Appendix E

Avifauna Impact Risk Assessment

emerge ASSOCIATES
Integrated Science & Design

Avifauna Impact Risk Assessment

Parron Wind Farm

Project No: EP23-085(18)

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Executive Summary

Zephyr Energy propose to develop the Parron Wind Farm within lots 3738, 3739, 3742, 3743 and 3744, Badgingarra (referred to herein as the 'site').

This *Avifauna Impact Risk Assessment* (AIRA) has been prepared following targeted avifauna surveys being undertaken for the site, and based on these the confirmed likelihood of listed Matters and National Environmental Significance pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) occurring within the site.

The two MNES identified as having a high or moderate likelihood of occurrence in the site are:

1. *Zanda latirostris* (Carnaby's black cockatoo) which is listed as 'endangered' under the EPBC Act
2. *Apus pacificus* (Pacific swift) which is listed as migratory under the EPBC Act.

This AIRA was therefore progressed to understand the likelihood of significant impacts that could arise on these two bird species, and to inform a significance assessment.

At a pre-referral meeting held to support the preparation and lodgement of an EPBC Act referral, the Department of Climate Change, Energy, the Environment and Water (DCCEEW) suggested that information be provided to *"clearly articulate the risks, including likelihood and consequences of direct, indirect and facilitated impacts on each MNES, including the Carnaby's Black Cockatoo"* and further advised the following:

1. *Any modelling of risk, including the estimated threshold of mortality before the local population is significantly affected.*
2. *Direct impacts could include loss of breeding individuals through injury or death via collision with wind turbines.*
3. *Indirect impacts could include changes in behaviour in accessing nearby habitat areas due to the presence of the wind farm, or any offsite impacts from the action.*
4. *Facilitated impacts could include the mentioned access tracks and surrounding public road upgrades, new transmission lines and future project expansion.*

A robust, qualitative risk assessment methodology was applied to define and evaluate risk to the Carnaby's black cockatoo and Pacific Swift.

The outcomes of the risk assessment are:

- The risk of direct, indirect or facilitated impacts to Carnaby's black cockatoo that the Parron Wind Farm proposal poses is considered **low.** This is because impacts are unlikely and the consequence of the impacts if they were to occur to the species would be marginal.
- The risk of direct, indirect or facilitated impacts to Pacific swift that the Parron Wind Farm proposal poses is considered **low.** This is because impacts are unlikely and the consequence of the impacts if they were to occur to the species would be marginal.

On this basis, and also the avoidance of direct impacts on potential habitat for either species, it is considered unlikely that there would be significant impacts on either the Carnaby's black cockatoo and Pacific Swift.

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Appendix A

Summary of peer review comments version A (Dr Mike Bamford)

Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
ALA	Atlas of Living Australia
BoM	Bureau of Meteorology
DAWE	Department of Agriculture, Water and the Environment (now DCCEEW)
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DoEE	Department of the Environment and Energy
DoW	Department of Water (now DWER)
DPaW	Department of Parks and Wildlife (now DBCA)
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
WAM	Western Australian Museum

Table A2: Abbreviations – General terms

General terms	
AIRA	Avifauna impact risk assessment
MNES	Matters of national environmental significance
UFI	Unique feature identifier
RSA	Rotor swept area

Table A3: Abbreviations – Legislation

Legislation	
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
BC Act	*Biodiversity Conservation Act 2016*

Table A4: Abbreviations – Units of measurement

Units of measurement	
cm	Centimetre
ha	Hectare
m	Metre
m^2	square metre
m AHD	m in relation to the Australian height datum
mm	Millimetre
MW	Megawatt
RPM	Revolutions per minute

Table A5: Abbreviations – Conservation codes

Conservation Codes	
CD	Conservation dependent
CR	Critically endangered
EN	Endangered
MI	Migratory
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
OS	Other specially protected
VU	Vulnerable

1 Introduction

1.1 Project background

Zephyr Energy propose to develop the Parron Wind Farm within lots 3738, 3739, 3742, 3743 and 3744 in Badgingarra (herein referred to as the 'site'). The location of the site is shown in **Figure 1.**

Technical assessments completed to inform the design and inform environmental approval considerations for the Parron Wind Farm identified two bird species listed as 'matters of national environmental significance' (MNES) under the *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act) that have potential to occur.

Zanda latirostris (Carnaby's black cockatoo) is listed as endangered (EN) under the EPBC Act and has been recorded in the site (Emerge Associates 2023).

Apus pacificus (Pacific swift[1]) is listed as migratory (MI) under the EPBC Act and has not previously been recorded in the site (Emerge Associates 2023).

In accordance with the EPBC Act, a proposed action needs to be referred if it has the potential to have a significant impact on MNES. The Department of Climate Change Environment Energy and Water (DCCEEW) advised, following a pre-referral meeting, that should the project be referred, information should be provided that *"clearly articulates the risks, including likelihood and consequences of direct, indirect and facilitated impacts on each MNES, including the Carnaby's black cockatoo"*.

DCCEEW also provided four guidance notes as follows:

1. *Any modelling of risk, including the estimated threshold of mortality before the local population is significantly affected.*
2. *Direct impacts could include loss of breeding individuals through injury or death via collision with wind turbines.*
3. *Indirect impacts could include changes in behaviour in accessing nearby habitat areas due to the presence of the wind farm, or any offsite impacts from the action.*
4. *Facilitated impacts could include the mentioned access tracks and surrounding public road upgrades, new transmission lines and future project expansion.*

1.2 Purpose of the document

This Avifauna Impact *Risk Assessment* (AIRA) has been undertaken to understand the likely risks of direct, indirect and facilitated impacts upon Carnaby's black cockatoo and Pacific Swift arising from the proposed Parron Wind Farm.

Accordingly, the AIRA:

- considers the development and environmental context for impact to the MNES
- outlines a risk assessment methodology, including likelihood and consequence, in line with risk assessment guideline principles and relevant literature

[1] Fork-tailed swift on the Species Profile and Threats Database

- classifies the risk posed to each MNES by the proposal.

1.3 Peer review

Peer review of this report has been completed by Dr Mike Bamford of Bamford Consulting Ecologists. Mike is a wildlife biologist with more than 35 years' experience. Following Mike's review of version A, version B was prepared addressing or responding to his comments as outlined in **Appendix A**.

1.4 Development context

The site provides for a development envelope of approximately 8,392 hectares (ha) within which 79 wind turbines are proposed to be constructed. Pre-construction and construction activities are expected to occur over a three-year period. The Parron Wind Farm is then expected to have an operational life of 30 years following which turbines would be decommissioned.

The proposed development layout is shown in **Figure 2.** A summary of the relevant development features is presented in **Table 1**. It is relevant to note that the proposed development features were refined as part of the proposal design process and when this AIRA was being progressed, and the confirmed development features have taken into consideration the findings of the AIRA and this is shown in **Table 1** below,

Table 1: Summary of proposed development features at Parron Wind Farm

Development feature	Description
Total development envelope	• 8,392 ha • No vegetation considered habitat for any MNES species will be cleared or impacted
Turbine design	• A total of **79** turbines • Minimum distance of 500 m apart • Blade length of 79 m • Hub height of 119 – 166 m (height of 149 m confirmed) • Tip height of 198 – 243 m (tip height of 230 m confirmed) • Rotor swept area (RSA) height of 70-228 m Maximum rotor speed of 12 RPM
Other design features	• Permanent tracks and structures across the site • Temporary and permanent fencing requirements (max height 3 m) • Temporary construction infrastructure and facilities including site offices, construction camps, ablutions, power and water supply, storage / laydown, parking and access points.

1.5 Environmental context

Environmental features within and surrounding the site were identified from publicly available datasets and previous technical investigations (Emerge Associates 2024a). A summary of relevant features is detailed in **Table 2** and **Figure 3** to **Figure 6.**

Table 2: Existing environmental conditions

Environmental feature	Relevant value within the site or adjacent
Climate	Mediterranean climate of hot dry summers and cool wet winters (BoM 2024).
Geomorphology and soils	The site occurs on the Geraldton Sandplains region within the Lesueur Sandplains subregion. Characterised by undulating lateritic sandplain with areas of coastal aeolian sands and limestone. Alluvial outwash plains exist in areas of valleys and hills (Purdie *et al.* 2004).
Topography	Elevation ranges from 94 m in relation to the Australian height datum (mAHD) to 278 mAHD (DoW 2008).
Hydrology and wetlands	The site contains 16 earth dams, 18 watercourses – minor, non-perennial and 9 unnamed hydrological features (DWER 2018). One dampland (Unique Feature Identifier (UFI) 581) and one non-classified wetland feature (UFI 258) occur (DBCA 2023a).
Vegetation	The site exists within the 'GES02' subregion which is classified as mainly containing *Acacia-Casuarina* thickets further inland and *Eucalyptus loxophleba* on hard-setting loams (Beard 1990). Further variations describe the site as comprising of vegetation association 'Lesueur 1034' which is described as 'medium woodland; marri and wandoo' and 'Lesueur 1031' which is described as 'mosaic: shrublands; hakea scrub-heath/shrublands; dryandra heath' (Beard *et al.* 2013). Site-specific vegetation information is provided in (Emerge Associates 2024b).
Fauna habitat	Ten broad fauna habitats occur within the site (Emerge Associates 2024a): **Agricultural vegetation** (738.07 hectares (ha)): planted rows o*f Chamaecytisus palmensis*. **Bare ground and pasture** (7246.97 ha): pastureland, paddocks, firebreaks and roads. **Dams and water features** (2.31 ha): agricultural dams and drainage lines. **Eucalyptus woodland** (19.58 ha): native canopy woodland with sparse understory. **Laterite hills and breakaways** (71.76 ha): shrubby/heathy vegetation on rocky ridges and breakaways. **Open forest** (120.68 ha): forest of mostly non-native trees with some native trees over cleared areas and non-native grassland. **Plateau** (58.75 ha): native shrubland on a rocky laterite plateau. **Riparian and wetland vegetation** (22.89 ha): riparian vegetation in areas with seasonal or permanent inundation. **Sandplain** (191.81 ha): open *Eucalyptus* and *Proteaceae* woodland on sandy soils. **Scattered trees and shrubs** (55.73 ha): scattered native and non-native trees with little to no understory.
Black cockatoo habitat	Carnaby's black cockatoo was recorded in the site in the form of foraging evidence (Emerge Associates 2024a). Breeding, roosting and foraging habitat for Carnaby's black cockatoo occurs within the site as relatively small scattered patches of vegetation (Emerge Associates 2024a). Foraging habitat within the site is limited and comprised of mainly primary native and primary and secondary non-native food plants, as shown in **Figure 6**. Multiple Carnaby's black cockatoo breeding sites occur to the north, east and south of the site, with the closest of these being 16 km from the site. None of these are within 12 km of the site. Twelve white tailed black cockatoo roosts occur within 50 km of the site, 6 are within 6 km of the site. Extensive areas of potential foraging habitat occur within 50 km of the site.
DBCA legislated lands and waters	Badgingarra National Park lies adjacent to the southern border of the site and Hill River Nature Reserve lies adjacent to the north-eastern corner of the site (DBCA 2023b).

