related to (1) possible loss of habitat and (2) disturbance from turbines if situated close to woodlands. Direct interaction with turbine blades is now considered unlikely for woodland specific bird species (unless otherwise stated in Table 4), as the rotor-swept area is higher than typical flight heights observed for woodland birds at Palmer Wind Farm.

A summary of the risk assessment for threatened woodland birds known to occur in the Project Area is as follows (Table 4):

- One species of threatened bird had their likelihood of an event causing mortality changed from unlikely to likely (Elegant Parrot (*Neophema elegans*)). The consequence to the species / population for this species remained as minor and as such the risk level has been upgraded to **medium**;
- Two species assessments remained the same and their risk rating remained as **low** (White-winged Chough (*Corcorax melanorhamphos*) and Hooded Robin (*Melanodryas cucullata cucullata*));
- The likelihood of an event causing mortality for the Diamond Firetail (*Stagonopleura guttata*) remained the same as unlikely and the consequence for the species / population was upgraded to moderate due to the absence of suitable habitat for this species in the broader landscape. As such the risk level increased to **medium**;
- White-bellied Cuckoo-shrike was added to the list and was assessed as having a **low** risk level due to vagrant presence in the area and low flight height between woodlands.

A summary of threatened birds listed as possibly or likely to occur within the Project Area is as follows (Table 4):

- Two newly listed EPBC Act listed threatened bird species have been added to the risk assessment: Southern Whiteface (*Aphelocephala leucopsis*) and Blue-winged Parrot (*Neophema chrysostoma*);
- Three bird species (Southern Whiteface, Jacky Winter (*Microeca fascinans*) and Restless Flycatcher (*Myiagra inquieta*)) have been assessed for the likelihood of an event causing mortality as rarely with a consequence of minor.
- The Southern Whiteface, Jacky Winter, Restless Flycatcher and Blue-winged Parrot have been assessed as having a risk level of **low**.

A summary of “at risk” common bird species within the Project Area is as follows (Table 4):

- Seven bird species observed flying in the rotor swept zone have been assessed as being likely to have an event causing mortality with nil / insignificant consequences. As such these species have been assessed as having a **low** risk level;

- Two bird species, Australian Pelican (*Pelecanus occidentalis*) and Rainbow Bee-eater (*Merops ornatus*), were assessed as having a **medium** risk level as they are likely to have an event causing mortality and the impact on the species / population will be minor.

In summary – level of risk

Eight species included in this risk assessment have been assessed as having a **medium** level of risk. Of these, four are raptors and two are threatened species (one of which are EPBC Act listed). The remaining seventeen species have been assessed as having a **low** level of risk.

If the level of risk for a species is determined as high to extreme, then resulting impact on an individual species and local population may be unacceptable when considered through regulatory approval processes. If the level of risk for a species is categorised as medium, then all efforts should be made to mitigate against potential impact on the species. If the level of risk for a species is determined to be low, then impact would be limited to the level of individuals only, and impact at a species level would be low, and is therefore considered to be unlikely to affect the viability of a local population.

Table 4. Updated avian risk assessment of the proposed Palmer Wind Farm.

Scientific name	Common name	Aus. status	SA status	Likelihood of utilising Project Area	Likelihood of an event causing mortality		Consequence at a species / population level		Level of risk	
					2014	2024	2014	2024	2014	2024
Raptor species										
Accipiter cirrocephalus	**Collared Sparrowhawk**			Known	-	Unlikely	-	Nil/ Insignificant	-	Low
Aquila audax	Wedge-tailed Eagle			Known	Unlikely	Likely	Nil/ Insignificant	Minor	Low	Medium
Elanus axillaris	Black-shouldered Kite			Known	Unlikely	Unlikely	Nil/ Insignificant	Nil/ Insignificant	Low	Low
Falco berigora	Brown Falcon			Known	Unlikely	Likely	Nil/ Insignificant	Minor	Low	Medium
Falco cenchroides	Nankeen Kestrel			Known	-	Likely	-	Minor	-	Medium
Falco peregrinus	Peregrine Falcon		R	Known	Unlikely	Likely	Nil/ Insignificant	Minor	Low	Medium
Milvus migrans	Black Kite			Known	Unlikely	Unlikely	Nil/ Insignificant	Nil/ Insignificant	Low	Low
Hieraaetus morphnoides	Little Eagle			Known	Unlikely	Unlikely	Nil/ Insignificant	Minor	Low	Low
Threatened birds known to occur in the Project Area										
Coracina papuensis	**White-bellied Cuckooshrike**		R	Known	-	Unlikely	-	Nil/ Insignificant	-	Low
Corcorax melanorhamphos	White-winged Chough		R	Known	Unlikely	Unlikely	Nil/ Insignificant	Minor	Low	Low
Melanodryas cucullata cucullata	Hooded Robin	EN	R	Known	Unlikely	Unlikely	Minor	Minor	Low	Low
Neophema elegans	Elegant Parrot		R	Known	Unlikely	Likely	Minor	Minor	Low	Medium
Stagonopleura guttata	Diamond Firetail	VU	V	Known	Unlikely	Unlikely	Minor	Moderate	Low	Medium
BDBSA determined as 'Possible' or 'Likely' to occur in the Project Area										
Aphelocephala leucopsis	**Southern Whiteface**	VU		Possible	-	Rarely	-	Minor	-	Low
Microeca fascinans	Jacky Winter		R	Likely	Rarely	Rarely	Nil/ Insignificant	Minor	Low	Low

