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Goyder South Hybrid Renewable Energy Facility – Stage 1

Stage 1A and Stage 1B Bird Adaptative Management Plan Annual Implementation Report 2024

Final

September 2025

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NEOEN
GOYDER SOUTH
GOYDER RENEWABLES ZONE

Goyder South Hybrid Renewable Energy Facility – Stage 1

Stage 1A and Stage 1B Bird Adaptative Management Plan Annual Implementation Report 2024

Final

Prepared by
Umwelt (Australia) Pty Limited

On behalf of
Neoen Australia Pty Ltd

Project Director: Travis How
Project Manager: Emma Tremain
Report No.: 31492/R08
Date: September 2025

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This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

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Acknowledgement of Country

Umwelt acknowledges the Traditional Owners of Country throughout Australia and their continuing values, culture and connection to the land, waters and sky.

We pay our respects to Elders past and present.

The below image is from the artwork *Yapung Maryiyang* (Pathway Forward) by Saretta Fielding.

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Document Status

Rev No.	Reviewer Name	Date	Approved for Issue Name	Date
V1	Jessica Skewes	24/09/2025	Travis How	24/09/2025
V2	Emma Tremain	26/09/2025	Travis How	26/09/2025

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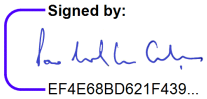
Declaration of Accuracy

In making this declaration, I am aware that section 491 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) make it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulation 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this decision.

Signed:



Full name: Pedro Gonçalves

Position: Chief Operating Officer

Organisation: Neoen Australia Pty Ltd on behalf of Goyder Wind Farm 1 Pty Ltd; Goyder Wind Farm 1B Pty Ltd

EPBC Referral Number: 2021/8958 and 2021/8957

Name of Action Management Plan this document and declaration refers to: *Goyder South Hybrid Renewable Energy Facility – Stage 1: Stage 1A and Stage 1B Bird Adaptive Management Plan Annual Implementation Report 2024*.

Date: 26 September 2025

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Executive Summary

Neoen Australia Pty Ltd (Neoen) is developing the Goyder South Hybrid Renewable Energy Facility (the Goyder South Project) between Burra and Robertstown in the Mid North of South Australia (SA). The Project combines wind, solar and energy storage in one integrated project and will be capable of delivering a steady, reliable, dispatchable output of power throughout the day and night.

Currently three stages have been constructed, including Stage 1A with 38 wind turbine generators (WTGs), Stage 1B with 37 WTGs, and the Overhead Transmission Line (OTL) and substation, which are collectively referred to as Goyder South Wind Farm Stage 1 (GSWF; the Project).

WTGs have the potential to impact upon birds, including threatened and migratory bird species protected by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and other bird species, including raptors, such as the Wedge-tailed Eagle (*Aquila audax*). As such, Neoen are implementing the *Goyder South Hybrid Renewable Energy Facility Stage 1A and Stage 1B Bird Adaptive Management Plan* (BAMP) (EBS Ecology 2024) to effectively monitor for any impacts to birds during operation of the Stage 1A and Stage 1B wind farms, from (but not limited to) wind turbine strikes and, if any impacts are detected, to implement management measures to mitigate any impacts, where practicable.

To do this, the BAMP identifies bird species of concern and relevant trigger levels for management responses. Then the BAMP outlines a Bird Monitoring Program, which includes bird utilisation surveys (BUS), raptor nest activity monitoring, a long-term WTG collision monitoring program and periodic carcass persistence (scavenger activity) and searcher efficiency trials, as well as recording of incidental finds of bird carcasses. All data collected during the Bird Monitoring Program will be analysed and used to understand bird activity across the Stage 1A and Stage 1B wind farms. Furthermore, the results of the Bird Monitoring Program will be used to inform an adaptive management framework to ensure that no significant impacts to EPBC Act listed bird species are likely to occur as a result of the project, and that potential impacts to other bird species (such as raptors) are minimised and mitigated, where practicable.

As part of implementing the BAMP, Neoen propose to prepare an annual BAMP implementation report which includes reporting on the Bird Monitoring Program and implementation of adaptive management actions undertaken in accordance with the BAMP. Implementation of the BAMP commenced with the first BUS undertaken in December 2023, prior to commissioning of Stage 1A commencing on 4 April 2024. As such, this *Goyder South Hybrid Renewable Energy Facility – Stage 1: Stage 1A and Stage 1B Bird Adaptive Management Plan Annual Implementation Report 2024* has been prepared and covers implementation of the BAMP from December 2023 until December 2024 (inclusive).

BUS were undertaken on a seasonal basis (summer; autumn; winter; spring) to record all bird species observed and contribute to understanding bird utilisation across the Stage 1A and Stage 1B Project Areas. A total of 7,329 individual birds, comprising 76 species, were recorded across four seasonal BUS surveys. The bird species recorded were predominately common grassland and woodland bird species, which aligns with the available habitat that consists mainly of grassland and cropping paddocks with some remnant woodlands.

One EPBC Act listed species, the Southern Whiteface (*Aphelocephala leucopsis leucopsis*), was observed, while two species listed as Rare under the NPW Act were observed, including the Elegant

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Parrot (*Neophema elegans*) and the Black Falcon (*Falco subniger*). The Black Falcon is a raptor species, which is potentially at risk of collision with wind farm infrastructure. As it was not previously identified as potentially relevant to the Goyder South Project and potentially at risk of collision with wind farm infrastructure, it has been added to the species of concern (listed in **Appendix A**).

A total of 877 birds from 15 different species were recorded at flight heights considered as being at-risk of collision with WTGs (i.e. at Rotor-swept Area (RSA) height), which equates to 11.9% of the total number of birds recorded via BUS survey. Of these 15 species, four were raptors, three were waterbirds, five were native species commonly found in grasslands and three were introduced species. However, none of the 15 species are listed under the EPBC Act and only one species, the Black Falcon, is listed under the NPW Act.

The absence of EPBC Act listed bird species observed suggests that the risk of impact (i.e. via WTG collision) to these species by the Stage 1A and Stage 1B wind farms is low. However, it is also acknowledged that 12 months of seasonal BUS data comprising 12 survey days, represents only a snapshot of bird activity during that 12-month period, and is therefore limited. Collection of more data during future BUS surveys will allow for statistical analysis and stronger conclusions.

Raptor nest activity monitoring was undertaken for known Wedge-tailed Eagle (WTE) nests to determine if they were in suitable condition for nesting and whether the nests are active and successful in fledging young. Of the five WTE nests known to occur within the Stage 1A and Stage 1B Project Areas, one was active, two were inactive and two were no longer present in 2024. The active nest was considered successful as it contained two large WTE chicks and is an early indication that WTEs are currently living and breeding successfully within the Stage 1B Project Area.

Long-term WTG collision monitoring was undertaken on a quarterly basis (i.e. once every three months) to detect potential impacts to EPBC Act listed bird species and other bird species as a result of WTG collision. Two quarterly WTG collision monitoring surveys were completed in 2024, in August and November. However, the monitoring was limited to commissioned WTGs within Stage 1A, as commissioning of WTGs in Stage 1B did not commence until after the November 2024 survey.

While no bird carcasses were observed during the 2024 WTG collision monitoring program, five feather-spots (see **Glossary**) were observed, including three Australian Magpie (*Gymnorhina tibicen*) and two Galah (*Eolophus roseicapilla*), neither of which are listed under the EPBC Act or NPW Act.

In addition to the feather-spots observed via the WTG collision monitoring program, four incidental finds were recorded in 2024, including two carcasses (Brown Falcon and Nankeen Kestrel) and two feather-spots (Galah and Australian Magpie). All four were found at different WTGs and none of the species are listed under the EPBC Act or NPW Act.

Results of the first scavenger activity and searcher efficiency trial undertaken previously within the Stage 1A and Stage 1B Project Areas in March 2023 suggest that small bird carcasses are removed later (7.8 days) than large bird carcasses (2.7 days), while a detection rate of 90.0% for the small bird model and 96.6% for the large bird model resulted in an overall carcass detection rate at the Project of 93.1%.

Results of the two scavenger activity and searcher efficiency trials undertaken in winter (19 August to 17 September 2024) and spring (11-22 November 2024), are slightly different, with small bird carcasses removed in 3.9 days, medium bird carcasses removed in 2.6 days and large bird carcasses removed in 3.2 days, while the overall carcass detection rate was 77.8%. These results will be used in conjunction with WTG collision monitoring data to calculate mortality estimates for the GSWF.

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While a total of two carcasses and seven feather-spots have been recorded during the Bird Monitoring Program in 2024, no trigger level impact has been detected. As such, the adaptive management framework protocol was not required to be implemented, and no adaptive management action was required or undertaken.

As 12 months of WTG collision monitoring data is not yet available and no collision monitoring was undertaken in Stage 1B, the annual mortality rate for each EPBC Act listed bird species and other bird species (i.e. species of concern) has not been estimated for 2024. Similarly, as 12 months of WTG collision monitoring has not yet occurred and no WTG collision monitoring was undertaken in Stage 1B, WTG risk ratings have not yet been reviewed or adjusted.

In accordance with the BAMP, the Bird Monitoring Program will continue to be implemented throughout 2025 and the data collected will continue to be used to inform the adaptive management framework to ensure that no significant impacts to EPBC Act listed bird species are likely to occur as a result of the Project and that potential impacts to other bird species (such as raptors) are minimised and mitigated, where possible.

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Abbreviations

Abbreviation	Full Word or Phrase
AM	AM stands for ante meridiem, meaning "before midday," and designates the 12-hour period from midnight to noon.
BAMP	Bird Adaptive Management Plan
BOM	Bureau of Meteorology
BUS	Bird Utilisation Survey
CI	Confidence Interval
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DOC	Day old chicken
EBS Ecology	Environmental and Biodiversity Services Pty Ltd – trading a EBS Ecology (which is now Umwelt)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GDA2020	Geocentric Datum of Australia 2020
GPS	Global Positioning System
GSWF	Goyder South Wind Farm Stage 1 (including Stage 1A, Stage 1B and the Overhead Transmission Line and Substation)
MGA2020	Map Grid of Australia 2020
MNES	Matter(s) of National Environmental Significance
Neoen	Neoen Australia Pty Ltd
NPW Act	*National Parks and Wildlife Act 1972*
OTL	Overhead Transmission Line
PDI Act	*Planning, Development and Infrastructure Act 2016* (SA)
PM	PM stands for post meridiem, meaning "after midday," and refers to the 12-hour period from noon to midnight.
RSA	Rotor-swept Area
SA	South Australia(n)
sp.	Species
Spp.	Species (plural)
ssp.	Subspecies
Std. Dev.	Standard Deviation
Std. Err.	Standard Error
Umwelt	Umwelt (Australia) Pty Ltd
VA(s)	Vegetation Association(s)
WTE	Wedge-tailed Eagle
WTG(s)	Wind Turbine Generator(s)
%	Percentage

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Glossary

Term	Definition / Meaning
Abundance	The number of individuals recorded at a survey site or a specific location
Commission / Commissioning	EPBC 2021/8957 and 2021/8958 Approval definition: All activities, including turning of turbines, after the components of the first complete wind turbine are installed. The date on which **commission/commissioning** commences is the first date on which the blades of the first completed wind turbine start rotating.
Department	EPBC 2021/8957 and 2021/8958 Approval definition: The Australian Government agency responsible for administering the EPBC Act. At the time of writing this report, DCCEEW is the Department.
Feather-spot	A collection of five or more feathers found grouped together in a manner that suggests a dead bird was once at the location.
Feather-spot (Scavenger Trial)	A collection of feathers remaining after a carcass used in a scavenger trial has been scavenged.
Observation	A record of a bird sighting within the Stage 1A or Stage 1B wind farms (or at the BUS Site at Porter Lagoon).
Occupancy	The number of sites at which a species is recorded. May be expressed as a whole number (i.e., 3 [of a maximum of 13 sites] or a percentage [i.e., 23.08% of sites].
Operation	EPBC 2021/8957 and EPBC 2021/8958 Approval definition: All activities that occur after the components of the final wind turbine generator are installed.
the Project	Goyder South Wind Farm Stage 1 (incorporating Stage 1A, Stage 1B and the OTL and Substation).
Project Area	The area (or boundary) in which the Project is located, as shown in mapping.
Species richness	The number of different species represented in an ecological community, landscape, region or survey site.
Suitably qualified bird expert	EPBC 2021/8958 Approval definition: A person who has relevant professional qualifications and at least 3 years of work experience designing and implementing plans for the conservation management of birds, who can identify bird species, and who can give an authoritative assessment and advice practices to avoid and mitigate impacts on birds using relevant protocols, standards, methods and/or literature. If the person does not have appropriate professional qualifications, the person must have at least 10 years of work experience identifying bird species, and designing and implementing plans for the conservation management of birds.

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1.0 Introduction

Neoen Australia Pty Ltd (Neoen) is developing the Goyder South Hybrid Renewable Energy Facility (the Goyder South Project) between Burra and Robertstown in the Mid North of South Australia (SA). The Project combines wind, solar and energy storage in one integrated project and will be capable of delivering a steady, reliable, dispatchable output of power throughout the day and night. As the Project will total up to $3 billion in investment, Neoen are implementing the Project in separate stages, with each stage having its own legal entity, construction contracts and financing packages.

Currently three stages have been constructed, including Stage 1A with 38 wind turbine generators (WTGs), Stage 1B with 37 WTGs, and the Overhead Transmission Line (OTL) and substation, which are collectively referred to as Goyder South Wind Farm Stage 1 (GSWF; the Project) and shown in **Figure 1.1**.

WTGs have the potential to impact upon birds, including threatened and migratory bird species protected by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and other bird species, including raptors, such as the Wedge-tailed Eagle (*Aquila audax*). As such, Neoen are implementing the *Goyder South Hybrid Renewable Energy Facility Stage 1A and Stage 1B Bird Adaptive Management Plan* (BAMP) (EBS Ecology 2024) to effectively monitor for any impacts to birds during operation of the Stage 1A and Stage 1B wind farms, from (but not limited to) wind turbine strikes and, if any impacts are detected, to implement management measures to mitigate any impacts, where practicable.

To do this, the BAMP identifies bird species of concern and relevant trigger levels for management responses. Then the BAMP outlines a Bird Monitoring Program, which includes bird utilisation surveys (BUS), raptor nest activity monitoring, a long-term WTG collision monitoring program and periodic carcass persistence (scavenger activity) and searcher efficiency trials, as well as recording of incidental finds of bird carcasses. All data collected during the Bird Monitoring Program will be analysed and used to understand bird activity across the Stage 1A and Stage 1B wind farms. Furthermore, the results of the Bird Monitoring Program will be used to inform an adaptive management framework to ensure that no significant impacts to EPBC Act listed bird species are likely to occur as a result of the project, and that potential impacts to other bird species (such as raptors) are minimised and mitigated, where practicable.

As part of implementing the BAMP, Neoen propose to prepare an annual BAMP implementation report which includes reporting on the Bird Monitoring Program and implementation of adaptive management actions undertaken in accordance with the BAMP. Implementation of the BAMP commenced with the first BUS undertaken in December 2023, prior to commissioning of Stage 1A commencing on 4 April 2024. As such, this *Goyder South Hybrid Renewable Energy Facility – Stage 1: Stage 1A and Stage 1B Bird Adaptive Management Plan Annual Implementation Report 2024* has been prepared and covers implementation of the BAMP from December 2023 until December 2024 (inclusive).

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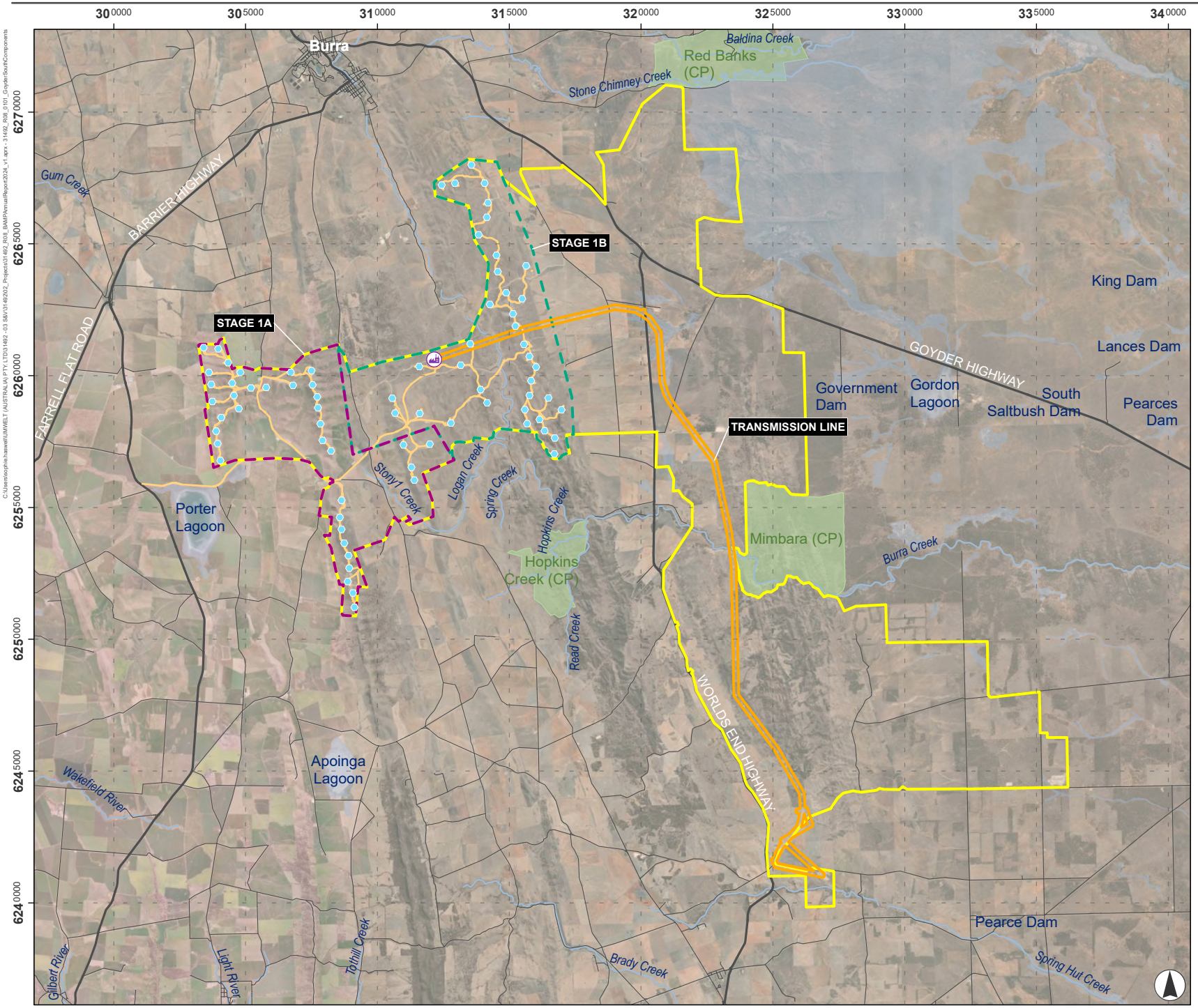
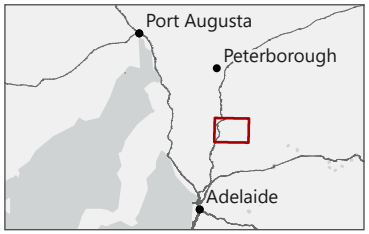


Figure 1.1

Components of the Goyder South Wind Farm Stage 1 Project

Legend

- Project Area
- Stage 1A
- Stage 1B
- Trasmission line
- WTG
- Substation west
- Access track
- Main road
- Local road
- Water course
- Water body
- NPWSA reserve



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2.0 Background

2.1 Legislative Approvals and Conditions

Approvals in accordance with the Commonwealth EPBC Act and South Australian *Planning, Development and Infrastructure Act 2016* (PDI Act) have been sought and obtained for the Project. Conditions of approval associated with both the EPBC Act approvals and PDI Act approval, are outlined in the BAMP.