1.5.1 Carnaby's black cockatoo

Carnaby's black cockatoo is endemic to the south west of Western Australia and is listed as endangered under the EPBC Act 1999 following significant population decline in the 20th century (DEC 2013; DCCEEW 2022).

The species breeds from July to December, nesting in native trees (typically *Eucalyptus* or *Corymbia* spp.) with hollows of suitable diameter and depth. Nesting mostly occurs in the Wheatbelt but local breeding populations occur across the species range (DAWE 2022). Breeding success is associated with the availability of foraging resources within 12 km of nest sites (Saunders 1977; Glossop *et al.* 2011). The breeding sites to the north and north-east of the site represent the Coomallo 'important bird area' for Carnaby's black cockatoo (DPaW 2013; BirdLife International 2022). The 12 km buffer applied to each breeding site (refer **Figure 5**) would provide the main foraging resources during the breeding season, none of which extend into the site. During the non-breeding season Carnaby's black cockatoo often aggregate into larger flocks to migrate and forage.

Roosting sites comprise a stand of tall trees in which black cockatoos congregate overnight. Their use varies depending on local food and water availability or flock movements in the region. Carnaby's black cockatoo typically forage within 6 km of a roost (Shah 2006; Le Roux 2017; DAWE 2022). No roosts have been recorded in the site but multiple roosts occur in the region, with the closest being 4.5 km from the site.

Carnaby's black cockatoo predominantly feed on fruits of native *Banksia* spp., *Hakea* spp., *Eucalyptus* spp., *Corymbia* spp. and *Grevillea* spp. In addition, they consume insect larvae especially from the fruit of banksia and under bark of eucalypts, pine nuts and orchard fruit or nuts (Groom 2011; Johnstone *et al.* 2011; DAWE 2022). Extensive areas of high quality Carnaby's foraging habitat occurs in the region, particularly within Badgingarra National Park and Coomallo Nature Reserve. The foraging habitat within the site occurs mainly as scattered patches which is expected to be less preferred to the large areas of habitat nearby.

Carnaby's black cockatoo is usually considered migratory but may permanently reside in high-rainfall areas with large areas of native vegetation (Saunders 1980; Saunders and Ingram 1995). Specific information pertaining to flock movements near the site is limited. Carnaby's black cockatoo are regularly recorded in the area, with small groups of less than ten individuals being most commonly sighted (Birdlife Australia 2024). However, larger flocks numbering in the hundreds are occasionally observed (pers. comms. Dr Mike Bamford). Individuals breeding in the Badgingarra area move west and then south, and birds breeding at Coomallo disperse more locally (DPaW 2013).

Breeding locations[2], roosts and foraging habitat for Carnaby's black cockatoo within a 50 km radius of the site are shown in **Figure 5**. Carnaby's black cockatoo have been recorded within or near the site during all known previous technical assessments (Brett Lane & Associates Pty Ltd 2008; Astron Environmental Services 2016; Ecoscape 2019; Emerge Associates 2023). Documentation of flight heights is almost non-existent but previous impact assessments for wind farms in WA have determined that Carnaby's black cockatoo typically fly below RSA height, particularly when wind turbines are placed on elevated areas (RPS 2014; Ecoscape 2019).

Threats to Carnaby's black cockatoo are reported to include land clearing, habitat fragmentation, the loss of hollow bearing trees, vehicle strikes, fires and competition for hollows from galahs, corellas and European honeybees (DEC 2013; DCCEEW 2022).

[2] A 12 km buffer is applied to all breeding locations in adherence to threatened species spatial data distribution policy

1.5.2 Pacific swift

Apus pacificus (Pacific swift)[3] are a highly mobile species found across Australia and Asia including several islands (DCCEEW 2023). The species is listed as migratory under the EPBC Act as it migrates to Australia from breeding grounds in Siberia through flyways throughout Asia, usually arriving in Australia around October and leaving again by April (Higgins 1999).

While in Australia Pacific swift forage over a widespread distribution. Being insectivorous, their occurrence typically corresponds with concentrations of flying invertebrates from 1 m to 300 m above the ground (Higgins 1999). They have been recorded from a wide range of habitats including intact tropical forests, wetlands, open ocean coastal areas, inland open plains and wooded areas (Commonwealth of Australia 2015). However, given they are exclusively aerial feeders it is generally accepted their occurrence is independent of surface conditions (be that terrestrial or marine habitat) (Marchant and Higgins 1990; Johnstone and Storr 1998; DCCEEW 2023).

Potential threats to Pacific swift in Australia are reported to include habitat destruction and predation by feral animals, albeit these are described as posing a negligible risk due to the species' widespread distribution (DCCEEW 2023).

[3] Fork-tailed swift on the DCCEEW Species Profile and Threats Database

2 Method

The AS/*NZS ISO 31000:2009 Risk Management Principles and guidelines* defines risk as "*the combination of the probability of an event and its consequence*" (Standards Australia Limited 2018).

The risk posed by the Parron Wind Farm to the relevant MNES was assessed by contrasting the:

- likelihood that the species might be impacted by the proposal's construction or operation
- consequence of that impact on the species.

To complete the risk assessment, likelihood and consequence were first assessed by contrasting contributary criteria (refer **Plate 1**).

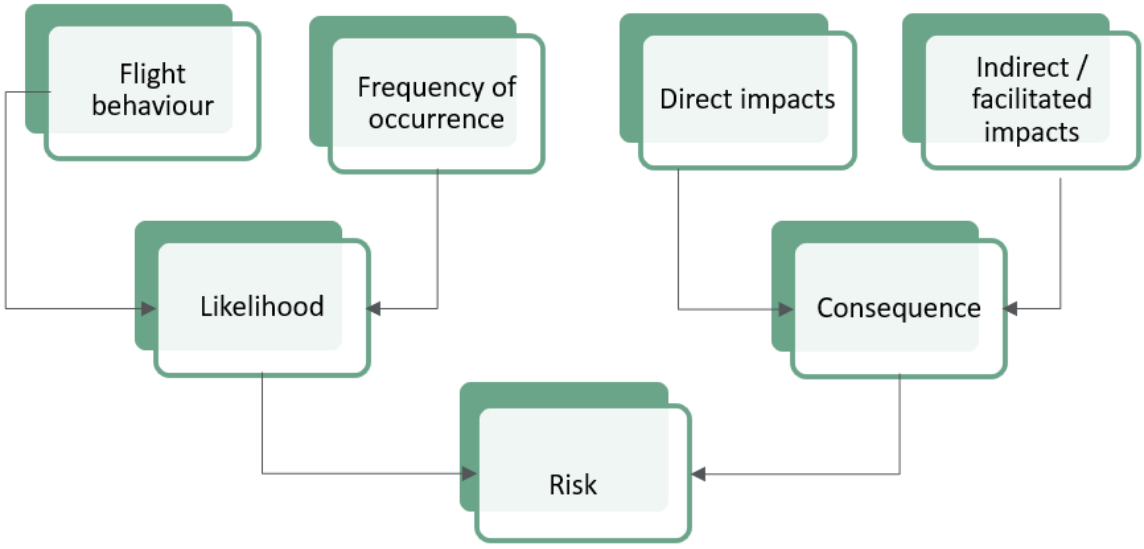

Plate 1: Risk assessment process

For likelihood, criteria were adapted from Lumsden *et al.* (2019) and included flight behaviour (how often the species might fly within RSA height) and frequency of occurrence (how often the species might occur in the site). For each occurrence event, less than 10 individuals of Carnaby's black cockatoo are most commonly expected to occur (occasionally flocks of 100 or more). Whereas Pacific swift is expected to be solitary and only occasionally occur in small groups of less than five. The likelihood of impact was classified as 'unlikely', 'possible' or 'likely' using the matrix in **Table 3**.

Table 3: Likelihood of impact matrix

		Flight behaviour		
		Rarely flies in RSA	Occasionally flies in RSA	Often flies in RSA
Frequency of occurrence	Species rarely occurs in site	Unlikely	Unlikely	Unlikely
	Species occasionally occurs in site	Unlikely	Possible	Possible
	Species regularly occurs in site	Unlikely	Possible	Likely

For consequence, the potential for the loss of individuals was forecast over the 30-year operational life of the Parron windfarm. Criteria were defined as losses due to collisions with turbines (direct impacts) and losses due to habitat modification or behavioural change (indirect/facilitated impacts). Thresholds of 4 and 40 were set for Carnaby's cockatoo losses, being respectively, 0.01% and 0.1% of the estimated total population of Carnaby's black cockatoo (DEC 2013; DCCEEW 2022). Thresholds of 10 and 100 individuals was set for Pacific swift, on the basis that 100 is the lower limit for further investigation of potential significant impact specified in the *Draft referral guideline for 14 birds listed migratory under the EPBC Act* (Commonwealth of Australia 2015). The consequence of impact was classified as 'negligible', 'marginal' or 'serious' using the matrices in **Table 4** and **Table 5**.

