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Cleve Wind Farm Bird and Bat Utilisation Survey

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Executive Summary

Vestas are proposing to construct the Cleve Wind Farm (CWF) approximately 6 km north of Cleve on the eastern Eyre Peninsula, South Australia. Ecosphere Ecological Solutions (Ecosphere) have been engaged by AECOM on behalf of Vestas to conduct ecological assessments within the CWF area and have previously undertaken baseline and targeted surveys to determine species and communities present within the area as well as ecological values associated with the site. While recognising species that were either known or expected to occur and use habitat within the CWF site, there was a level of uncertainty around the habitat utilisation and time spent in areas for species that are more mobile or potentially forage in areas where wind turbines will be present on an ongoing basis. There was a focus on species of conservation significance and species known to have life history strategies that utilise blade sweep zones such as soaring raptors and bats.

Eight sites were chosen to conduct avian surveys from the 31st of March to the 8th of April. Each site had four one-hour point bird surveys, two in the morning and two in the afternoon, with each species flight height, soaring time and general movements being recorded. Forty-five bird species were recorded across the eight sites, with one threatened species being recorded, the Purple-gaped Honeyeater (*Lichenostomus cratitius occidentalis*) listed as Rare under the NPW Act. This species was observed flying and foraging at an average height of 4.5 metres.

Three raptor species were observed, with two flying within the RSA, the Wedge-tailed Eagle (*Aqulia audax*) and the Nankeen Kestrel (*Falco cenchroides*). No active nests of Wedge-tailed Eagles were located within the Project area, however one dis-used nest was found along with several sightings of adult birds at Site 5. Another four species were recorded flying with the RSA, Dusky Woodswallow (*Artamus cyanopterus perthi*), Raven sp. (*Corvus* sp.), Purple-crowned Lorikeet (*Parvipsitta porphyrocephala*) and Rainbow Lorikeet (*Trichoglossus moluccanus moluccanus*). The majority of species observed during the surveys were flying or foraging well below RSA height, either foraging on the ground or in and just above the canopy of the trees.

Two sites were chosen to deploy acoustic monitoring (AM) devices to record bat calls and were left in place for a period of 30 recording nights. One AM was mounted at 150 metres elevation on the Meteorological Mast within the Project area, and the other on a tree at 4.5 metres in a natural 'flyway corridor' in proximity to intact vegetation. Results confirmed White-striped Free-tailed Bat (*Austronomus australis*) along with species from a further four genera which included Free-tailed Bats (*Ozimops* sp.) and Evening Bats (*Chalinolobus* sp., *Nyctophilus* sp., *Vespadelus* sp.), with no threatened species being recorded. The majority of calls recorded at the Meteorological Mast were from White-striped Free-tailed

Bats, which is a species that is known to forage at height. The second low level AM recorded a significantly higher frequency of calls and species in comparison to the Met mast AM device.

The results of the bird and bat surveys indicate that soaring bird species were at a relatively low risk of collision due to low frequency of occurrence and low time spent within open areas near proposed turbine locations. Bat activity was predominantly recorded below rotor height and in areas closer to intact vegetation. Limited detections occurred at rotor sweep heights. Importantly, no threatened bird or bat species were recorded within the RSA during surveys. Based on these findings, the ecological risk to threatened species are considered low. The risk to commonly occurring bird and bat species is not expected to be above background levels experienced at other windfarms locations and may be lower than average with generally low remnancy of vegetation, a lack of significant outcrops or high peaks and low foraging habitat due to the level of land utilised for cropping.

Glossary

Abbreviation	Description
AHD	Australian Height Datum
AuAu	White-stiped Free-tailed Bat (*Austronomus australis*)
BBUA	Bird and Bat Utilisation Assessment
BDBSA	Biological Databases of South Australia
CWF	Cleve Wind Farm
EAAF	East Asia-Australasian Flyway
Ecosphere	Ecosphere Ecological Solutions
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EP	Eyre Peninsula
km	Kilometres
MetMast	Meteorological Mast
NPW Act	*National Parks and Wildlife Act 1972*
PMST	Protected Matters Search Tool
Project area	Cleve Wind farm project area
RSA	Rotor-swept Area
SA	South Australia
WTG/s	Wind Turbine Generator/s

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1 Introduction

1.1 Site

Owned and operated by Vestas, the proposed Cleve Windfarm Project (CWF) (i.e., the Project area) will consist of up to the 70 wind turbine generators (WTGs), providing a potential 500mW of energy. The proposed CWF is located on the eastern Eyre Peninsula (EP) (Figure 1), approximately 6 kilometres (km) north of the regional town of Cleve (Figure 2).

1.1.1 Objectives

Ecological assessments have been conducted over two surveys (Ecosphere Ecological Solutions (Ecosphere) 2024) initially as a baseline assessment with which to refine a provisional layout and then as a follow up targeted assessment in spring 2024 to determine the presence of threatened species or issues associated with flora and fauna values present within the CWF Project area. In 2025, Ecosphere was engaged by AECOM on behalf of Vestas to undertake a Bird and Bat Utilisation Assessment (BBUA) within the CWF Project area.

The objectives of the BBUA were:

- Review existing bird and bat data for the Project area
- Describe the diversity of birds and bats found in the Project area
- Identify the known or likely occurrence of conservation significant species
- Identify bird species that are susceptible to collision impacts based on flight behaviours
- Identify bat species that are susceptible to barotrauma by passive acoustic detection
- Determine overall risk to populations of fauna within the CWF Project area

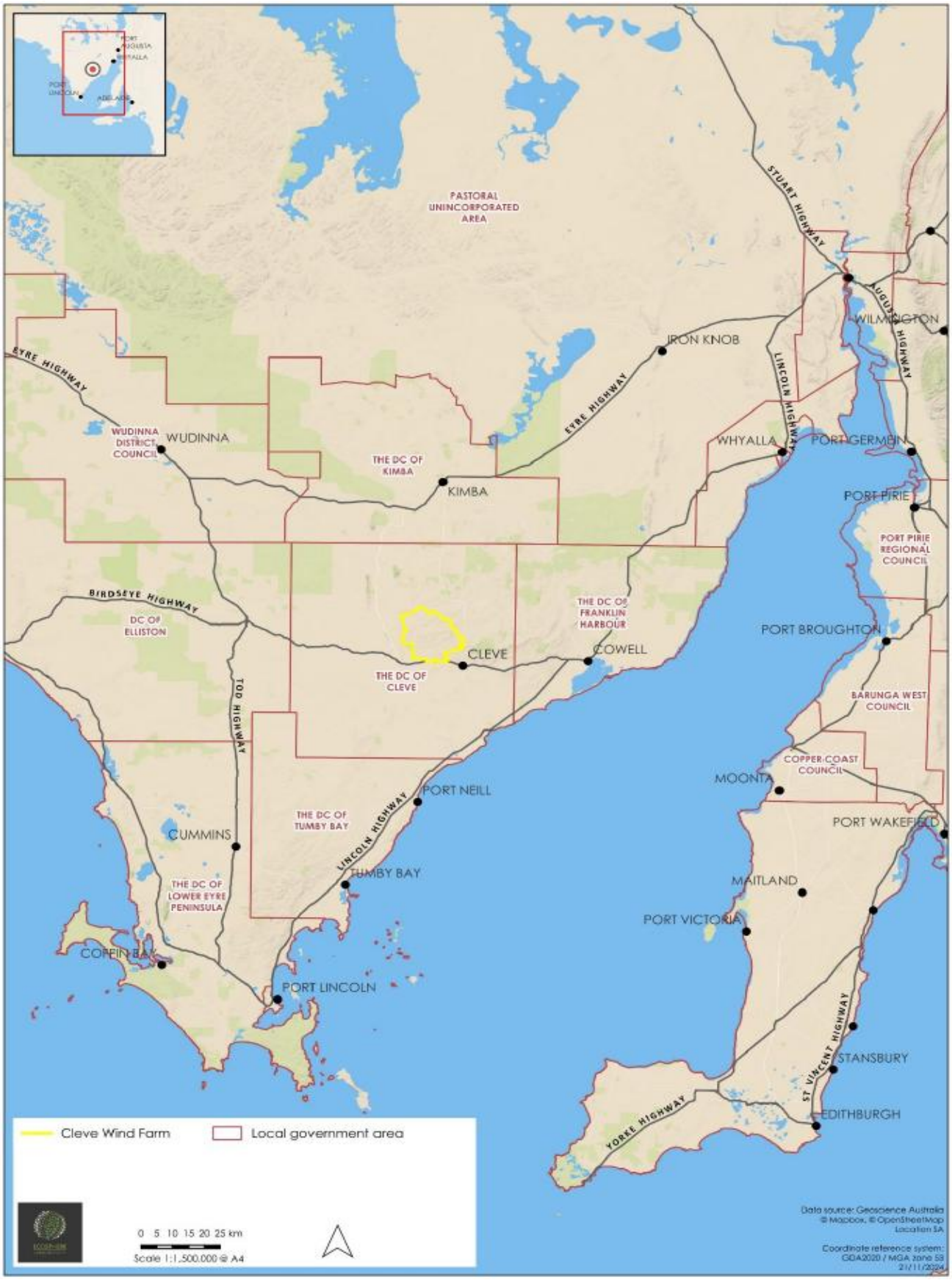

Figure 1. General location of the CWF project.