2.1.1 Important Dates Associated with EPBC Act Approval Conditions

Important dates associated with the EPBC approval conditions are outlined in **Table 2.1**.

Table 2.1 Important Dates Associated With the EPBC Approval Conditions

	Stage 1A (EPBC 2021/8958)	Stage 1B (EPBC 2021/5897)
EPBC Approval Date	5/07/2022	13/07/2022
Commencement of the Action Date	7/07/2022	23/08/2022
Minister's Approval of the BAMP Date	23/02/2024	23/02/2024
Implementation of the BAMP Start Date	19/12/2023	19/12/2023
Commissioning Commencement Date	4/04/2024	11/11/2024
Operation Start Date	21/03/2025	4/04/2025

Neoen is contracted by Goyder Wind Farm 1 Pty Ltd (Stage 1A) and Goyder Wind Farm 1B Pty Ltd (Stage 1B) to ensure compliance with the EPBC Act and PDI Act approvals on behalf of the Goyder South Project.

2.2 Bird Adaptive Management Plan (BAMP)

As outlined previously, Neoen are implementing the BAMP to effectively monitor for any impacts to birds during operation of the Stage 1A and Stage 1B wind farms, from (but not limited to) wind turbine strikes and, if any impacts are detected, to implement management measures to mitigate any impacts, where practicable. The BAMP identifies bird species of concern and relevant trigger levels for management responses, both of which are reiterated in **Section 2.2.2** and **Section 2.2.3**, respectively, below for clarity. Then the BAMP outlines a Bird Monitoring Program, where all data collected is analysed and used to inform an adaptive management framework to ensure that no significant impacts to EPBC Act listed bird species are likely to occur as a result of the Project, and that potential impacts to other bird species (such as raptors) are minimised and mitigated, where practicable.

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2.2.1 Background Information Within The BAMP

Refer to the BAMP for important background information on the GSWF Project, including specifications of the Stage 1A and Stage 1B WTGs as well as reference reports and supporting documentation. Furthermore, the BAMP provides important background information on the following for the GSWF and the BAMP:

- Site characteristics and ecological values.
- Topography.
- Weather patterns and prevailing winds.
- Vegetation Associations.
- Floodplains, wetlands, lakes and watercourses within 25 km of the Project site.
- Woodland habitats within the Project Area.
- Bird species at the GSWF, including:
    - Relevant EPBC Act listed bird species (and their likelihood of occurrence within the Goyder South Stage 1A and Stage 1B Project Areas).
    - Other bird species (potentially relevant to the Project).
- Species of concern (also see **Section 2.2.2** below).
- Potential impacts and risks for turbine collision, including:
    - Potential likelihood of collision with wind farm infrastructure.
- Thresholds for significant impacts.
- Trigger levels for management responses to bird collisions (also see **Section 2.2.3** below).

2.2.2 Species of Concern

The BAMP identifies species of concern for which trigger levels for management responses apply. The BAMP is applicable to all of the bird species listed in BAMP Table 10 and BAMP Table 11, which are also included in **Appendix A**. The BAMP also applies to any native species subsequently found to occur at the site and that are listed as:

- Threatened or migratory under provisions of the EPBC Act.
- Threatened on schedules of the SA *National Parks and Wildlife Act 1972* (NPW Act).
- Non-threatened species of 'at risk' birds that were not previously known to occur or predicted to occur at the site and/or have not been included in Table 11 in the BAMP.

As stated in the BAMP, these are collectively termed 'species of concern'. Introduced / non-native species are not included as 'species of concern'.

A total of 11 relevant EPBC Act listed threatened and/or migratory bird species have been identified as species of concern (which are listed in Table 10 in the BAMP; see **Appendix A**).

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2.2.3 Trigger Levels for Management Responses to Bird Collisions

The BAMP specifies trigger levels for species of concern which will be used, if required, as triggers for implementation of adaptive management aimed at reducing impacts to a level below the set trigger levels.

Trigger levels for management responses to bird collision are specified in Section 7.2 of the BAMP and are for numbers of bird fatalities detected during carcass searches (WTG collision monitoring) and/or incidental finds. The trigger levels apply for all native avifauna that may use the site and for any avifauna species that are listed as threatened in the future. No trigger level applies to any introduced / non-native avifauna species.

Table 2.2 Trigger Levels For Species of Concern

Species Group	Trigger Level Details
EPBC Act listed threatened and migratory bird species (listed in Table 12 of the BAMP)	A trigger level impact will occur when any carcass; feather-spot; or injured individual of a single species is found under or close to a WTG during any WTG collision monitoring search or incidentally by wind farm personnel.
Other non-threatened bird species (including non EPBC Act listed bird species listed in Table 12 of the BAMP)	A trigger level impact will occur when more than four carcasses or feather-spots of a single species are found under or close to a WTG during any WTG collision monitoring search, and/or incidentally by wind farm personnel, in any two consecutive months.

Source: Table 19 in Section 7.2 of the BAMP.

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3.0 BAMP Bird Monitoring Program

As outlined in the BAMP, the overall environmental objectives of the BAMP are to effectively monitor for any impacts to EPBC Act listed bird species during the operation of the Stage 1A and Stage 1B wind farms from (but not limited to) wind turbine strikes and, if any impacts are detected, to implement the technology, measures and procedures necessary to ensure that impacts are accurately measured, reported and remain insignificant. In addition to EPBC Act listed bird species, the BAMP will also include an on-going monitoring and mitigation protocol for raptor and other bird species that may be impacted by the development. As such, the BAMP will also monitor for any impacts to raptors and other bird species that may be subject to wind turbine strike and propose mitigation measures to minimise impacts, where practicable. Therefore, a Bird Monitoring Program, which involves multiple survey types, is an essential component of the BAMP.

3.1 BAMP Bird Monitoring Program Objectives

As stated in the BAMP, the objectives of the Bird Monitoring Program are to:

- Record which EPBC Act listed bird species, state listed species, and species of concern (e.g., raptors) occur on site.
- Determine whether WTE and other raptor nests are in a suitable condition for nesting and whether the nests are active and successful in fledging young.
- Detect potential impacts to EPBC Act listed bird species and other bird species as a result of WTG collision.
- Identify trigger level impacts.
- Undertake further periodic carcass persistence and searcher efficiency trials (to check if correction factors necessary to estimate total fatalities need revision).
- Record incidental finds of bird carcasses.
- Estimate the number and species of birds suspected to have been killed by collision with turbines, on an annual basis.
- Contribute data and other information to inform an adaptive management framework.

To achieve these objectives, the following surveys and monitoring is proposed to be undertaken:

- BUS.
- Raptor nest activity monitoring.
- Long-term WTG collision monitoring.
- Periodic carcass persistence (scavenger activity) and searcher efficiency trials.
- Opportunistic observations of agricultural practices and pest species.
- Incidental finds of bird carcasses.
- DNA testing.

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3.2 Implementation of the Bird Monitoring Program

Implementation of the Bird Monitoring Program commenced with the first BUS undertaken in December 2023 and continued throughout 2024. Each component of the Bird Monitoring Program undertaken in 2023-2024 is summarised in **Table 3.1**.

Table 3.1 Bird Monitoring Program Components Undertaken in 2023-2024

Survey / Monitoring Type	Method	Timeframe / Frequency	Undertaken / Comments	Reference
BUS	In accordance with BAMP Section 8.3.1.	Each season (summer; autumn; winter; spring) for the first two years; then as outlined in BAMP Section 8.3.1.	• 19-21/12/2023 (summer 2023/24) • 5-7/06/2024 (autumn 2024) • 22/24/07/2024 (winter 2024) • 14-16/10/2024 (spring 2024)	**Section 5.0**
Raptor Nest Activity Monitoring	In accordance with BAMP Section 8.3.2.	Once a year in October / November (each year for twenty years); then once every second year for twenty years.	• 14-16/10/2024 (spring 2024)	**Section 6.0**
Long-term WTG Collision Monitoring	In accordance with BAMP Section 8.3.3.	Quarterly (i.e., once every three months) (for the duration of the Bird Monitoring Program).	• August 2024 • November 2024	**Section 7.0**
Incidental Finds of Bird Carcasses	In accordance with BAMP Section 8.3.6.	No set timeframe or frequency, but recorded when found, during operation of the GSWF.	Four incidental finds occurred and have been reported on.	**Section 7.4**
DNA Testing	In accordance with BAMP Section 8.3.7.	As required, when DNA testing is necessary.	Not required (as all bird carcasses were identified).	**Section 7.5**
Carcass Persistence (Scavenger Activity) and Searcher Efficiency Trials	In accordance with BAMP Section 8.3.4.	Two carcass persistence trials in the first year of the Bird Monitoring Program as outlined in BAMP Section 8.3.4.1. Two searcher efficiency trials in the first year of the Bird Monitoring Program as outlined in BAMP Section 8.3.4.2.	• Winter: 19 August – 17 September 2024 • Spring: 11-22 November 2024	**Section 8.0**
Opportunistic Observations of Agricultural Practices and Pest Species	In accordance with BAMP Section 8.3.5.	Opportunistically (during other monitoring events and regular Project operations).	Undertaken opportunistically during monitoring events.	**Section 9.0**

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Survey / Monitoring Type	Method	Timeframe / Frequency	Undertaken / Comments	Reference
Data Analysis – Annual Mortality Rate	In accordance with BAMP Section 8.4.1.	After 12 months of WTG collision monitoring.	As WTG collision monitoring only commenced in August 2024, 12 months of data is not yet available.	**Section 10.2**
Data Analysis – WTG Risk Rating	In accordance with BAMP Section 8.4.2.	After the initial 12 months of BUS and WTG collision monitoring.	As WTG collision monitoring only commenced in August 2024, 12 months of data is not yet available.	**Section 10.3**
Adaptive Management	In accordance with BAMP Section 9.	As required (refer to the BAMP for details).	Not required in 2024.	**Section 11.0**

3.3 Permits / Approvals / Licences

All Bird Monitoring Program survey and monitoring work was undertaken under the following permits / approvals / licences:

- Scientific Research Permit No. K25613-23; K25613-26; K25613-27 (Department for Environment and Water).
- Wildlife Ethics Committee Approval No. 27/2022 (Wildlife Ethics Committee).
- Scientific Licence No. 158 (Animal Welfare, National Parks and Wildlife SA).

3.4 Relevant Guidelines

All Bird Monitoring Program survey and monitoring work, as well as data and reporting, has been undertaken and prepared in accordance with:

- Survey guidelines for Australia's threatened birds. Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia 2010).
- Guidelines for Biological Survey and Mapped Data (Commonwealth of Australia 2018).
- Guide to providing maps and boundary data for EPBC Act projects (DAWE 2021).

3.5 Spatial Data

All spatial data has been captured or converted to the following coordinate reference system:

- **Datum**: Geocentric Datum of Australia 2020 (GDA2020).
- **Projection**: Map Grid of Australia 2020 (MGA2020), Zone 54.

All location coordinates listed in this report are expressed using this system. Spatial data converted from other coordinate reference systems may have accuracy limitations.

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4.0 Environmental and Meteorological Conditions

4.1 Landscape Context and Vegetation

The Goyder South Project Area is centred on the Bald Hills Range, an area of moderately steep undulating hills interspersed with deep valleys. Outcropping of sedimentary rocks such as siltstone and sandstone occurs on the higher hills, while valley floors contain alluvial deposits of gravel, sand and colluvium. Soils range from shallow clays and clay-loams over rock on the hills to deep loams and clay-loams in valleys.

As explained in the BAMP, majority of the vegetation within the Stage 1A and Stage 1B Project Areas has been modified as a result of historical and current agricultural practices. Whilst patches of native vegetation remain, majority of the Project Areas consist of *Austrostipa* spp. (Spear Grass) Mixed Grassland (43.35% of Stage 1A and 74.34% of Stage 1B). Furthermore, 57.82% of vegetation in Stage 1A is grassland (of different types) and 37.02% is cropping, while only 4.88% is woodland, as outlined in **Table 4.1**. Similarly, 76.98% of vegetation in Stage 1B is grassland (of different types) and 11.68% is cropping, while only 10.52% is woodland (**Table 4.1**).

Table 4.1 Vegetation Types Within the Stage 1A and Stage 1B Project Areas

Vegetation Type	Stage 1A		Stage 1B	
	Extent Within Project Area (ha)	% of Project Area	Extent Within Project Area (ha)	% of Project Area
Grassland	2,146.11	57.82	3,432.04	76.98
Cropping	1,374.09	37.02	520.84	11.68
Woodland	181.04	4.88	469.14	10.52
Other (amenity/urban)	10.16	0.27	36.14	0.81
Totals	**3,711.40**	**100%**	**4,458.16**	**100%**

Native grasslands are generally in poor condition with minimal variation throughout the Project Areas. All vegetation in the Project Areas is impacted by grazing and weed encroachment. Grassland associations are heavily grazed, with palatable emergent shrubs often over-utilised with little or no regeneration occurring.

Vegetation Associations (VAs) across the Stage 1A and Stage 1B Project Areas are shown in **Figure 4.1** and **Figure 4.2**. Out of the 38 WTGs in Stage 1A, 33 are located entirely within grassland vegetation, four are located across vegetation consisting of grassland and cropping and one is located entirely within grassland vegetation but has woodland vegetation within approximately 100 m of the WTG tower (**Figure 4.1**). Out of the 37 WTGs in Stage 1B, 24 are located entirely within grassland vegetation, six are located across vegetation consisting of woodland and grassland, three are located within grassland with emergent woodland, three are located within woodland and one is located entirely within cropping **Figure 4.2**.

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Refer to the BAMP for more information on topography, weather patterns and prevailing winds, vegetation associations, floodplains, wetlands, lakes and watercourses within the region, and woodland habitats within the Stage 1A and Stage 1B Project Areas.