Forecast losses were determined heuristically, based on the limited publicly available information regarding windfarm related fatalities for each species. The consequence of losses was broadly evaluated so as to encompass mortality of adults and/or juveniles, and, by association, loss of existing or future breeding individuals leading to lower recruitment. The thresholds for serious consequence are intentionally conservative and, as such, a serious consequence should not exceed the fecundity of local populations or ability for recruitment. Nor should it contribute to a population tipping point once other threatening processes and cumulative risk factors are considered.

Table 4: Consequence of impact matrix – Carnaby's black cockatoo

		Loss due to collisions with turbines (direct impact)		
		≤ 4	5 to 40	> 40
Loss due to habitat modification or behavioural change (indirect impact)	≤ 4	Negligible	Marginal	Serious
	5 to 40	Marginal	Marginal	Serious
	> 40	Serious	Serious	Serious

Table 5: Consequence of impact matrix – Pacific swift

		Loss due to collisions with turbines (direct impact)		
		≤ 10	10 to 100	> 100
Loss due to habitat modification or behavioural change (indirect impact)	≤ 10	Negligible	Marginal	Serious
	10 to 100	Marginal	Marginal	Serious
	> 100	Serious	Serious	Serious

Risk of impact to the MNES was then classified as 'very low', 'low', 'moderate', 'high' or 'very high' using the matrix shown in **Table 6**.

Table 6: Risk of impact matrix

		Consequence		
		Negligible	Marginal	Serious
Likelihood	Unlikely	Very low	Low	Moderate
	Possible	Low	Moderate	High
	Likely	Moderate	High	Very High

3 Results

3.1 Carnaby's black cockatoo

Result of the risk assessment for Carnaby's black cockatoo are summarised in **Table 7** and discussed in **Section 4.1**.

Table 7: Carnaby's black cockatoo risk assessment results

MNES	Likelihood			Consequence			Risk
Carnaby's black cockatoo	Flight behaviour	Species rarely flies at RSA height	Unlikely	Loss due to collisions with turbines (direct impact)	≤ 4	Marginal	Low
	Local abundance	Species occasionally occur in, or move through, the site		Loss due to habitat modification or behavioural change (indirect impact)	5 to 40		

3.2 Pacific swift

Result of the risk assessment for Pacific swift are summarised in **Table 8** and discussed in **Section 4.2**.

Table 8: Pacific swift risk assessment results

MNES	Likelihood			Consequence			Risk
Pacific swift	Flight behaviour	Species often flies at RSA height	Unlikely	Loss due to collisions with turbines (direct impact)	10 to 100	Marginal	Low
	Local abundance	Species rarely occur in, or move through, the site		Loss due to habitat modification or behavioural change (indirect impact)	≤ 10		

4 Discussion

4.1 Risk to Carnaby's black cockatoo

The risk that the Parron Wind Farm will result in a direct, indirect or facilitated impact on Carnaby's black cockatoo is considered **low.** Impacts are in the first instance unlikely to occur. If impacts were to occur, their consequence is assumed to be of marginal relevance to the ongoing conservation of the species.

4.1.1 Likelihood

Flight behaviour influences the likelihood that bird species may collide with a wind turbine through exposure (how often the species flies within the rotor swept area (RSA)) and propensity (the ability of the species to detect and avoid rotors). Limited research on Carnaby's black cockatoo flight heights and ability to detect and avoid wind turbines exists. Some research suggests avian species will detect rotors with faster rotation speeds more often than slower rotation speeds (Blary *et al.* 2023). Literature also indicates that behaviours that may distract birds like foraging, courting or searching for habitat, are more likely to result in collisions (Balmori-de la Puente and Balmori 2023).

In this assessment it was considered that Carnaby's black cockatoo would rarely fly at RSA height (70 to 228 m) and so the species self-limits exposure through flight behaviour. Observations of flight indicate that the species typically flies close to the ground and only occasionally up to 50m high (pers. comms. Dr. Mike Bamford). Nevertheless, given the high-speed rotation turbines that are proposed, if the species did happen to fly at RSA height, Carnaby's black cockatoo are further considered likely to detect and avoid the turbines. This is because Carnaby's black cockatoo are most likely to fly through the site using movement behaviours rather than distraction behaviours. There is, as far as known to the authors, no records of Carnaby's black cockatoo colliding with turbines. Therefore, based on their flight behaviour they would appear to have a low propensity for collision.

Bird monitoring at the Badgingarra Wind farm indicates Carnaby's black cockatoo may exhibit avoidance behaviour near turbines. Significantly more records of Carnaby's black cockatoo were collected prior to construction (2017-2018 – 9751 birds) compared with after construction/during turbine operation (2019 – 923 birds) (Ecoscape 2019). While this difference was not confirmed as being a product of the presence of turbines alone, it is supportive of some level of avoidance and is furthermore reinforced by the lack of any construction or turbine operation impact (Ecoscape 2019).

Some 439 ha of foraging habitat for Carnaby's black cockatoo occurs in the site (Emerge Associates 2023). While this appears a large quantity, it represents only 5.19% of the total site area. The site is otherwise not cropped and comprise cleared pasture. The pasture is not comprised of plants that Carnaby's black cockatoo feed upon (Emerge Associates 2024a). The highest value foraging resources within the site are associated with large patches of *Banksia* spp. dominated woodland / heathland in the south and south-eastern portions adjacent to Badgingarra National Park(Emerge Associates 2024a)

Extensive areas of foraging habitat surround the site including within nearby Badgingarra National Park, Coomallo Nature Reserve, Hill River Nature Reserve, Lesueur National Park and other reserves and landholdings within 20 km. The site is therefore unlikely to be singularly attractive to Carnaby's

black cockatoo as a foraging option in comparison to surrounding areas. Access to these resources from nearby Badgingarra National Park would not be affected by turbines according to the proposed layout.

The relatively small number of records for Carnaby's black cockatoo within the site, including recent foraging evidence by Emerge Associates (2024a) indicates the species' likely occurs with relatively low abundance. DBCA's threatened species database includes records of Carnaby's black cockatoo traversing the site but most records in the surrounding region are associated with Coomallo Creek, approximately 16 km northwest of the site (DBCA 2024). Coomallo Creek is an important breeding site, and individuals are likely to fly between this area and patches of foraging habitat including native woodland and pine plantations within a 6-12 km radius. It is important to note that Carnaby's black cockatoo would not need to fly through the site to reach these foraging grounds from Coomallo Creek.

There are also six roosts recorded in the 12 km surrounding the site (Birdlife Australia 2023). Four of these occur in the vegetation adjacent to Coomallo Nature Reserve located 5 km from the nearest turbine (DANHILR001, DANHILR002, DANHILR003 and DANHILR004), one occurs east of Brand Highway (DANBADR001) approximately 9.7 km from nearest turbine, and one occurs adjacent to Munbinea Road (DANHILR005), approximately 13.3 km west of the nearest turbine. Unpublished data on Carnaby's black cockatoo movements (recorded through satellite tracking of individuals) indicates that there may be consistent corridors of movement in the region, with areas to the east and west of the site mainly used for traversal between Coomallo Creek breeding area and pine plantations (pers. comms. Murdoch University 2024)(Murdoch University 2019). However, it is acknowledged that data on Carnaby's black cockatoo is limited and it is likely that the birds roost in unreported locations and traverse the region surrounding the site widely.

It was therefore assumed that Carnaby's black cockatoo may occasionally occur in, or move through, the site. While they are not known to currently roost or nest in the site (refer Emerge Associates (2024a)) they could in the future. Nevertheless, due to the relatively small extent of foraging habitat present, Carnaby's black cockatoo are considered more likely to fly over the site than forage within it. If they were to forage in the site it would be irregularly, and generally in small numbers.

4.1.2 Consequence

A fatality or injury could arise from a collision by an individual bird with a turbine or rotor. A direct impact such as this would not only remove an individual from the population, but if involving an adult may disrupt an existing breeding pair resulting in the loss of opportunity for future recruitment. If a juvenile is lost, recruitment is limited through removal of a potential future breeding adult. While it is difficult to recommend any impact to Carnaby's black cockatoo isn't significant, in the absence of clear official guidance, the proportion of population impacted was considered an appropriate basis to evaluate consequence.

Four or less fatalities or injuries over the approximately 30-year operational life of the proposal were classified as a 'negligible' impact on the basis that this represents an impact of 0.01% the estimated total population of Carnaby's black cockatoo (DEC 2013; DCCEEW 2022). An upper threshold of 40 was conservatively set above which impacts were considered 'serious' on the basis that this represents 0.1% the estimated total population.

Literature review did not provide any evidence of Carnaby's black cockatoo being directly impacted by wind turbines (fatalities or injuries). Monitoring of nearby wind turbines indicated that the species may avoid turbines (Ecoscape 2019). Therefore, the consequence of direct impact to Carnaby's black cockatoo from the Parron Wind farm was adjudged as likely being on the most minor end of the specified scale (worse case 4 individuals or 0.01% of population might be directly impacted). However, it is equally possible that zero Carnaby's black cockatoo individuals would be directly impacted.

No Carnaby's black cockatoo habitat will be cleared as a part of the proposal and as such indirect impacts would largely be behavioural. To some extent where direct impact avoidance by Carnaby's black cockatoo occurs, the possibility for indirect behavioural impacts might increase (i.e. the species alters its behaviour to avoid direct impact). However, given few individuals are expected to occur in the site in the first place, indirect impacts to local populations might also be assumed to be uncommon. Nonetheless, indirect or facilitated impacts were conservatively assessed as being marginal as it is acknowledged the potential for Carnaby's black cockatoo behavioural change resulting from infrastructure development, be it localised or cumulative, is largely unknown.

4.2 Risk to Pacific swift

The risk that the Parron Wind Farm could result in a direct, indirect or facilitated impact on Pacific swift is considered **low.** Impacts are in the first instance unlikely to occur. If impacts were to occur, their consequence is assumed to be of marginal relevance to the species ongoing conservation.