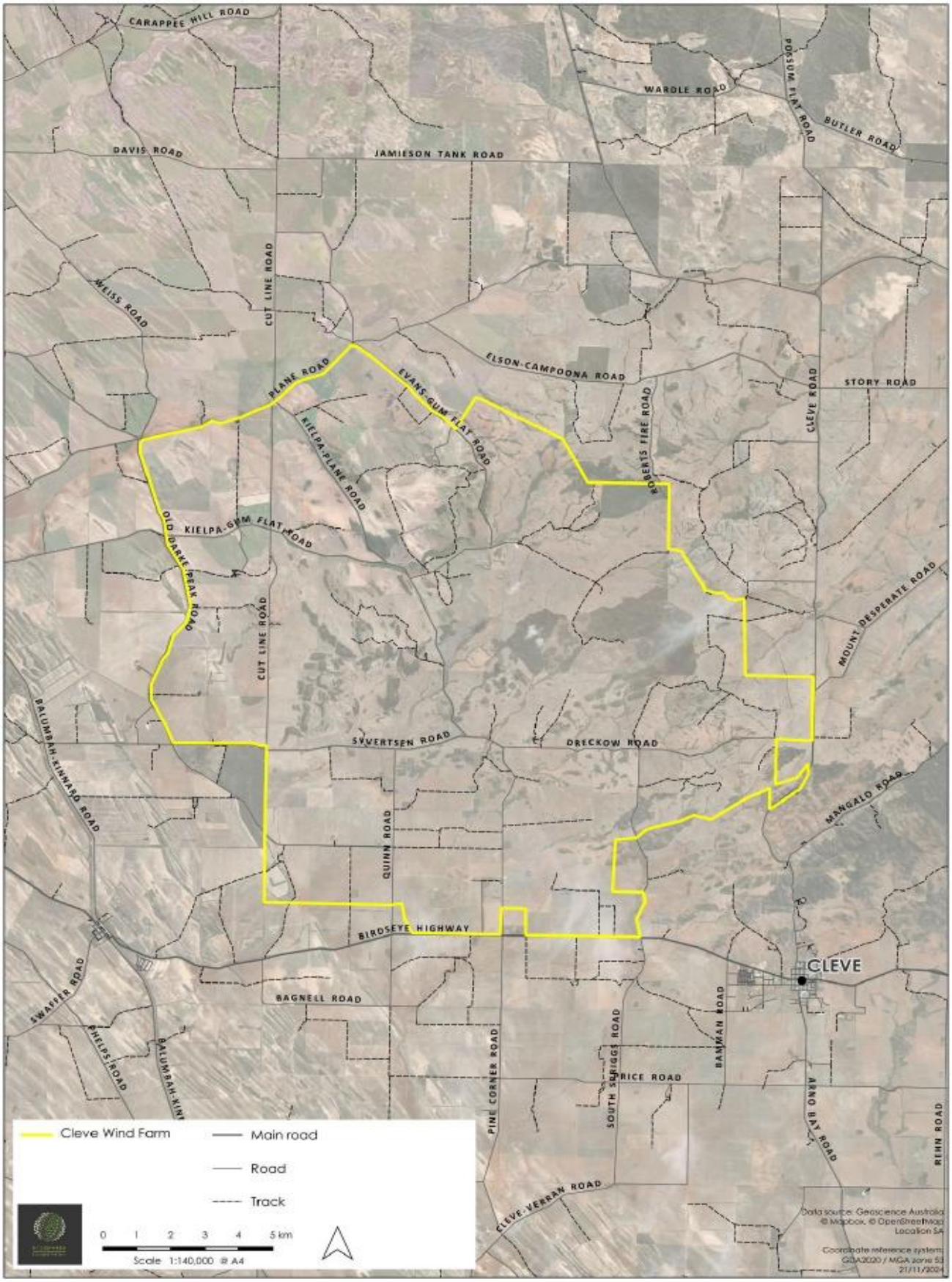

Figure 2. Location of the CWF north of the Cleve township.

2 Background

2.1 Wind Turbine Generators

The CWF will consist of approximately 70 WTGs (Figure 4). The turbines proposed to be utilised are the Vestas V172-7.2 MW with a maximum overall height of 234 m and a maximum rotor diameter of 168 m as summarised in Table 1 and visualised in Figure 3. Other infrastructure incorporated into the project include access tracks, transmission lines and towers, a battery storage facility and a substation.

Table 1. Vestas V172-7.2MW turbine specifications

Description	Ration
Hub Height	150 m
Blade Length	84 m
Rotor Diameter	168 m
WTG Height	234 m
Rotor-swept area (RSA) (height above ground)	66 – 234 m

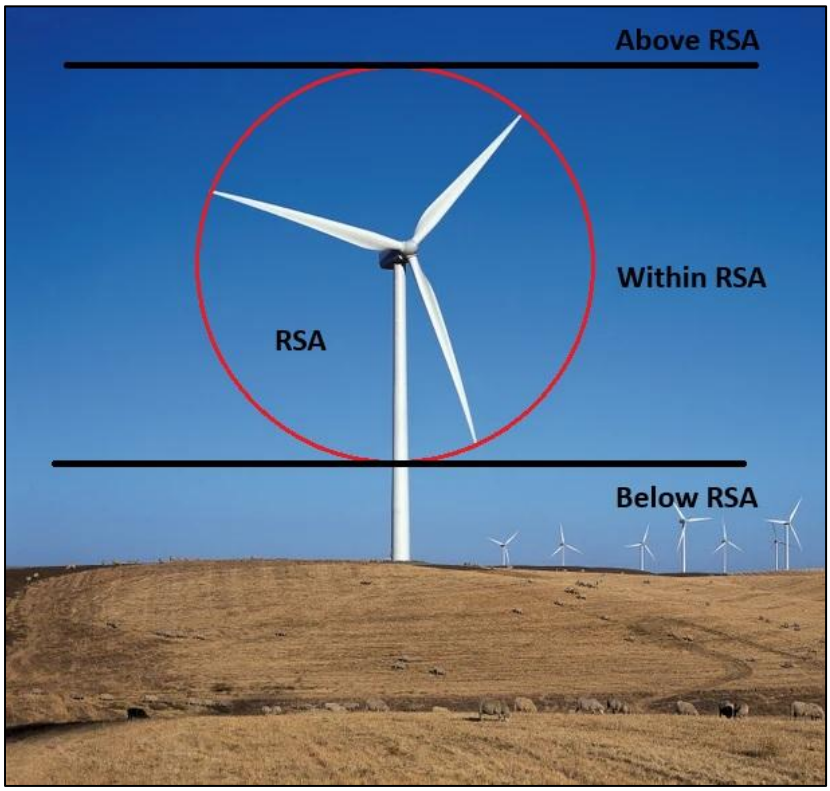

Figure 3. Visual representation of the Vestas V172 RSA

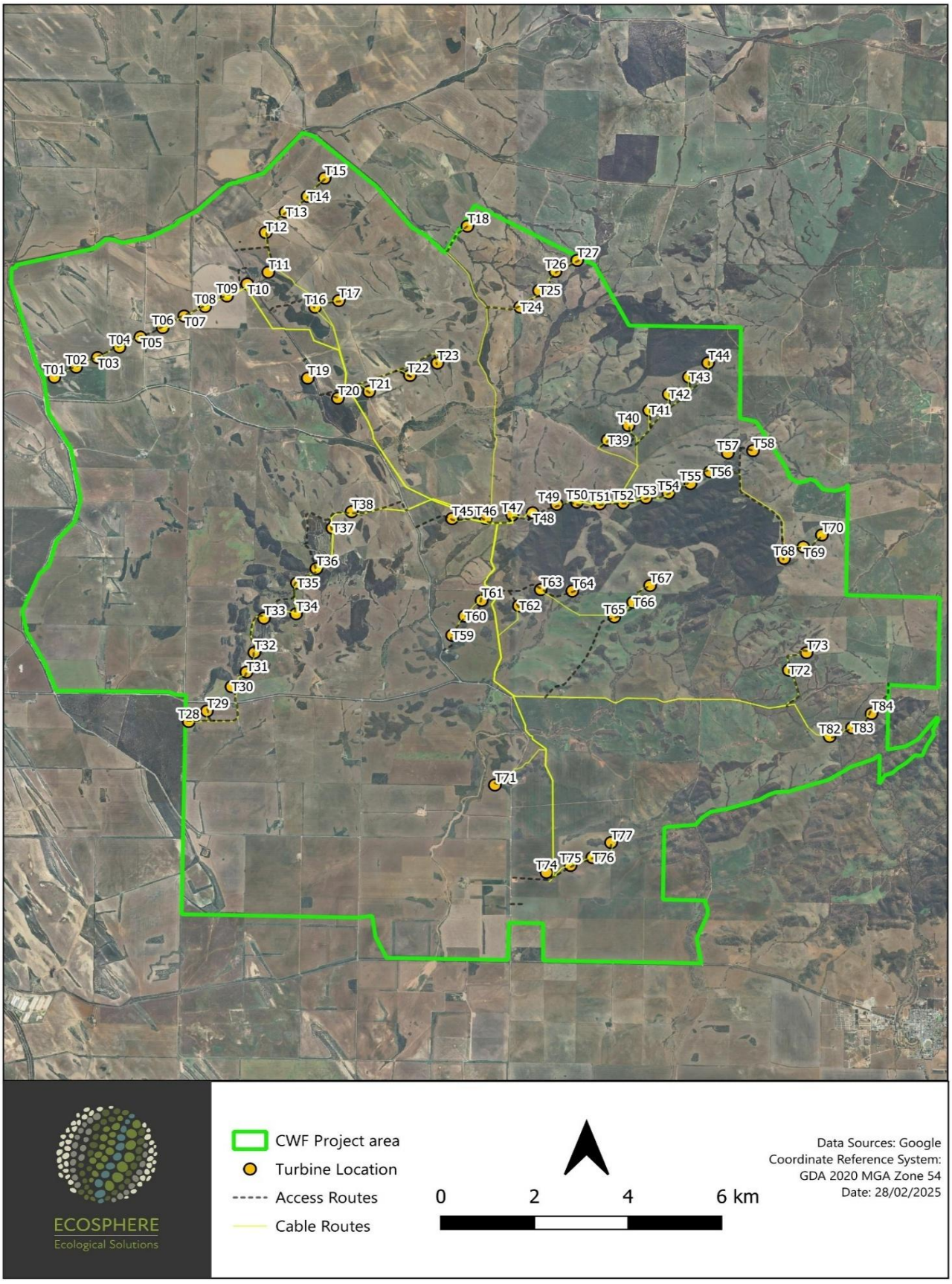

Figure 4. Proposed WTG layout for the CWF Project.