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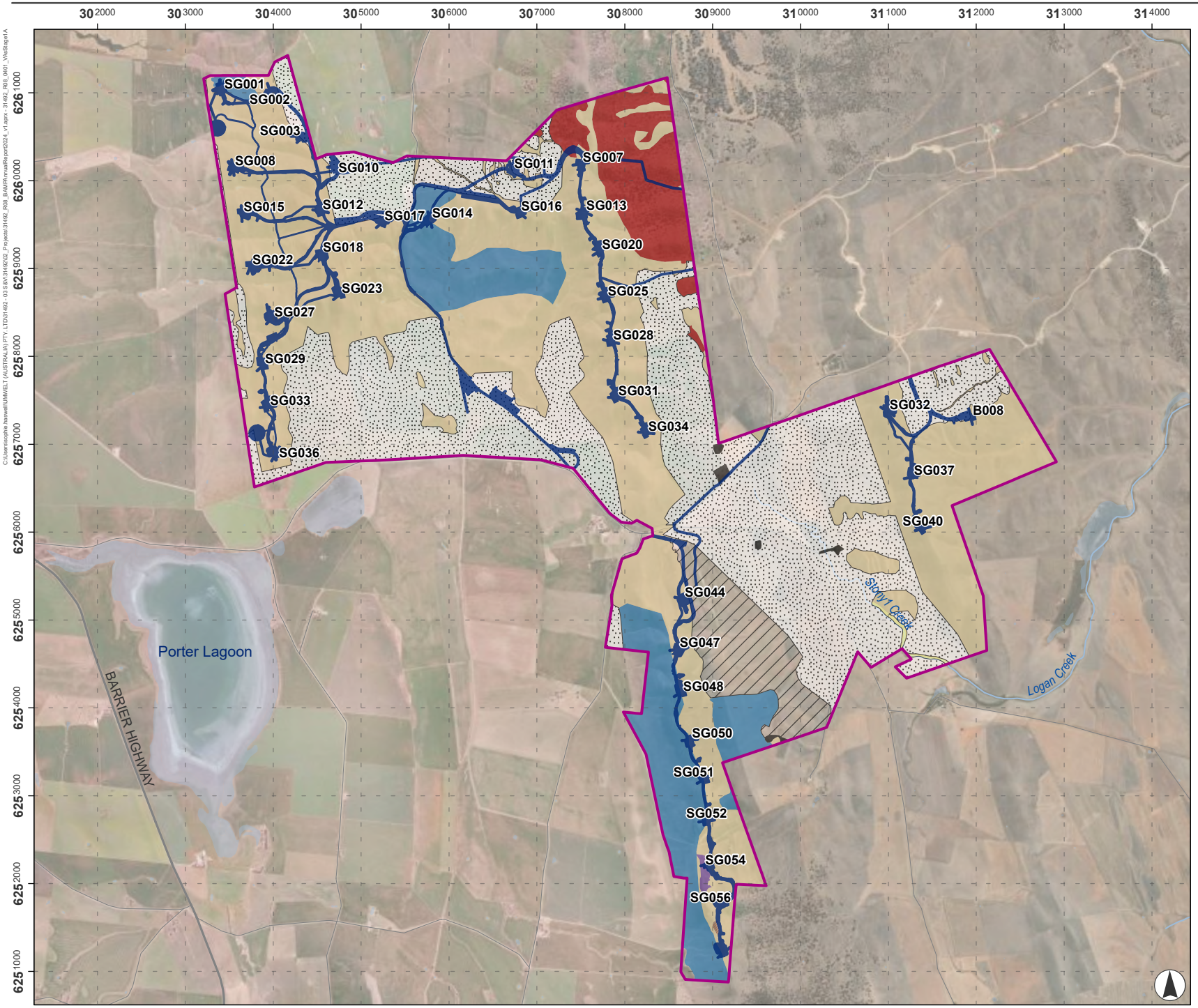
Figure 4.1

WTGs and VAs Across the Stage 1A Project Area

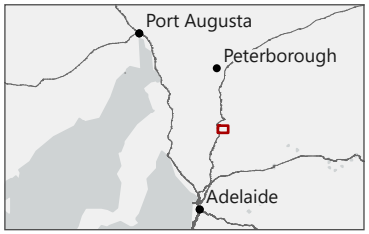


Legend

- Stage 1A
- Goyder South Infrastructure

Vegetation association

- 2: *Lomandra multiflora ssp. Dura* (Hard Mat-rush) / *Lomandra effusa* (Scented Mat-rush) Mixed Open Grassland
- 4: *Eucalyptus odorata* (Peppermint Box) Closed Woodland
- 6: *Eucalyptus leucoxylon ssp. Pruinosa* (Inland South Australian Bluegum) Open Woodland
- 8: *Austrostipa spp.* (Spear Grass) Mixed Grassland
- 9: Exotic Grassland
- 10: *Callitris gracilis* (Southern Cypress Pine) Low Open Woodland
- 11: *Juncus sp.* (Rush) / *Cyperus gymnocaulos* (Spiny Flat-sedge) Mixed Low Closed Sedgeland
- 24: *Allocasuarina verticillata* Open Woodland over *Bursaria spinosa ssp.* and *Austrostipa spp.*
- Amenity / Urban
- Cropping



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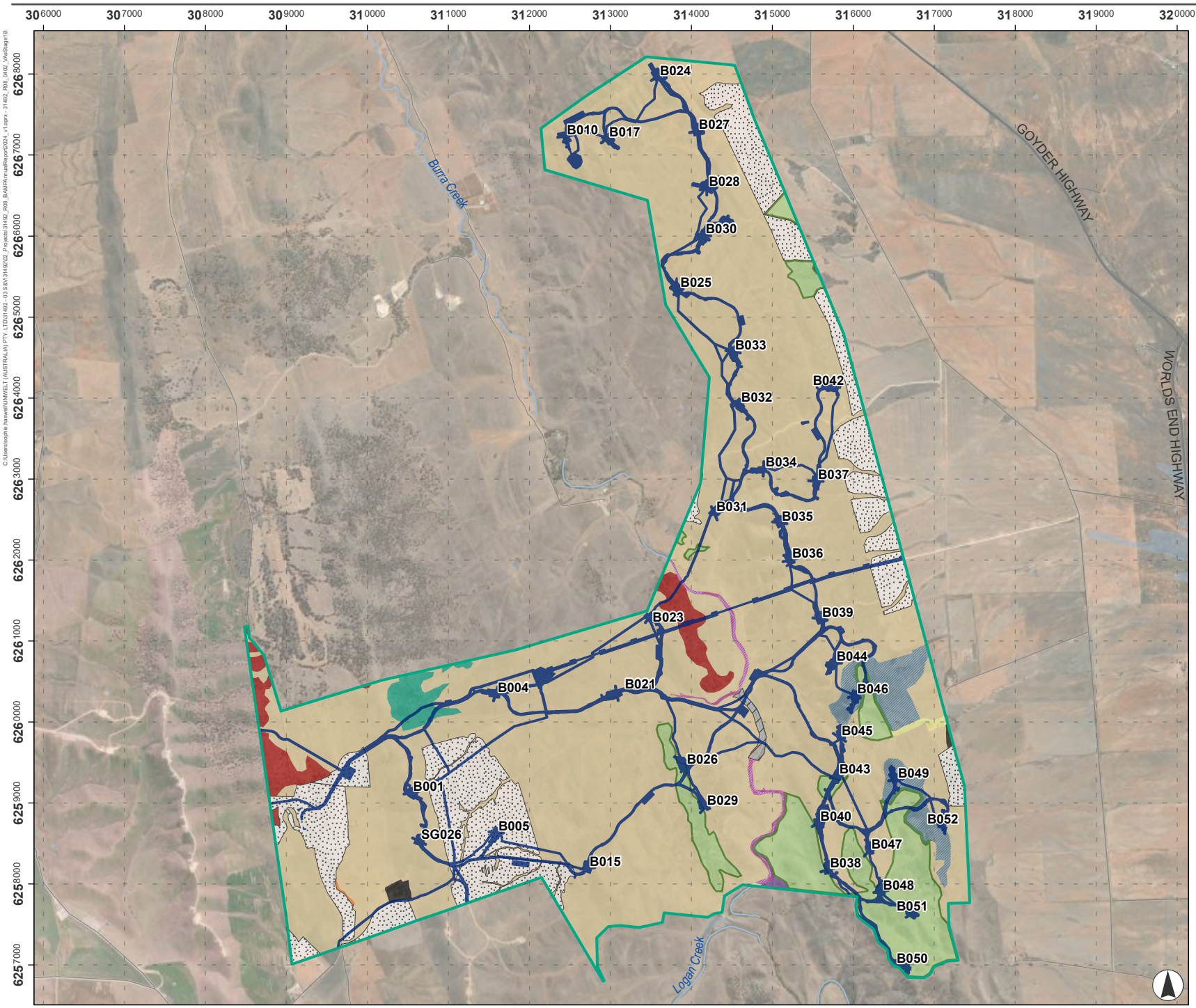


Figure 4.2

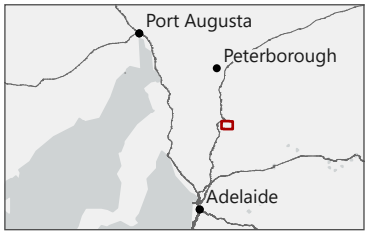
WTGs and VAs Across the Stage 1B Project Area

Legend

- Stage 1B
- Goyder South Infrastructure

Vegetation association

- 3: *Eucalyptus porosa* (Mallee Box) Open Woodland
- 4: *Eucalyptus odorata* (Peppermint Box) Closed Woodland
- 6: *Eucalyptus leucoxylon ssp. Pruinosa* (Inland South Australian Bluegum) Open Woodland
- 7: *Eucalyptus camaldulensis ssp. camaldulensis* (River Redgum) Woodland
- 8: *Austrostipa spp.* (Spear Grass) Mixed Grassland
- 9: Exotic Grassland
- 10: *Callitris gracilis* (Southern Cypress Pine) Low Open Woodland
- 11: *Juncus sp.* (Rush) / *Cyperus gymnocaulos* (Spiny Flat-sedge) Mixed Low Closed Sedgeland
- 14: *Triodia irritans* (Spinifex) Grassland +/- *Emergent Eucalyptus oleosa ssp. oleosa* (Red Mallee)
- 17: *Phragmites australis* (Common Reed) Grassland
- Amenity / Urban
- Cropping



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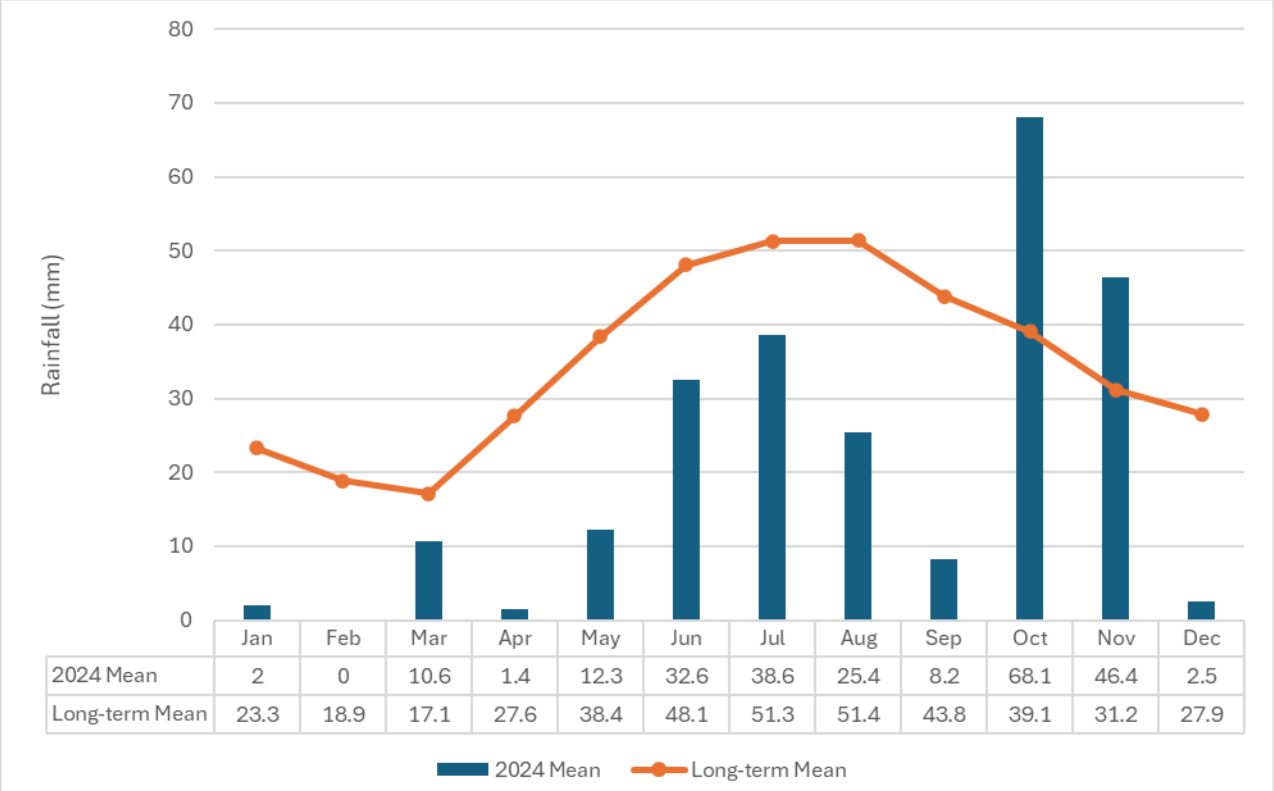
4.2 Average Temperature and Rainfall

The Project Area is located between Burra and Robertstown in the Mid North of SA (**Figure 1.1**), where the climate consists of mild winters and hot summers, with rain occurring predominantly in the winter months (NY NRM 2018).

The long-term average annual rainfall at Burra is 418 mm, with winter (June, July and August) receiving the highest rainfall, and summer (January, February and March) receiving the lowest rainfall (**Graph 4.1**). However, in 2024, while there was above average rainfall in mid-late spring (October and November), there was significantly below average rainfall in all other months, with an annual total of 248.1 mm.

Rainfall data has been obtained from the Bureau of Meteorology (BOM) Burra Community School weather station (#21077) (BOM 2025a), which is located approximately 10 km north of the Stage 1A and Stage 1B Project Areas.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2024 Mean	2	0	10.6	1.4	12.3	32.6	38.6	25.4	8.2	68.1	46.4	2.5
Long-term Mean	23.3	18.9	17.1	27.6	38.4	48.1	51.3	51.4	43.8	39.1	31.2	27.9

Graph 4.1 Mean Monthly Rainfall in 2024 Compared with Long-term Mean Monthly Rainfall

January and February are the warmest months, with mean temperatures ranging from a low of about 15°C and a high of about 30°C, while June and July are the coolest months, with mean temperatures ranging from a low of about 4°C and a high of about 13°C (**Graph 4.2**). As temperature data is not available at the Burra Community School weather station, temperature data has been obtained from the BOM Clare High School weather station (#21131) (BOM 2025b) which is approximately 30 km west of the Project Areas.

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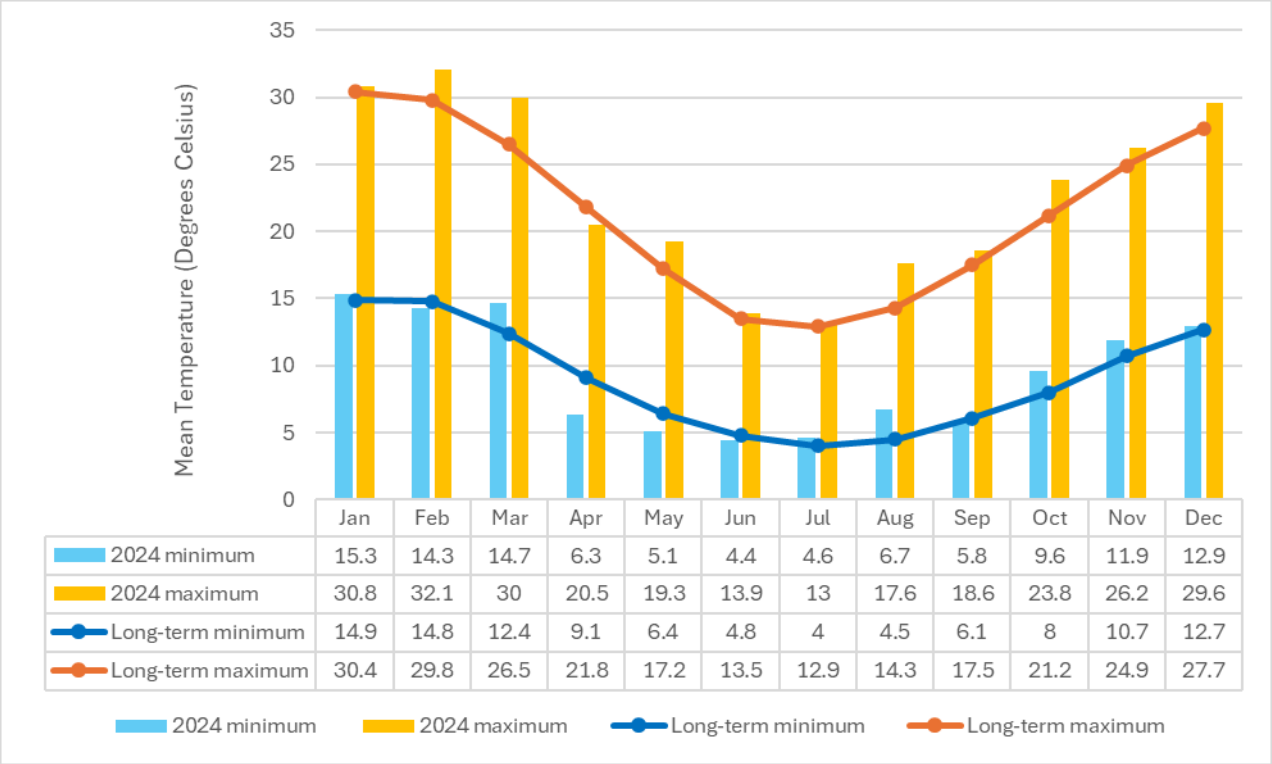

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2024 minimum	15.3	14.3	14.7	6.3	5.1	4.4	4.6	6.7	5.8	9.6	11.9	12.9
2024 maximum	30.8	32.1	30	20.5	19.3	13.9	13	17.6	18.6	23.8	26.2	29.6
Long-term minimum	14.9	14.8	12.4	9.1	6.4	4.8	4	4.5	6.1	8	10.7	12.7
Long-term maximum	30.4	29.8	26.5	21.8	17.2	13.5	12.9	14.3	17.5	21.2	24.9	27.7

Graph 4.2 Mean Minimum and Maximum Daily Temperatures Each Month in 2024 Compared with Long-term Mean Minimum and Maximum Daily Temperatures

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5.0 Bird Utilisation Survey

The objective of the Bird Monitoring Program to *record which EPBC Act listed bird species, state listed species, and species of concern (e.g., raptors) occur on site* will be achieved via undertaking Bird Utilisation Surveys (BUS).

The BAMP requires BUS to be undertaken each season (summer; autumn; winter; spring) for the first two years of operation (refer to **Glossary** for definition of operation). As operation of Stage 1A started on 21/03/2025, seasonal BUS will continue through to Summer (January) 2027 (inclusive). Refer to BAMP Section 8.3.1 for BUS frequency after the first two years of operation.

Although operation did not start until 21/03/2025 (Stage 1A) and 4/04/2025 (Stage 1B), the first BUS was undertaken on 19-21 December 2023, as implementation of the BAMP had to commence before commissioning (which started on 4/04/2024 for Stage 1A), which is why BUS started prior to operation (refer to **Glossary** for definition of commissioning).