4.2.1 Likelihood

Flying anywhere from 1 m to 300 m above the ground, Pacific swift have opportunity to collide with the RSA and as such were assessed as often flying at RSA height. However, outside of a lack of reported impacts from turbines, little is known as to the propensity of this species to detect and avoid or collide with rotors. The species would nonetheless be expected to be foraging wherever it was to occur (Johnstone and Storr 1998), and so potentially distracted and subject to collision.

The Pacific swift has not been recorded within or close to the site in any previous assessment. A 20 km radius search using DCCEEW's *Protected Matters Search Tool* states that the species or its habitat are likely to occur. DBCA's threatened species database contains one record from 2000 located approximately 16 km north west of the site (DBCA 2024). No other records exist within 20 km of the site in the *Atlas of Living Australia* (ALA 2024) and Birdata (Birdlife Australia 2024) databases. This corresponds with the understanding that Pacific swift occur sparsely across a broad range of habitats.

Given the difficulty confirming the presence or absence of the species it was assumed that they would occur at some point during the operational life of the Parron Windfarm. However, their occurrence is expected to be both rare and temporary and so an 'unlikely' likelihood classification was considered appropriate.

4.2.2 Consequence

The *Draft referral guideline for 14 birds listed migratory under the EPBC Act* (2015) lists the lower threshold for further investigation of future potential significant impacts to Pacific swift at 100 individuals. This threshold was used conservatively as the upper limit above which impacts were considered serious. As the occurrence of the Pacific swift within the site or the wider region is likely to be as individuals, or a small flock (<10), it is not expected that more than 100 birds could be directly impacted by the proposal, even over a 30-year time frame. The loss of Pacific swift individuals from direct turbine collision is likely to be a relatively very small, and could be zero. However, direct impacts were conservatively assessed as resulting in the loss of between 10 and 100 individuals.

Due to the widespread distribution of Pacific swift and habitat requirements being largely independent from terrestrial conditions it is difficult to conceive how indirect or facilitated impacts to the species might occur, let alone be demonstrated. Indirect or facilitated impacts were accordingly assessed at the lowest end of scale (<10).

4.3 Mitigation and monitoring recommendations

As the risks to Carnaby's black cockatoo and Pacific swift are low, further risk assessment and mitigation may not be considered necessary[4]. It is also considered unlikely that there would be a risk of significant impacts on either Carnaby's black cockatoo or the Pacific swift associated with the progression of the wind farm in the context of EPBC Act obligations.

It is expected that post-construction monitoring of the impacts of the Parron Wind Farm on avifauna generally will be undertaken. This monitoring will enable review and validation of the outcomes of this AIRA on Carnaby's black cockatoo and Pacific swift and is expected to confirm the conclusions made from this risk assessment, in line with other operational wind farms in proximity to the Parron Wind Farm.

In conclusion, it is not expected that the potential impacts on any avifauna MNES that are likely to occur within or in proximity to the Parron Wind Farm would be sufficiently material enough to be considered significant.

5 Conclusion

The risk of direct, indirect or facilitated impacts that the Parron Wind Farm proposal poses to Carnaby's black cockatoo is considered **low.** This is because impacts are unlikely, and the consequence of the impacts if they were to occur to the species would be marginal.

The risk of direct, indirect or facilitated impacts that the Parron Wind Farm proposal poses to Pacific swift is considered **low.** This is because impacts are unlikely and the consequence of the impacts if they were to occur to the species would be marginal.

On this basis the Parron Wind Farm proposal should not result in a significant impact to either the Carnaby's black cockatoo or Pacific swift.

6 References

Atlas of Living Australia (ALA) 2024, *Spatial Portal*.

Astron Environmental Services 2016, *2D Seismic Survey On-ground Ecological Survey November - December 2015*, UIL-REF-EPA-ERD-01, Version 4.0.

Balmori-de la Puente, A. and Balmori, A. 2023, *Flight Type and Seasonal Movements Are Important Predictors for Avian Collisions in Wind Farms*, Birds, 4: 85-100.

Beard, J. S. 1990, *Plant Life of Western Australia*, Kangaroo Press Pty Ltd., Kenthurst, N.S.W.

Beard, J. S., Beeston, G. R., Harvey, J. M., Hopkins, A. J. M. and Shepherd, D. P. 2013, *The vegetation of Western Australia at the 1:3,000,000 scale. Explanatory memoir. Second edition.*, Conservation Science Western Australia, 9: 1-152.

Birdlife Australia 2023, *Great Cocky Count Roost Dataset*,

Birdlife Australia 2024, *Birdata*, Victoria, <https://birdata.birdlife.org.au/explore#map=-22.5083100_136.0786120_4>.

BirdLife International 2022, *Important Bird Areas*, <http://datazone.birdlife.org/site/factsheet/northern-swan-coastal-plain-iba-australia>.

Blary, C., Bonadonna, F., Dussauze, E., Potier, S., Besnard, A. and Duriez, O. 2023, *Detection of wind turbines rotary motion by birds: A matter of speed and contrast.*, Conservation Science and Practice, 5(10).

Bureau of Meterology (BoM) 2024, *Climate Data Online*, <http://www.bom.gov.au/climate/data/>.

Brett Lane & Associates Pty Ltd 2008, *Proposed Badgingarra Wind Farm Flora and Fauna Assessment*, No. 7044 Version 1.9.

Commonwealth of Australia 2015, *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act*.

Department of Agriculture, Water and the Environment (DAWE) 2022, *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black-cockatoo*, Canberra.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023a, *Geomorphic Wetlands, Cervantes Eneabba (DBCA-015)*, Perth, Western Australia.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023b, *Legislated Lands and Waters (DBCA-011)*, Perth, WA, <https://catalogue.data.wa.gov.au/dataset/dbca-lands-of-interest>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2024, *Threatened Species and Communities - Data Searches*, Perth, WA, <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities>.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2022, *Species Profile and Threats Database - Zanda latirostris — Carnaby's Black Cockatoo, Short-billed Black-cockatoo*, Canberra, <https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=87737>.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2023, *Species Profile and Threats Database: Apus pacificus - Fork-tailed swift*, <https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=678>.

Department of Environment and Conservation (DEC) 2013, *Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan*, Perth.

Department of Water (DoW) 2008, *LiDAR Elevation Dataset, Swan Coastal Plain*, Perth.

Department of Parks and Wildlife (DPaW) 2013, *Carnaby's Cockatoo (Calyptorphynchus latirostris) Recovery Plan*.

Department of Water and Environmental Regulation (DWER) 2018, *Hydrography Linear (Heirarchy) (DWER-031)*, Perth.

Ecoscape 2019, *Carnaby's Cockatoo and Other Birds Year One Operational Monitoring*, 4309-19R, Ver 0.

Emerge Associates 2023, *Parron Wind Farm Development Support - Basic Fauna and Targeted Bird and Bat Assessment*, EP23-085(02)--004 AJU, Version 1.

Emerge Associates 2024a, *Basic Fauna and Targeted Bird and Bat Assessment: Parron Wind Farm Development Support*, EP23-085(02)--004A AJU, Version A.

Emerge Associates 2024b, *Detailed Flora and Vegetation Assessment - Parron Wind Farm Development Support*, EP23-085(01)--006B MS, Version B.

Glossop, B., Clarke, K., Mitchell, D. and Barrett, G. 2011, *Methods for mapping Carnaby's cockatoo habitat*, Department of Environment and Conservation, Perth.

Groom, C. 2011, *Plants Used by Carnaby's Black Cockatoo*, Department of Environment and Conservation, Perth.

Higgins, P. J. 1999, *Handbook of Australian, New Zealand and Antarctic Birds. Volume Four - Parrots to Dollarbird*, Oxford University Press, Melbourne.

Johnstone, R. E., Johnstone, C. and Kirkby, T. 2011, *Black Cockatoos on the Swan Coastal Plain: Carnaby's Cockatoo (Calyptorhynchus latirostris), Baudin's Cockatoo (Calyptorhynchus baudinii) and the Forest Red-tailed Black Cockatoo (Calyptorhynchus banksii naso) on the Swan Coastal Plain (Lancelin–Dunsborough), Western Australia. Studies on distribution, status, breeding, food, movements and historical changes.*, Department of Planning, Western Australia.

Johnstone, R. E. and Storr, G. M. 1998, *Handbook of Western Australian Birds. Volume 2 - Passerines (Blue-Winged Pitta to Goldfinch)*, Western Australian Museum, Perth.

Le Roux, C. 2017, *Nocturnal roost tree, roost site and landscape characteristics of Carnaby's Black-Cockatoo (Calyptorynchus latirostris) on the Swan Coastal Plain*, Edith Cowan University Research Online.

Lumsden, L. F., Moloney, P. D. and Smales, I. 2019, *Developing a science-based approach to defining key species of birds and bats of concern for wind farm developments in Victoria*, Arthur Rylah Institute for Environmental Research: Department of Environment, Land, Water and Planning, Heidelber, Victoria.

Marchant, S. and Higgins, P. J. 1990, *Handbook of Australian, New Zealand and Antarctic Birds. Volume One - Ratites to Ducks*, Oxford University Press, Melbourne, Victoria.

Murdoch University 2019, *Black Cockatoo Conservation Project: February - March 2019 update*, Perth.

Purdie, B., Tille, P. and Schoknecht, N. 2004, *Soil-landscape mapping in south-Western Australia: an overview of methodology and outputs. Resource Management Technical Report 280*, State of Western Australia.

RPS Group (RPS) 2014, *Fauna Assessment - Waddi Wind Farm*. 113208, Version 3.

Saunders, D. A. 1977, *The effect of agricultural clearing on the breeding success of the White-tailed Black Cockatoo*, Emu, 77: 180-184.

Saunders, D. A. 1980, *Food and Movements of the Short-billed Form of the White-tailed Black Cockatoo*, Australian Wildlife Research, 7: 257-269.