Scientific name	Common name	Aus. status	SA status	Likelihood of utilising Project Area	Likelihood of an event causing mortality		Consequence at a species / population level		Level of risk	
					2014	2024	2014	2024	2014	2024
Myiagra inquieta	Restless Flycatcher		R	Likely	Rarely	Rarely	Nil/ Insignificant	Minor	Low	Low
Neophema chrysostoma	**Blue-winged Parrot**	VU	V	Possible	-	Unlikely	-	Minor	-	Low
"At risk" common bird species that occur in the Project Area										
Cacatua sanguinea	**Little Corella**			Known	-	Likely	-	Nil/ Insignificant	-	Low
Corvus mellori	**Little Raven**			Known	-	Likely	-	Nil/ Insignificant	-	Low
Eolophus roseicapilla	**Galah**			Known	-	Likely	-	Nil/ Insignificant	-	Low
Gymnorhina tibicen	**Australian Magpie**			Known	-	Likely	-	Nil/ Insignificant	-	Low
Hirundo neoxena	**Welcome Swallow**			Known	-	Likely	-	Nil/ Insignificant	-	Low
Merops ornatus	Rainbow Bee-eater	Ma		Known	Unlikely	Likely	Nil/ Insignificant	Minor	Low	Medium
Pelecanus occidentalis	**Australian Pelican**			Known	-	Likely	-	Minor	-	Medium
Petrochelidon ariel	**Fairy Martin**			Known	-	Likely	-	Nil/ Insignificant	-	Low
Platycercus elegans	**Crimson Rosella**			Known	-	Likely	-	Nil/ Insignificant	-	Low

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). SA: South Australia (*National Parks and Wildlife Act 1972*). Conservation Codes: EN/E: Endangered. VU/V: Vulnerable. R: Rare. Mi: Migratory. Ma: Marine – protected in Marine Protected Areas. "-" = not assessed. Species in bold were not assessed in the 2014 assessment.

Likelihood definitions (how likely is mortality from collision to occur):

- **Chronic – the event is expected to occur in most circumstance**
- **Frequent - the event probably will occur in most circumstances**
- **Likely - the event should occur at some time**
- **Unlikely – the event could occur at some time**
- **Rarely – the event may occur only in exceptional circumstances.**

Consequence definitions (significance of associated impact on species viability):

- **Catastrophic disaster – the event has the potential to lead to collapse of species**
- **Major– critical event, very likely to have significant impact on species**
- **Moderate– likely to have impact on population, potential to impact on long term viability under some scenarios**
- **Minor – the event may impact on local population, no impact on species**
- **Nil/Insignificant - individuals may be affected, but viability of local population not impacted.**

5 BAT RISK ASSESSMENT

5.1 Results from previous risk assessments (EBS 2014)

The risk assessment matrix (EBS 2014) was not used to determine the likelihood and significance of bat mortality associated with turbine collision. However, the potential risk of impact to bat species was considered to be very low (EBS 2014), based on the identification of only common bat species in the area and that the majority of bats recorded were within the vicinity of woodlands, open water and linear movement corridors. These location preferences reduced the likelihood of collisions.

AnaBat surveys confirmed the presence of seven bat species (EBS 2014), none of which had a conservation rating at state or national level. Although undetected, a further three species of bat were determined as likely to be in the Project Area and two threatened bat species (one national/state vulnerable and one state rare), were determined as potentially occurring within the region, which was based on potential habitat and distribution of the species. The state listed threatened species was determined as possibly occurring, although only infrequently and in low numbers (EBS 2014).