5.1 BUS Sites

Thirteen (13) BUS sites were established across a range of different vegetation associations (VAs) in the Project Area to optimise the detection of bird assemblages, as outlined in **Table 5.1** and shown in **Figure 5.1**. Of the 12 other BUS Sites, five are located within Stage 1A (3,714.56 ha) and seven are located within Stage 1B (4,448.59 ha), across six different VAs.

The habitat type at each BUS site is broadly categorised as Lagoon, Grassland or Woodland. Seven BUS sites (53.8%) are located within Grassland habitat and five sites (38.5%) are located within Woodland habitat, while one site (7.7%) (BUS Site 1) is located at the edge of Porter Lagoon (a large body of water which occurs outside of the Stage 1A and Stage 1B Project Areas) and includes grassland at the edge of the lagoon as well as planted woodland adjacent to the lagoon. BUS Site 1 is located at Porter Lagoon, to survey specifically for migratory wader species which might specifically utilise that habitat.

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Table 5.1 BUS Site Locations, Vegetation Associations and Habitat Types

BUS Site	Stage 1A / Stage 1B	Latitude	Longitude	Vegetation Association	Habitat Type
1	N/A	-33.820983	138.871917	Grazed Mixed Grassland next to Porter Lagoon	Lagoon
2	Stage 1A	-33.788291	138.881921	*Austrostipa* spp. (Spear Grass) mixed grassland (VA 8)	Grassland
3	Stage 1A	-33.778633	138.919149	*Eucalyptus leucoxylon* ssp. *pruinosa* (Inland South Australian Blue Gum) open woodland (VA 6)	Woodland
4	Stage 1A	-33.841198	138.931216	*Lomandra multiflora* ssp. *dura* (Hard Mat-rush) / *Lomandra effusa* (Scented Mat-rush) mixed open grassland (VA 2)	Grassland
5	Stage 1B	-33.780569	138.953826	*Eucalyptus odorata* (Peppermint Box) closed woodland (VA 4)	Woodland
6	Stage 1B	-33.792663	138.991502	*Eucalyptus porosa* (Mallee Box) open woodland (VA 3)	Woodland
7	Stage 1B	-33.749617	139.006506	*Austrostipa* spp. (Spear Grass) mixed grassland (VA 8)	Grassland
8	Stage 1B	-33.779672	138.993384	*Eucalyptus leucoxylon* ssp. *pruinosa* (Inland South Australian Blue Gum) open woodland (VA 6)	Woodland
9	Stage 1B	-33.800154	139.013894	*Eucalyptus porosa* (Mallee Box) open woodland (VA 3)	Woodland
10	Stage 1A	-33.788661	138.902949	*Lomandra multiflora* ssp. *dura* (Hard Mat-rush) / *Lomandra effusa* (Scented Mat-rush) mixed open grassland (VA 2)	Grassland
11	Stage 1A	-33.809142	138.968271	*Austrostipa* spp. (Spear Grass) mixed grassland (VA 8)	Grassland
12	Stage 1B	-33.780426	139.017011	*Triodia irritans* (Spinifex) Grassland +/- Emergent *Eucalyptus oleosa* ssp. *oleosa* (Red Mallee) (VA 14)	Grassland
13	Stage B	-33.720469	138.996799	*Austrostipa* spp. (Spear Grass) mixed grassland (VA 8)	Grassland

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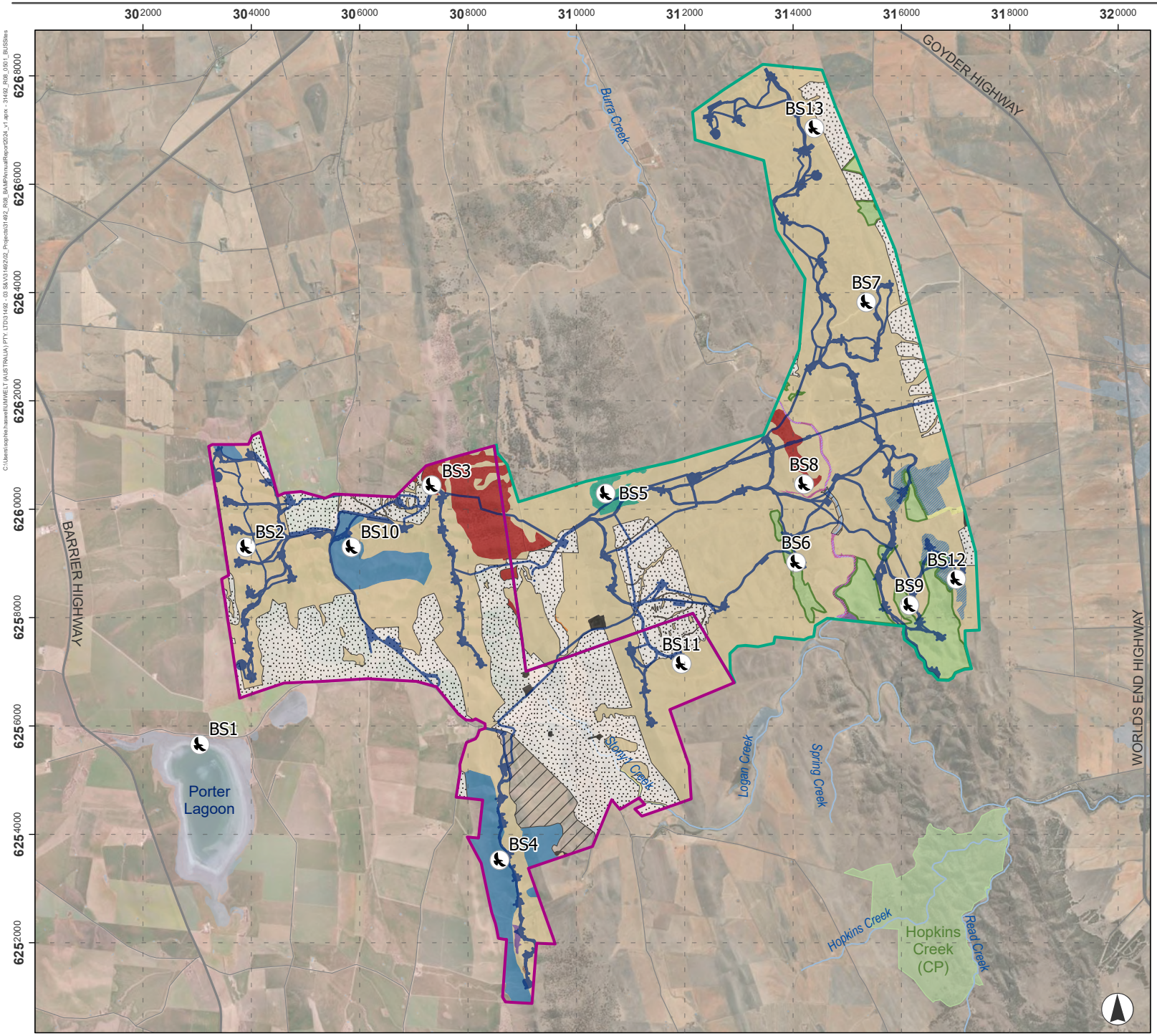


Figure 5.1

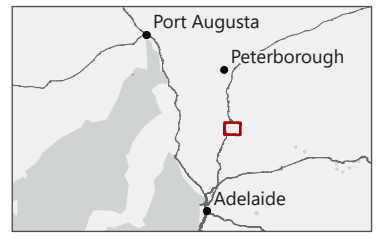
BUS Site Locations And Vegetation Associations

Legend

- Stage 1A
- Stage 1B
- Goyder South Infrastructure
- BUS site

Vegetation association

- 2: *Lomandra multiflora ssp. Dura* (Hard Mat-rush) / *Lomandra effusa* (Scented Mat-rush) Mixed Open Grassland
- 3: *Eucalyptus porosa* (Mallee Box) Open Woodland
- 4: *Eucalyptus odorata* (Peppermint Box) Closed Woodland
- 6: *Eucalyptus leucoxylon ssp. Pruinosa* (Inland South Australian Bluegum) Open Woodland
- 7: *Eucalyptus camaldulensis ssp. camaldulensis* (River Redgum) Woodland
- 8: *Austrostipa spp.* (Spear Grass) Mixed Grassland
- 9: Exotic Grassland
- 10: *Callitris gracilis* (Southern Cypress Pine) Low Open Woodland
- 11: *Juncus sp.* (Rush) / *Cyperus gymnocaulos* (Spiny Flat-sedge) Mixed Low Closed Sedgeland
- 14: *Triodia irritans* (Spinifex) Grassland +/- *Emergent Eucalyptus oleosa ssp. oleosa* (Red Mallee)
- 17: *Phragmites australis* (Common Reed) Grassland
- 24: *Allocasuarina verticillata* Open Woodland over *Bursaria spinosa ssp.* and *Austrostipa spp.*
- Amenity / Urban
- Cropping



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5.2 BUS Methodology

5.2.1 20 Minute 2-ha Bird Survey

At each BUS site, a 2-ha area was traversed for 20 minutes in accordance with the standard Birdlife Australia 2-ha survey method (Birdlife Australia 2025), originally adapted from Lyon (1986), and in accordance with the *Survey guidelines for Australia's threatened birds. Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia, 2010).

The surveys were conducted twice at each site, once in the morning and once in the afternoon. Surveys were undertaken in typical seasonal weather conditions (summer, autumn, winter and spring).

For each bird observed at a BUS site during a 20-minute survey, the following data is collected:

- Species.
- Number of individuals (of each species) observed.
- Flight height above ground (m) (minimum and maximum) (where relevant).
- Distance of bird species from observer.
- Behaviour, including:
    - Flying in a single direction – FLM.
    - Flying (hovering or circling) over or around a single point – FLH.
    - Foraging (feeding) on ground – FOG.
    - Foraging on trees or shrubs – FOT/FOS.
    - Perching/resting/walking on ground – ROG.
    - Perching/resting/climbing on trees or shrubs – ROT/ROS.
    - Flight details: height (m) and direction flown, where possible and relevant.

Flight heights and distances are estimated with the aid of existing meteorological masts, wind turbines, landmarks and mapping, aided by the use of a range-finder in the absence of these reference points.

All birds observed or heard while traversing a BUS Site are recorded, including those that are observed directly outside of the 2-ha area within the same vegetation association, up to a distance where a positive species identification could reasonably be obtained. Birds observed outside of the 2-ha area are recorded as being offsite.

Behaviour is assigned to birds as per the activity undertaken upon initially being observed, or if disturbed by surveyors, prior to being disturbed. For example, for birds commonly observed for the first time after being flushed, behaviour would be recorded as resting on ground or foraging on ground, as relevant.

Flight height details are recorded for all bird species observed flying during the surveys. These details are used to help assess the potential collision risk of the bird species (refer to **Section 5.4)**.

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5.2.2 Opportunistic Bird Observations

Opportunistic observations are recorded separately and will be used to supplement BUS Site observations across the Project Area and to detect any species that are not recorded during the BUS Site surveys.

All opportunistic records of 'at risk' bird species (such as threatened species and raptors) and species not already observed during BUS Site surveys, are recorded while travelling between BUS Sites and throughout the Project Area. For each opportunistic observation, the following information is recorded:

- Bird species.
- Number of individuals.
- Flight height and direction (where relevant).
- Behaviour.
- Location (e.g. via Global Positioning System (GPS) waypoint).

5.2.3 Limitations

Where possible, survey windows aim to be flexible and can be planned to coincide with favourable seasonal weather conditions as much as possible, including low wind and clear skies. Due to scheduling, this is not always possible and sometimes surveys are undertaken during inclement weather, which is likely to impact observations during the survey. Furthermore, each seasonal survey (13 BUS Sites surveyed twice) occurs over a 3-day period, which represents only a snapshot of avian activity and utilisation at the time of the survey.

BUS Site 9 and BUS Site 12 were not surveyed during the Summer 2023 (19-21 December) BUS as the sites could not be accessed due to ongoing construction works.

The results detailed in this report consist of descriptive statistics (i.e., not inferential statistics) that display and summarise the avian observations and data collected at specific sites at a given point in time. Seasonality and variation in local weather conditions may impact on avian activity and thus survey results, as birds are known to be generally less active when climatic conditions are challenging (i.e., low/high temperatures, strong winds/rain).

Estimation of flight height is prone to observer error and may not accurately represent the actual risk of bird collision with WTGs, based on their actual distance from the ground and the height of the WTGs. Additionally, the survey methods do not account for the time a bird species spends within the Rotor-swept Area (RSA), which is likely to influence the actual level of risk. For example, the level of risk of collision for a bird species which spends 5% of its time airborne in the RSA, is likely to be different to a bird species which spends 50% of its time airborne in the rotor-swept risk area.

5.3 BUS Results

Four BUS surveys were undertaken at the following times:

- 19-21 December 2023 (summer).
- 5-7 June 2024 (autumn).

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- 22-24 July 2024 (winter).
- 14-16 October 2024 (spring).

5.3.1 Weather Conditions During BUS Surveys

Weather conditions during the four BUS surveys are presented in **Table 5.2**. Rainfall data has been obtained from the BOM Burra Community School weather station (#21077) (BOM 2025a), and temperature data has been obtained from the BOM Clare High School weather station (#21131) (BOM 2025b).

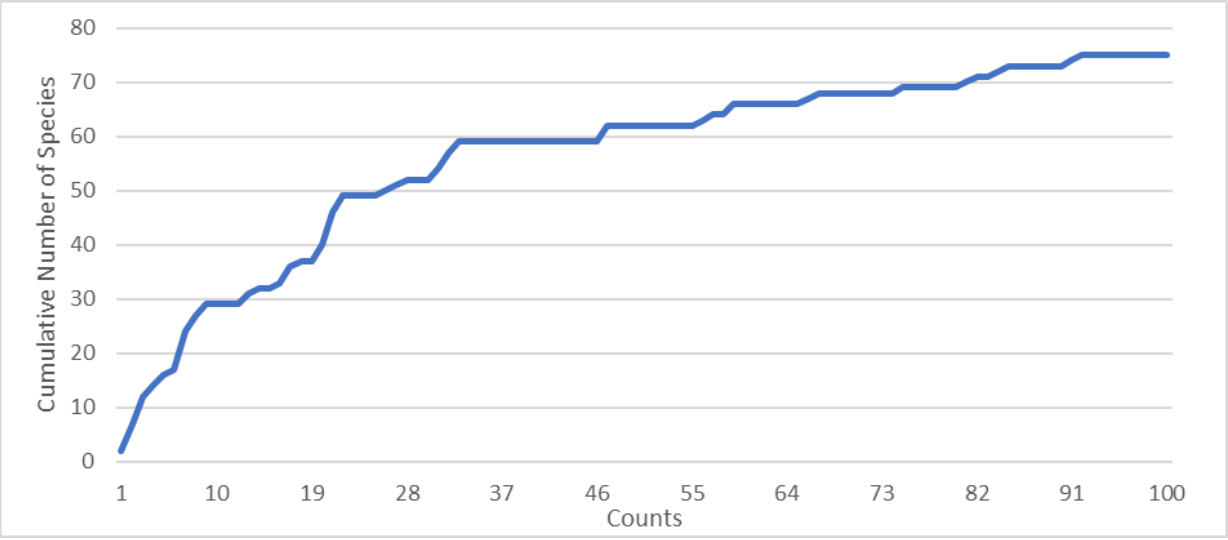
Table 5.2 Weather Conditions During BUS Surveys

Season	Survey Period	Rain During Survey (BOM 2025a)	Rain Prior to Survey* (BOM 2025a)	Lowest Temperature (BOM 2025b)	Highest Temperature (BOM 2025b)	Wind Speed
Summer	19-21/12/2023	0 mm	26.2 mm	8.6°C	24.9°C	N/A
Autumn	5-7/06/2024	0.4 mm	12.2 mm	2.1°C	15.2°C	Low
Winter	22-24/07/2024	4.0 mm	33.6 mm	-0.5°C	19.2°C	Low
Spring	14-16/10/2024	17.6 mm	0.3 mm	15.0°C	28.5°C	Low

*Rain up to 2 weeks prior to survey.

5.3.2 Survey Adequacy

The cumulative number of bird species observed across the four seasonal surveys is plotted in **Graph 5.1**. A total of 75 different bird species were observed via a total of 100 counts (with each 20 minute 2- ha bird survey undertaken at a BUS Site being a 'count'). Note that as two BUS Sites were unable to be surveyed in the summer 2023 BUS survey (i.e. four counts (2 AMs and 2 PMs) were missed), the total number of counts is 100 (two counts (AM and PM) completed at each BUS Site, across 13 BUS Sites, over four BUS surveys).



Graph 5.1 The Cumulative Number of Bird Species Recorded During BUS Surveys

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The first BUS survey (the summer 2023 survey which involved 22 counts) recorded a total of 49 species; the second survey (autumn with all 26 counts) recorded 13 new species; the third survey (winter survey with all 26 counts) recorded six new species; and the fourth survey (spring survey with all 26 counts) recorded seven new species.

The shape of the curve in **Graph 5.2** demonstrates that after the initial BUS survey, the number of new species being recorded is starting to plateau, demonstrating that the surveys provide a representative picture of the diversity of bird species using the Project Areas and surrounding region (i.e. Porter Lagoon). Given that different assemblages of bird species may occupy the site across different seasons, it is expected that the number of new species detected will plateau even further in subsequent years of survey, as all seasons have now been surveyed on at least one occasion.

In accordance with the bird species listed in BAMP Table 10 and BAMP Table 11 (see **Appendix A**) and species of concern (**Section 2.2.2**), only one NPW Act listed threatened species, which was not previously known to occur or predicted to occur at the site, the Black Falcon (*Falco subniger*) was recorded via BUS survey. One individual of this species was recorded at Site 10 during the summer 2023 survey. No other records of this species have been made during the three other BUS survey periods. Refer to **Section 5.3.4.3** for more information.

