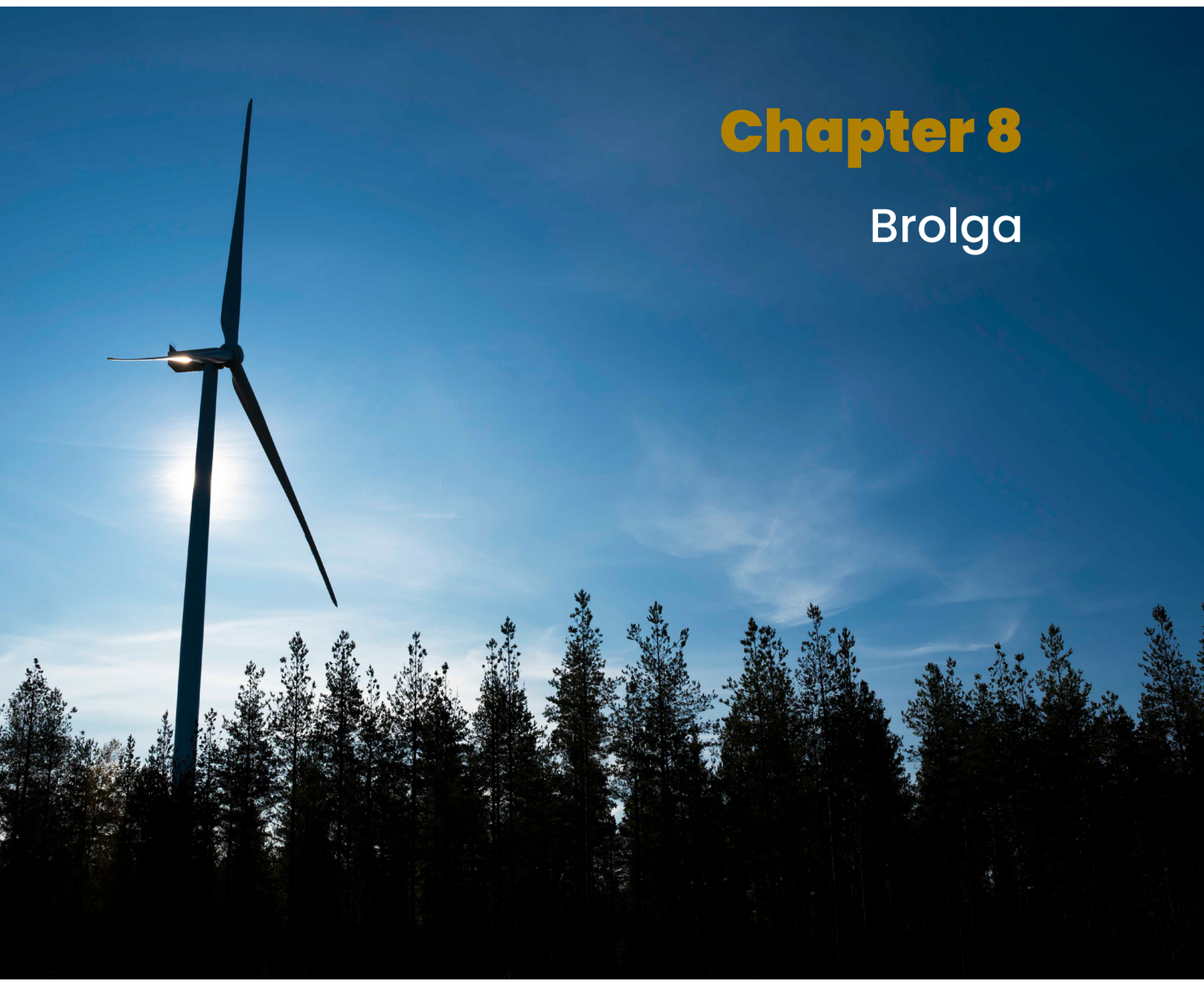


# Chapter 8

## Brolga

## Acknowledgement of Country

Neoen Australia acknowledges the traditional custodians of the land in which we live, and pays its respects to their elders, past and present. The Gunditjmara are the original custodians of the Country on which the Project is located and we acknowledge them as the original custodians. We are committed to Aboriginal engagement and reconciliation and aim to bring Aboriginal and Torres Strait Islander people, local communities and the councils along for the journey to strengthen relationships and enhance local community outcomes.

## Disclaimer

# 8 Brolga

This chapter describes the potential impacts on Brolga associated with the construction and operation of the Project, as well as the mitigation measures proposed to avoid, minimise, and manage potential adverse impacts.

This chapter summarises the outcomes of the **Brolga Impact Assessment (Appendix D).**

## 8.1 Overview

The Brolga (*Antigone rubicunda)* is listed as endangered under the *Flora and Fauna Guarantee Act 1988* (VIC) (FFG Act). A detailed survey and assessment program was undertaken to assess potential impacts of the Project on the Victorian Brolga population, and to inform the identification of appropriate avoidance, mitigation, and management measures. This assessment was conducted in accordance with the methodology described in the *Interim guidelines for the assessment, avoidance, mitigation and offsetting of potential wind farm impacts on the Victorian Brolga population 2011* (2011 Brolga Guidelines) (DSE, 2012), with the objective of ensuring that the Project would have, at a minimum, a net zero impact on the Victorian Brolga population.

The assessment identified that some aspects of the Project pose a risk to Brolga, namely collisions with turbines and overhead powerlines, and noise and disturbance. Avoidance measures have already been incorporated into the Project design as assessed in this Environment Effects Statement (EES) to minimise potential impacts, including the removal of turbines and reconfiguration of transmission lines from overhead to underground near Brolga breeding habitat and movement corridors.

With the implementation of these avoidance measures, collision risk modelling results for the Project indicate a low risk of turbine collisions (less than 0.21 collisions per year, or up to one collision every five years on average at a 95% avoidance rate). Only one recent Brolga collision has been detected at a Victorian wind energy facility (wind farm), despite intensive monitoring over many years at multiple wind farms. It is likely that the turbine avoidance capacity of Brolgas is very high and close to 100%. It is therefore considered that the modelled result for an avoidance rate of 0.99 is likely to be closer to reality than those for lower avoidance rates (0.05 collisions per year or one collision every 20 years on average).