No flight heights were recorded for bat species recorded during the surveys conducted by EBS, due to the methods used to identify bat species (a combination of AnaBat and Harp Traps), as well as the fact that the methodology used was at a Level 1 bat survey (as per *AUSWIND Best Practice Guidelines* 2006).

5.2 Updated bat risk assessment 2024

For the purposes of this risk assessment, EBS has assumed that all bat species recorded during the surveys and determined as likely to occur within the Palmer Wind Farm, are at risk of colliding with turbines.

There is a possibility of bats flying into the rotor swept area as they traverse between areas and through wooded habitats. Being nocturnal, bats need places to roost during the day that provide shelter from the weather and potential predators. Most microbats will roost in tree hollows or under bark; flight height of bats as they leave their roosting sites and fly between areas may coincide with the revised rotor swept area.

The risk assessment includes assessing 12 bat species (Table 5):

- Seven bat species (confirmed through AnaBat surveys);
- Three additional bat species, which were determined as likely to occur in the Project Area; and
- Two threatened bat species determined as potentially occurring within the region (based on habitat and distribution of the species).

The likelihood of occurrence for the EPBC Act listed South-eastern Long-eared Bat (*Nyctophilus corbeni*) was decreased from likely in the 2014 risk assessment to unlikely as the removal of turbines in Area A has increased the distance from past records and as such reduced the likelihood the species will occur in the Project Area.

The consequence of mortality at a species/population level was determined as minor for all 12 bat species; the consequence of mortality may impact on the local population for these species, however, is unlikely to impact on the overall species.

Updated literature indicates that bat species in Australia are known to have mortality events with turbines (Maloney *et al.* 2019) and as such the risk level was increased to medium for all bats, except the South-eastern Long-eared Bat. Risk to bats from this Project is discussed further in section 6. As such the overall level of risk for all bat species was determined as **medium**, except for the nationally threatened South-eastern Long-eared Bat which was assessed as **low**.

Table 5. Updated bat risk assessment of the proposed Palmer Wind Farm.

Scientific name	Common name	Aus status	SA status	Likelihood of utilising Project Area	Likelihood of an event causing mortality 2024	Consequence at a species / population level 2024	Level of risk 2024
Bat species (ID AnaBat)							
Chalinolobus gouldii	Gould's Wattled Bat			Known	Likely	Minor	Medium
Chalinolobus morio	Chocolate Wattled Bat			Known	Likely	Minor	Medium
Mormopterus species 4 "big dick")	Southern Freetail-bat			Known	Likely	Minor	Medium
Nyctophilus geoffroyi	Lesser Long-eared Bat			Known	Likely	Minor	Medium
Tadarida australis	White-striped Freetail-bat			Known	Likely	Minor	Medium
Vespadelus darlingtoni	Large Forest Bat			Known	Likely	Minor	Medium
Vespadelus regulus	Southern Forest Bat			Known	Likely	Minor	Medium
Threatened bats (potentially in the region)							
Nyctophilus corbeni	South-eastern Long-eared Bat	VU	V	Unlikely	Unlikely	Minor	Low
Saccolaimus flaviventris	Yellow- bellied Sheath-tail Bat		R	Likely	Likely	Minor	Medium
BDBSA determined as 'Likely to occur in the Project Area'							
Mormopterus species 3.	Inland Freetail Bat			Likely	Likely	Minor	Medium
Scotorepens balstoni	Inland Broad-nosed Bat			Likely	Likely	Minor	Medium
Vespadelus vulturnus	Small Forest Bat			Likely	Likely	Minor	Medium

Aus: Australia (*Environment Protection and Biodiversity Conservation Act 1999*). SA: South Australia (*National Parks and Wildlife Act 1972*). Conservation Codes: VU/V: Vulnerable. R: Rare.