Furthermore, and in accordance with the bird species listed in BAMP Table 10 and BAMP Table 11 (see **Appendix A**) and species of concern (**Section 2.2.2**), only two non-threatened species, which were not previously known to occur or predicted to occur at the site, including the Australian Reed Warbler (*Acrocephalus australis*) and Varied Sitella (*Daphoenositta chrysoptera*), were recorded via BUS survey. The Australian Reed Warbler was heard on two separate days, offsite from BUS Site 8, in a nearby creek line, during the spring 2024 survey period. No other records of this species have been made during the three other survey periods. The Varied Sitella was recorded opportunistically in the Project Area across all four survey periods. However, neither of these species are considered to be a species potentially at risk for collision with wind farm infrastructure. As such, they are not considered to be a species of concern.

Low occurrence of opportunistic observations of unique species outside of dedicated BUS sites, suggests that survey sites have adequate coverage of the Stage 1A and Stage 1B Project Areas and represent the diversity of species present.

5.3.3 Bird Species Diversity and Abundance

A total of 76 bird species (72 native and four introduced species) were observed across the four seasonal surveys, including 75 species at BUS sites and one additional species observed opportunistically. Bird species recorded were predominately common grassland and woodland species, which aligns with the available habitat that consists mainly of grassland and cropping paddocks with some remnant woodlands. A complete list of all species observed across all four seasonal surveys at BUS sites, as well as opportunistic observations, is provided in **Appendix B**.

A total of 7,329 individuals were recorded across the four seasonal survey periods, including 6,419 individuals observed at BUS sites and 910 individuals observed opportunistically. Bird abundance varied over the four seasonal surveys, being greatest in summer (December) 2023 with 3,628 individuals recorded, and lowest during spring (October) 2024 with 759 individuals recorded (**Table 5.3**).

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Table 5.3 Bird Species Composition and Abundance During Each Survey Period (Excluding Opportunistic Observations)

Survey Period	Seasonal Species Richness	Seasonal Avian Abundance	Avian Abundance Per Season as a Percentage of all Observations (%)
Summer 2023	49	3,628	56.5
Autumn 2024	40	918	14.3
Winter 2024	43	1,114	17.3
Spring 2024	47	759	11.8
Total	**75**	**6,419**	**100**

Across all four seasonal survey periods, the most abundant native species was Grey Teal (*Anas gracilis*) followed by Galah (*Eolophus roseicapilla*) and Australian Magpie (*Gymnorhina tibicen*), accounting for 47.3%, 7.9% and 5.7% of all sightings, respectively. In general, the number of birds recorded at each site was similar, with little variation between the sites, except when large flocks of birds were recorded, such as the group of Grey Teal present on Porter Lagoon at BUS Site 1 or passing flocks of Galahs.

Four introduced species, including Eurasian Skylark (*Alauda arvensis arvensis*), Rock Dove (*Columba livia*), House Sparrow (*Passer domesticus domesticus*) and Common Starling (*Sturnus vulgaris vulgaris*), were observed and accounted for 1.6%, 0.01%, 1.6% and 3.5% of sightings respectively.

5.3.3.1 Seasonal Variation in Diversity and Abundance

Total avian diversity was similar between all four seasonal surveys (**Table 5.3**), however avian abundance varied significantly between seasons. The highest diversity and abundance of bird species recorded at BUS sites was during the summer 2023 survey period when a total of 49 species were recorded, and 3,628 individuals accounting for 56.5% of all individual bird observations across the four seasons. The lowest avian diversity recorded was during the autumn 2024 survey period when a total of 40 bird species were recorded. However, the lowest avian abundance (number of individuals of all species) was recorded in spring 2024, accounting for 11.8% of individual birds recorded across all seasons, which may be as a result of the unfavourable rainy weather conditions during the survey (**Section 5.3.1**).

5.3.3.2 Habitat Variation in Diversity and Abundance

The diversity of species recorded at each BUS site varied from a low of nine at BUS Site 11 (*Austrostipa* spp. (Spear Grass) mixed grassland; Grassland habiata), to a high of 30 at each of the following three Woodland habitat BUS sites, suggesting that higher species diversity is recorded in Woodland habitats:

- BUS Site 5 (Eucalyptus odorata (Peppermint Box) closed woodland)
- BUS Site 6 (Eucalyptus porosa (Mallee Box) open woodland)
- BUS Site 8 (Eucalyptus leucoxylon ssp. pruinosa (Inland South Australian Blue Gum) open woodland).

The total species diversity, together with the number of unique species (which were not recorded at any other habitat type) and the total abundance recorded at each of the three habitat types (Grassland; Woodland; and Lagoon), is presented in **Table 5.4**.

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Table 5.4 Total Species Diversity and Number of Unique Species Recorded at Each Habitat Type

Habitat Type	BUS Site(s)	Total Species Diversity	Number of Unique Species	Total Abundance Recorded
Grassland	2, 4, 7, 10, 11, 12 and 13	36	10	1,340
Woodland	3, 5, 6, 8 and 9	56	31	1,749
Lagoon	1	23	6	3,330

The highest species diversity was recorded at BUS sites within Woodland habitat with 56 species, including 31 unique species (which were not recorded at any other habitat type) recorded, accounting for 74.67% of total species and 41.33% of unique species. Lower species diversity was recorded at BUS sites within Grassland habitats, which recorded 36 species, including 10 unique species, representing 48.00% of overall diversity and 13.33% of unique species.

High diversity was also recorded at BUS Site 1, situated at Porter Lagoon, which recorded a total of 23 species, which despite being a single site, supported 30.67 % of total species and 8% of unique species. This included the following six unique species which were not recorded at any other habitat type or BUS site:

- Red-capped Plover (*Charadrius ruficapillus*)
- Silver Gull (*Chroicocephalus novaehollandiae novaehollandiae*)
- Australian Hobby (*Falco longipennis*)
- Noisy Miner (*Manorina melanocephala*)
- Australian Shelduck (*Tadorna tadornoides*) and
- Masked Lapwing (*Vanellus miles*).

Overall bird abundance was highest at the Lagoon habitat, with 3,330 individual birds recorded, accounting for 51.87% of total abundance (**Table 5.4**). However, this habitat is located outside of the Stage 1A and Stage 1B Project Areas and this value is skewed by observations of 3,037 Grey Teal (*Anas gracilis gracilis*) observed at BUS Site 1 (Porter Lagoon). Furthermore, of these, 3,000 were recorded at BUS Site 1 during the summer BUS survey period, including 1,400 during the PM survey on 19/12/2023 and 1,600 during the AM survey on 20/12/2023.

Within the Stage 1A and Stage 1B Project Areas, Woodland habitat had the highest abundance, with 1749 individual birds recorded, accounting for 27.25% of total abundance recorded, while Grassland habitat had the lowest abundance, with 1340 individual birds recorded, accounting for 20.88% of total abundance recorded.

5.3.4 Species of Concern

Species of concern are outlined in the BAMP and **Section 2.2.2** of this report.

5.3.4.1 EPBC Act Listed Threatened Species

Only one EPBC Act listed species, the Southern Whiteface (*Aphelocephala leucopsis leucopsis*), was observed in the Stage 1A and Stage 1B Project Areas, with it observed during all four BUS surveys. The Southern Whiteface occurs in open woodland and shrubland habitat with an understorey of grasses

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and / or low shrubs. Suitable habitat is usually dominated by grassland or *Eucalyptus* spp., many of which occur in the Project Area (DCCEEW 2023).

The most observations of Southern Whiteface occurred in the autumn 2024 survey when a total of 27 birds were observed across three BUS Sites (**Table 5.5**). Overall, the species was observed at five of the 13 BUS sites including four woodland sites (Site 5, 6, 8 and 9) and one grassland site (Site 7), with the highest number observed at BUS Site 6, where a total of 22 individuals were observed over the four survey periods (**Graph 5.2**). The species was not observed opportunistically.

Table 5.5 Southern Whiteface Abundance and Occupancy During Each BUS Survey Period

Survey Period	Abundance	Occupancy at BUS Sites	Opportunistically Recorded	Total Abundance
Summer 2023	20	3	-	20
Autumn 2024	27	3	-	27
Winter 2024	17	4	-	17
Spring 2024	12	3	-	12

Graph 5.2 Abundance of Southern Whiteface Observed at Each BUS Site (BS) Over the Four BUS Surveys

5.3.4.2 EPBC Act Listed Migratory Bird Species

No EPBC Act listed migratory bird species were recorded during the four survey periods (**Appendix B**). As outlined in the BAMP (Section 8.3.1) seasonal (summer, autumn, winter and spring) BUS will continue to be undertaken for the first two years of operation. After this, BUS will be undertaken twice a year (once in summer (to detect migratory species) and once in Spring (optimal survey time for birds) for operation years 3 – 10 inclusive. The seasons have been selected as they are the optimal survey times for migratory bird species.

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5.3.4.3 NPW Act Listed Species

Two species listed as Rare under the NPW Act were observed, with each only observed within a single survey period (**Table 5.6**). The Elegant Parrot (*Neophema elegans*) was observed during the autumn 2024 survey, with two individuals recorded at Site 5 in woodland habitat (Peppermint Box habitat). The Black Falcon (*Falco subniger*) was observed during the summer 2023 survey, with one individual recorded at Site 10 in grassland habitat (Lomandra Grassland). No additional observations of these species were recorded opportunistically in any of the four survey periods.

Table 5.6 NPW Act Listed Threatened Species Observed During Each BUS Survey

Scientific Name	Common Name	NPW Act Status	Summer 2023	Autumn 2024	Winter 2024	Spring 2024
Neophema elegans	Elegant Parrot	R	-	2	-	-
Falco subniger	Black Falcon	R	1	-	-	-

NPW Act: *National Parks and Wildlife Act 1972*. **Conservation Codes**: R: Rare.

The Black Falcon is a raptor species which is potentially at risk of collision with wind farm infrastructure. However, it was not previously identified as a bird species potentially relevant to the Goyder South Project and potentially at risk of collision with wind farm infrastructure (refer to BAMP Section 4.2). As such, it has been added to the species of concern listed in **Appendix A**.

5.3.4.4 Non-threatened species of 'at risk' birds (not previously known to occur or predicted to occur at the site)

Although the Australian Reed Warbler (*Acrocephalus australis*) and Varied Sitella (*Daphoenositta chrysoptera* were not previously known to occur or predicted to occur at the site, neither are listed as threatened or migratory under the EPBC Act, nor are they listed as threatened under the NPW Act. Furthermore, neither is considered to be a species potentially 'at risk' for collision with wind farm infrastructure. As such, neither are considered to be a species of concern.

5.3.5 Raptors and Waterbirds

The data from all four survey periods was used to evaluate the number of raptors and waterbirds utilising the Project Area and surrounding region.

5.3.5.1 Raptors

Seven raptor species were recorded in one or more BUS survey periods. Nankeen Kestrel (*Falco cenchroides cenchroides*) was recorded in all four BUS survey periods and occupied 11 of 13 BUS sites, while Wedge-tailed Eagle (*Aquila audax audax*) was recorded in three of the four survey periods at six BUS sites. The Brown Falcon (*Falco berigora berigora*) was recorded during two surveys periods, while Brown Goshawk (*Accipiter fasciatus fasciatus*), Black-shouldered Kite (*Elanus axillaris*) and Australian Hobby (*Falco longipennis*) were each recorded during one BUS survey period.

Observations of Nankeen Kestrel were highest across all four survey periods with ten observations in summer 2023 and nine observations in spring 2024 (**Table 5.7**). Nankeen Kestrel was the most

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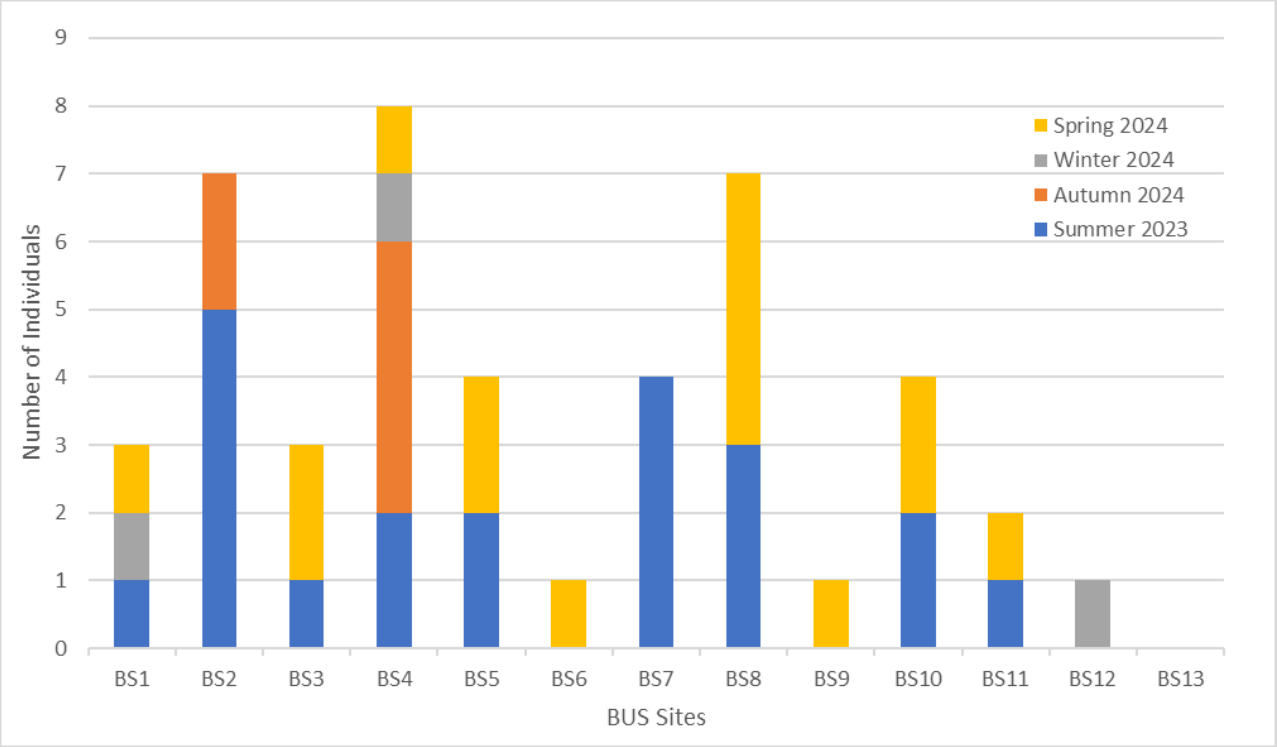
abundant raptor species accounting for 51.9% of all raptors recorded during the survey periods. The total abundance of raptors observed over the survey periods at each BUS site is shown in **Graph 5.3**.

Table 5.7 Number of Observations of Raptors During Each BUS Survey

Scientific Name	Common Name	Summer 2023	Autumn 2024	Winter 2024	Spring 2024	Total
Accipiter fasciatus fasciatus	Brown Goshawk	1	-	-	-	1
Aquila audax audax	Wedge-tailed Eagle	5	-	1	6	12
Elanus axillaris	Black-shouldered Kite	3	-	-	-	3
Falco berigora berigora	Brown Falcon	1	-	-	7	8
Falco cenchroides cenchroides	Nankeen Kestrel	10	6	2	9	27
Falco longipennis	Australian Hobby	-	-	-	2	2
Falco subniger	Black Falcon	1	-	-	-	1
	Total	**21**	**6**	**3**	**24**	**54**



Graph 5.3 Abundance of Raptors Observed at Each BUS Site (BS) Over the Four BUS Surveys

Nankeen Kestrel and Brown Falcon were the only two raptor species observed opportunistically over all four survey periods. A total of 19 individual Nankeen Kestrels were observed opportunistically, including 15 individuals during summer 2023 (**Graph 5.4**). Wedge-tailed Eagles were observed opportunistically during autumn, winter and spring 2024 survey periods, while nine Black-shouldered Kites were observed during the summer 2023 survey period. The other three raptor species observed during BUS surveys were not observed opportunistically.

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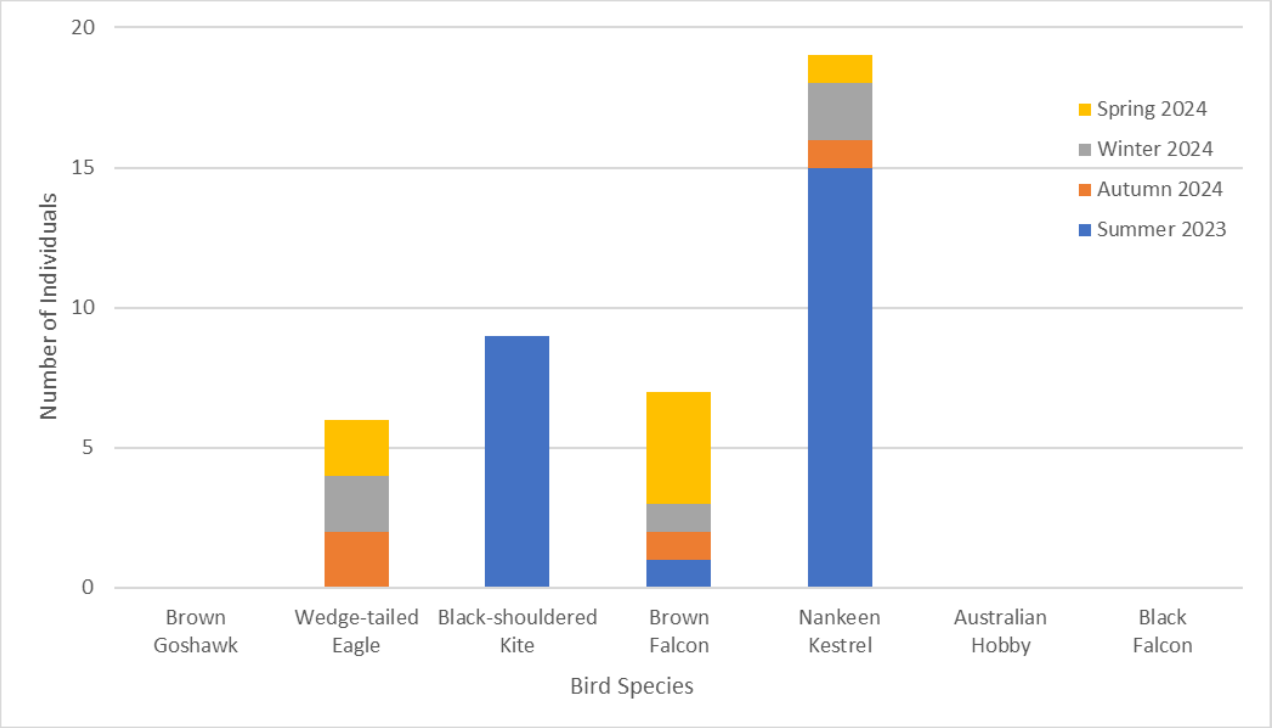

Graph 5.4 Opportunistic Observations of Raptors Over the Four BUS Surveys

Species richness and abundance for each raptor species across all four survey periods is provided in **Appendix B**.