Results from the Population Viability Analysis (PVA) indicate that a south-west Victorian Brolga population of 625 birds would decline to a similar number both with and without the Project, approximately 556 birds within 25 years without the Project, and approximately 555 birds within 25 years with the Project (assuming a 0.99 avoidance rate). The PVA indicates that a net zero impact on the south-west Victorian Brolga population, as required by the 2011 Brolga Guidelines, can be achieved by increasing recruitment into the population by approximately one juvenile every two years. A Compensation Plan will be prepared prior to Project construction involving the identification of appropriate compensation strategies to be implemented to ensure net zero impact, in accordance with the 2011 Brolga Guidelines.

Construction works have potential to disturb Brolgas through increased noise, traffic, and artificial lighting. Such disturbance can result in pairs moving away from nests, disrupting incubation and separating chicks from adults, which can potentially impact on breeding success. However, with the implementation of mitigation and monitoring, including setback distances and restrictions on construction activities during breeding activities, residual impacts on Brolga during construction are not anticipated to be significant.

## 8.2 EES evaluation objective

The specific environmental matters to be investigated and documented in this EES are set out in the *Scoping Requirements for Kentbruck Green Power Hub Environment Effects Statement* (Scoping Requirements). The Scoping Requirements provide evaluation objectives that describe the desired outcomes to be achieved for each of the matters being addressed in this EES.

The following draft evaluation objective is relevant for the Brolga Impact Assessment:

> ***Biodiversity and habitat*** *– To avoid or minimise potential adverse effects on biodiversity values within the project site and its environs, including native vegetation, listed species and ecological communities other protected species and habitat for these species.*

This chapter and the **Brolga Impact Assessment (Appendix D)** address the Project's biodiversity matters relating to Brolga, in response to the Scoping Requirements.

## 8.3 Assessment methodology

The **Brolga Impact Assessment (Appendix D)** was undertaken across three levels of assessment in accordance with the 2011 Brolga Guidelines. This assessment methodology involves several stages of assessment across the three levels, each of which has different requirements and triggers. The steps involved in each level are summarised below.

### 8.3.1 Level one assessment

The level one assessment aimed to determine if the Project would pose a risk to the Victorian Brolga population by identifying the potential presence, number and location of any Brolgas or potential Brolga habitat within a 'radius of investigation' (ROI). This level of assessment utilised a three-step methodology covering an ROI of 10 kilometres (km) around the Project Area:

1. Victorian Biodiversity Atlas (VBA) and NatureKit database review
2. Field inspection to identify known and potential Brolga habitat from publicly accessible locations (e.g. roadsides), over three days from 9–11 November 2018
3. Local community consultation to gain an understanding of local knowledge of Brolga habitat and movements in the area. Two Victorian Department of Environment, Land, Water and Planning (now split into DEECA and DTP) (DELWP) officers were consulted (one retired), as was the Green Triangle Forest Products (GTFP) plantation manager, a member of BirdLife South East SA, members of the Portland Field Naturalists Club Inc, and local landowners.

The level one assessment triggered the need for a level two assessment as all four triggers were met:

1. Records of breeding or flocking habitats occur within the ROI.
2. The wind farm site is in an area that may be used by Brolgas moving seasonally between breeding and foraging sites, and has the potential to create a barrier effect reducing movements between these habitats.
3. The wind farm site is in an area that may be used by Brolgas for diurnal movements between foraging and roosting sites.
4. The overhead powerlines may create new collision risks for Brolgas.

### 8.3.2 Level two assessment

The level two assessment aimed to provide a comprehensive record of the location, nature and extent of Brolga habitats within the ROI and to assess the potential for impacts arising from collision risk, indirect disturbance and barrier effects.

The 2011 Brolga Guidelines require the mitigation of potential wind farm impacts by implementing turbine-free buffers for identified breeding and flocking habitats. The default buffer is 5 km from a flock roost site and 3.2 km from a breeding site (DSE, 2012). The field investigations in the level two assessment were therefore undertaken within 5 km of the Project Area, although a desktop assessment to identify potential flocking sites beyond 5 km was undertaken to understand the potential impact of the Project on Brolgas moving between breeding and flocking sites.

Data was collected on Brolga occurrence and habitat using the following methods (first three are (DSE,2012) recommended methods):

- Roaming surveys during the Brolga breeding season in 2020
- Aerial surveys during the Brolga breeding season in 2020
- Flight behaviour studies and flight path mapping, involving bird utilisation surveys (BUS) every alternate month between April 2020 and February 2021
- Additional database review in 2021, including the VBA, BirdLife Shorebirds 2020, BirdLife BirdData, eBird and the Sheldon 2004 south-west Victorian Brolga Flocking Database
- Additional local community consultation to the level one assessment, targeting areas with suitable Brolga habitat and overlapping Project infrastructure. A member of the Portland Field Naturalists Club Inc and three landowners were consulted
- Targeted flocking season survey between December 2020 and June 2021 at a DELWP-mapped wetland with frequent Brolga activity during the breeding season surveys
- Remote nest camera deployed at a suspected nest site in July-August 2021
- Additional targeted habitat assessment in 2021
- Follow up targeted breeding season survey in 2021.

The level two assessment triggered the need for a level three assessment as a qualitative risk assessment of the Project (AusWEA, 2005) was determined to be greater than low.

### 8.3.3 Level three assessment

The level three assessment aimed to avoid significant impacts on Brolga breeding and flocking habitat through design response and the siting of turbines away from these habitats, and to quantify residual risk. This level of assessment involved a four-step methodology:

1. Avoid or mitigate all potential impacts on Brolga breeding and flocking home ranges within the radius of investigation using turbine-free buffer areas
2. Develop a site-specific collision risk modelling (CRM) for Brolgas utilising or moving through the radius of investigation
3. Use PVA to estimate the potential impact of the Project
4. Identify appropriate compensation strategies to ensure a zero net impact on the Victorian Brolga population.

The 2011 Brolga Guidelines provide the following guidance on methods for siting turbines away from breeding and non-breeding home ranges:

- Avoid the Brolga breeding home range (identified in the level two assessment or using the default buffer of 3.2 km)
- Avoid the Brolga flocking home range (identified in the level two assessment or using the default buffer of 5 km)
- Avoid an additional 300 m radius around each home range to avoid disturbance effects.

No flocking roost sites were identified during the level two assessment, however breeding sites were identified. The 2011 Brolga Guidelines allow for site-specific buffers to be used instead of the default buffers, if site-based data on the location of breeding pairs, their nesting wetland and chicks can be gathered to demonstrate the site-specific Brolga breeding home ranges to avoid.