Saunders, D. A. and Ingram, J. A. 1995, *Birds of Southwestern Australia: An Atlas of Changes in the Distribution and Abundance of the Wheatbelt Avifauna*, Surrey Beatty and Sons, Chipping Norton, NSW.

Shah, B. 2006, *Conservation of Carnaby's Black Cockatoo on the Swan Coastal Plain, Western Australia*, Birds Australia, Perth.

Standards Australia Limited 2018, *AS ISO 31000:2018 Risk Management - Guidelines*, SAI Global Pty Limited, Version 3.

Figures

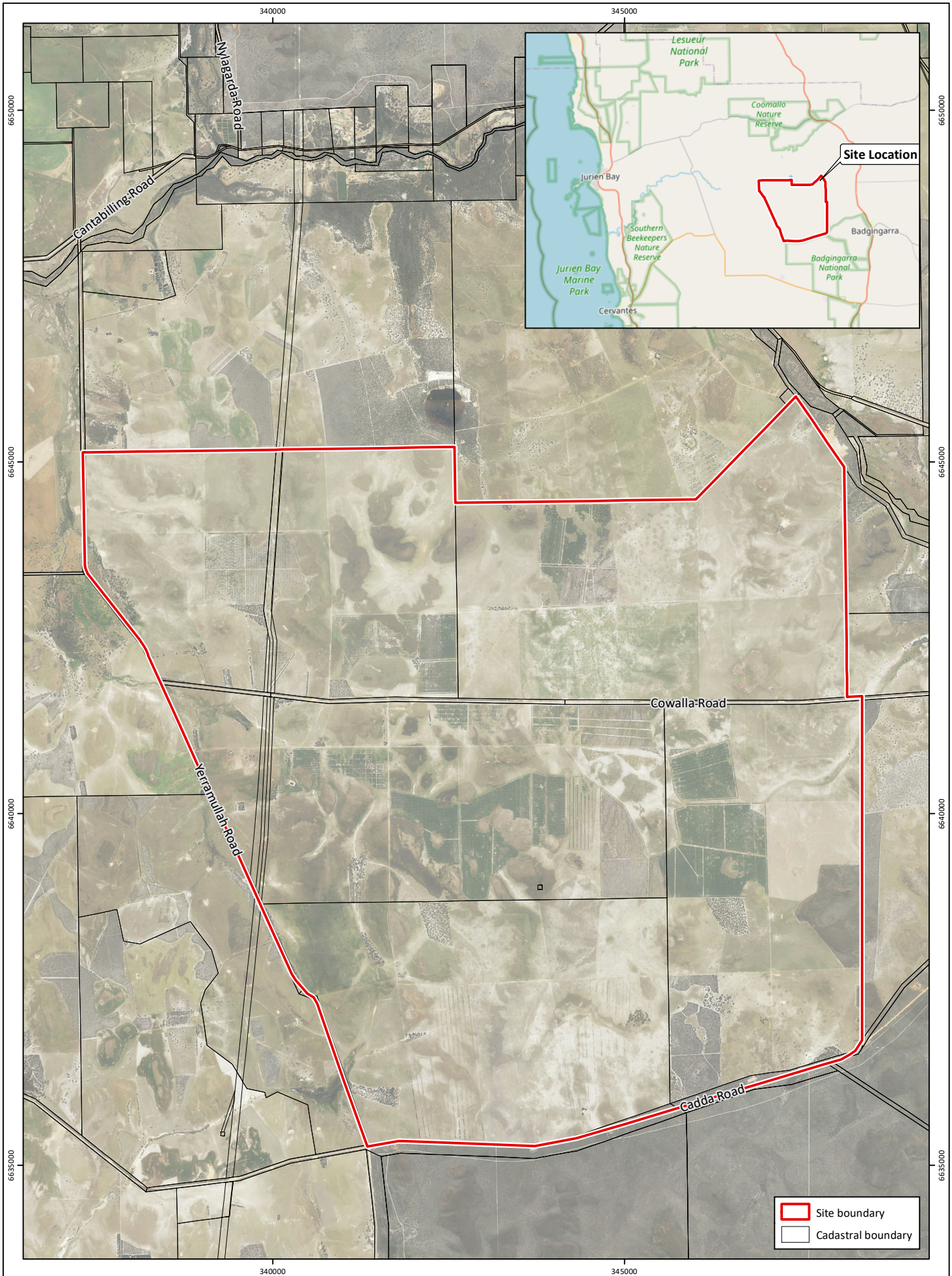

Figure 1: Site Location

Project: Bird Risk Assessment
Parron Wind Farm Development Support

Client: Zephyr Energy Pty Ltd

Plan Number:
EP23-085(18)--F70

Drawn:	GAR
Date:	26/08/2024
Checked:	AJU
Approved:	RAW
Date:	10/09/2024

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Kilometers

Scale: 1:70,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

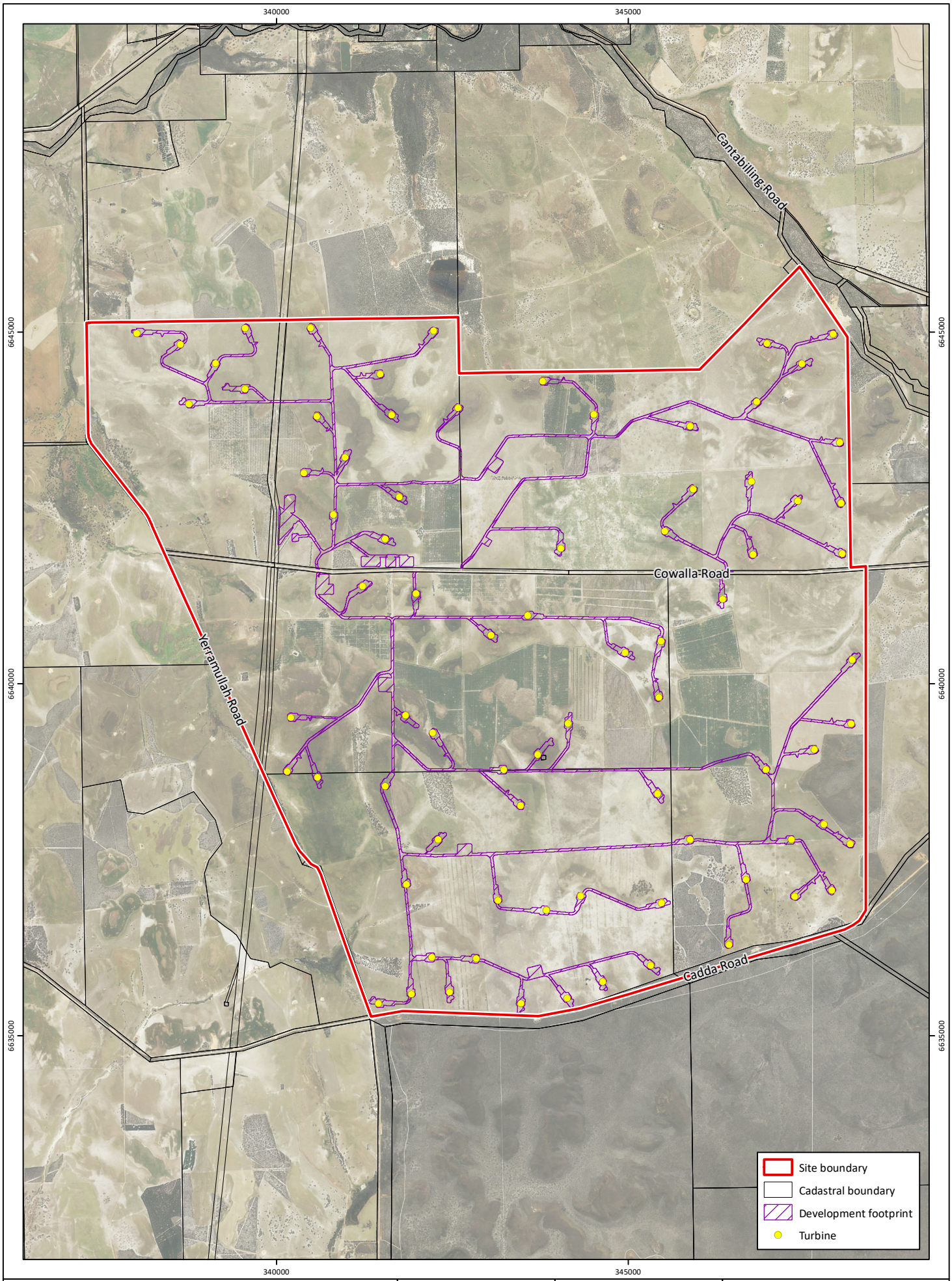

Figure 2: Development Context

Project: Bird Risk Assessment
Parron Wind Farm Development Support

Client: Zephyr Energy Pty Ltd

Plan Number: EP23-085(18)--F71

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Date:	26/08/2024
Checked:	AJU
Approved:	RAW
Date:	10/09/2024