2.2 Birds of the CWF

Birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *National Parks and Wildlife Act 1972* (NPW Act) relevant to the CWF project were first identified via the desktop assessment and field assessments completed for the initial flora and fauna assessment for the project (Table 2). Previous surveys focussed on threatened species that were deemed as possible, likely and highly likely to occur within habitat within the Project area. Wedge-tailed Eagles (*Aquila audax*) and other raptor species were also targeted during the surveys. Although not threatened, larger raptors have a heightened collision risk from WTGs due to their soaring flight patterns during foraging. See Section 2.2.1 for information on threatened species within the CWF Project area.

Table 2. Threatened fauna and migratory species identified by the PMST (Source 1) and BDBSA (Source 2) database searches.

Scientific Name	Common Name	Conservation Status		Source	Last BDBSA record (Year)	Observed during previous surveys?
		EPBC	NPW			
Actitis hypoleucos	Common Sandpiper	Mi	R	1,2	16/10/2002	-
Amytornis textilis myall	Western Grasswren (Gawler Ranges)	VU	V	1	None	-
Aphelocephala leucopsis leucopsis	Southern Whiteface	VU	-	1	None	-
Apus pacificus	Fork-tailed Swift	Mi	-	1	None	-
Botaurus poiciloptilus	Australasian Bittern	EN	E	1	None	-
Calidris acuminata	Sharp-tailed Sandpiper	VU, Mi	-	1	None	-
Calidris ferruginea	Curlew Sandpiper	CR, Mi	E	1	None	-
Calidris melanotos	Pectoral Sandpiper	Mi	R	1	None	-
Charadrius veredus	Oriental Plover	Mi	-	1	None	-
Cinclosoma castanotum	Chestnut Quailthrush	-	R	2	01/08/2020	-
Falco hypoleucos	Grey Falcon	VU	R	1	None	-
Gallinago hardwickii	Latham's Snipe	Mi	R	1	None	-
Grantiella picta	Painted Honeyeater	VU	R	1	None	-
Hylacola cauta cauta	Shy Heathwren (EP, YP, FR, MM, upper SE)	-	R	2	20/11/2004	-
Leipoa ocellata	Malleefowl	VU	V	1,2	1/1/1973	-
Lichenostomus cratitius occidentalis	Purple-gaped Honeyeater (mainland SA)	-	R	2	28/11/2002	Yes
Motacilla cinerea	Grey Wagtail	Mi	-	1	None	-
Motacilla flava	Yellow Wagtail	Mi	-	1	None	-
Neophema chrysostoma	Blue-winged Parrot	VU	V	1	None	-
Pachycephala inornata	Gilbert's Whistler	-	R	2	28/09/1995	-
Pandion haliaetus	Osprey	Mi	E	1	None	-
Pedionomus torquatus	Plains-wanderer	CR	E	1	None	-
Rostratula australis	Australian Painted Snipe	EN	E	1	None	-
Stagonopleura guttata	Diamond Firetail	VU	V	1,2	27/11/2012	Yes
Sternula nereis nereis	Australian Fairy Tern	VU	E	1	None	-

Conservation codes: EPBC Act; CR: Critically Endangered, EN: Endangered, VU: Vulnerable, Mi: Migratory, NPW Act; E: Endangered, V: Vulnerable, R: Rare

2.2.1 EPBC Act Threatened Species

One species listed threatened under the EPBC Act was identified as likely to occur within the CWF Project area and has been observed during previous surveys. While this species is known as a predominantly ground foraging species, and remains a focus of utilisation assessment:

Diamond Firetail (*Stagonopleura* guttata) EPBC: VU, NPW: V – Occurs in Project area.

Diamond Firetail was listed as Vulnerable under the EPBC Act on 31st March 2023 due to continued population decline (DCCEEW, 2023) attributed to the clearance of native vegetation for large scale agriculture which has reduced the size and quality of important nesting and breeding habitats. Diamond Firetails occur in *Eucalypt, Acacia* or *Casuarina* woodlands, open forests and other lightly timbered habitats, including farmland and grassland with scattered trees. They feed predominantly on grass and herb seeds, green leaves and insects. Habitat critical to the survival of the Diamond Firetail includes areas of low tree density, few large logs, and little litter cover but high grass cover for foraging, roosting and breeding. This type of habitat is present across the wind farm site with many fragments having good grass cover despite the loss of mid and lower storey shrubs in many areas. The species and species habitat is known to occur within the Project area and was observed during targeted surveys in spring 2024.

2.2.2 NPW Act Threatened Species

Three species listed as threatened under the NPW Act were identified as potentially occurring within the CWF Project area:

Shy Heathwren (*Hylacola cauta cauta*) NPW: R – Possibly occurs in Project area.

This species occurs within dense shrub or heath understorey in mallee woodland or shrubland so is likely to be largely confined to larger remnant patches away from the project footprint. The most recent record occurs from 2004 in the heritage agreement in the eastern portion of the Project area and is unlikely to occur within more fragmented areas of the site. The threats to this species from a project perspective are increased fragmentation of intact areas and disturbance from noise associated with construction.

Purple-gaped Honeyeater (*Lichenostomus cratitius occidentalis*) NPW: R – Known to occur in Project area. Occurs in Mallee and woodland habitats within the Project area and therefore is likely to occur periodically. Primarily feeds on nectar from mallee eucalypts and banksias but will also take insects from foliage and bark or whilst on the wing. Seeds, pollen and honeydew from scale insects (coccids) are less frequently consumed. Key threats in this area would be loss of connectivity between feeding areas such as creek lines, road reserves and other corridors that allow for movement through the landscape in search of foraging habitat.

Gilbert's Whistler (*Pachycephala inornata*) NPW: R - Possibly occurs in Project area.

The species is typically found in semi-arid mallee woodland and occasionally in taller, semi-arid eucalypt woodland or forest, usually where a dense understory is present (Higgins and Peter 2002). The Gilbert's Whistler feeds on the ground and in understorey layers, primarily on invertebrate prey, although they also eat fruit and seeds.

2.2.3 Migratory Bird Species

Ten migratory species listed under the EPBC Act were highlighted as potentially present within the Project area (Table 2). Of these, five were rare vagrants and not further considered in this report. Five species were waders and unlikely to utilise the Project area considering the lack of wetland or saltmarsh habitats that support many of these species.

Migratory birds breed in wetland environments in the northern hemisphere during the northern summer, before migrating south to Australia and other locations over winter (Australian summer). As part of the annual migration, shorebirds tend to aggregate at significant coastal wetland and intertidal sites across Australia. Within South Australia the main feeding grounds for these species are in the Adelaide International Bird Sanctuary (AIBS) and Northern Gulf St Vincent.

The Project area is located approximately 193 km to the west from the AIBS, an important rest and feeding stop for migratory birds, which is at the southern end of the East Asian-Australasian Flyway (EAAF). The EAAF is a route that migratory birds traverse on an annual basis. It is especially important for the millions of migratory waders or shorebirds that breed in northern Asia and Alaska and spend the non-breeding season in South-east Asia and Australasia.

Waders departing feeding grounds for migration climb steeply to high altitude just after take-off. Several studies focussing on various shorebird/wader species confirm many fly anywhere between 2000m and 5000, above sea level during migratory flights.

The height of each WTG (including blade length) is 234m and the highest elevation for the Project area is 395m Australia Height Datum (AHD). With the combined height of the WTG and highest elevation being 629mAHD, this falls well below the altitudes that migratory birds have been recorded flying. This factor, in conjunction with the distance of the CWF location and direction (west) from the nearest habitat for migratory birds (migratory birds are travelling in north-south directions) and how quickly they gain altitude after take-off, this project is unlikely to pose a significant impact upon migratory species, and other than a brief fly-over, migratory species are unlikely to utilise habitat within the project area.

2.3 Bats of the CWF

Bat species were not surveyed for during previous assessments within the CWF Project area. South Australia has historical records for 12 bat species classified as threatened under the NPW Act, with three of these also listed as threatened under the EPBC Act. None of these species however were expected to occur within the CWF

Project area. The nearest record for a threatened bat species is for the Grey-headed Flying Fox (*Pteropus poliocephalus*, listed as Vulnerable under both the EPBC Act and the NPW Act), located approximately 120 km northeast in Whyalla. Critical habitat associated with threatened bat species such as caves for roosting/nurseries or specific flora/habitat for foraging is not present within the CWF. Additionally, the project area does not interact with the known distribution for threatened bat species. Therefore, bats have not been a key focus of the ecological assessment as the likelihood of threatened bat species presence within the CWF Project area has been considered low.