In line with this approach, site-specific turbine-free buffers were identified for several locations, including locations where turbines overlap with known Brolga habitat, areas of frequent Brolga activity, and habitat most suitable for breeding. Turbine-free movement corridors were also identified, as were overhead powerline-free buffers. Section 5 of the **Brolga Impact Assessment (Appendix D)** details the buffer design methodology adopted for the Project.

Following the removal and relocation of turbines and powerlines in response to the identified buffers, CRM was used to model the risk of Brolgas colliding with turbines and overhead powerlines. The results of this were then used in PVA to determine the level of offsetting required to achieve a net zero impact on the Victorian Brolga population. PVA is a widely accepted modelling method that attempts to predict the trajectory of the population of a plant or animal over a certain time period under existing conditions (i.e. without the effects of the Project). It then simulates the trajectory with the added effects of collision fatalities associated with the Project, as determined by the CRM.

## 8.4 Existing conditions

There have been several Brolga sightings within the ROI. As shown in **Figure 8.1**, database records are mostly located within the Glenelg Estuary and Discovery Bay Ramsar site (the Ramsar site), with clusters around the Glenelg River Estuary and near Lake Mombeong.

Biosis recorded the presence of 11 Brolga breeding pairs and identified the assumed presence of an additional five pairs within three km of the Project Area. Three of these pairs were located within farmland wetlands in the eastern section of the wind farm site (see **Plate 8.1**). Two other breeding pairs were recorded nearby, outside of the wind farm site, with additional pairs confirmed near the eastern end of the transmission line corridor.

No flock roost sites were identified within the ROI. The nearest known flocking area to the Project is at Strathdownie (Kaladbro/Mingbool), Victoria, approximately 50–70 km north of the Project Area. This is most likely to be the flocking area used by Brolga breeding near the Project Area. The Biosis field surveys indicated that most Brolgas depart the area around the Project after the breeding season and return at the end of the flocking season. Regular seasonal movements between December and May in and out of the area are therefore expected. Brolgas undertake such flights mostly between 11 am and 2 pm and can reach breeding or flocking areas within 1–2 days, potentially stopping over at wetlands along the way.

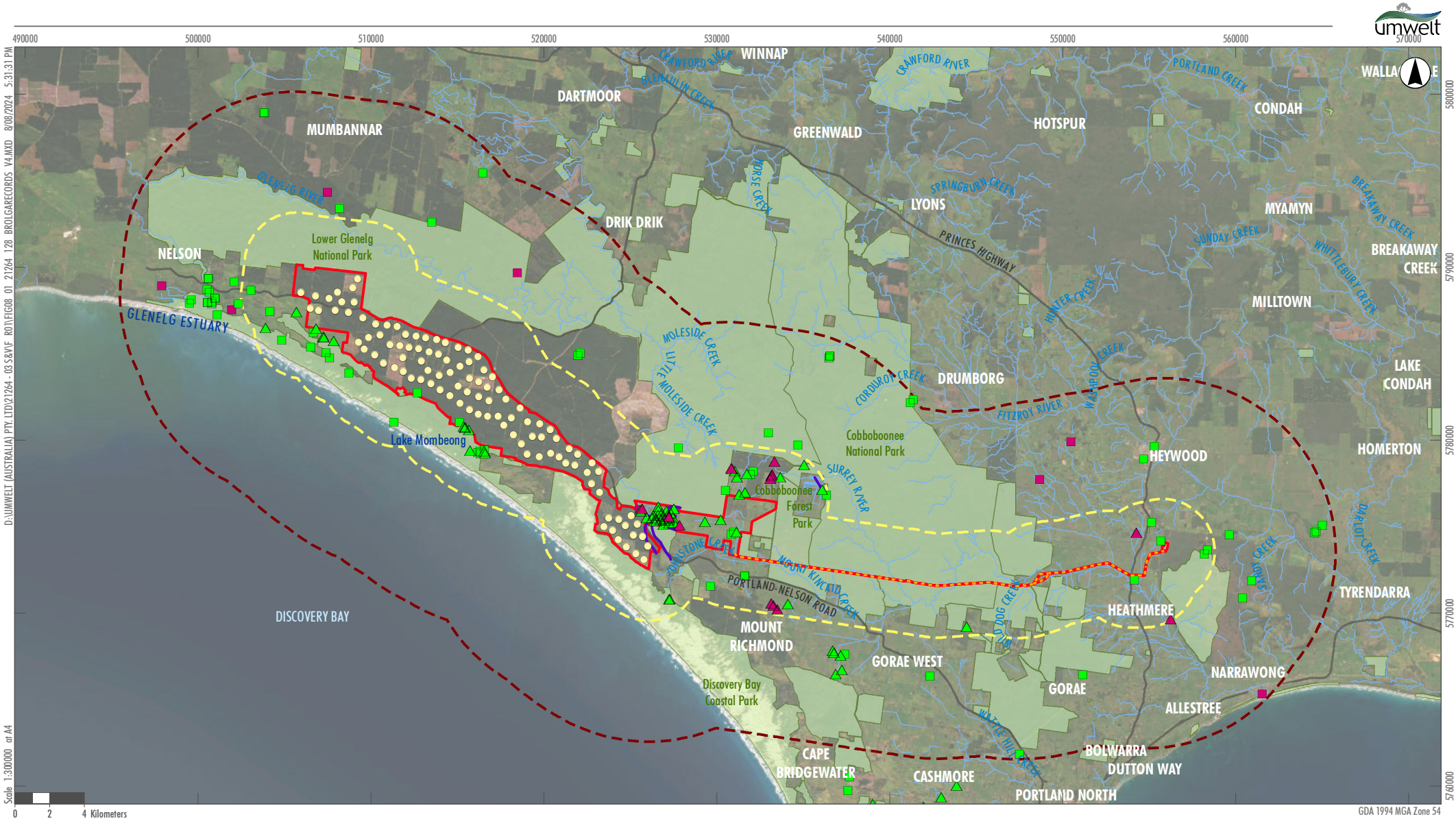
One non-flocking roosting wetland was found, with an adult pair with two young flying between the western paddock of the Mt Kincaid Road and Swan Lake. Further targeted surveys found the family roosting at night at Swan Lake.