The Wedge-tailed Eagle (WTE) is considered to be a high-profile species and one of the most vulnerable species to collision with operating turbines. This species was observed at a minimum of one BUS site over all four survey periods and recorded opportunistically over three survey periods.

Five Wedge-tailed Eagles nests occur within the Project Area, with additional nests also observed outside the Project Area as shown in **Figure 5.2**. As WTE pairs are known to reuse nests across varying seasons, and to minimise WTG collision risk for WTEs, wind farm design has involved implementing a 1,000 m buffer around known WTE nests, where practicable. However, two WTE nests were found late in the design process and do not have a 1,000 m buffer, with one of these WTE nests located approximately 470 m east of WTG SG072 and outside of the southern extent of the Stage 1A Project Area, and the other located approximately 480 m south-west of WTG B049, towards the southern extent of Stage 1B (**Figure 5.2**). Refer to **Section 6.0** for information on raptor nest activity monitoring.

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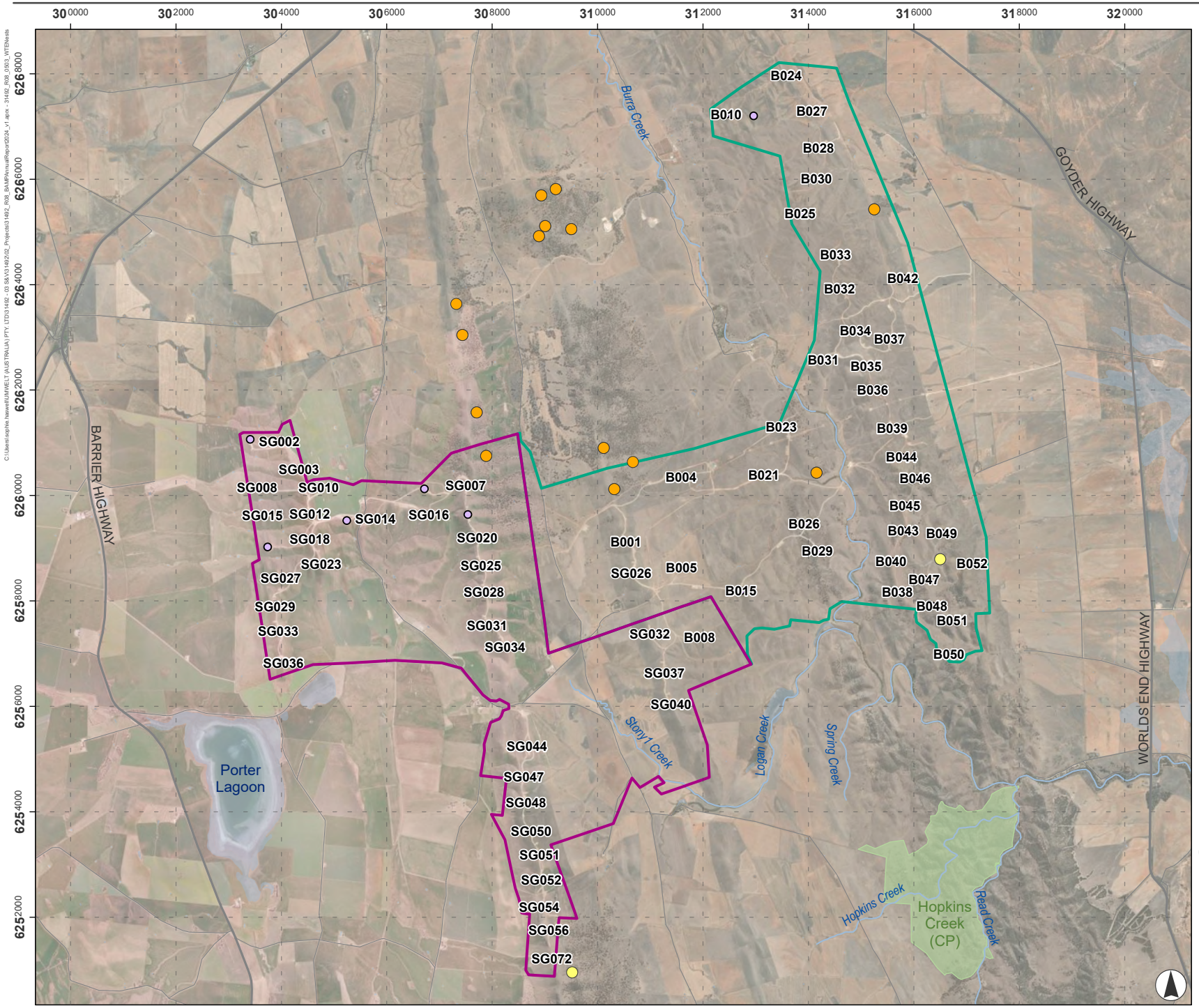
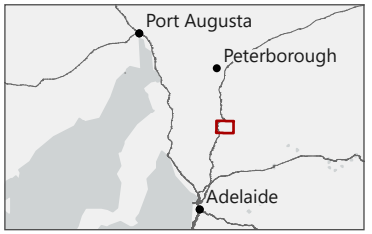


Figure 5.2

Wedge-tailed Eagle Nests Within and Surrounding the Project Area

Legend

- Stage 1A
- Stage 1B
- Goyder South Infrastructure
- WTE nest (2019)
- WTE nest (2021 / 2022)
- Main road
- Local road
- Water course
- Water body
- NPWSA reserve



0 2.5 5

Kilometres

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GDA2020 MGA Zone 54

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5.3.5.2 Waterbirds

The Project Area contains many small farm dams, creeks (mainly ephemeral) and drainage lines. Porter Lagoon (a large natural body of water) is situated approximately 2 km west of the Stage 1A and Stage 1B Project Areas (**Figure 5.1**) and is considered potential habitat for some migratory bird species. BUS Site 1 is situated next to Porter Lagoon and consists of grassland at the edge of the lagoon as well as planted woodland adjacent to the lagoon and allows for migratory species to be observed in the surveys. The dams in the Project Area generally lack aquatic vegetation, have bare edges trampled by stock (cattle and/or sheep) and are not considered suitable foraging habitat for most migratory bird species.

Nine waterbird species were recorded during the surveys, comprising 51.3% of all birds observed during the four survey periods. However, this value is skewed by observations of 3,123 Grey Teal (*Anas gracilis gracilis*) across all four surveys, with 3,037 observed at BUS Site 1 (Porter Lagoon). Furthermore, of the 3,123 recorded, 3,000 were recorded at BUS Site 1 during the summer BUS survey period, including 1,400 during the PM survey on 19/12/2023 and 1,600 during the AM survey on 20/12/2023.

None of the waterbirds observed are listed under EPBC Act or NPW Act (**Appendix B**). Most of the waterbirds were recorded near BUS Site 1, 2 and 13, which are sites close to Porter Lagoon or small dams.

While larger flocks of waterbirds have been recorded flying across the Project Area, most waterbirds recorded were flying below Rotor-swept Area (RSA) height. This is not unusual as most of these species fly at low heights when travelling between dams in the area. However, the Grey Teal, Australian Wood Duck and Little Pied Cormorant were observed flying at RSA heights (**Table 5.8**).

While the Australian Shelduck often flies at RSA heights, this was not observed. Two other duck species were also recorded foraging on Porters Lagoon or farms dams and flying across the Project Area between the dams.

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Table 5.8 Flight Height Details of Waterbirds Observed

Scientific Name	Common Name	EPBC Act	NPW Act	Maximum Flight Height Observed (m)	Abundance (Recorded Via BUS Survey)	Occupancy at BUS Sites	Opportunistic Records
Acrocephalus australis	Australian Reed Warbler	-	-	NA	2	1	-
Anas gracilis gracilis	Grey Teal	-	-	80	3123	3	-
Anas superciliosa	Pacific Black Duck	-	-	10	4	1	-
Charadrius ruficapillus	Red-capped Plover	-	-	NA	94	1	-
Chenonetta jubata	Australian Wood Duck	-	-	80	31	2	-
Chroicocephalus novaehollandiae novaehollandiae	Silver Gull	-	-	NA	2	1	1
Elseyornis melanops	Black-fronted Dotterel	-	-	NA	5	1	-
Microcarbo melanoleucos melanoleucos	Little Pied Cormorant	-	-	110	1	1	-
Tadorna tadornoides	Australian Shelduck	-	-	NA	29	1	64

The Australian Wood Duck, Australian Shelduck, Grey Teal and Red-capped Plover are waterbirds known to move and forage in flocks, as recorded at multiple sites and dams throughout the Project Area. The most abundant waterbird recorded across all four survey periods was the Grey Teal, with 3000 individuals being observed during the summer 2023 survey period at Porter Lagoon, BUS Site 1.

5.4 Birds at RSA Height

Details regarding flight height were recorded for birds observed through the Project Area during all four BUS survey periods. For this Project, bird flight heights were classified as being below RSA height (less than 43 m), at RSA height (43-199 m) and above RSA height (greater than 199 m), which aligns with the WTG design of the GSWF.

The data from the four surveys was used for height analysis of bird species considered flying at a height that constitutes being within the RSA and therefore at risk of collision with the WTGs. As such, 877 individual birds from 15 different species were recorded at flight heights considered as being at-risk within the Stage 1A and/or Stage 1B Project Areas, recorded either at BUS sites or opportunistically (see **Table 5.9**). This equates to approximately 11.9% of the total number of birds counted during the four survey periods. Of these 15 species, four were raptors, three were waterbirds, five were native species commonly found in grasslands and three were introduced species.

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Table 5.9 Flight Height Details of Birds Observed Within the Project Area

Scientific Name	Common Name	EPBC Act	NPW Act	Maximum Flight Height (m)	Occupancy at BUS Sites	Opportunistic Records
*Alauda arvensis arvensis**	Eurasian Skylark	-	-	60	11	-
Anas gracilis gracilis	Grey Teal	-	-	80	3	-
Aquila audax audax	Wedge-tailed Eagle	-	-	150	6	4
Chenonetta jubata	Australian Wood Duck	-	-	80	2	-
*Columba livia**	Rock Dove	-	-	60	5	-
Corvus coronoides	Australian Raven	-	-	80	13	-
Corvus mellori	Little Raven	-	-	100	8	-
Corvus sp.	Crow	-	-	50	8	-
Eolophus roseicapilla	Galah	-	-	120	13	-
Falco berigora berigora	Brown Falcon	-	-	50	6	1
Falco cenchroides cenchroides	Nankeen Kestrel	-	-	80	11	1
Falco subniger	Black Falcon	-	R	50	1	-
Gymnorhina tibicen	Australian Magpie	-	-	70	13	-
Microcarbo melanoleucos melanoleucos	Little Pied Cormorant	-	-	110	1	-
*Sturnus vulgaris vulgaris**	Common Starling	-	-	50	8	1

*Introduced species.

The five most abundant species observed flying at RSA height include the Common Starling, Galah, Rock Dove, Australian Raven and Grey Teal. These five species accounted for almost 92.5% of the birds counted at RSA height, with introduced Common Starling comprising the bulk of these flights (73.1%). The five most common birds at RSA height were common species that were observed throughout the Project Area and wider region. Starlings, Magpies, Ravens and Galahs are resident birds usually more abundant in late summer, some of which (Starling, Raven and Galah) often move and forage in larger flocks.

Birds of prey, accounted for 3.1% of birds flying at RSA height, including Wedge-tailed Eagle, Brown Falcon, Nankeen Kestrel and the NPW Act listed Rare Black Falcon. Raptors are more susceptible to bird strike from WTG rotors because of their behaviour and foraging techniques and especially as they are less agile and have restricted forward field of view (Duriez, 2023).

Three waterbirds, the Grey Teal, Australian Wood Duck and Little Pied Cormorant, were observed at BUS sites flying at RSA height, putting them at-risk of collision with operating WTGs.

The distribution of birds flying at RSA heights at each of the 13 BUS sites was random during all four surveys. Birds were not recorded flying at RSA heights at any one BUS site more than another, which may suggest that risk to birds is rather uniformly distributed over the Project Area. However, 12 months of data is too limited to draw conclusions and collection of more data during future BUS surveys will assist to understand risk. Furthermore, future data analysis could involve investigating any potential habitat link with at risk flights, for example, flights in Grassland habitat compared with flights in Woodland habitat and whether birds utilising Woodland habitat are at lower risk of collision compared to birds using Grassland habitat.

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5.5 BUS Conclusions

Findings from the four BUS survey periods (summer (December 2023) to spring (October 2024)) are summarised as follows:

- Bird species recorded were predominately common grassland and woodland bird species, which aligns with the available habitat that consists mainly of grassland and cropping paddocks with some remnant woodlands.
- Woodland habitats contributed the highest to bird diversity, supporting a high number of species and a large proportion of unique species not found elsewhere. Site 1 at Porter Lagoon also contributed high diversity, with a high proportion of unique species relative to the number of sites surveyed in that habitat type.
- Within the Stage 1A and Stage 1B Project Areas, Woodland habitat supported a higher abundance of birds compared to Grassland habitat.
- Observations of species of concern included:
    - One EPBC Act listed species, the Southern Whiteface, which was observed at multiple woodland and one grassland BUS sites during the four survey periods.
    - Two NPW Act listed species, including the Black Falcon and Elegant Parrot (both listed as Rare under the NPW Act), were each only observed within a single survey period.
- No species listed under the EPBC Act as threatened or migratory were observed flying at RSA height.
- One observation of NPW Act listed species, the Black Falcon, was recorded during a BUS survey period flying at RSA height and was only observed within a single BUS survey period.
- A total of 15 species were observed flying at RSA heights, with the five most abundant species observed flying at RSA height being common, widespread species, including the Common Starling (introduced), Galah, Rock Dove (introduced), Australian Raven and Grey Teal, and accounted for 92.5% of the birds counted at RSA height.
- No EPBC Act listed migratory bird species were recorded during the four survey periods.
- The lack of EPBC Act listed bird species observed in general and at RSA height, suggests that the risk of impact (i.e. via WTG collision) to these species by the Stage 1A and Stage 1B wind farms is low. However, it is also acknowledged that 12 months of BUS data is limited and collection of more data during future BUS surveys will allow for statistical analysis and stronger conclusions.

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6.0 Raptor Nest Activity Monitoring

The objective of the Bird Monitoring Program to *determine whether WTE and other raptor nests are in suitable condition for nesting and whether the nests are active and successful in fledging young* will be achieved via undertaking raptor nest activity monitoring.

As outlined in BAMP Section 8.3.2, known WTE nest locations within the Stage 1A and Stage 1B Project Areas will be monitored to determine whether nests are in a suitable condition for nesting and whether the nests are active and successful in fledging young.

Nests are proposed to be surveyed once a year in October/November, which coincides with the time that WTE nestlings are generally still in the nest, but close to fledging, to determine nesting success (NR SAMDB 2012). Any other raptor nests observed will also be monitored for condition and activity. Raptor nest activity monitoring is proposed to be undertaken over 30 years as follows:

- Once a year for ten years, and
- then once every second year for twenty years.

Known WTE nests within the Stage 1A and Stage 1B Project Areas are summarised in **Table 6.1** and mapped in **Figure 6.1**.