There are currently no records for any bat species within the proposed CWF area. Bats are cryptic in nature and generally can only be reliably identified through passive acoustic monitoring or by visual identification through trapping. The lack of records for the area may also be attributed to insufficient survey efforts. A search of the BDBSA database returned records for five bat species within 50 km of the Project area, with two species being considered as highly likely to occur within the Project area, and three species considered to possibly occur within the Project area (Table 3 and Figure 5).

A further two species were considered as likely occur, two species as possible to occur and one unlikely to occur within the Project area (Table 4). Although none of these species had records within 50 km, the Project area is within, or close to the species natural distribution and contains suitable habitat.

Table 3. Bat species with historical records within 50 km of the CWF Project area and likelihood of occurrence within the CWF Project area.

Scientific Name	Common Name	Habitat, Roosting Preferences and Foraging Behaviour[1]	Likelihood of occurrence
Austronomus australis	White-striped Free-tailed Bat	Urban areas, forests, woodland, shrubland and open agricultural landscapes with scattered stands of trees. Roost in hollows in Eucalypts with large trunk cavities, hollow branches and under loose bark. Form colonies of several hundred individuals. Feeds on flying insects above the tree canopy. Not manoeuvrable in flight compared to other microbat species, they catch prey 50m or more above ground.	Highly Likely
Chalinolobus gouldii	Gould's Wattled Bat	Found in virtually all habitats including eucalypt forests and woodlands, grassland, agricultural lands and urban areas. Roost in hollows and hollow limbs of mature living trees. Form colonies of around 30 individuals. Feeds on a variety of flying and terrestrial insects and fly just below or within the lower level of the tree canopy, along forest edges, creek lines and isolated paddock trees.	Highly Likely
Nyctophilus geoffroyi	Lesser Long-eared Bat	Wet to dry sclerophyll forests, grasslands, agricultural land and urban areas. Roost alone or small groups of two or three in hollows and fissures in trees, under bark, in old fairy martin nests, buildings, and occasionally in caves. Forage close to vegetation and into the understorey, also near the ground for flying insects and catch insects off the ground or leaves.	Possible
Nyctophilus major tor	Central Long-eared Bat	Desert habitats including mallee, desert shrublands and mixed eucalypt woodlands. Less common in open woodlands. Roost in hollows or amongst foliage, and under loose bark. Very manoeuvrable in flight, feed on predominantly flying insects at low heights around tree trunks and close to vegetation, also known to forage on the ground.	Possible
Vespadelus regulus	Southern Forest Bat	Shrubland and low shrub woodland, mallee and open woodland. Sensitive to extreme vegetation fragmentation and avoid small forest remnants, corridors and open areas. Roost in hollows and under bark in groups up to 100 individuals, often with Lesser Long-eared bats. Commonly roost in houses. Forage very close to vegetation at less than half the canopy height and at ground level for flying and terrestrial insects.	Possible

1 – (Churchill, 2008).

Table 4. Bat species without historical records but with species distribution close to, or within the CWF Project area

Scientific Name	Common Name	Habitat Preferences and Foraging Behaviour[1]	Likelihood of occurrence
Chalinolobus morio	Chocolate Wattled Bat	Wet and dry sclerophyll forest, woodlands and mallee. Most roosts are in tree hollows or under exfoliating bark. Will also roost in houses, culverts and under bridges. Mostly forage in the zone between the top of the understorey and the canopy, although sometimes fly low along open corridors. Species distribution within CWF Project area.	Likely
Ozimops petersi	Inland Free-tailed Bat	Generally associated with open woodland or shrubland in more arid areas, water courses lined with red gums, cypress pine woodlands, mallee, chenopod shrublands and grasslands. More common in areas of taller vegetation along creek and drainage lines. Known distribution starts 25 km north of CWF project boundary.	Possible
Ozimops planiceps	Southern Free-tailed Bat	Dry open forest, river red gum, and cypress woodlands, mallee, grassland and coastal heathlands, have adapted well to urban areas, often found in houses and sheds. Roost in tree hollows and roofs of houses. Forage at or above canopy height, along roadways and the outer edge of remnant vegetation. Species distribution within CWF Project area.	Likely
Scotorepens balstoni	Inland Broad-nosed Bat	Arid and semi-arid regions of inland Australia along river red gum-lined waterways, in open woodland, shrubland, mallee and grasslands. Roost in tree hollows or in roofs of houses. Forage mostly between trees, but also at the edge of vegetation, into open areas and stay within 15m from the ground and do not forage above the canopy. Known distribution starts 9 km north of CWF project boundary.	Possible
Vespadelus baverstocki	Inland Forest Bat	*Acacia, Callitris* and *Casuarina* woodlands, mallee, open eucalypt woodland, shrubland and grassland. Roost in extremely small tree hollows in stunted trees only a few metres high and abandoned buildings. Little known about foraging behaviour but presumed to eat mainly flying insects. Known distribution starts 53 km north of CWF project boundary.	Unlikely

1 – (Churchill, 2008).

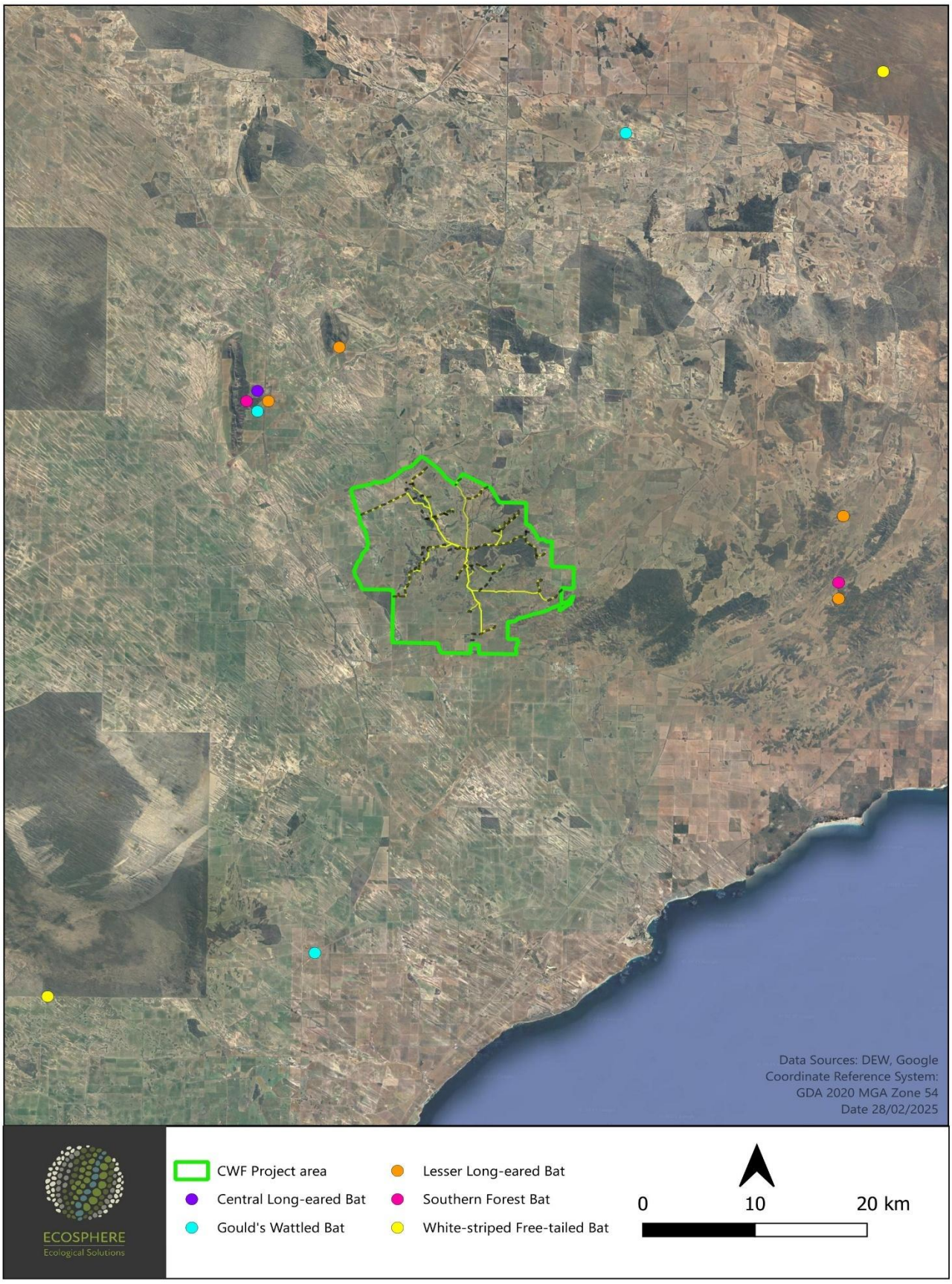

Figure 5. Bat species records within 50 km of the CWF Project area.