Biosis recorded Brolgas flying in the farmland in the eastern section of the wind farm site near Mt Kincaid Road, where breeding pairs were found (see **Figure 8.1**). The landholder at Mt Kincaid Road reported that Brolgas fly to the property from the south and south-west, and fly from the property to the north and north-east into adjacent properties. Other Brolga flights were observed in the western part of the wind farm site and across Lake Mombeong. Local movements of 5 km were observed by Biosis prior to breeding season. Most local movements would be expected to be within 5 km and much less once pairs are on breeding territories, which vary in size from 70 to 523 hectares (ha), with the majority of movements contained within 2 km of the centre of the night roosts.

During the Biosis BUS (see **Chapter 7 *Biodiversity***), Brolgas were seen flying at heights of 2, 10, 20 and 70 metres (m). During targeted surveys, Brolgas were recorded flying at heights within 5 m (nine birds), within 5 and 35 m (five birds) and at 50 m (two birds). These results indicate that individuals will at times fly at rotor swept height, and more commonly at the height of powerlines when undertaking local movements. One family group was observed flying at around canopy height in the pine plantation through the eastern part of the wind farm site. Brolgas could occasionally fly over the pine plantation and have been observed doing so in south-western Victoria, and are likely to sometimes fly at turbine height.

Based on all the above information, breeding habitat was identified at wetlands within the Ramsar site and the farmland in the eastern section of the wind farm site. Turbine-free buffers were then placed around this habitat in accordance with the 2011 Brolga Guidelines, to avoid and minimise potential impacts. This is discussed further in **Section 8.5**.

*Plate 8.1: Brolga pair on a nest in farmland within the eastern section of the wind farm site, 9 July 2021 (Biosis)*




Legend

- Proposed Turbine Location
- Underground Transmission Line
- Roads
- Watercourses
- Project Area
- 3km Buffer
- 10km Buffer
- Parks and Reserves
- Biosis Records
- Brolga records
- Brolga breeding records
- Flight paths
- Database breeding records
- Database non-breeding records

FIGURE 8.1

Brolga records within 10 km of the Project Area

Image Source: ESRI Basemap (2022) Data source: DELWP (2021)

## 8.5 Avoidance and minimisation of impacts

### 8.5.1 Removal and relocation of turbines

As discussed in **Section 8.3.3**, the Level Three Assessment in the 2011 Brolga Guidelines aims to avoid significant impacts on Brolga breeding and flocking habitat through design response and the siting of turbines away from these habitats. No flocking roost sites were identified within the ROI, therefore, no flocking roost home ranges needed to be avoided by the Project. However, breeding sites were identified requiring avoidance (see **Section 8.4**).

The Brolga Guidelines allow for site-specific buffers to be used instead of the default 3.2 km breeding habitat buffers, if site-based data can be gathered to demonstrate the site-specific brolga breeding home ranges to avoid. In line with this approach, site-specific turbine-free buffers have been applied for several locations within the wind farm site (see **Figure 8.2**). These buffers cover areas where the turbines and powerlines overlapped with known Brolga habitat, areas of frequent Brolga activity, and habitat most suitable for breeding, including:

- Three wetlands on farmland in the eastern section of the wind farm site
- Wetland within a blue gum plantation to the north-east of the wind farm site
- Two wetlands on farmland near Heywood.

In addition, buffers have been applied at suitable habitat with likely breeding activity at Long Swamp and associated wetlands within the Ramsar site and other suitable habitat within 3 km of the wind farm site not recorded by Biosis but based on aerial photography interpretation. A buffer was also applied on the identified non-flocking roost at Swan Lake.

Movement corridors were identified during Biosis' field investigations in which Brolgas were observed to be walking, foraging or flying. Turbine-free movement corridors are not required under the 2011 Brolga Guidelines but were applied to protect movement pathways known to be used by Brolgas and other birds in the area to further reduce the collision risk. A 300 m-wide turbine-free buffer was applied to these movement corridors to further minimise potential impacts on Brolga. These buffers are shown in **Figure 8.2**.

A total of 91 turbines were removed or relocated from the Project's original layout in response varying factors as outlined in **Section 4.3.1.2** of **Chapter 4** ***Project development*****,** this included 57 turbines being removed or relocated in response to the application of Brolga breeding buffers and seven for Brolga movement corridors (see **Figure 8.3**).

### 8.5.2 Relocation and reconfiguration of overline transmission lines

The overhead powerline that was originally positioned down the centre of the farmland to the east of Portland-Nelson Road, was moved to the northern boundary of the property to minimise direct interaction with mapped wetlands. The powerline was also reconfigured to be underground through this area of farmland to remove collision risk.