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Kilometers

Scale: 1:70,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

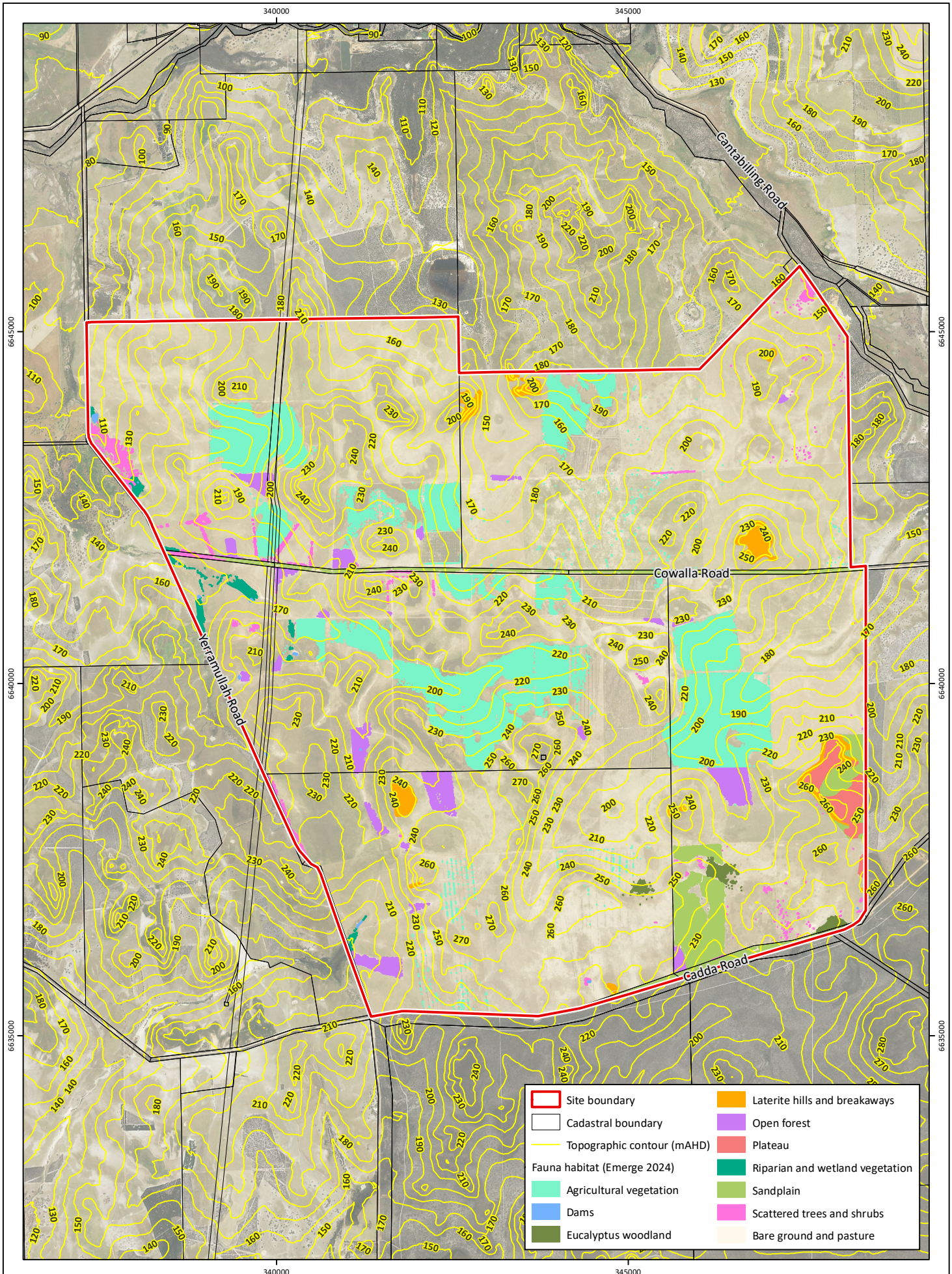

Figure 3: Fauna Habitat and Topography

Project: Bird Risk Assessment
Parron Wind Farm Development Support

Client: Zephyr Energy Pty Ltd

Plan Number:
EP23-085(18)--F72

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Date:	26/08/2024
Checked:	AJU
Approved:	RAW
Date:	10/09/2024

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Kilometers

Scale: 1:70,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

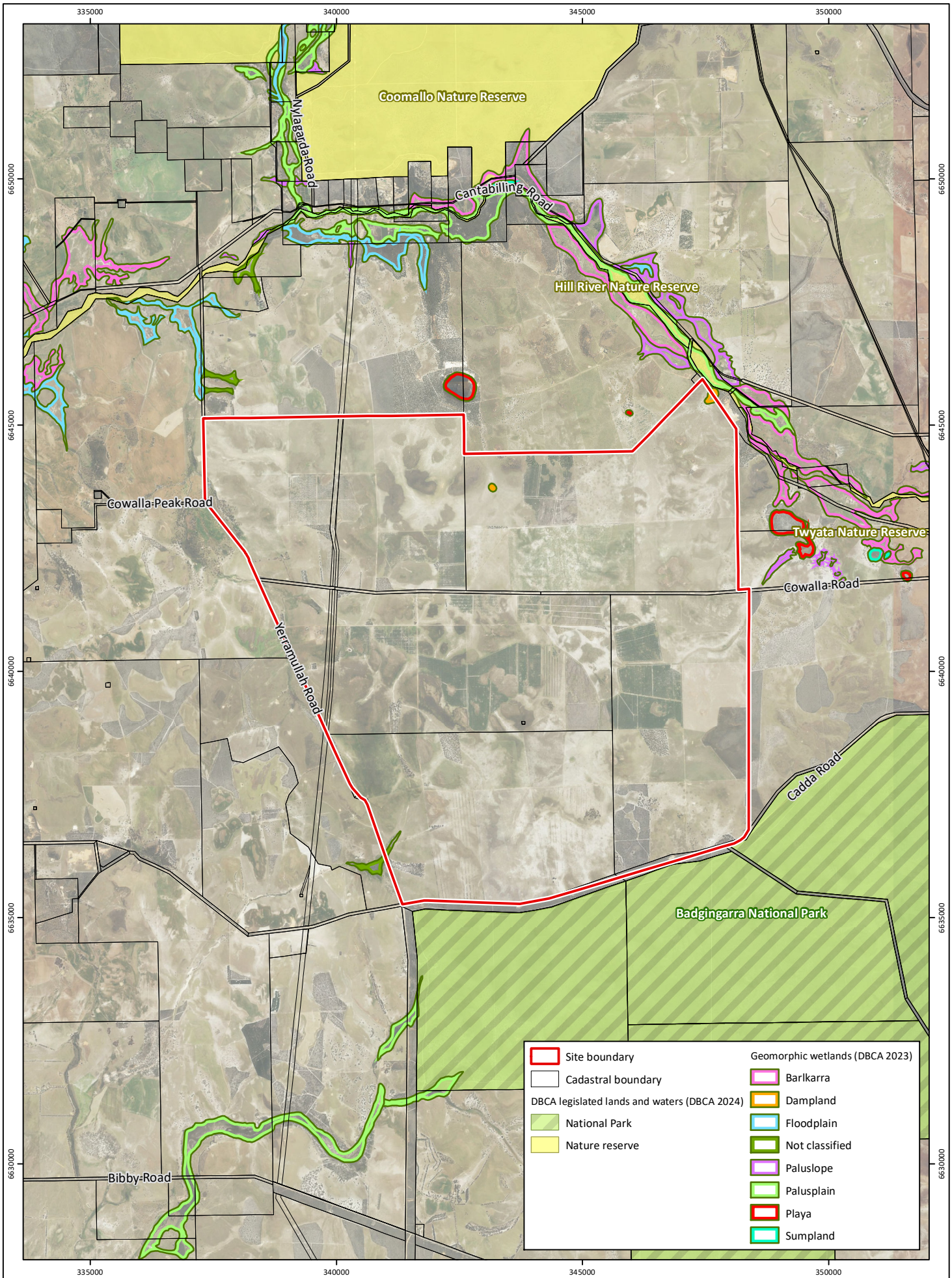

Figure 4: **Environmental Context - Legislated Lands and Hydrology**

Project: Bird Risk Assessment
Parron Wind Farm Development Support

Client: Zephyr Energy Pty Ltd

Plan Number: EP23-085(18)--F73

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Date:	26/08/2024
Checked:	AJU
Approved:	RAW
Date:	10/09/2024