3 Potential Impacts

The potential impacts of wind farms on bird and bat species range from habitat loss due to vegetation clearance during turbine construction or alienation from habitat, noise pollution disturbing the surrounding habitat during construction and operation, and direct mortality from collisions with operational turbine blades, as well as posing a high level of risk to microbat species due to barotrauma-induced fatalities.

3.1 Habitat Reduction

The development of wind farms can lead to both direct and indirect reductions in suitable habitat for bird and bat species. One of the most immediate impacts is the clearance of native vegetation for turbines, access roads, and associated infrastructure. This process can reduce the availability of critical resources such as foraging grounds and nesting areas, or, in the case of bats, roosting sites. For many species, particularly those that rely on specific habitat features like tree hollows or dense understory, the loss of even small areas can significantly affect local populations.

Beyond the physical removal of habitat, wind farm construction and operation can create disturbances that alter wildlife behaviour. Noise, increased human activity, and the movement of turbine blades may deter birds and bats from using nearby habitat that would otherwise be suitable. These indirect impacts can reduce the effective size of available habitat, especially for species that are sensitive to disturbance or show high site fidelity. Habitat fragmentation is another key concern. When continuous habitat is broken into smaller, isolated patches by roads or cleared areas, the landscape becomes more difficult for wildlife to navigate. Some smaller bird species are reluctant to cross open spaces, which can limit their ability to move between feeding and nesting areas. Similarly, bat species that rely on linear features such as tree lines or riparian corridors for navigation and commuting may be disrupted by breaks in the landscape. This fragmentation can lead to reduced genetic diversity, lower reproductive success, and ultimately population declines if connectivity is not maintained. Micro siting of the turbines has been undertaken to avoid vegetation and access, and transmission routes have minimised the need for vegetation clearance to very low levels across the CWF and habitat reduction is therefore a very low risk factor for these species.

3.2 Barotrauma

Barotrauma is a significant cause of mortality in bats associated with wind turbine operations. It is a condition caused by rapid changes in air pressure, which can lead to severe internal injuries. In the context of wind turbines, barotrauma primarily affects bats due to their highly sensitive respiratory systems. As a turbine blade moves through the air, it creates areas of low pressure. When a bat flies into these low-pressure zones, the sudden drop in pressure can cause their lungs to expand rapidly, leading to internal haemorrhaging and fatal injuries.

Studies have shown that a substantial proportion of bat fatalities at wind farms exhibit internal injuries consistent with barotrauma rather than direct collision, suggesting that this mechanism is a primary contributor to bat mortality.

In contrast, birds are generally less affected by barotrauma due to anatomical and physiological differences. Bird respiratory systems, characterized by rigid lungs and unidirectional airflow supported by air sacs, appear to provide greater resilience to pressure changes. Consequently, bird fatalities at wind farms are more often attributed to direct collision with turbine blades rather than pressure-induced trauma.

3.3 Direct Impact

Operational windfarms are widely recognised as presenting a degree of risk to bird and bat species that inhabit or migrate through these areas. The risk primarily arises from the potential for direct collisions with turbine rotors (rotor strike), which can lead to injury and mortality. Such collisions are considered a significant ecological concern, as they may contribute to population declines, particularly for species that are already threatened or have low reproductive rates.

Species-specific flight behaviour in birds is one factor that can influence this collision risk. Species with high wing loading, low manoeuvrability and limited powered flight have been linked to a greater risk of collision (De Lucas et al., 2008). Species with these flight behaviours rely more on thermal updrafts for altitude gain and soaring, however their limited manoeuvrability reduces their ability to escape an encountered object fast enough to avoid collision (Marques et al, 2014).

Due to these flight behaviours, Accipitriformes (raptors and birds of prey) experience the highest turbine collision rates, resulting in significantly greater mortality compared to other bird groups (Thaxter et al. 2017). Many raptor species also exhibit life-history traits characterised by low fecundity, delayed sexual maturity, and slow reproductive rates. Consequently, the loss of a single individual may exert a disproportionately greater impact on population dynamics compared to species with higher reproductive rates (See Section 7 for the risk assessment of individual species).

4 Species of Concern

Species of concern are those that are known, likely or have the potential to occur within the CWF Project area or in the broader area that are listed as threatened or migratory in biodiversity legislation, or that are known to be particularly vulnerable to wind turbine impacts, have historical records or have been observed within the CWF Project area. Species that have been the subject of this risk assessment include the following:

- Species listed as threatened based on state and federal legislation and have habitat present within or surrounding the CWF Project area or in the region.
- Species or groups known or likely to be prone to collision with operating turbines or sensitive to disturbance.
- Species recorded through habitat assessment and reporting (Ecosphere 2024).

From the background information sources and previous surveys, a list of species with potential to occur in the region was created. Of these, a shortlist of species of concern was then generated based on the likelihood of occurrence within the CWF Project area and surrounding region given the habitat present and the known habitat preferences of species (Table 5). Further discussion on the occurrence of these species is provided in Table 11.

Table 5. Species highlighted as of concern based on background information and previous assessments.

Category	Species
EPBC Act listed migratory species	• None
EPBC Act listed threatened birds	• Diamond Firetail
NPW Act listed threatened birds	• Shy Heathwren • Purple-gaped Honeyeater • Gilbert's Whistler
Flocking and Passerine (perching) birds	• Honeyeaters • Woodswallows • Ravens/magpies/butcherbirds • Galahs
Raptors	• Wedge-tailed Eagle • Nankeen Kestrel • Australian Hobby • Black-shouldered Kite
Waterbirds	• Ducks
Bat Species	• Evening Bats • Free-tailed Bats • Sheath-tailed Bats

Threatened and/or migratory wetland bird species were omitted from Table 5 due to the lack of habitat within the CWF Project area and surrounding region (as previously discussed in Section 2.2.3).

4.1 Species Commonly at Risk

Studies within Australia and other parts of the world such as Perold (2020), species most commonly at risk from wind farm interactions include raptors (e.g., kites and eagles), passerines (perching birds, e.g., honeyeaters), waterbirds, swifts, large terrestrial birds (e.g., ibis) and pigeons (e.g., Crested Pigeon). The capacity for birds to 'habituate' to the presence of turbines, particularly in the presence of other significant disturbances may vary between species. Risk factors include:

- Foraging in the blade sweep area.
- Flocking or colonial movements i.e., species such as Galahs.
- Migrating at night.

Typical flight behaviours of raptors can put them at risk from wind farm interactions. Different species of raptors may have slightly modified flight behaviours however the following principles generally apply:

- Soaring: many raptors are expert soarers, using updrafts, thermals and wind currents to conserve energy during flight, and often circle in the air riding these currents.
- Gliding: Raptors often use gliding to cover large distances with minimal energy expenditure.
- Hovering: Some raptors, particularly kestrels and smaller kites, are capable of hovering in mid-air, often in conditions with no wind. This is achieved by rapidly flapping their wings while maintaining a fixed position relative to the ground. Hovering is useful for hunting as it allows them to maintain a stationary position while scanning for prey below.
- Diving and stooping: Falcons, known for their high-speed flight, employ a hunting technique called stooping, or diving. They climb to great altitudes and then tuck in their wings to dive and occasionally flap their wings to exceed terminal velocity when pursuing prey. This rapid descent helps them close in on their target quickly, and often undetected.
- Spiralling: When searching for prey or gaining altitude, raptors may spiral upward on thermal currents, as commonly seen in eagle species.
- Aerial manoeuvring: Raptors often display remarkable agility and precision in the air, especially when chasing prey or evading other birds. Some can make tight turns, sudden dives and rapid changes in direction.
- Low-level flight: When hunting in wooded or cluttered environments, raptors such as Goshawks and Sparrowhawks, may fly close to the ground, or through small gaps in vegetation, using trees and obstacles for cover. This low-level flight helps them surprise prey and navigate through complex terrain.

Passerine and flocking birds have flight behaviours that are innate and learnt, and typically juvenile attrition is high in these species due to predation and natural means such as starvation. General flapping flight increases with maturation and practice and then more complex foraging flights are learnt over time. These types of

functional groups are likely to be adaptable to changes in habitat through presence of turbines as foraging is likely to occur closer to ground level and below blade sweep heights while also learning cohabitation with obstructions or disturbance associated with turbines.

5 Methods

Field surveys were undertaken by Nina Maurovic from Ecosphere from the 31st of March to the 8th of April 2025. Bird surveys were conducted across eight sites (See Section 5.1 for further information) with bat surveys being conducted at two sites (Figure 7) (See Section 0 for further information). The locations of the survey sites were selected to cover a range of vegetation associations within the Project area and include larger areas of intact vegetation that may have a higher potential for threatened species to occur.

Woodland areas were assessed for potential bat roost sites (e.g. Hollow trunks/limbs), and larger trees for Wedge-tailed Eagle (*Aquila audax*) nests.

5.1 Avian Surveys

Four, 60-minute surveys were conducted at each of the eight survey sites within the CWF Project area for a total of 32 surveys over nine days. Two morning and two afternoon surveys were carried out at each site. The morning surveys commenced at approximately 7:15am and 8:45am, and afternoon surveys commenced at approximately 3:00pm and 4:30pm.