Likelihood definitions (how likely is mortality from collision to occur):

- **Chronic – the event is expected to occur in most circumstance**
- **Frequent - the event probably will occur in most circumstances**
- **Likely - the event should occur at some time**
- **Unlikely – the event could occur at some time**
- **Rarely – the event may occur only in exceptional circumstances.**

Consequence definitions (significance of associated impact on species viability):

- **Catastrophic disaster – the event has the potential to lead to collapse of species**
- **Major– critical event, very likely to have significant impact on species**
- **Moderate– likely to have impact on population, potential to impact on long term viability under some scenarios**
- **Minor – the event may impact on local population, no impact on species**
- **Nil/Insignificant - individuals may be affected, but viability of local population not impacted.**

6 DISCUSSION

The level of risk was categorised as medium for 8 out of 25 bird species listed in Table 4 (p18) and for 11 of 12 bat species listed in Table 5 (p22). The species with medium risk level assessments were generally also defined as having a minor consequence at a species / population level. This implies that there may be an impact on the local population of this species in the event of collision with a turbine. As such all efforts should be made by Tilt Renewables to mitigate against potential impact on bird and bat species, in particular placing turbines away from woodland areas as much as possible and away from sensitive areas, such as raptor nest locations.

Since the designs were approved in 2019, two new species have been added to the EPBC Act list of threatened species: Southern Whiteface (*Aphelocephala leucopsis*) (EPBC Act: Vulnerable) and Diamond Firetail (*Stagonopleura guttata*) (EPBC Act: Vulnerable; NPW Act: Vulnerable). Both of these species are woodland birds, and with the minimum tip height for the turbines being 40 m as a result of the variation, the likelihood of these birds experiencing a collision is reduced. However, given the presence of Diamond Firetails in the Project Area and the limited connected woodland habitat within the broader region, the consequence of a collision event for the Diamond Firetail has been assessed as having a moderate impact on the species. As such, the consequence of mortality may have the potential to impact the long-term viability of the population for this species.

Four raptors remain at a medium impact level due to their flight behaviour (particularly while foraging) and that they are frequently recorded flying at heights within the rotor swept area. Additionally, raptor species listed as medium have been observed in the Project Area occurring near proposed turbine sites (in particular Nankeen Kestrel and Wedge-tailed Eagles) (Appendix 1). Raptors such as Wedge-tailed Eagles and Peregrine Falcons generally reside and nest in permanent home ranges. As such when they intersect with wind farms there is a higher risk of collision (Smales 2006). These raptors are particularly at risk during the breeding season as they are restricted to a nesting location and are foraging more regularly to feed their young. Given there are known nest locations of Wedge-tailed Eagles and Peregrine Falcons at the Palmer Wind Farm, these species have been assessed as having a medium risk level.

Common bird species have been added to this assessment for the potential for these species to be impacted at the local population level. In particular, the Australian Pelican has been highlighted as having a medium risk level with the potential for collisions to impact on local populations as this species has been observed catching the thermal updrafts over the Project Area at potential turbine locations (pers. obs.). Additionally, Australian Pelicans typically fly in flocks and so if a collision is to occur, it is likely to result in the fatalities of multiple Pelicans at each collision event. There is, however, limited research into avoidance of turbines by these species, and if Pelicans do display avoidance behaviour, then the likelihood of collision incidence may be reduced.

All bats (except the South-eastern Long-eared Bat) were assessed as having a medium risk level. Despite not having flight height data for bats, the medium risk level was based on knowledge of bat movements and on the study by Maloney *et al.* (2019) which highlighted that six bat species that also occur at Palmer Wind Farm have previously been recorded in mortality events with wind turbines. Bats are more at risk of rotor strike when traversing between woodlands, as such, similar to woodland birds, the proximity of

turbines to woodlands and the minimum blade tip height are likely to be the main risk factors for strikes. Tilt have reduced the number of turbines placed in woodland by 4 compared to the 2014 risk assessment, which may reduce the risk of strike for bats. However, as we do not have flight height data for bats we cannot decrease the potential risk to these species.

For bats, a risk level of medium can be defined as all efforts should be made to mitigate against potential impact on the species. If efforts cannot be made to mitigate against potential impacts, alternative methods should be considered. For example, curtailment (restricting operation of turbines at low wind speeds between dusk and dawn during periods of high bat activity (summer to autumn) may reduce bat strikes (Bennet et. al 2022).

Fewer turbines with larger turbine capacity versus collision rates

A systematic literature review of recorded collisions between birds and bats and wind turbines within developed countries was undertaken by Thaxter *et al.* (2017). Collision rate was related to species-level traits and turbine characteristics to quantify the potential vulnerability of 9538 bird and 888 bat species globally. For birds, larger turbine capacity (megawatts) increased collision rates; however, constructing a smaller number of large turbines with greater energy output reduced total collision risk per unit energy output (Thaxter *et al.* 2017). Compared to previous designs, the number of turbines proposed for construction within the Varied Project is fewer as a result of the variation. The overall rotor swept area for all turbines combined is 26% less than the approved Project design and as such may promote fewer collision events for both birds and bats compared to previous designs. In addition, 4 fewer turbines have been located in or near woodlands than the approved Project designs, reducing the potential risks for woodland birds and bats.