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Kilometers

Scale: 1:100,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

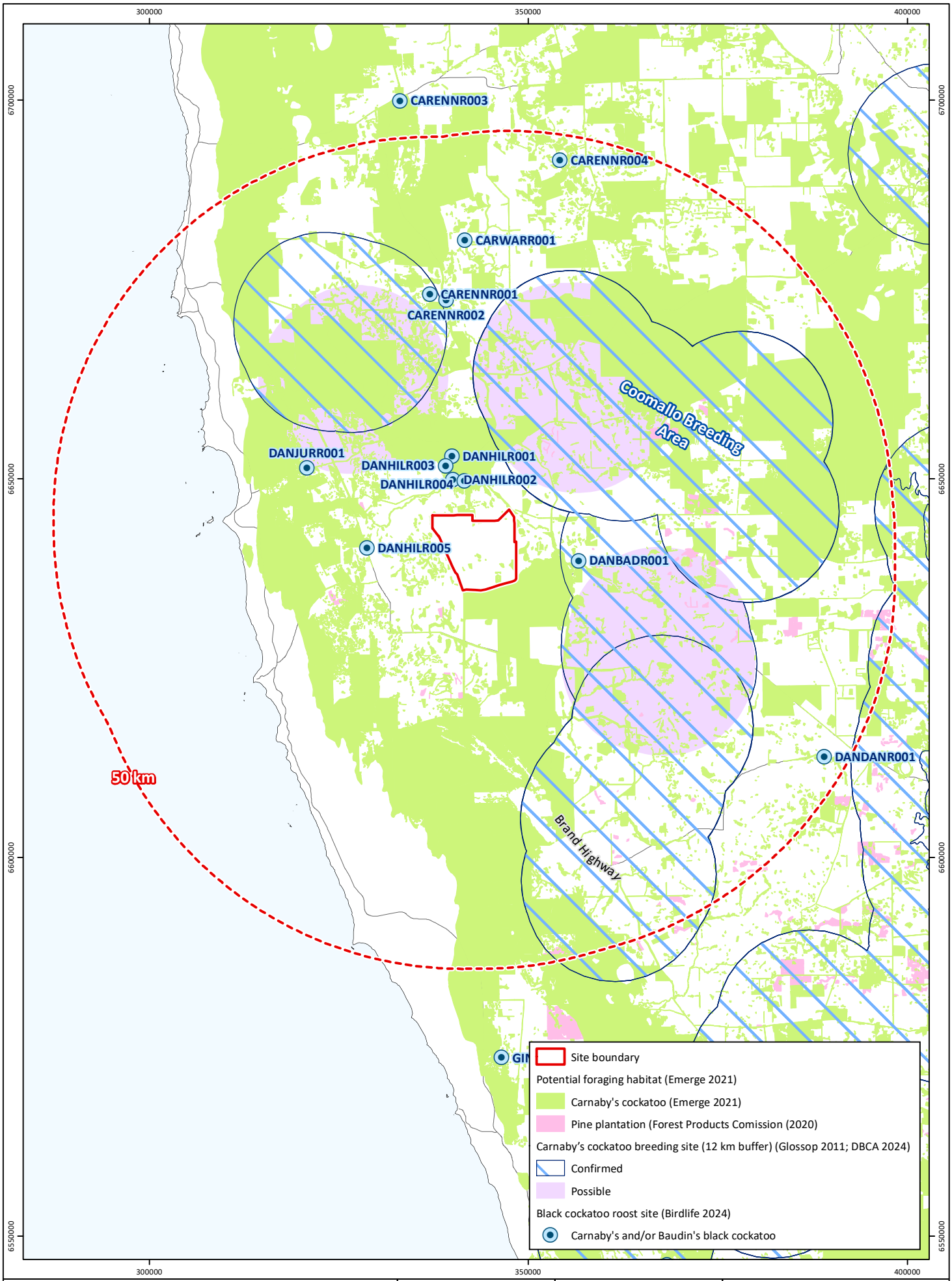

Figure 5: **Carnaby's Black Cockatoo Habitat Context**

Project: Bird Risk Assessment
Parron Wind Farm Development Support

Client: Zephyr Energy Pty Ltd

Plan Number: EP23-085(18)--F74

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Date:	26/08/2024
Checked:	AJU
Approved:	RAW
Date:	10/09/2024

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Kilometers

Scale: 1:650,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

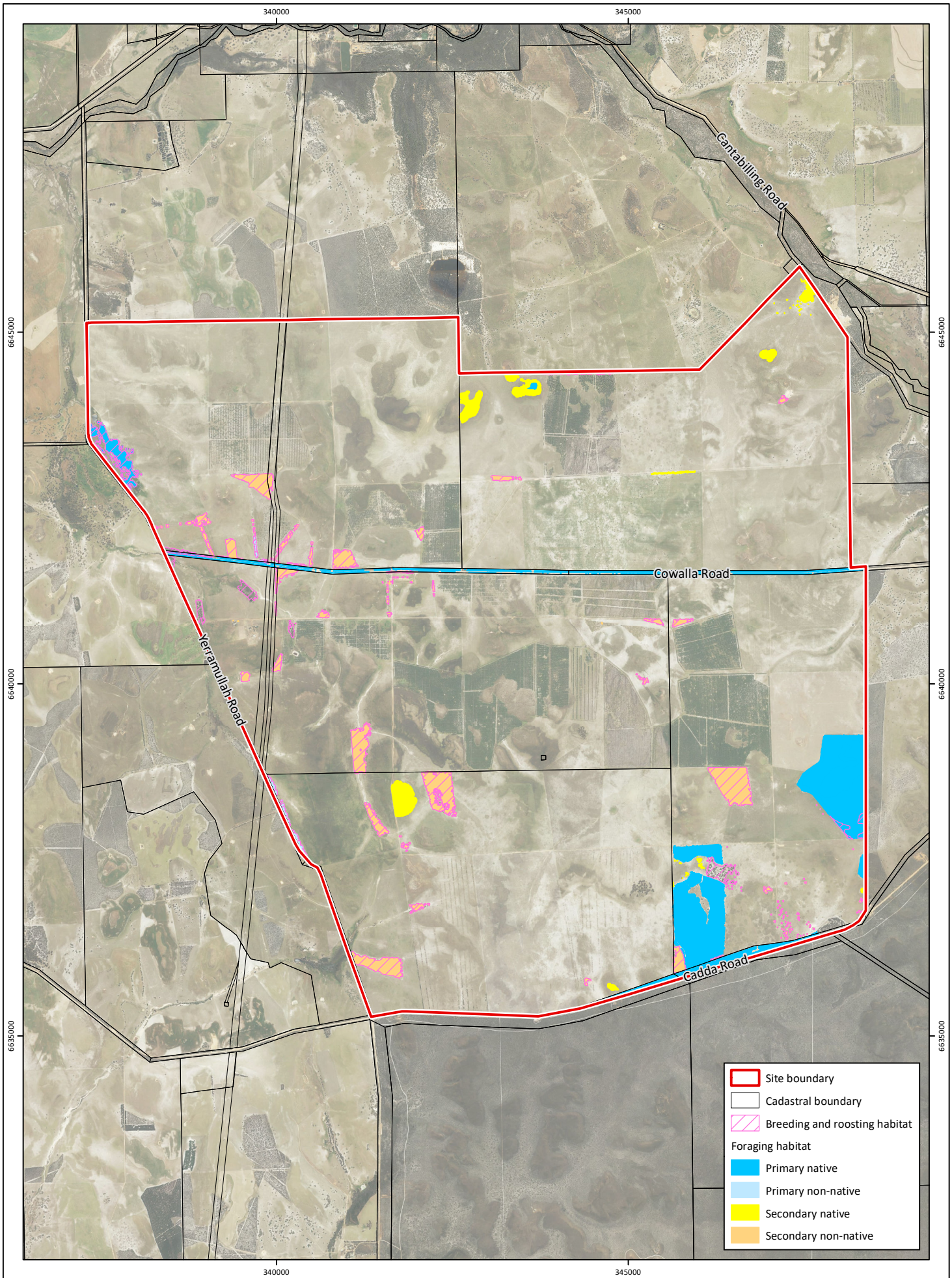

Figure 6: **Carnaby's Black Cockatoo Habitat (Emerge Associates 2024)**

Project: Bird Risk Assessment
Parron Wind Farm Development Support

Client: Zephyr Energy Pty Ltd

Plan Number: EP23-085(18)--F96

Drawn:	GAR
Date:	10/09/2024
Checked:	AJU
Approved:	RAW
Date:	10/09/2024

N

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Kilometers

Scale: 1:70,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

Appendix A

Summary of peer review comments version A (Dr Mike Bamford)

Parron Windfarm Bird Risk Assessment; Emerge EP23-085(18)--024A AJU

Review comments. M Bamford.

October/November 2024

ID	Mike Bamford comment on Ver A	Emerge response	Mike Bamford response
1	Executive summary, second paragraph. 'Environment' not 'Environmental' in EPBC Act.	Change made	
2	Executive summary, species names. Most authorities (not DBCA nor the Australian style manual)!!) recommend Carnaby's Black-Cockatoo and Fork-tailed Swift as English names. Note use of capitals and hyphens. There is international guidance on this (IUCN, Birdlife International).....a bit over the top really but just pointing it out.	Standard Emerge style is to not capitalise common names.	
3	Executive summary, DCCEEW requests. Surprised they make no mention of mortality of juvenile birds that could result in very low annual recruitment. There are probably studies that look at the age of mortalities; there are for roadkill which found most roadkill birds were juveniles.	Impact has (had) been evaluated broadly (that is inclusive of all impacts including to juvenile or adults). Note removing juveniles from population is ultimately the same impact as removing breeding adults but arguably lower risk as likely attrition rate of juveniles is naturally higher.	Population dynamics is interesting. Juvenile mortality should be lower impact on population than adult mortality as in most species juvenile mortality is naturally high. Of more concern for CBC because it is naturally low recruiting species so more vulnerable to juvenile mortality than many other species
4	Executive summary, conclusion regarding Carnaby's...will be interested to see how this is substantiated. It is seasonally abundant in the	Seasonal abundance of Carnaby's has been further emphasised. Noting that Carnaby's would still we think	Worries me a bit...depends on how the birds use the site. If it is mainly for traversing then risk might be

ID	Mike Bamford comment on Ver A	Emerge response	Mike Bamford response
	region. For the Swift, the species occurs very, very infrequently in the region.	have a lower propensity to occur in site as mainly traversing and the site is not core target habitat. Noted regarding swift.	heightened. I don't know; emphasises the need to understand how the birds are using the site.
5	Page 1. Para 1. Project background. Different tense used for proponent than in the Exec summ. Singular correct?	Change made	
6	Page 1. Para 5. Punctuation missing from DCCEEW.	Change made	
7	Page 2. Table 1. No mention of access tracks. Note that 40m ground clearance of RSA puts this within the flight height of Carnaby's that we have observed (often lower than this but occasionally up to 50m).	Access tracks added under 'other design features'. Internal access tracks considered to pose little if any risk to the birds. Note that the RSA is 70 m above ground. The way the table has been set up may have caused confusion as it presents a previous (not current) design outcome alongside the current proposed design option. This has been corrected.	Much better. I'm trying two track down a report from NSW that found much lower mortality rates with higher RSA.
8	Page 3. Table 2. Vegetation description does not sound right for that area west of Badgingarra….obviously mostly cleared now but that is a region of extensive kwongan so mostly proteaceous heath.	Shrubland vegetation is kwongan but restricted to small areas within the site. Text updated to clarify.	
9	Page 4. Para 1. Also eats a lot of insect larvae especially from the fruit of banksia and under	Noted and updated.	