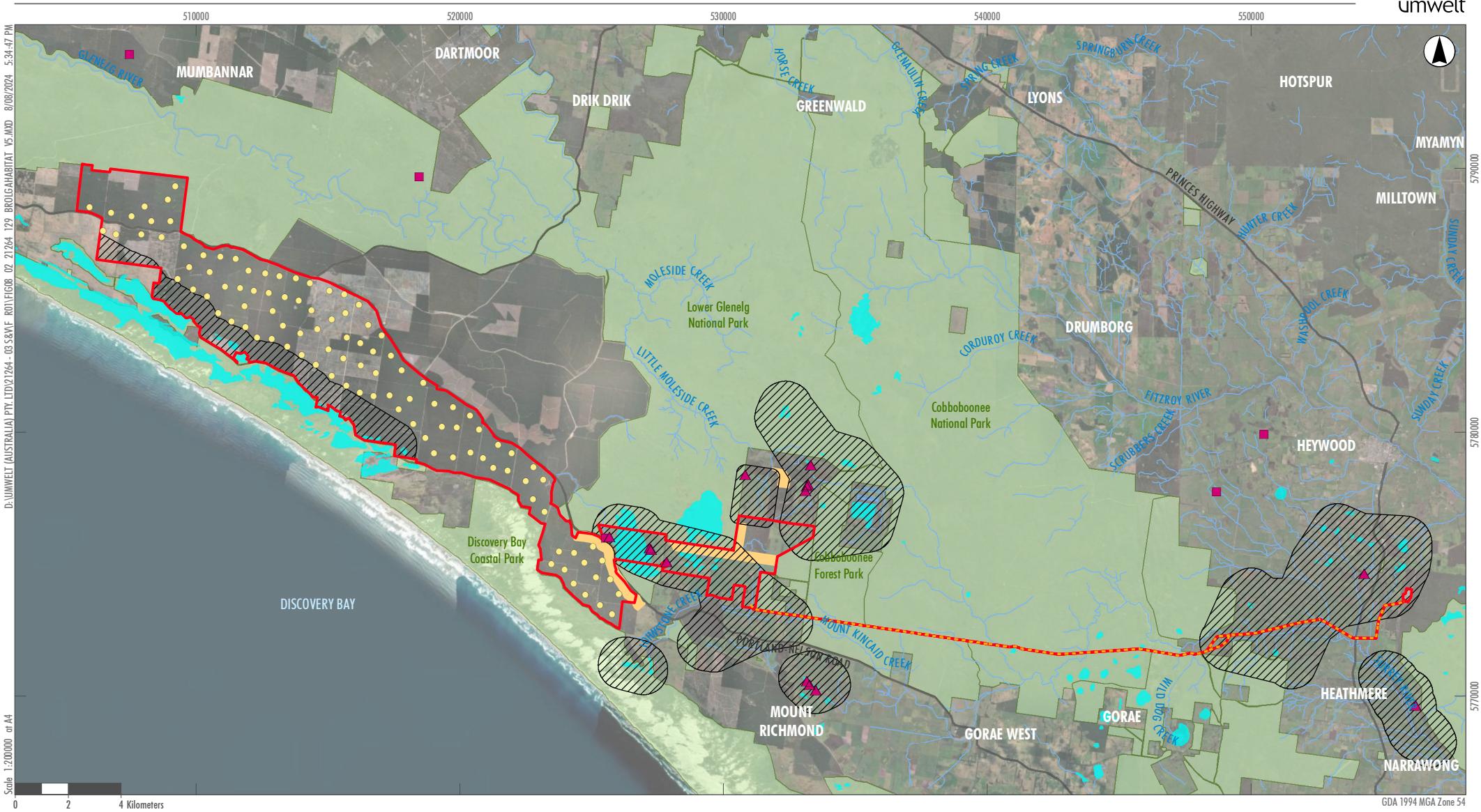
The Project's transmission line that extends from the main wind farm substation to Heywood Terminal Station has also been revised to remove collision risk. Originally, the section of transmission line between the eastern boundary of Cobboboonee Forest Park and Heywood Terminal Station through farmland was proposed to be overhead. But the design has since been reconfigured to be underground, removing the risk of collision with Brolga that utilise wetlands near Heywood Terminal Station.

### 8.5.3 Increase in minimum blade tip height

The Project's indicative wind turbine dimensions originally included a minimum blade tip height of 45 m above ground level (see **Plate 3.1**, **Chapter 3** ***Project description***). The minimum blade tip height was later increased to 60 m above ground level to minimise potential avifauna and bat collision impacts. This is substantially higher than that of turbines installed or proposed for other onshore wind farm projects in south-eastern Australia.

CRM was undertaken to compare the collision risk for turbines with a lower blade tip height of 60 m versus the original 45 m, to estimate the difference in potential collisions due to this design change (the proportion of Brolga flights within the rotor swept area, where they could collide with the moving turbine blades, would be greater for the original 45 m height). The CRM projected that the number of Brolga collisions would be below 0.24 collisions per year for turbines with a minimum blade tip height of 45 m (or approximately one collision every four years on average), which is a 20 % increase compared to a turbine with minimum blade tip height of 60 m.

The results of the CRM are discussed further in **Section 8.7.1**. Refer also to **Chapter 4** ***Project development*** for further information on design changes made to minimise potential environmental impacts of the Project.