Upon arrival at the site, the observer would remain in the vehicle with the engine off for 10 minutes to allow any disturbance from arrival to subside. The sites were then traversed by foot for 60 minutes using a ramble method (observers chose a random route through the site). All birds observed or heard while traversing the site were recorded, including those that were observed outside of the survey area within the same vegetation association, up to a distance where a positive species ID could be obtained. Data collected for each site included:

- Date, weather conditions, temperature, wind speed, survey start and finish time
- Species observed
- Number of individuals
- Flight height:
    - Bird flight height was classified as below (<66m), at (66-234m), and above (>234) RSA height.
- Direction of flight; and
- Behaviour
    - Flying in a single direction
    - Flying (hovering or circling) over or around a single point
    - Foraging (feeding) on ground; perching/resting/walking on ground
    - Perching/resting/climbing on trees or shrubs; and foraging on trees of shrubs.

Opportunistic sightings within roadside vegetation were also recorded while travelling between sites.

5.1.1 Survey Site Photos

Site 1: Turbines within 1 km - T55, T56, T57, T58

Site 2: Turbines within 1 km - T48, T49, T50, T51

Site 3: Turbines within 1 km **-** T42, T43, T44

Site 4: Turbines within 1 km - T36, T37, T38

Site 5: Turbines within 1 km - T83, T84

Site 6: Turbines within 1 km - T20, T21, T22

Site 7: Turbines within 1 km - T26, T27

Site 8: Turbines within 1 km – T28, T29

5.2 Bat Surveys

Microbats rely on echolocation for navigation and hunting. While the calls of nearly all species are outside the range that humans can hear, they can be picked up and recorded by bat detectors. AnaBat Chorus passive high-frequency sound recorders (Titley Electronics, Ballina, New South Wales) were used to record the ultrasonic calls of bats to gain an understanding of species using the Project area. Two recording units were used for the CWF Project. Each unit was powered by four AA batteries and set to record bat calls from sunset to sunrise (approximately 12 hours per night), the units were triggered to record upon detecting a bat call.

One detection unit was installed on the Meteorological Mast (MetMast) within the Project area (Figure 7) at a height of 120 metres and recorded for 18 nights from the 23rd of March to the 10th of April 2025 before running out of power. The second unit was placed at Survey Site 1 (Figure 7) on the 31st of March and secured to a tree trunk at a height of 4.5 metres. This site was chosen due to a natural 'flyway' corridor between vegetated areas that some species of bats are likely to use while foraging at lower levels, in conjunction with a large farm dam that bats potentially utilise for drinking water and foraging for insects. The unit at Site 1 recorded for 19 nights before being retrieved on the 29th of April.

Recorded bat echolocation calls were viewed as spectrograms (Figure 6) and analysed using Anabat Insight software. The distinct pulse rates and frequency characteristics of bat calls were analysed and compared with known reference calls from bat species to identify them to genus, and species level when possible. Identifications to species level were made only when the call identification was certain. The calls of some species, such as those belonging to the genus *Nyctophilus* (Long-eared Bats) are indistinguishable from one another using current call analysis techniques.

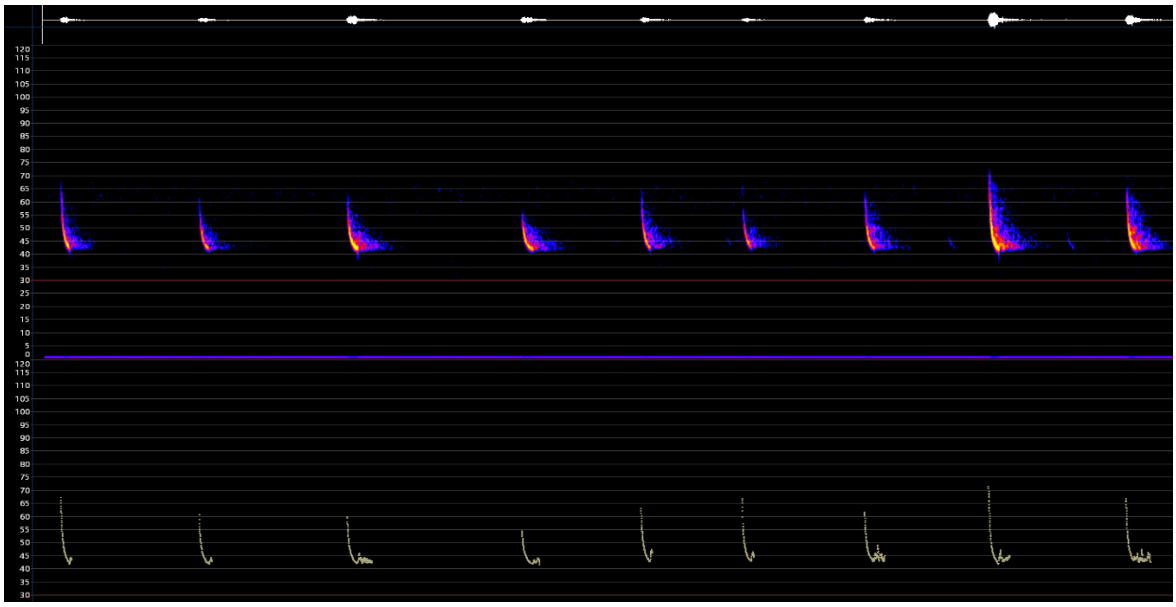

Figure 6. Example of a bat call recording viewed in Anabat Insight showing nine sound pulses.

Site 1: Turbines within 1 km – T28, T29

Met Mast: Turbines within 1 km – T28, T29

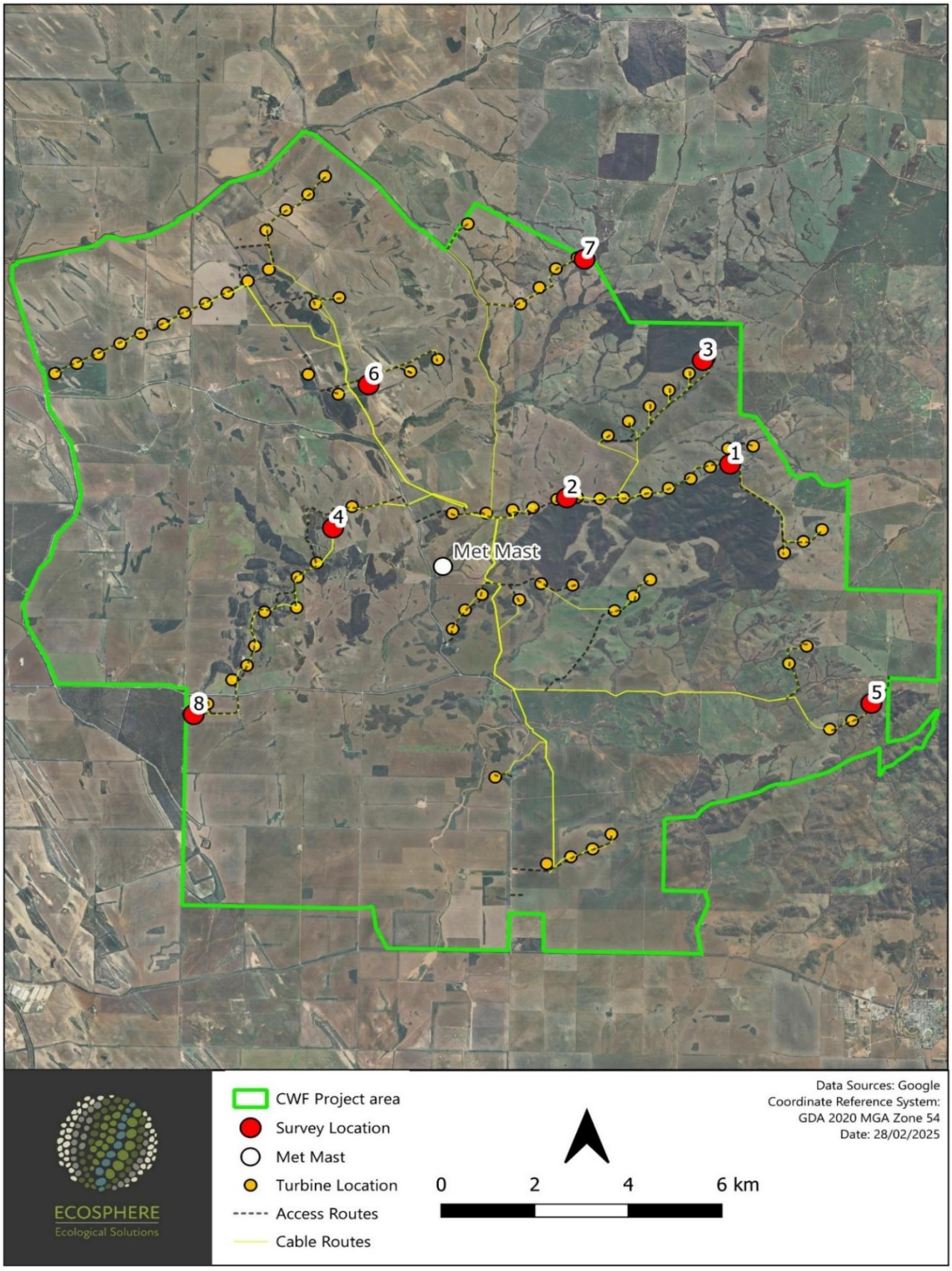

Figure 7. Bird and bat survey locations within the CWF Project area.

5.2.1 Limitations

The identification of microbat calls is facilitated by the species-specific nature of many vocalizations. However, the methodology employed in this survey has certain limitations. While the recording device can indicate the potential diversity of species present within the area, it does not provide data on population density or habitat utilisation rates. Rather, it is only capable of confirming the presence or absence of bat species. Additionally, the placement height of the recording device is acknowledged as a factor influencing species detection, as different species exhibit varying flight behaviours.