In the data summarised by Thaxter *et al.* (2017), vulnerability to collision was related to habitat, migratory status and dispersal distance for birds. It was found that high collision rates for species associated with agricultural habitats may reflect the disproportionate number of wind farms from agricultural landscapes that were in the sample. Results suggested that grassland species may also be more vulnerable to collision (Thaxter *et al.* 2017). Migratory species are often suggested as being vulnerable to collision with wind farms, for which the results outlined in Thaxter *et al.* (2017) were supportive.

Thaxter *et al*. (2017) cautioned that model certainty for bats was low, as more research is required to understand the relationship between collision risk and turbine size for larger (and more efficient) turbines, and how this may vary between habitats. For example, grassland cover may best reflect openness of a landscape, a factor generally associated with reduced bat activity and abundance that may also reduce turbine collisions. Thaxter *et al.* (2017) reported that for bats, optimum turbine size of approximately 1.25MW may minimize collision and described that for bats, long-distance dispersers had the highest collision rates. It is known that tree-roosting bat species are frequently recorded in collision, potentially through attraction mechanisms (Cryan *et al.* 2014 in Thaxter *et al.* 2017), although this effect was weaker than dispersal.

The location of the wind farm relative to bird species that may be present, the layout of the turbines, particular landscape features and the behaviour of bird species influence the likelihood that a bird flying through a wind farm will collide with a turbine (Krijgsveld *et al.* 2009). As such, where possible, features that increase the risk of birds colliding with turbines (such as placement of turbines near Wedge-tailed

Eagle nest and Peregrine Falcon Nest, or placement of turbines near woodlands) should be considered and mitigated against.

Mitigation undertaken by Tilt

Based on previous recommendations, since the approved 2019 wind farm layout, Tilt have reduced the number of turbines and amended locations to reduce impacts on sensitive areas in the following ways:

- All wind turbines have been removed from Area A (an area with a high density of Wedge-tailed Eagle and Peregrine Falcon nests);
- In Area B turbines are being placed outside of a 1,000 m exclusion buffer of Wedge-tailed Eagle and Peregrine Falcon nest sites, compared to the 500 m exclusion buffer included in the approved Project; and
- In Area C, near areas of multiple Peregrine Falcon and Wedge-tailed Eagle nests (such as Bakers Gorge and Harrisons Gorge) turbine numbers have been reduced with a reduction from 38 (Approved Project) to 21 (Varied Project).

7 RECOMMENDATIONS

Based on the risk assessment, EBS recommends adopting exclusion buffers between turbines and avoiding identified bat habitat (such as woodlands) to minimise potential impacts on bat species using the Project Area.

Given the increase in WTG size, EBS would advise that incorporating a bird and bat strike monitoring program, including scavenger and detectability trials, as this would assist with understanding the potential impact of the Palmer Wind Farm on birds and bats. This information can then be used to determine the adequacy of mitigation measures.

If the tower height and/or blade length (and ultimately the lowest extent of the rotating tip and the rotor swept area) of proposed WTGs change, this risk assessment will need to be re-evaluated and updated accordingly.

EPBC Act listed threatened species

The following EPBC Act listed threatened species have been identified in this risk assessment:

- Hooded Robin (*Melanodryas cucullata cucullata*) (EPBC Act: Endangered);
- Diamond Firetail (*Stagonopleura guttata*) (EPBC Act: Vulnerable);
- Southern Whiteface (*Aphelocephala leucopsis*) (EPBC Act: Vulnerable);
- Blue-winged Parrot (*Neophema chrysostoma*) (EPBC Act: Vulnerable); and
- South-eastern Long-eared Bat (*Nyctophilus corbeni*) (EPBC Act: Vulnerable)

Four of the bird species, listed above, are species that have been recently listed as being of national conservation significance under the EPBC Act. These include the Hooded Robin, Diamond Firetail, Southern Whiteface and Blue-winged Parrot. For all of the species mentioned above, an EPBC self-assessment should be undertaken to determine the potential impact the construction and operation of the proposed windfarm may have on these species. This risk assessment and information from the two-year bird utilisation survey monitoring can be used to inform impacts to these species. If a significant impact is identified as potentially occurring, an EPBC referral is required.