Table 6.1 WTE Nests Located Within the Project Area

Nest ID	Latitude	Longitude	Location Description	Condition	Comment	VA Description
9	-33.776	138.9253	682 m NE of WTG SG007	Good		*Eucalyptus odorata* (Peppermint Box) Closed Woodland
11	-33.7821	138.9514	1022 m N of WTG B001	Poor		*Eucalyptus leucoxylon* ssp. *pruinosa* (South Australian Blue Gum) Open Woodland
12	-33.7351	139.0057	1129 m NE of WTG B033	Moderate	Two WTEs observed near nest (Autumn 2019)	*Eucalyptus leucoxylon* ssp. *pruinosa* (South Australian Blue Gum) Open Woodland
13	-33.7799	138.9928	1001 m NNE of WTG B026	Good	Adult WTE Observed on nest (Spring 2019)	*Eucalyptus leucoxylon* ssp. *pruinosa* (South Australian Blue Gum) Open Woodland
16	-33.7951	139.0178	490 m NE of WTG B047	Unknown	Found in 2021/2022.	*Eucalyptus porosa* (Mallee Box) Open Woodland

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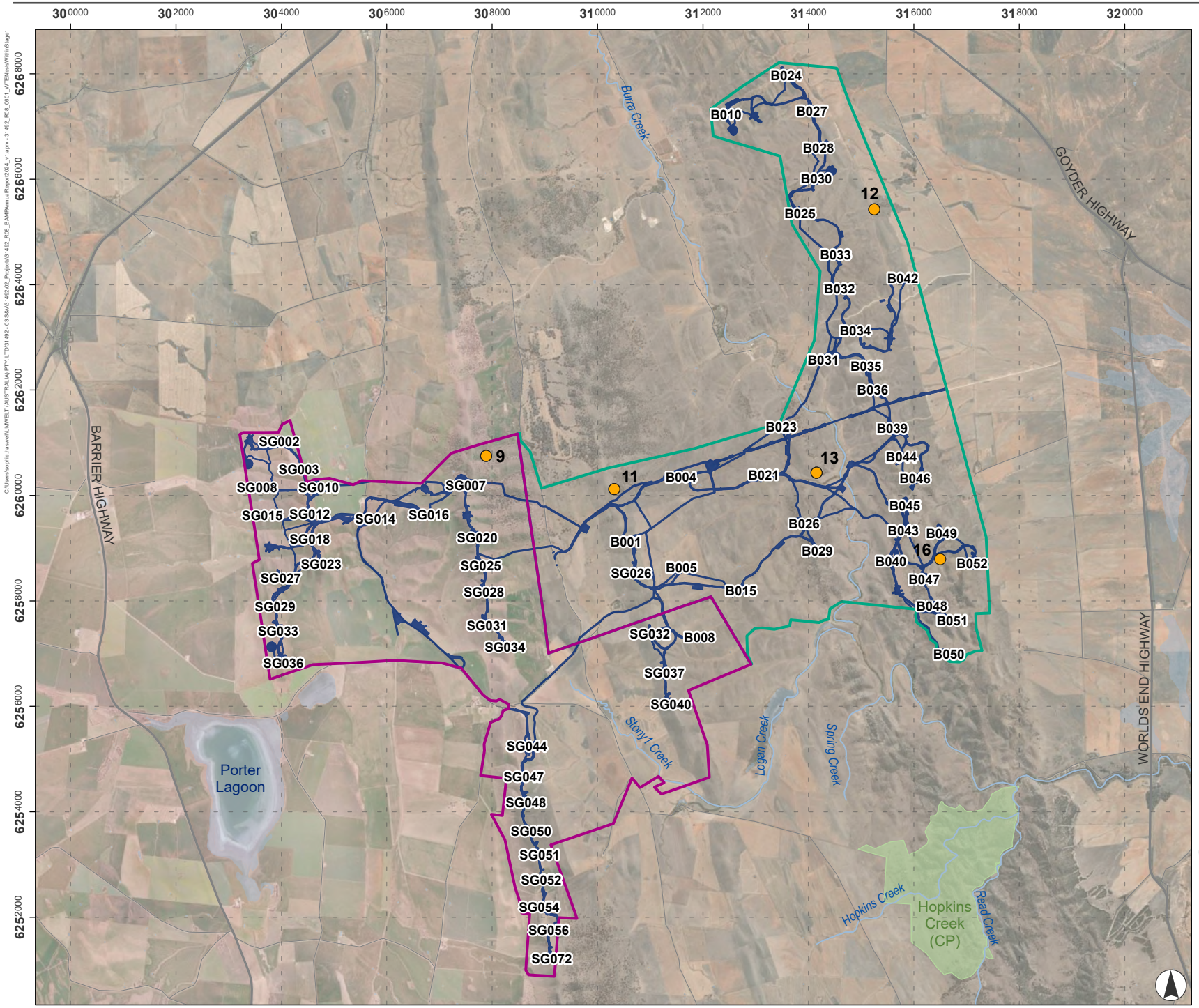
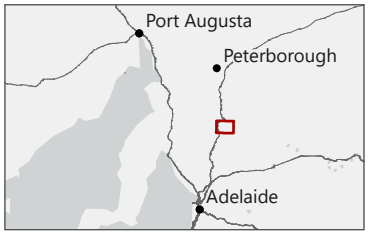


Figure 6.1

Known WTE Nests Within and Adjacent to the Stage 1A and Stage 1B Project Areas

Legend

- Stage 1A
- Stage 1B
- Goyder South Infrastructure
- WTE Nest
- Main road
- Local road
- Water course
- Water body
- NPWSA reserve



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6.1 Methodology

To determine the condition and activity of each WTE and/or raptor nest, the following data is recorded (where possible):

- Location (gully, slope, hill crest, plain).
- Nest condition:
  - Whether the nest is intact or dilapidated.
  - Visually determined to be either poor, moderate or good.
  - Nest height (measured in metres (m), from the ground to the bottom of the nest).
  - Nest depth (measured in centimetres (cm), from the bottom of the nest to the rim of the nest).
  - Nest diameter (measured in m, distance between the outer rim of the nest).
- Size of nest:
  - Small (<60 cm deep, <1.2 m diameter).
  - Medium (60 – 100 cm deep, 1.2 m – 1.5 m diameter).
  - Large (>1 m deep, >1.5 m diameter).
- Nest activity (active or in-active) as determined by:
  - Whether whitewash (areas covered in droppings) and nesting material (e.g., fresh branches and/or leaves) are present or absent.
  - Species of raptor observed incubating or located near the nest.
- Nesting success: nests that contained a large-feathered nestling are considered successful (i.e., nestling(s) likely to fledge).

6.2 Results

Raptor nest activity monitoring was undertaken on 14-16 October 2024. All five nests within the Project Area were checked with the results presented in **Table 6.2**. Only one of the five nests was active, while two were inactive and two were no longer present. The active nest was a successful nest, with two white fluffy chicks present and an adult observed in a tree nearby.

The active nest is located 1001 m NNE of WTG B026 and is an early indication that WTEs are currently living and breeding successfully within the Stage 1B Project Area. However, the fate of juveniles beyond fledging is not known.

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Table 6.2 Raptor Nest Monitoring Results

Nest ID	Location Description	Date of check	Status	Notes
Nest 11	1022 m N of WTG B001	14/10/2024	Inactive	Dilapidated / falling apart. No signs of activity. Located on a slope. Small nest, approximately 7 m above ground, 1 m wide and 30 cm deep. Not currently a successful nest.
Nest 9	682 m NE of WTG SG007	15/10/2024	Inactive	Intact, with only a few sticks on the ground underneath. Could not see into bowl of nest due to angle. Handful of bones (likely to be kangaroo joey and rabbit) under the nest tree, but no whitewash. As such, the site is possibly used as a feeding perch but not currently for breeding. An adult WTE took off from a tree within 50 m of the nest tree, when surveyors approached the broader area of the nest site.
Nest 12	1129 m NE of WTG B033	16/10/2024	Gone	No nest present at this location, or remains of any kind.
Nest 13	1001 m NNE of WTG B026	15/10/2024	Active	Two large, white fluffy chicks in nest and one adult observed in tree nearby which flew off when surveyors approached the broader area of the nest site. Due to the nest being active with chicks, nest condition and size data was not collected, as the surveyors stayed away from the nest to minimise disturbance to the adult and chicks. A nest supporting successful breeding.
Nest 16	490 m NE of WTG B047	15/10/2024	Gone	No nest present. However, sticks on the ground were possibly the remains of a fallen nest, but have been there long enough that vegetation has grown up through the sticks.

In addition to the above, an active Australian Hobby Nest was observed in a Sugar Gum (*Eucalyptus cladocalyx*) (which was presumably planted as it is not a native species in the area) adjacent to BUS Site 1, which is at Porter Lagoon (**Figure 5.1**) during BUS survey work on 15/10/2024. Due to the nest being active (presumably with chicks) nest condition and size data was not collected, as the surveyors moved away from the nest (once it was known that it was there) to minimise disturbance.

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7.0 Long-term WTG Collision Monitoring

The objective of the Bird Monitoring Program to *detect potential impacts to EPBC Act listed bird species and other bird species as a result of WTG collision* will be achieved via undertaking long-term WTG collision monitoring.

The BAMP requires WTG collision monitoring to be undertaken on a quarterly basis (i.e. once every three months) at a total of 26 WTGs, including 13 in Stage 1A and 13 in Stage 1B.

All WTGs proposed to be monitored were selected at random. However, they are considered to be representative of the habitat available for the bird species of concern throughout the Stage 1A and Stage 1B Project Areas. Refer to BAMP Section 8.3.3 (and sub-sections) for more information, including the Vegetation Association (i.e. vegetation and habitat type) that each WTG monitored is located within, and the collision risk level of each WTG proposed to be monitored.

The BAMP requires the long-term WTG collision monitoring program to commence as soon as practicable upon the commencement of commissioning. While commissioning of WTGs in Stage 1A was anticipated to commence in February 2024, it did not commence until mid-April and was slow to progress with the second WTG not commissioned until early June 2024. As such, the long-term WTG collision monitoring program commenced in August 2024. Details on the WTGs monitored and the methodology implemented are provided in the following subsections.

7.1 WTGs Monitored in 2024

Twelve out of 13 Stage 1A WTGs proposed to be monitored were monitored in 2024, while one WTG (SG034) was not monitored as it had not yet been commissioned.

Commissioning of WTGs in Stage 1B did not commence until November 2024. As such, no Stage 1B WTGs were monitored in 2024.

Out of the Stage 1A WTGs that are proposed to be monitored, SG012 was the first to be commissioned, which occurred on 15 April 2024. The next WTG to be commissioned was SG008 on 3 June 2024, followed by SG015 on 10 June 2024 and SG007 on 28 July 2024.

The first quarterly WTG monitoring survey was undertaken on 19-21 August 2024, with five WTGs monitored, as summarised in **Table 7.1**. The next WTG monitoring survey was undertaken on 12-15 November 2024, with 12 WTGs monitored. As noted above, WTG SG034 was not monitored in 2024 as it had not yet been commissioned.

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Table 7.1 Stage 1A WTGs Monitored in 2024

WTG	Vegetation Association	WTG Commission Date	Collision Monitoring Survey	
			19-21 August 2024	12-15 November 2024
SG007	**VA8**: *Austrostipa* spp. (Spear Grass) Mixed Grassland. (Also adjacent to **VA6**: *Eucalyptus leucoxylon* ssp. *pruinosa* (Inland South Australian Blue Gum) Open Woodland.)	28/07/2024	✓	✓
SG008	**VA8**: *Austrostipa* spp. (Spear Grass) Mixed Grassland	03/06/2024	✓	✓
SG012	**VA8**: *Austrostipa* spp. (Spear Grass) Mixed Grassland	15/04/2024	✓	✓
SG013	**VA8**: *Austrostipa* spp. (Spear Grass) Mixed Grassland	7/09/2024		✓
SG015	**VA8**: *Austrostipa* spp. (Spear Grass) Mixed Grassland	10/06/2024	✓	✓
SG022	**VA8**: *Austrostipa* spp. (Spear Grass) Mixed Grassland	19/08/2024	✓	✓
SG023	**VA8**: *Austrostipa* spp. (Spear Grass) Mixed Grassland	8/10/2024		✓
SG032	**VA8**: *Austrostipa* spp. (Spear Grass) Mixed Grassland	27/10/2024		✓
SG034	**VA8**: *Austrostipa* spp. (Spear Grass) Mixed Grassland	(not commissioned in 2024)		
SG040	**VA8**: *Austrostipa* spp. (Spear Grass) Mixed Grassland	13/10/2024		✓
SG044	**VA8**: *Austrostipa* spp. (Spear Grass) Mixed Grassland	13/10/2024		✓
SG048	**VA2:** *Lomandra multiflora* ssp. *dura* (Hard Mat-rush) / *Lomandra effusa* (Scented Mat-rush) Mixed Open Grassland. **VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland.	7/09/2024		✓
B008	**VA8**: *Austrostipa* spp. (Spear Grass) Mixed Grassland	12/10/2024		✓

7.2 WTG Collision Monitoring Methodology

Each WTG to be monitored was overlayed with a 240 m x 240 m monitoring quadrat, with the WTG in the centre. Markers (flat, black rubber mats marked with bright pink paint) were installed at each of the outer four corners. The monitoring quadrat was further sub-divided into four 120 m x 120 m cells.

To search for carcasses, searchers/surveyors traversed each 120 m x 120 m cell of the monitoring quadrat on foot, along parallel transects at 5 m intervals (or slightly more if visibility was quite good). A handheld GPS equipped device was used to assist the searcher/surveyor to traverse parallel transects

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at 5 m (or similar) intervals. Data outlined in the *WTG monitoring survey datasheet* (BAMP Appendix 7) is collected for each WTG monitored, including (but not limited to):

- Date and time details (including start and finish time).
- WTG ID and observer names.
- Survey details (including ground visibility; amount of quadrat searched; limitations; site photo).
- Weather details (including temperature; precipitation; wind conditions).
- WTG bird mortality record.
- Any additional comments / notes.

When a bird carcass or feather-spot (5 or more feathers grouped together) is observed, data outlined within *Dead or injured bird datasheet* (BAMP Appendix 8) is collected, including (but not limited to):

- Date and location details (including WTG ID and easting and northing of carcass/feather-spot).
- Survey and detection details (including search or incidental find; visibility; photo).
- Weather at time of detection (including temperature; precipitation; wind conditions).
- Carcass / injured animal details (including species; age; sex; condition; degree of decay).

Each bird carcass or feather-spot found is left in-situ and tagged to allow for collection of passive carcass persistence scavenger data during future monitoring events. However, if a dead bird or feather-spot cannot be identified in the field, it must be collected upon discovery and placed into a plastic bag (i.e., zip-lock bag) and clearly labelled with the date, time, location (WTG number and GPS waypoint / coordinates) for species identification by an ecologist and/or suitably qualified bird expert. Dead bird carcasses and feather-spots should always be handled with gloves to avoid contamination of samples.

As outlined in the BAMP (Section 8.3.3.2), purpose-trained dogs may be used to search the quadrat for carcasses / feather-spots. However, purpose-trained dogs were not used as part of the long-term WTG collision monitoring in 2024.

7.3 WTG Collision Monitoring Results

While no bird carcasses were observed during the 2024 WTG collision monitoring program, five feather-spots were observed, as summarised in **Table 7.2** and shown in **Figure 7.1**, **Figure 7.2** and **Figure 7.3**. Of these, three were Australian Magpie and two were Galah. Neither of these species is listed under the EPBC Act or NPW Act.

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Table 7.2 Bird Carcass and Feather-spots Observed Via WTG Collision Monitoring

WTG	Date	Carcass / Feather-spot	Species	Latitude	Longitude	Figure Reference
SG008	19/08/2024	Feather-spot	Australian Magpie (*Gymnorhina tibicen*)	-33.7814	138.8789	**Figure 7.1**
SG007	21/08/2024	Feather-spot	Australian Magpie (*Gymnorhina tibicen*)	-33.782	138.9215	**Figure 7.2**
SG007	21/08/2024	Feather-spot	Galah (*Eolophus roseicapilla*)	-33.7819	138.9221	**Figure 7.2**
SG007	13/11/2024	Feather-spot	Galah (*Eolophus roseicapilla*)	-33.7820	138.9208	**Figure 7.2**
SG040	14/11/2024	Feather-spot	Australian Magpie (*Gymnorhina tibicen*)	-33.8186	138.9615	**Figure 7.3**

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Figure 7.1

Location of Feather-spot Observed at WTG SG008

Legend

- WTG Stage 1A surveyed
- Monitoring quardrat
- Feather-spot

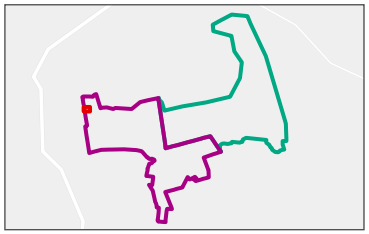

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Figure 7.2

Location of Feather-spots Observed at WTG SG007

Legend

- WTG Stage 1A surveyed
- Monitoring quardrat
- Feather-spot

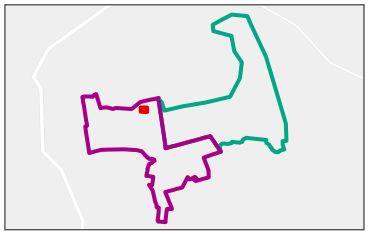

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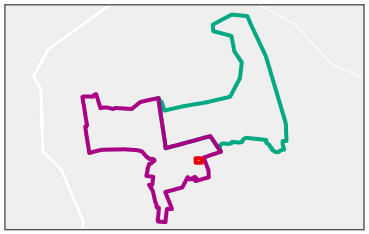
Figure 7.3

Location of Feather-spot Observed at WTG SG040

Legend

- WTG Stage 1A surveyed
- Monitoring quardrat
- Feather-spot



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7.4 Incidental Finds of Bird Carcasses

As outlined in Section 8.3.6 of the BAMP, it is possible that during the life of the Stage 1A and Stage 1B wind farms, bird carcasses will be discovered incidentally by site personnel. Upon incidental discovery, carcasses and feather-spots must be photographed in situ and the *Dead or injured bird datasheet* (Appendix 8 of the BAMP) must be completed.

7.4.1 Incidental Finds of Bird Carcasses in 2024

Four incidental finds were recorded in 2024, including two carcasses and two feather-spots, which are summarised in **Table 7.3**. A photograph of each is provided in **Photo 7.1** to **Photo 7.4**, while the location of each is shown in **Figure 7.4**.

The four incidental finds consist of four different species, including Brown Falcon, Galah, Australian Magpie and Nankeen Kestrel. None of these species are listed under the EPBC Act or NPW Act.

Table 7.3 Incidental Finds of Bird Carcasses and/or Feather-spots

Date of Find	Carcass / Feather-spot	Species	Location of Find	Latitude	Longitude	Activity That Resulted in Incidental Find
4/09/2024	Carcass	Brown Falcon (*Falco berigora berigora*)	WTG SG002	-33.7731	138.8834	Inspection of WTG pad / hardstand for final handover to Project Owner.
14/10/2024	Feather-spot	Galah (*Eolophus roseicapilla*)	BUS Site 10 Adjacent WTG SG014	-33.7878	138.9016	BUS at BUS Site 10.
15/10/2024	Feather-spot	Australian Magpie (*Gymnorhina tibicen*)	BUS Site 4 Adjacent WTG SG050	-33.8415	138.9318	BUS at BUS Site 4.
1/11/2024	Carcass	Nankeen Kestrel (*Falco cenchroides cenchroides*)	WTG SG013	-33.786	138.921	Driving along access road adjacent WTG hardstand.