Lastly, the activity levels of bats can be greatly affected by environmental factors, such as low air temperatures or heavy rainfall, which have been linked to decreased activity levels (Perks & Goodenough 2020).

6 Field Survey Results

6.1 Bird Surveys

A total of 45 bird species were recorded across the eight sites within the CWF Project area (Table 6) with a further five species of interest observed opportunistically within the CWF Project area.

6.1.1 Threatened Species

One threatened species, the Purple-gaped Honeyeater (*Lichenostomus cratitius occidentalis* – NPW: R) was recorded foraging in flowering gums within remnant vegetation at Sites 1, 4 and 7, with an average flight height of 4.5 m. No other threatened species were recorded within the survey areas.

6.1.2 Raptors

Three species of raptor were recorded within the survey areas, with two of these observed flying within the RSA height:

- Collared Sparrowhawk (*Accipiter cirrocephalus cirrocephalus*)
- Wedge-tailed Eagle (*Aquila audax*) – within RSA
- Nankeen Kestrel *(Falco cenchroides*) – within RSA

A pair of Wedge-tailed Eagles (*Aquila* audax) (Figure 9) were observed three sperate times at Site 5 soaring between 30 m and 150 m, resting on the ground or perched in a tree. An old nest was located (Figure 8) approximately 3 m off the ground in an *Allocasuarina verticillata* (Drooping Sheoak) tree with several bones from rabbits and a fox skull littered on the ground underneath. However, after an extensive search of the surrounding area an active nest could not be located, however it is likely that one does exist in proximity.

6.1.3 Species in RSA Height

Four species (none threatened) were observed flying with the RSA height:

- Dusky Woodswallow (*Artamus cyanopterus perthi*)
- Raven sp. *(Corvus* sp.)
- Purple-crowned Lorikeet (*Parvipsitta porphyrocephala*)
- Rainbow Lorikeet (*Trichoglossus moluccanus moluccanus*)

The majority of species observed during the surveys were flying or foraging well below RSA height, either foraging on the ground or in and just above the canopy of the trees.

Figure 8. Old Wedge-tailed Eagle (*Aquila audax*) nest at Site 5.

Figure 9. Pair of Wedge-tailed Eagles at Site 5

Table 6. Bird species recorded within the CWF Survey sites and likelihood to utilise RSA.

Scientific Name	Common Name	Site								Average Flight Height (metres)	Utilises RSA
		1	2	3	4	5	6	7	8		
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	✓	✓	✓	✓	✓	✓	✓	✓	3.6	-
Acanthiza apicalis apicalis	Inland Thornbill	✓		✓	✓			✓		3.1	-
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	✓			✓			✓		0.3	-
Accipiter cirrocephalus cirrocephalus	Collared Sparrowhawk			✓			✓			5.5	-
Anthochaera carunculata	Red Wattlebird	✓	✓	✓	✓	✓	✓	✓	✓	4.9	-
Anthus australis australis	Australian Pipit				✓			✓		0	-
Aquila audax	Wedge-tailed Eagle					✓	✓			90	Yes
Artamus cyanopterus perthi	Dusky Woodswallow			✓						55	Yes
Barnardius zonarius	Australian Ringneck	✓	✓	✓	✓	✓	✓		✓	9.4	-
Colluricincla harmonica	Grey Shrike-thrush	✓			✓			✓		2	-
Coracina novaehollandiae	Black-faced Cuckoo-shrike	✓					✓			5	-
Corvus sp.	Ravens	✓	✓	✓	✓	✓	✓	✓	✓	25.3	Yes
Coturnix sp.	Quails						✓			0	-
Cracticus torquatus leucopterus	Grey Butcherbird	✓	✓	✓	✓	✓	✓	✓	✓	4.3	-
Dromaius novaehollandiae	Emu			✓						0	-
Eolophus roseicapilla	Galah		✓		✓	✓	✓			24.5	Likely
Falco cenchroides cenchroides	Nankeen Kestrel		✓	✓						85	Yes
Gavicalis virescens sonorus	Singing Honeyeater	✓			✓	✓			✓	2.3	-
Grallina cyanoleuca cyanoleuca	Magpielark				✓					10	-
Gymnorhina tibicen	Australian Magpie	✓	✓		✓	✓	✓		✓	7.4	Possible
Hirundo neoxena neoxena	Welcome Swallow				✓			✓	✓	15.4	-
Lichenostomus cratitius occidentalis	Purple-gaped Honeyeater (NPW: R)	✓			✓			✓		4.5	-
Lichenostomus leucotis	White-eared Honeyeater	✓		✓	✓	✓			✓	5.3	-

Scientific Name	Common Name	Site								Average Flight Height (metres)	Utilises RSA
		1	2	3	4	5	6	7	8		
Manorina flavigula	Yellow-throated Miner	✓	✓	✓	✓	✓	✓		✓	7.4	-
Melithreptus brevirostris	Brown-headed Honeyeater	✓		✓	✓					6	-
Ocyphaps lophotes lophotes	Crested Pigeon				✓	✓				1.5	-
Pachycephala fuliginosa fuliginosa	Western Whistler			✓				✓		2.5	-
Pardalotus punctatus	Spotted Pardalote	✓		✓	✓			✓		4.8	-
Pardalotus striatus	Striated Pardalote	✓		✓				✓		5.8	-
Parvipsitta porphyrocephala	Purple-crowned Lorikeet		✓							150	Yes
Phaps chalcoptera	Common Bronzewing	✓	✓	✓	✓	✓		✓	✓	1	-
Phaps elegans elegans	Brush Bronzewing					✓				0	-
Phylidonyris novaehollandiae	New Holland Honeyeater							✓		5	-
Pomatostomus superciliosus	White-browed Babbler	✓			✓	✓	✓	✓		0.1	-
Psephotellus varius	Mulga Parrot	✓								9	-
Purnella albifrons	White-fronted Honeyeater	✓		✓						9.25	-
Rhipidura albiscapa	Grey Fantail	✓						✓		3	-
Rhipidura leucophrys leucophrys	Willie Wagtail	✓	✓	✓	✓	✓	✓	✓		2.1	-
Sericornis frontalis	White-browed Scrubwren	✓								5	-
Smicrornis brevirostris	Weebill	✓		✓	✓	✓		✓	✓	4.7	-
Strepera versicolor intermedia	Brown Currawong	✓				✓		✓		9.7	-
Sturnus vulgaris vulgaris	Common Starling	✓							✓	17.2	-
Trichoglossus moluccanus moluccanus	Rainbow Lorikeet					✓				100	Yes
Vanellus miles	Masked Lapwing				✓					0	-
Zosterops lateralis pinarochrous	Silvereye	✓						✓		5.8	-

Table 7. Opportunistic bird sightings within the CWF Project area.

Scientific Name	Common Name	EPBC	NPW	Utilises RSA
Aquila audax	Wedge-tailed Eagle	-	-	Yes
Circus assimilis	Spotted Harrier	-	-	Possible
Corcorax melanorhamphos whiteae	White-winged Chough	-	R	-
Falco cenchroides	Nankeen Kestrel	-	-	Yes
Stagonopleura guttata	Diamond Firetail	VU	V	-

6.2 Bat Surveys

A total of 7,722 files were recorded by the detector installed on the MetMast, and 3,235 files at Site 1. Using Anabat Insight software, files without bat calls—such as those triggered by insects, brief noises that do not persist, or recordings lacking sufficient pulses for identification—were filtered out. Files containing multiple, clearly defined pulses are generally the most suitable for species-level identification. After filtering, 44 files from the MetMast detector were deemed suitable for identification, with 2,734 files for Site 1. Along with sound files, the ambient temperature every 10 minutes while in recording mode.

Small hollows suitable for microbat species were observed in larger eucalypt trees across the Project area, with trunk-sized hollows present in some mature trees along watercourses within the CWF Project area, with decorticating bark also provided additional roosting opportunities. Old farm buildings, sheds, and accumulated farm refuse (e.g. piled tarpaulins) also provided habitat, with occasional bat roosts recorded in these structures (pers. comm.).

6.2.1 MetMast

Average temperature from 12am to 7am – 15.2°C, average temperature from 7pm to 11:30pm – 16.31°C.

One bat species and two genera were identified from calls on the MetMast detector, the White-striped Free-tailed Bat (*Austronomus australis* (AuAu)), and species of Free-tailed bat in the *Chalinolobus* and *Ozimops* genera. The majority of calls were from AuAu, a species that typically forages at height and is commonly recorded in open habitats. Its activity at the height of the MetMast is consistent with what was expected for this survey. Other species recorded may have been conducting exploratory flights, however, are generally not frequently foraging at this height.

6.2.2 Site 1

Average temperature from 12am to 7am – 14.7°C, average temperature from 7pm to 11:50pm – 17°C.

One species was identified from the detector from Site one (White-striped Free-tailed Bat), and species from four genera, Free-tailed Bats (*Ozimops* sp.) and Evening Bats (*Chalinolobus* sp., *Nyctophilus* sp., *Vespadelus* sp.). The detector was positioned below the canopy in an area with dense and more open vegetation, which likely

contributed to the high number of calls and the diversity of species detected, as such conditions are known to support a variety of low- and mid-flying bat species.