If additional EPBC Act listed threatened species are detected during additional bird utilisation surveys, then these species should also be included in a self-assessment to determine impacts.

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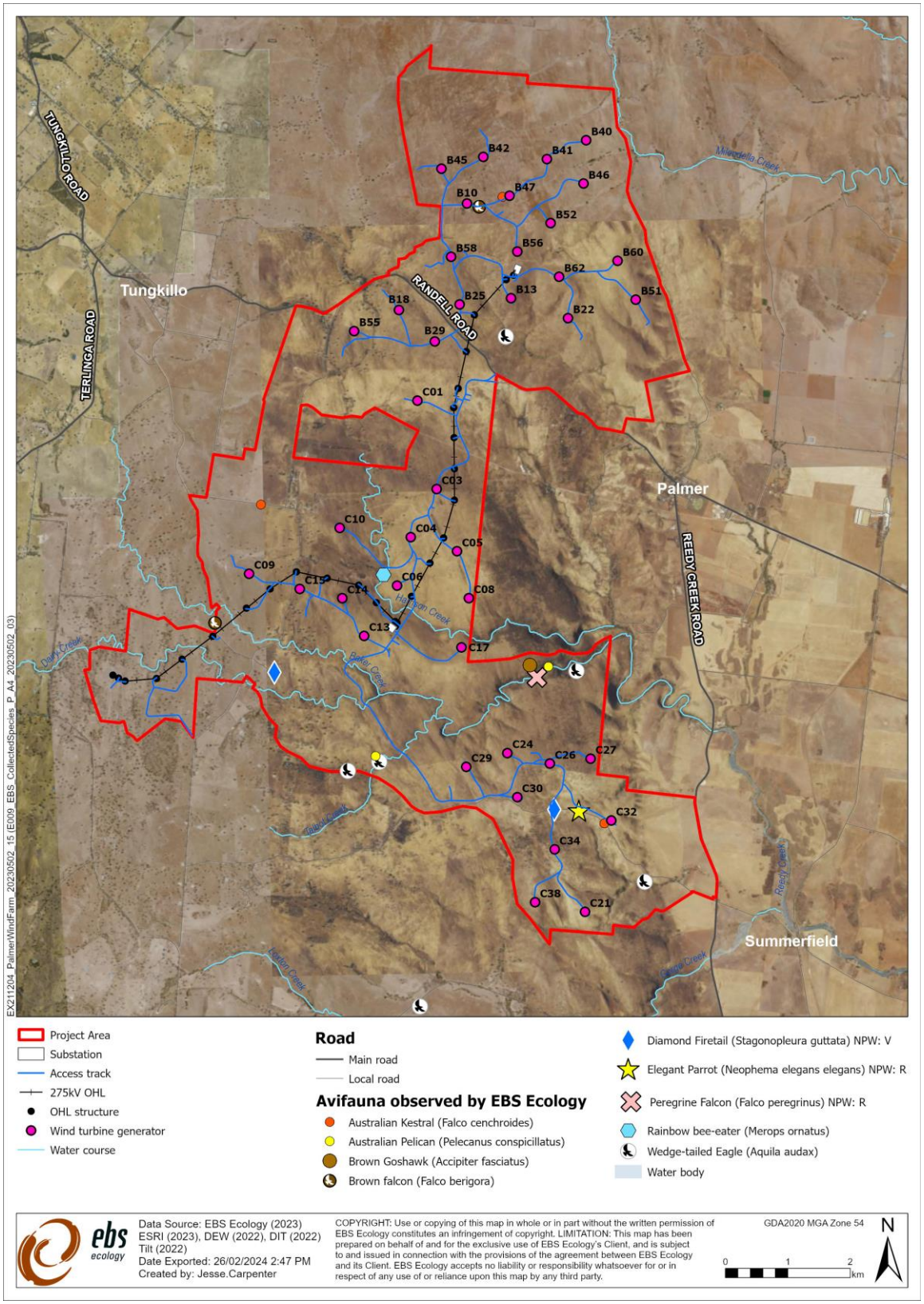
9 APPENDICES

Appendix 1. Threatened species and raptors recorded in the Varied Project Area in October 2022 and January 2023 in relation to the location of the Wind Turbine Generators.



EBS Ecology
112 Hayward Avenue
Torrensville, SA 5031
www.ebsecology.com.au
t. 08 7127 5607