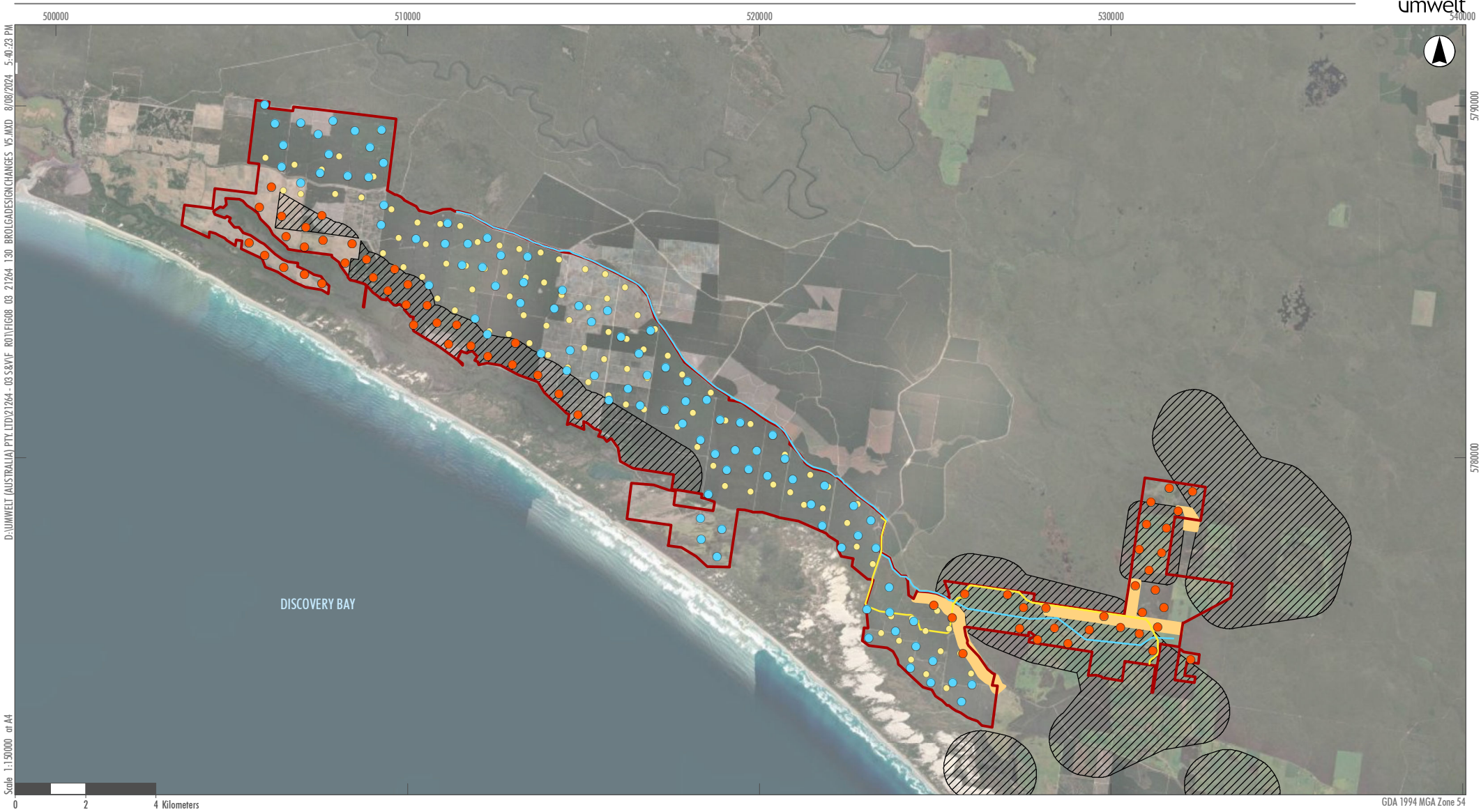

Legend

- Proposed Turbine Location
- Biosis Brolga breeding records
- Database Brolga breeding records
- DELWP Current Wetlands
- Underground Transmission Line
- Roads
- Watercourses
- Project Area
- Brolga Breeding Habitat Buffers
- Brolga 300m Movement Corridors
- Parks and Reserves

FIGURE 8.2

Turbine-free buffers on brolga breeding habitat and movement corridors

Image Source: ESRI Basemap (2022) Data source: DELWP (2021)




Legend

- Original turbine layout
- Turbines removed or relocated
- Proposed Turbine Location
- 275 kV powerline - original location
- 275 kV powerline - current location
- Previous Project Area
- Brolga 300m Movement Corridors
- Brolga Breeding Habitat Buffers

FIGURE 8.3

Project design changes to minimise impacts on Brolga

Image Source: ESRI Basemap (2022) Data source: DELWP (2021)

## 8.6 Construction impacts

Wetland habitat, including Brolga breeding habitat, would not be removed by the Project, so no direct impacts on habitat are anticipated. However, indirect impacts associated with construction work disturbance, and unmanaged groundwater, surface water and sediment run-off from construction has potential to occur.

### 8.6.1 Disturbance to breeding habitat

Construction works have potential to disturb Brolgas through increased noise, traffic, and artificial lighting. Such disturbance can result in pairs moving away from nests, disrupting incubation and separating chicks from adults, which can potentially impact on breeding success.

To minimise disturbance on Brolga and their breeding habitat, construction works will not be undertaken within Brolga breeding buffers when Brolga pairs are present and engaging in breeding activity. This includes but is not limited to turbine foundation excavation and installation, cable installation and road construction. Although Brolga breeding season is generally July to November, numbers can vary annually and so the adaptive mitigation approaches will be implemented during construction. This includes conducting pre-clearance surveys at all known and suitable breeding wetlands and the buffers applied, and postponing construction in proximity to wetlands if breeding activity is detected. Monthly monitoring will also be undertaken of known and suitable wetlands (at a minimum distance of 400 m), with triggers in place to cease construction if breeding is detected (see mitigation measure MM-BR01).

A minimum set back distance of 900 m from the edge of known and suitable Brolga breeding wetlands will also be implemented during construction. No construction works will occur within this setback distance during Brolga breeding season (July to November) (see mitigation measure MM-BR02). Construction of turbines and other infrastructure that are closer than the agreed set-back distance from breeding wetlands will be scheduled to occur only during non-breeding period of the year. Noting the exact timing of the breeding period can vary annually and breeding can occur outside of the generally accepted July–November breeding season, the non-breeding period of the year will be determined by the presence and activity of breeding pairs. All nests will be monitored during construction activities to monitor the presence and breeding activity of pairs (see mitigation measure MM-BR02).

These potential impacts will also be managed in accordance with the mitigation measures specified in **Chapter 14 *Noise and vibration*** and **Chapter 15 *Transport***. The spread of weeds, pathogens and pest animals during construction is unlikely to occur with the implementation of industry best practice methods as specified in the Construction Environmental Management Plan (CEMP) (see mitigation measures in **Chapter 7 *Biodiversity***).

With the implementation of mitigation and monitoring during construction, residual impacts on Brolga are not anticipated to be significant.

### 8.6.2 Unmanaged groundwater and surface water

Dewatered groundwater or surface water runoff have potential to contain sediments and other pollutants. If not managed properly when being discharged from the construction site, discharged water could transport sediments or contaminants into nearby waterbodies, including known or potential Brolga breeding habitats.

Industry standard sediment control measures will be implemented to manage the discharge of collected water so that no substantial increase in sedimentation or contamination is registered within neighbouring waterways and waterbodies. A Sediment, Erosion and Water Quality Management Plan (SEWQMP) will be implemented as part of the Project's CEMP to ensure surface water run-off is managed effectively. Dewatering will be managed through the CEMP. Refer to **Chapter 9 *Surface water, groundwater and groundwater dependent ecosystems*** for further information on proposed mitigation.

Implementation of the SEWQMP and identified mitigation measures would ensure that residual impacts would not be significant.

## 8.7 Operation impacts

Brolgas are known to be at risk of powerline collisions. Three powerline collisions have recently been reported in the Portland district and a landowner near the Project Area has recorded a powerline collision on their property. Collisions from wind turbines are a concern for the Victorian Brolga population; however, despite substantial targeted search effort at multiple operational wind farms within the species' range, no mortalities have been recorded from turbine collisions anywhere to date.

As discussed in **Section 8.5.2,** all overhead powerline and transmission lines that intersected with the applied habitat buffers have been revised to be underground, removing the risk of collision. An assessment of turbines collision risk for the Project is provided in **Section 8.7.1**.

The effects of noise and disturbance from operational turbines on Brolgas is not known, but is considered possible as cranes are known to be sensitive to disturbance and there are some reports of wind farm avoidance behaviour by other species of cranes. As discussed in **Section 8.5** however, turbines have been excluded from important Brolga habitat, thereby minimising the potential for indirect impacts. Other noise emitting infrastructure such as substations have also not been sited within the turbine-free buffers.

### 8.7.1 Turbine collision risk

There is potential for individual Brolga flight paths to intersect with Project infrastructure such as turbines and overhead powerlines given the distribution of potential and known habitat south, north, and east of the Project Area, the frequency of Brolga activity and local movements in farmland areas during their seasonal presence in the area, and regular seasonal movements in and out of the region.