7 Risk Assessment

An avian and bat specific risk assessment has been undertaken for the CWF Project area, and commentary has also been provided regarding risk factors. The risk assessment has followed the procedure for risk assessment as per AS ISO 31000:2018 guidelines. The assessment has been undertaken as individual bird or bat species or groups of concern that have been short-listed based on their likelihood of occurrence at the site. Two impact pathways have been assessed:

- Direct collision with wind turbines
- Indirect barrier effects for migratory or general flight pathways

The risk level for each species or group of concern from the two impact pathways has been determined consistent with a risk matrix and definitions for likelihood and consequence adapted from Nature Advisory (2020) (Table 8Table 9Table 10).

Table 8. Likelihood criteria utilised for risk assessment.

Likelihood	Description
Certain	It is very probable that the risk event could occur in any year (>95%)
Almost Certain	It is more probable than not that the risk event could occur in any year (>50%)
Likely	It is equally probable that the risk event could or could not occur in any year (50%)
Unlikely	It is less probable than not that the risk event could occur in any year (<50%)
Rare	It is improbable that the risk event could occur in any year (<5%). The risk event is only theoretically possible or would require exceptional circumstances to occur.

Table 9. Impact criteria (consequence) summary.

Insignificant	Minor	Moderate	High	Severe
Occasional individuals lost but no reduction in local or regional population viability.	Repeated loss of small numbers of individuals but no reduction in local or regional population viability.	Moderate loss in numbers of individuals, leading to minor reduction in localised or regional population viability for between one and five years.	Major loss in numbers of individuals, leading to reduction in regional or state population viability for between	Extreme loss in numbers of individuals, leading to reduction in regional or state population viability for a period of at least 10 years.

Table 10. Risk assessment matrix.

		Consequence				
		Insignificant	Minor	Moderate	High	Severe
Likelihood	Certain	Low	Moderate	High	Severe	Severe
	Almost Certain	Very Low	Low	Moderate	High	Severe
	Likely	Very Low	Low	Moderate	High	High
	Unlikely	Very Low	Very Low	Low	Moderate	High
	Rare	Very Low	Very Low	Very Low	Low	Moderate

Table 11. Risk assessment for individual threatened species and non-threatened species assemblages likely to occur in within the CWF Project area.

Common Name Avian assemblage	EPBC Act	NPW Act	CWF Project area risk assessment			
			Likelihood	Consequence	Risk	Comment
Diamond Firetail	VU	V	Rare	Insignificant	Very Low	Flight described as low, with foraging behaviour being exclusively at ground level. Roost in dense shrubs or small nests made specifically for roosting. This species has been observed within the Project area during previous surveys,
Shy Heathwren	-	R	Unlikely	Insignificant	Very Low	Ground foraging species, inhabit dense and shrubby heath understorey in mallee, likely confined to larger areas of remnant vegetation and usually nest near the ground in grass tussocks or shrubs.
Purple-gaped Honeyeater	-	R	Rare	Insignificant	Very Low	Mallee heathlands, less common in mallee with open understorey. Moves locally following flowering flora also takes insects from foliage and bark. Nests constructed normally less than 3m above ground.
Gilbert's Whistler	-	R	Unlikely	Insignificant	Very Low	Feed mostly on the ground and in the understorey primarily on invertebrates. Nest in dense shrubs. Sensitive to disturbance, most likely restricted to large patches of remnant vegetation.
Flocking and Passerine birds	-	-	Likely	Minor	Low	Species which flock as nomadic groups including granivorous species such as Galahs, and species taking advantage of resources due to agriculture (e.g., corvids). Generally, feed on the ground however can fly at height when travelling following resources.
Wedge-tailed Eagle	-	-	Likely	Moderate	Moderate	Species mature slowly, breed from around five years old, and produce few young—typically one surviving chick per year. Juveniles stay with parents for up to ten months. Losing a territorial adult can increase eagle activity as new individuals compete for the vacancy, potentially raising strike risk. Flight behaviours of this species also increases the risk of rotor-strike.

Common Name Avian assemblage	EPBC Act	NPW Act	CWF Project area risk assessment			
			Likelihood	Consequence	Risk	Comment
Other Raptors	-	-	Likely	Minor	Low	Generally, raptor species take many years to reach sexual maturity and produce small numbers of young. Their flight behaviour increases risk of rotor strike.
Waterbirds	-	-	Likely	Insignificant	Very Low	Habitat for waterbirds within the CWF Project area is limited to farm dams, ephemeral creeks and drainage lines. No habitat present for wading birds in particular migratory birds. Larger flocks of duck species may pass through the area when conditions are good.
Bat Species	-	-	Likely	Minor	Low	Most species fly just above or below canopy height while foraging. The White-striped Free-tailed Bat is the only species known to forage almost exclusively at height and is at high risk of rotor-strike.

8 Discussion

8.1 Bird Surveys

The time of year could play a significant role in influencing both the density and diversity of bird species observed within the CWF Project area. Seasonal agricultural activities, such as crop harvesting, can create temporary shifts in bird populations. During harvest, small mammals like rodents and ground-dwelling birds such as quail are often flushed from cover by machinery, attracting higher densities of raptors that exploit this sudden increase in prey availability. This was confirmed pers comms from property owners during the surveys. Additionally, the spillage of grain and greater access to paddock residues attract flocking bird species, leading to noticeable increases in numbers of granivorous birds such as pigeons, finches, and cockatoos, which were generally absent from the area during this survey.

While relatively few birds were observed flying within the rotor-swept height of the wind turbines during the survey, this does not necessarily indicate an absence of risk. Many bird species, particularly raptors and larger flocking birds, may periodically fly at these heights depending on weather conditions, foraging behaviour, or during dispersal. The low flight activity within rotor height observed during this survey may reflect the specific conditions at the time, such as dry weather and limited foraging activity, rather than representing typical flight behaviour throughout the year.

8.2 Bat Surveys

Bat activity recorded within the RSA was notably low, with very few usable echolocation files detected at this height. In contrast, Site 1 yielded a significantly higher number of bat call recordings, suggesting that the majority of bat activity is concentrated closer to or within the canopy layer. This aligns with known foraging behaviours of many bat species, which typically prefer cluttered habitats where insect prey is more abundant, and conditions are more sheltered. Cooler temperatures during the survey period may have reduced bat activity, as bats are generally more active in warmer conditions when insect abundance is higher and foraging opportunities are greater

AuAu, a fast-flying, open-air forager known to hunt at higher altitudes, was detected during the surveys, however, few calls were recorded at lower levels, supporting the idea that its primary activity occurs above the canopy and within the RSA. Some bat species are also known to adjust their flight heights seasonally in response to environmental conditions and prey availability, which may occasionally bring individuals of different species into the RSA.

Given this vertical stratification, the risk of collision with turbines appears low for most bat species within the CWF, as their activity is largely restricted to below the rotor height. However, the high-altitude foraging

behaviour of AuAu presents a relatively higher risk for this species. Even so, while there is a potential for some mortality, the impact is unlikely to be significant at the population level. AuAu is a widespread and common species, and the level of risk posed by the development is not expected to result in any measurable decline or adverse effect on the broader population.

No species listed as threatened were detected during the surveys, nor were any expected to occur within the CWF Project area. This is supported by the lack of previous records in the region, the general absence of suitable habitat within the Project area, and the Eyre Peninsula being outside of the normal distribution of any threatened species. As such, the risk to conservation significant bat species is considered negligible.

Overall, the results of the bird and bat surveys indicate that the current project layout does not pose a major risk to local bird or bat populations. While some bird species were observed flying within the RSA, the frequency and behaviour of these movements suggest a relatively low risk of collision. Bat activity was predominantly recorded below rotor height, with limited detections at higher altitudes. Importantly, no threatened bird or bat species were recorded flying within the RSA during the surveys. Based on these findings, the development and operation of the wind farm at this location is unlikely to result in adverse impacts on bird or bat populations, and the ecological risks, particularly to threatened species, are considered low.

9 Recommendations

While the existing surveys provide a solid understanding of general bird and bat activity across the site, further bird surveys could be helpful in capturing seasonal variation in the presence and behaviour of certain species—particularly raptors, which were observed using the RSA, and flocking species such as cockatoos. Conducting surveys during more favourable conditions, such as post-harvest periods when prey availability may attract more raptors, could offer a clearer picture of potential collision risk. These additional insights may assist in refining species-specific risk assessments, particularly for birds whose flight behaviour makes them more susceptible to turbine interactions.

To minimise potential indirect impacts on wildlife, it is also recommended that vegetation clearance be planned to avoid fragmenting larger areas of connected habitat. Maintaining habitat continuity is important for supporting movement and foraging of both bird and bat species, as well as preserving ecological function more broadly. Where possible, clearing should be restricted to already modified or narrow vegetation zones to reduce the risk of disrupting important habitat corridors

Post-construction monitoring is recommended to evaluate the actual impacts of wind farm operation on bird and bat species. This should include carcass searches and behavioural observations to detect any collisions or changes in usage of the area by key species. If monitoring identifies a significant impact on bats—especially higher-flying species like AuAu, a curtailment strategy may be considered as a mitigation option. Curtailment involves limiting turbine operation during periods of high bat activity, typically low wind speeds at dusk and during the early night. As shown by Bennett et al. (2022), AuAu was the most common species found to be affected by turbine-strike/barotrauma, and this approach can reduce bat mortality by up to 54% without meaningfully reducing energy output. Ongoing seasonal monitoring will help ensure that any required mitigation remains responsive to observed patterns of use and risk.

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