ID	Mike Bamford comment on Ver A	Emerge response	Mike Bamford response
	bark of eucalypts….think this is mentioned by most of these references.		
10	Page 4. Para 2. Some minor edits in this sentence Individuals breeding in the Badgingarra area move west and then south, and birds breeding at Coomallo disperse….	Change made	
11	Page 4. Pacific Swift section. Pacific Swift is…..	Change made	
12	Page 5. Plate 1. I love this sort of methodical, objective approach; but struggling with this whole section. Plate 1 doesn't work for me. Perhaps try to avoid using terms like risk, likelihood and consequence, and just focus on the main concern, which is that the local population may decline as a result of birds being killed, or in some other way being adversely impacted (such as displaced). In the case of mortality, this decline will be a function of the proportion of the local population killed, and the fecundity of that population. The mortality rate will itself be a function of the behaviour of the birds (flight height) and where they fly (so how thy move around the landscape). How they move around the landscape is not just 'habitat suitability'; for example, Carnaby's will fly across paddocks for several kilometres when moving between foraging and roosting areas. If you frame the discussion in this way and try to revert to the	Plate 1 has been inverted. Most comments here are not supported but have been incorporated to the extent we think appropriate. Note we intentionally aim to maintain a structure and use terms derived from DCCEEW request. And while banal, risk = likelihood and consequence and so can and should be understood using that framework. Regarding mortality, direct impact is additional mortality (birds killed by wind farm). The consequence of the impact relates to whether additional mortality is significant (that is in excess of fecundity or past tipping point once other cumulative risk factors are considered). The behaviour of the birds (flight height) and where they fly (so how	Accepted

ID	Mike Bamford comment on Ver A	Emerge response	Mike Bamford response
	language of 'risk assessment', and do not try to use likelihood/risk/consequence, the population decline seems to be the consequence, and the risk of this decline comes down to population characteristics interacting with the likelihood of actual mortality. Maybe I'm over-thinking this. Incidentally, I don't find direct/indirect impacts a very helpful division (I know in all the guidance but that doesn't make it right). Displacement is still a direct consequence of an action as it would not happen if the action didn't happen, and it occurs at the location of the action. I find it more useful to review threatening processes. For example, are Tables 4 and 5 actually useful; even if the thresholds are accepted (see below) the combination of mortality from multiple threats could result in a serious 'consequence'.	they move around the landscape) is <u>likelihood</u>. It is understood that how birds move around the landscape is not just 'habitat suitability', but habitat suitability necessarily influences behaviour and *in lieu* of anything like specific information on the movement of Carnabý's (including from official sources such as DBCA or DCCEEW) we have adopted this approach to assist in evaluating risk. Note a 'risk assessment' is assessment of likelihood and consequence. Emerge agrees and has attempted to convey that risk of impact to birds relates to the consequence of mortality on the population and the likelihood that mortality occurs. Emerge has interpreted direct impact as physical impact (causing mortality and by association loss of breeding individuals and lower recruitment). Indirect impact has been interpreted	

ID	Mike Bamford comment on Ver A	Emerge response	Mike Bamford response
		as changes to habitat or behaviour that may then result in later mortality and or failure to recruit and or stress or threatening process).	
13	Page 6. Thresholds. Need to be careful with these. DCCEEW specifies loss of breeding adults and impact on population, so maybe thresholds should be linked to monitoring and population trends. Such monitoring might work for Carnaby's if done jointly with multiple WF projects in area. Unworkable with the swift. Also need to consider that while a few deaths might be insignificant at the species level, for the local population it could be devastating.	Agree that monitoring data particularly from nearby wind farms would be useful but is, for the most part, not publicly available. Therefore, these thresholds have been derived from available sources of information, including that published by DCCEEW. We acknowledge that local population reduction may be relevant, but this document does need to first evaluate the risk of significant impact on the species as a whole in accordance with DCCEEW guidelines. With respect to local populations, we have set the threshold for negligible at <4. The local population is we suspect at least numbering in the hundreds. Therefore, the serious consequence threshold of >40 hopefully adequately addresses local impacts as well as those at species level.	This is a problem (one of many) with DCCEEW guidance. Some consultants interpret this risk of significant impact as any impact on a significant species. But if you take the guidance literally, you could wipe out CBC in the Badgingarra area and the species would still be secure. I don't know the answer to this except to keep challenging DCCEEW

ID	Mike Bamford comment on Ver A	Emerge response	Mike Bamford response
14	Page 7. Results. Do you have any data to back up what appears in Tables 7 and 8? I don't feel you can draw those conclusions without data. Carnaby's occurs in the area regularly and will occasionally fly at RSA (our data), while the swift almost never occurs in the area (we have spent two weeks a year since 1990 at the nearby Cooljarloo minesite and never recorded it) but probably regularly flies at RSA. I would replace 'habitat suitability' with 'abundance'.	As little data are publicly available we have designed what we consider reasonable (heuristic) methodology for review by DCCEEW. Comment re habitat suitability is accepted we will find a better label.	Lots of data for that region to compare abundance of CBC and the swift. I don't have the maps in front of me, but there are hundreds of records of the cockies in birdata and ebird, but just a handful of swift records. Happy for you to pers comm me. I've spent two weeks to a month every year since 1989 doing bird surveys in the Cataby to Dongara region and have recorded the swift once (about 10 birds over Dongara in November 2022). Black cockies on almost every trip, often in 100s. These two species are so different in an ecological sense.
15	Page 8. Section 4.1. I don't feel you can draw this conclusion based on the data you have presented. Page 8. Section 4.1.1. While you may be right about Carnaby's and wind turbines, I don't feel you have enough data to support these statements. The Ecoscape work should have been referenced earlier, and if the pre and post construction numbers (9751 compared with 923) are standardised for effort, then they suggest a massive decline in activity around the Badgingarra WF; this suggests displacement on a significant scale. I would consider that to be	Section 4.1 This conclusion is based on our likelihood and consequence assumptions. Section 4.1.1 The decline in Carnaby's activity following the adjacent Badgingarra WF bird monitoring does indicate the species' movement patterns may have been altered but there is no evidence to indicate this negatively affected population or breeding. Nearby Coomallo Creek breeding	Is Coomallo Creek breeding area relevant? It is >10km from the existing WF so those breeding birds unlikely to be foraging west of Badgingarra. What do the ecoscape numbers look like when standardised for survey effort? If this is a real decline and with so many WFs proposed for that region, the cumulative impact could be a serious concern.

ID	Mike Bamford comment on Ver A	Emerge response	Mike Bamford response
	a real concern as it may be that the birds cannot access important foraging areas. This would qualify as an indirect impact according to DCCEEW, and one of the reasons I dislike the term 'indirect' is that it gives the impression the impact is not so important. In the last paragraph of this section, you could compare the 439ha of foraging habitat with the area of foraging habitat in reserve within 20km (ie quantify your statement that there is lots of forage habitat nearby).	area has not reported a decline in breeding in association with Badgingarra WF operation. Text added to standardise data in relation to survey effort and quantify foraging habitat within 20 km of the site.	
16	Page 9. Para 1. Is the small number of records of Carnaby's due to low abundance or small sampling effort?	Text added to detail survey effort. We acknowledge survey effort is limited but as the extent of foraging habitat in the site is small (particularly compared to nearby reserves), and very little foraging evidence was detected we are comfortable(ish) with our conclusions.	
17	Page 9. Para 2. Be careful in concluding that the Murdoch data indicate consistent movement pathways. Food resources vary with season and fire history, so pathways may be consistent for one season but in the following year in the same season the resources may be distributed differently.	Agree, text added to include this point.	
18	Page 9. Para 3. You can't conclude the birds do not roost in the project area if roosting surveys	Noted and text added. Note though that no indirect evidence of roosting	Be careful with this. We've just found a new (ie previously unrecorded)

ID	Mike Bamford comment on Ver A	Emerge response	Mike Bamford response
	have not been conducted. The Great Cocky Count sites are not the result of systematic regional surveys.	was observed during field surveys. In our experience outside of transient roosts, large or regularly used roost are usually obvious or likely previously documented.	roost of 100+ birds just to the east of Badgingarra. Sorry I can't provide details at the moment; but overall the Great Cocky Count is not as comprehensive as we would all like.
19	Section 4.1.2. Page 9. The first paragraph in this section is a blend of methods and discussion....loss of juveniles should also be considered at it threatens recruitment.	The definition of impacts (direct indirect) was provided by DCCEEW. We feel the definitions given account for the mortality of juvenile individuals be that directly or indirectly via associated reduction in recruitment.	
20	Section 4.1.2. Page 10. First para. I don't feel you have provided enough data to conclude that few birds occur in the area. But I'm not clear from this document just how much survey effort has taken place. Note there is a small typo in this paragraph (a lonely 't').	We have added some further information. We have done a single survey and including surveys by others we acknowledge that survey effort is limited (text added to explain). This is why we have taken the approach to evaluate risk heuristically.	
21	Section 4.2.1. Other swift species are known to suffer mortality at windfarms. Check also the 'needletails' (they are also swifts). The point here is that swifts I suspect may be a high risk group. Conclusion in this section is good but please don't use the expression 'confirm presence or absence'. Confirming absence is a logical impossibility. You can conclude absence based on landscape interpretation	Noted. Will review. The risk classification provided acknowledged that there is a potentially a higher consequence of impact for swift (using DCCEEWs own thresholds impact of 1000 individuals is not considered significant). However, the likelihood (as you have acknowledged) that	

ID	Mike Bamford comment on Ver A	Emerge response	Mike Bamford response
	(there will be no dolphins), but you cannot confirm absence of the Swift through sampling.	swift would occur in the site is very low (we used the label unlikely). Therefore risk to the species is (we think) low.	
22	Section 4.2.2. I don't think 'conservativity' is really a word. Otherwise this section is a good conclusion.	Typo corrected.	
23	Section 4.3. I don't feel you can conclude this about Carnaby's on available data.	Noted. The lack of data is key to the objective relative approach that we have adopted.	
24	Figure 3. What is 'agricultural vegetation' if it is not pasture? Carnaby's will feed in paddocks and can rely heavily on Canola when breeding.	We acknowledge and agree that Carnaby's feed on crops and paddocks. The agricultural vegetation in the site is tagasaste which is not a Carnaby's foraging species. The paddocks are not cropped as the soils are largely infertile and we have (and have further clarified following your comments here) that the cleared pasture in the site and agricultural vegetation largely wouldn't provide any foraging habitat value. This includes pasture weeds as those that are present are also largely not suitable foraging species. Text has now been added to clarify this.	Do you know if Wild Radish is present? Again to east of Badgingarra, we've documented males of breeding pairs foraging on Wild Radish in paddocks and on road verges.

ID	Mike Bamford comment on Ver A	Emerge response	Mike Bamford response
25	Figure 6. Some more information on the primary and secondary categories might be good.	Change made.	