The level three assessment involved the use of modelling to quantify the risk of Brolgas colliding with turbines and powerlines (see **Section 8.3.3**). The CRM involved scenario modelling in which assumptions were made based on empirical information for the species, including published and authoritative unpublished information about the biology of the south-western Victorian Brolga population, and observations of Brolgas within the ROI. Three scenarios were modelled with three different avoidance rates, as it is not certain how well Brolgas might be able to avoid collision with moving blades. Avoidance rate is the capacity for a bird to avoid a collision. For example, an avoidance rate of 0.99 (99 %) equates to one flight in 100 in which a bird does not avoid a turbine.

As shown in **Table 8.1**, the CRM results for the Project indicate a low risk of turbine collisions (less than 0.21 collisions per year, or up to one collision every five years on average). Only one recent Brolga collision has been detected at a Victorian wind farm, despite intensive monitoring over many years at multiple wind farms. It is likely that the turbine avoidance capacity of Brolgas is very high and close to 100%. Investigations of turbine collision avoidance rates for a wide variety of birds indicate that virtually all are above 95%, with most being above 98% and many as high as 99.9%. It is therefore considered that the modelled result for an avoidance rate of 0.99 is likely to be closer to reality than those for lower avoidance rates (0.05 collisions per year or one collision every 20 years on average).

*Table 8.1: Projected number of Brolga collisions with turbines per annum (60m blade clearance)*

| | Turbine avoidance rate | | |
|---|---|---|---|
| | **0.95** | **0.98** | **0.99** |
| **Turbine collisions (annual average total)** | **0.21** | **0.09** | **0.05** |
| *Breeding season (including migration flights)* | *0.14* | *0.06* | *0.03* |
| *Non-breeding season* | *0.07* | *0.03* | *0.02* |

As discussed in **Section 8.5.3**, indicative dimensions for the Project's turbines initially involved a minimum blade tip height of 45 m above ground level. The Brolga collision risk associated with this lower turbine blade height was predicted to be up to 0.24 collisions per year (one collision every four years on average), which is a higher mortality of between one and two additional birds over the Project's lifetime. Therefore, increasing the minimum blade tip height from 45 m to 60 m above ground level has reduced the risk of collision for Brolga.

Potential collision impacts on Brolga as a result of operation of the Project will be managed through the Project's Bird and Bat Adaptive Management Plan (BBAMP) (see mitigation measures in **Chapter 7 *Biodiversity***).

### 8.7.2 Population viability

Based on the results of the CRM, an evaluation of the potential effects of collisions on the south-western Victorian Brolga population was undertaken by Professor Michael McCarthy from the University of Melbourne, using PVA. Simulations were run over a 25-year period. The exact size of the south-western Victorian Brolga population is not known with certainty, so the PVA was run for populations with two different starting sizes, one of 625 individuals and another of 907.

As shown in **Table 8.2** for the minimum estimated current population size of 625 individuals, results from the PVA indicate that the south-west Victorian Brolga population would decline to approximately 556 birds within 25 years without the Project (11 % decline). With the Project, the population would decline to approximately 555 birds assuming a 0.99 avoidance rate, which is a very similar rate of decline over 25 years. The predicted population size was similar for the lower avoidance rates of 0.98 and 0.95.

For the maximum estimated current population size of 907 individuals, the population was predicted to decline to approximately 807 birds within 25 years both without the Project , and with the Project assuming a 0.99 avoidance rate (11% decline). The predicted population size was similar for the lower avoidance rates of 0.98 and 0.95.

*Table 8.2: Expected minimum population size of the south-west Victorian Brolga population for each of the three different turbine avoidance rates used in the CRM*

| | PVA population estimate | |
|---|---|---|
| | **Minimum current population size (625 individuals)** | **Maximum current population size (907 individuals)** |
| No collision mortality due to the Project | 556 | 807 |
| Collision mortality due to the Project (0.95 avoidance rate) | 553 | 805 |
| Collision mortality due to the Project (0.98 avoidance rate) | 554 | 806 |
| Collision mortality due to the Project (0.99 avoidance rate) | 555 | 807 |

The PVA indicates that a net zero impact on the south-west Victorian Brolga population, as required by the 2011 Brolga Guidelines, can be achieved by increasing recruitment into the population by approximately one juvenile every two years. The objective of the 2011 Brolga Guidelines is to ensure a net zero impact on the Victorian Brolga population, by increasing fecundity (fertility) or reducing mortality. The 2011 Brolga Guidelines provide protection and enhancement of breeding sites as an offset option to achieve net zero impact.

Design and development of appropriate compensatory measures that will actually achieve the intended outcome of increasing breeding success and successfully recruiting juveniles into the population that survive to adulthood will need careful planning, consideration and further analysis of achievable options. A Compensation Plan will be prepared prior to Project construction which involves the identification of appropriate compensation strategies to be implemented to ensure net zero impact (see mitigation measure MM-BR02). The Compensation Plan will include quantifiable measures of compensation, with a key focus on the restoration and management of wetlands to improve Brolga breeding success.

## 8.8 Mitigation measures

**Table 8.3** outlines the mitigation measures developed to avoid, minimise, and manage impacts on Brolgas from construction, operation and decommissioning of the Project. These measures are for managing potential residual impacts on Brolga, given that the avoidance and minimisation measures discussed in **Section 8.5** have already been implemented in the Project's layout and design.

Mitigation measures outlined in **Chapter 7 *Biodiversity*** would also be implemented to avoid, minimise, and manage potential impacts on Brolgas.

*Table 8.3: Mitigation measures for Brolga*

| ID | Mitigation measure | Relevant work area | Project phase |
|---|---|---|---|
| **MM-BR01** | **Construction during Brolga breeding season**<br>Construction works will not be undertaken within Brolga (*Antigone rubicunda*) breeding buffers when Brolga pairs are present and engaging in breeding activity (mating displays, nest building, incubating, with unfledged chicks), until chicks fledge and the families dispersed from the buffers. This includes but is not limited to cable installation and road construction but excludes substation works. Brolga breeding buffers are as per the buffers shown in **Figure 11.1** to **Figure 11.3** of the **Flora and Fauna Existing Conditions and Impact Assessment (Appendix C).**<br>If a new site is found within 3 kilometres of the Project footprint, a breeding buffer will be determined and construction activity will stop within the new breeding buffer. The breeding buffer will be developed using the methodology outlined in the **Brolga Impact Assessment (Appendix D).**<br>Construction activity will also not occur within the Brolga breeding buffers during the breeding season (July–November) even if Brolgas have not been observed during pre-clearance surveys, to ensure construction does not prevent Brolgas from breeding in those areas in any given season. Although Brolga breeding season is generally July to November, numbers can vary annually and so the following adaptive mitigation approaches will be implemented during construction:<br>• Pre-construction clearance surveys will be undertaken at all known and suitable breeding wetlands within the Brolga breeding buffers.<br>• Construction in proximity to any wetlands with breeding activity will be postponed while breeding activity is detected.<br>• Monthly monitoring of known and suitable breeding wetlands within the Brolga breeding buffers with triggers to cease construction while breeding Brolgas are detected in proximity to such wetlands.<br>• Monitoring will be undertaken at a minimum distance of 400 metres to avoid undue disturbance on breeding pairs.<br>The main wind farm substation will be accessed from Portland-Nelson Road via Blacks Road and Mt Kincaid Road to completely avoid disturbance to known breeding pairs. If a pair is observed during construction or operation of the wind farm, adaptive measures will be implemented to monitor the pair, breeding activity and breeding success, and to avoid and minimise potential disturbance impacts. | All areas | Construction |

| ID | Mitigation measure | Relevant work area | Project phase |
|---|---|---|---|
| **MM-BR02** | **Brolga Monitoring and Compensation Plan**<br>A Brolga Monitoring and Compensation Plan will be prepared prior to Project construction in accordance with the I*nterim guidelines for the assessment, avoidance, mitigation and offsetting of potential wind farm impacts on the Victorian Brolga population* (DSE 2012). The aim of the Brolga Monitoring and Compensation Plan is to achieve net zero impact on the Victorian Brolga population. The Brolga Monitoring and Compensation Plan must be prepared in consultation with the Victorian Department of Energy, Environment and Climate Action (DEECA) and to the satisfaction of the responsible authority.<br>The Brolga Monitoring and Compensation Plan must:<br>• Be implemented for the life of the Project.<br>• Identify the locations of potentially at risk Brolga breeding and migration activities.<br>• Include recommendations in relation to a mortality rate for Brolga that would trigger the requirement for responsive mitigation measures to be undertaken.<br>• Specify who is accountable for implementing the plan and the monitoring required under the plan.<br>• Specify the locations of historical and potential Brolga breeding wetlands that will be enhanced.<br>• Include evidence of landholder agreements to participate in the breeding site enhancement project for its duration.<br>• Include appropriate methods of enhancement.<br>• Include monitoring and reporting requirements.<br>Implementation of the Brolga Monitoring and Compensation Plan must commence before the development starts, and must be to the satisfaction of the responsible authority in consultation with DEECA.<br>Compensatory measures to achieve net zero impact on the Victorian Brolga population, from modelled collision impacts resulting from the Project operation must include selection and management of wetland habitats to improve Brolga breeding success. Approximately one juvenile every two years will need to be added to the population based on the population viability analysis, for an estimated 0.21 annual mortality from wind farm operation.<br>The population viability analysis must be re-run on the basis of a final Project design to provide an indication of the level of positive management that would be required to achieve a zero net impact on the south-eastern Australian Brolga population. | All areas | Design |

## 8.9 Conclusion

A Brolga Impact Assessment was undertaken in accordance with the *Interim guidelines for the assessment, avoidance, mitigation and offsetting of potential wind farm impacts on the Victorian Brolga population* to assess potential impacts of the Project on the Victorian Brolga population and inform avoidance, mitigation and management measures.

Biosis recorded the presence of 11 Brolga breeding pairs and identified the assumed presence of an additional five pairs within three kilometres of the Project Area. Three of these pairs were located within farmland wetlands in the eastern section of the wind farm site. Two other breeding pairs were recorded nearby, outside of the wind farm site, with additional pairs confirmed near the eastern end of the transmission line corridor. Brolgas were also observed flying in these areas.

Site-specific buffers were applied to Brolga breeding habitat and movement corridors which resulted in the removal or relocation of 53 turbines from the original Project layout. The overhead powerline that was originally positioned down the centre of the farmland to the east of Portland-Nelson Road was also changed to underground and moved to the northern boundary of the property, to further minimise collision risk and potential impacts on Brolga habitat. The section of the Project's external transmission line that extends between the eastern boundary of Cobboboonee Forest Park and Heywood Terminal Station through farmland has also been revised from overhead to underground to remove collision risk.

With the implementation of these avoidance measures, CRM results for the Project indicate a low risk of turbine collisions (less than 0.21 collisions per year, or up to one collision every five years on average). Only one recent Brolga collision has been detected at a Victorian wind farm, despite intensive monitoring over many years at multiple wind farms. It is likely that the turbine avoidance capacity of Brolgas is very high and close to 100%. Investigations of turbine collision avoidance rates for a wide variety of birds indicate that virtually all are above 95%, with most being above 98% and many as high as 99.9 %. It is therefore considered that the modelled result for an avoidance rate of 0.99 is likely to be closer to reality than those for lower avoidance rates (0.05 collisions per year or one collision every 20 years on average).

Results from the PVA indicate that the south-west Victorian Brolga population would decline to a similar number both with and without the Project, from 625 birds to approximately 556 birds within 25 years without the Project, and to approximately 555 birds within 25 years with the Project (assuming a 0.99 avoidance rate). The predicted population size was similar for the lower avoidance rates of 0.98 and 0.95.

The PVA indicates that a net zero impact on the south-west Victorian Brolga population, as required by the 2011 Brolga Guidelines, can be achieved by increasing recruitment into the population by approximately one juvenile every two years. A Compensation Plan will be prepared prior to Project construction involving the identification of appropriate compensation strategies to be implemented to ensure net zero impact, in accordance with the 2011 Brolga Guidelines. The Compensation Plan will include quantifiable measures of compensation, with a key focus on the restoration and management of wetlands to improve Brolga breeding success.

Construction works have potential to disturb Brolgas through increased noise, traffic, and artificial lighting. Such disturbance can result in pairs moving away from nests, disrupting incubation and separating chicks from adults, which can potentially impact on breeding success. However, with the implementation of mitigation and monitoring, including setback distances and restrictions on construction activities during breeding activities, residual impacts on Brolga during construction are not anticipated to be significant.

It is therefore considered that the Project satisfies the relevant Brolga (biodiversity) evaluation objective specified in the EES Scoping Requirements, to avoid and minimise adverse effects on biodiversity values, including listed species and habitat for these species.

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