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Photo 7.1 Brown Falcon Carcass at WTG SG002

Photo 7.2 Nankeen Kestrel Carcass at WTG SG013

Photo 7.3 Galah Feather-spot At BUS Site 10 Adjacent WTG SG014

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Photo 7.4 Magpie Feather-spot at BUS Site 4 Adjacent WTG SG050

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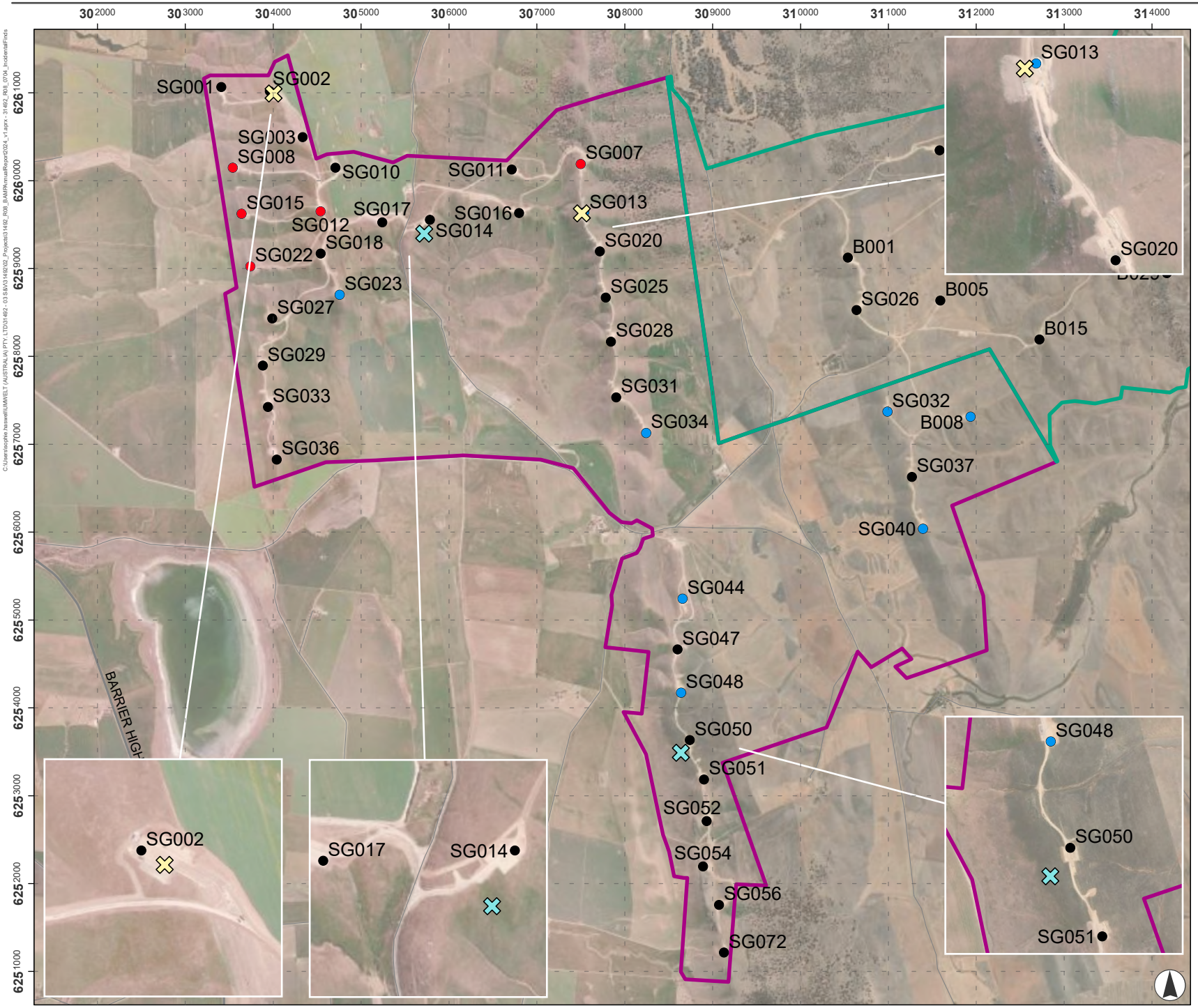


Figure 7.4

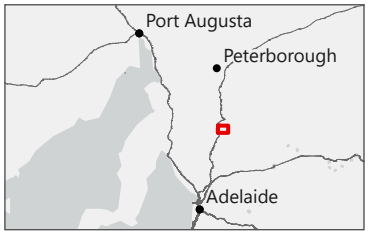
Incidental Carcass and Feather-spot Finds Within the Project Area

Legend

- Goyder south - Stage 1A
- Goyder south - Stage 1B
- WTG
- WTG Stage 1A proposed monitoring
- WTG Stage 1A surveyed

Incidental find

- Carcass
- Feather-spot



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7.5 DNA Testing

In accordance with Section 8.3.7 of the BAMP, if a bird carcass cannot be identified by a suitably qualified bird expert, then it will be subject to DNA testing to determine the bird species.

All bird carcasses detected during the Bird Monitoring Program were identified. As such, DNA testing was not required.

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8.0 Carcass Persistence (Scavenger Activity) and Searcher Efficiency Trials

As outlined in the BAMP (Section 8.3.4 and sub-sections) carcasses of birds that collide with WTGs may be removed by scavengers or will ultimately disappear due to decomposition. Carcass persistence and searcher efficiency affects the detection of dead birds that collide with WTGs and consequently influences estimation of the total number of fatalities for each species.

As one of the objectives of the Bird Monitoring Program is to *estimate the number and species of birds suspected to have been killed by collision with turbines, on an annual basis*, it is essential that the monitoring program is scientifically and statistically robust. As such, trials to determine persistence time of carcasses and efficiency of searchers are required to determine and apply appropriate correction factors for carcasses scavenged (removed) and/or missed by searchers, to inform estimation of total collision mortality for species of interest and/or concern.

As such, scavenger activity trials have been completed to determine the length of time before scavengers (such as Red Fox (*Vulpes vulpes*)) remove a carcass from the site and searcher efficiency trials have also been completed to determine the likelihood of detecting a carcass during searches, at the Goyder South Project. These trials are designed to complement WTG collision monitoring data and will be used to inform appropriate correction factors necessary to estimate total collision mortality.

8.1 Background

As outlined in the BAMP (Section 8.2.1), the first scavenger activity and searcher efficiency trials at the Project were undertaken in March 2023 (EBS Ecology 2023) and involved both small bird and large bird models. Results of those trials suggest that small bird carcasses are removed later (μ = 7.8 days) than large bird carcasses (μ = 2.7 days), while a detection rate of 90.0% for the small bird model and 96.6% for the large bird model resulted in an overall carcass detection rate at the Project of 93.1%.

However, two additional scavenger and searcher trials have been undertaken in the first year of the Bird Monitoring Program to account for different site conditions, specifically seasonal differences in scavenger activity levels, and carcass detectability due to vegetation growth.

Scavenger activity experiments are conducted to estimate the probability that the carcass of a bird that has been killed by a WTG will remain observable at the next search (Huso and Dalthorp 2014). This is achieved by placing sample carcasses at locations representative of habitats found in the fatality fall-zone around turbines, and monitoring each experimental carcass through time to determine how long it persists (Huso *et al*. 2017). The average time until carcass removal can then be used to develop a 'correction factor' that can be used in calculations of mortality rate estimates.

Imperfect detection of bird carcasses also requires the use of a statistical correction factor in mortality estimate calculations. This is achieved through searcher efficiency trials, which assess the rate at which searchers detect carcasses beneath wind turbines or at proposed wind turbine locations. The detection efficiency (the percentage of carcasses detected) is then incorporated into subsequent analyses to estimate mortality rates.

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Detectability, or searcher efficiency rates, are expressed as the proportion of trial carcasses that are detected by searchers (*p*) (Erickson et al. 2003, Anderson et al. 2004). Searcher efficiency is calculated using the formula:

$$p = \frac{\#\text{of carcasses detected}}{\#\text{of carcasses placed}}$$

p is then used in the following equation to calculate estimated total number of carcasses:

$$m = \frac{N \times I \times C}{K \times T \times P}$$

Where:

- m = total number of birds killed by wind turbines
- N = the number of turbines in the windfarm
- I = interval between searches in days
- C = the number of carcasses found
- K = number of turbines sampled
- P = searcher efficiency
- T = the average time in days for carcasses to be removed from sample sites (derived from the scavenger activity trial)

Estimates for individual species can also be calculated using the data collected in these trials using the following model (Smallwood 2007):

$$\gamma = \frac{\bar{x}}{p \times S}$$

Where γ is the adjusted mortality rate per turbine per year, $\bar{x}$ is the unadjusted mean number of mortalities per turbine per year, p is the probability of detecting the carcass and S is the proportion of carcasses remaining since the last survey.

8.2 Objectives

The objectives of the scavenger activity trials were to:

- Record the rate of removal by scavengers of small, medium and large bird carcasses from the site.
- Record details of scavenger activity where possible to provide an indication of avian versus mammalian scavenger rates.
- Assess whether a carcass can be detected after scavenger activity.
- Compare and account for differences in scavenger activity between seasons.
- Determine *T* = the average time in days for carcasses to be removed from sample sites.

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The objectives of the searcher efficiency trials were to:

- Test the detectability of different sized bird carcasses at sites.
- Compare and account for differences in detectability between seasons.
- Determine *p*= searcher efficiency.

8.3 Methodology

8.3.1 Scavenger Activity Trials

8.3.1.1 Survey Timing

Two rounds of scavenger activity trials were conducted, to account for variability in site conditions between seasons:

- Winter: 19 August – 17 September 2024.
- Spring: 11-22 November 2024.

8.3.1.2 Site Selection

Scavenger activity trials were undertaken at 10 WTGs, which are listed in **Table 8.1** and shown in **Figure 8.1**. The sites are separate to the WTGs which are part of the long-term WTG collision monitoring program. All ten sites occur within *Austrostipa* spp. (Spear Grass) Mixed Grassland, which is the dominant vegetation type in the Goyder South Project Area (**Section 4.0**). Photographs of each site were taken at the northeast corner of the sampling quadrat looking towards the southwest corner, to document the nature of the site and the condition of the vegetation at the time of the trial. These photos are provided in **Appendix D**.

Table 8.1 WTGs Selected for Scavenger and Searcher Trials

Stage 1A	Stage 1B
SG014	B001
SG025	B004
SG027	B021
SG050	B025
SG056	B037

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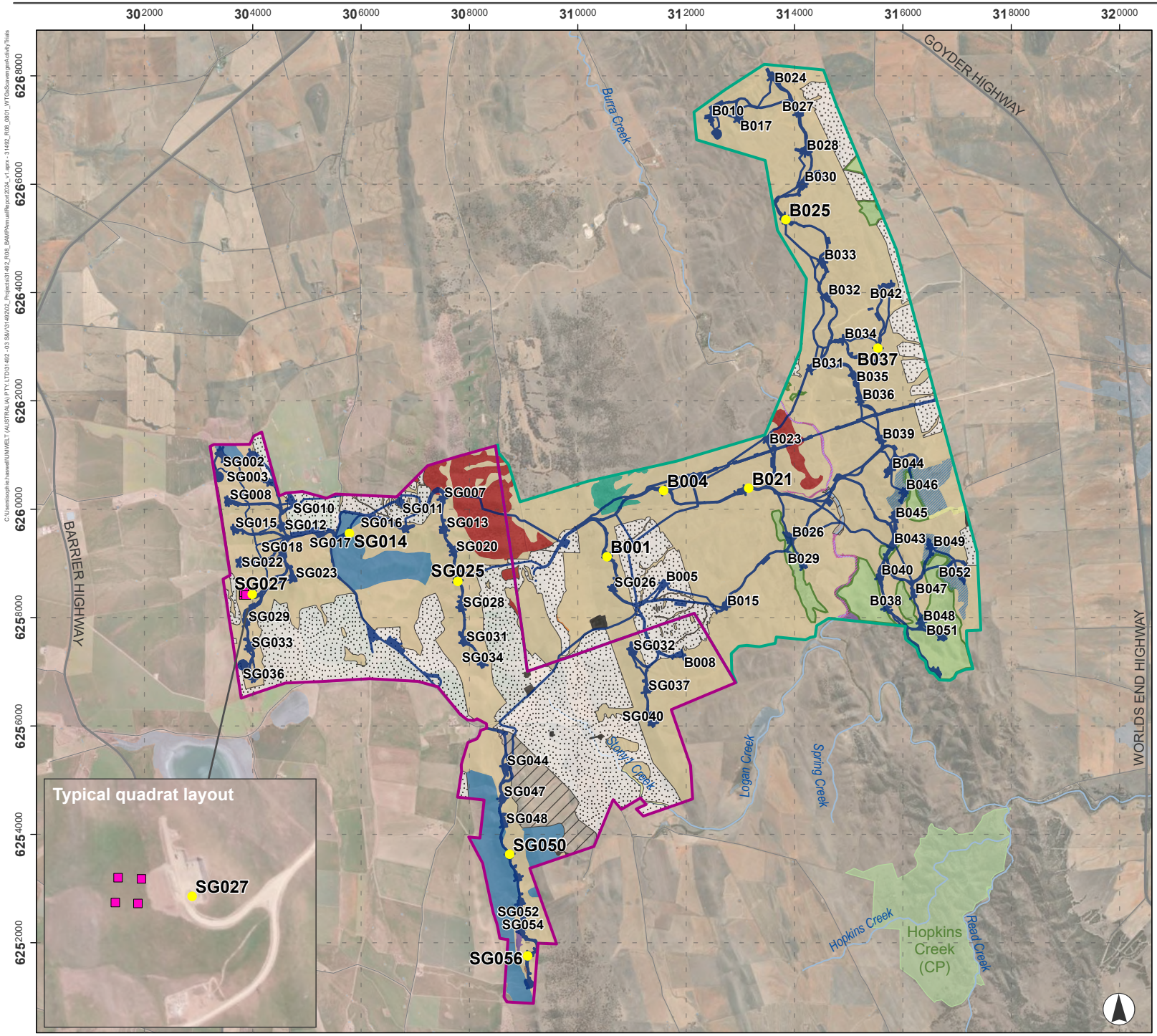
Figure 8.1

WTGs Selected for Scavenger Activity Trials

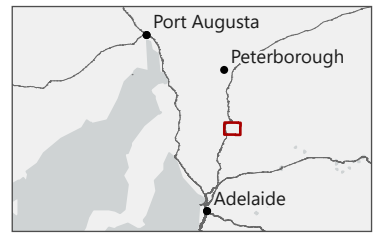


Legend

- Stage 1A
- Stage 1B
- Goyder South Infrastructure
- WTGs selected for scavenger activity trials
- Scavenger trial quadrat boundary

Vegetation association

- 2: *Lomandra multiflora ssp. Dura* (Hard Mat-rush) / *Lomandra effusa* (Scented Mat-rush) Mixed Open Grassland
- 3: *Eucalyptus porosa* (Mallee Box) Open Woodland
- 4: *Eucalyptus odorata* (Peppermint Box) Closed Woodland
- 6: *Eucalyptus leucoxylon ssp. Pruinosa* (Inland South Australian Bluegum) Open Woodland
- 7: *Eucalyptus camaldulensis ssp. camaldulensis* (River Redgum) Woodland
- 8: *Austrostipa spp.* (Spear Grass) Mixed Grassland
- 9: Exotic Grassland
- 10: *Callitris gracilis* (Southern Cypress Pine) Low Open Woodland
- 11: *Juncus sp.* (Rush) / *Cyperus gymnocaulos* (Spiny Flat-sedge) Mixed Low Closed Sedgeland
- 14: *Triodia irritans* (Spinifex) Grassland +/- *Emergent Eucalyptus oleosa ssp. oleosa* (Red Mallee)
- 17: *Phragmites australis* (Common Reed) Grassland
- 24: *Allocasuarina verticillata* Open Woodland over *Bursaria spinosa ssp.* and *Austrostipa spp.*
- Amenity / Urban
- Cropping



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8.3.1.3 Sampling Quadrats

To simulate WTG bird strike and the potential distribution of bird carcasses under a WTG, a 50 m x 50 m sampling quadrat was established at each survey site, within approximately 100 m of the WTG tower. The quadrat was set up using a tape measure and a compass or handheld GPS to measure distance and direction. The corners of each quadrat were marked in the field with black rubber tiles approximately 30 cm in width, secured to the ground with steel pegs. Each rubber tile was marked with pink spray-paint to increase visibility (**Photo 8.1**). An electronic waypoint of each corner was also recorded. The typical layout of a quadrat is shown in **Figure 8.1**.

Carcasses were randomly placed within each quadrat by dividing the area into one-meter square plots and using a random number generator to select the plot for each carcass. The location of each carcass was also recorded via electronic waypoint.

8.3.1.4 Carcasses

In accordance with the BAMP, three categories of carcasses (small, medium and large) were used in the scavenger activity trials to represent the small, medium and large bird species that occur at the GSWF. These were sourced as fresh whole carcasses prior to the trials and frozen, then subsequently defrosted on the first day of each trial. A total of 85 carcasses across the three size categories were used across the two trials, as outlined in **Table 8.2**.

Day old chickens (*Gallus gallus*) (DOC), which weighed approximately 25 g, were used to represent a small bird (e.g., small passerine). A total of 28 DOC were used, with most being yellow in colour (**Photo 8.2**), although some were black.

Feral pigeons (*Columba livia*), which weighed approximately 300 g, were used to represent a medium bird (e.g., wader, parrot). A total of 26 pigeons were used and plumage on these birds was usual for the species, consisting of varying shades of grey, although some individuals had reddish-brown patches (**Photo 8.3**).

Adult chickens, which weighed approximately 3 kg, were used to represent a large bird (e.g., large raptor such as a Wedge-tailed Eagle). A total of 32 chickens were used and were reddish-brown in colour (**Photo 8.4**). White chicken carcasses were specifically avoided for these trials as they were expected to be more visible than brown, black, or red coloured birds.

For identification purposes, all bird carcasses were individually labelled by attaching a small tag with a unique identification number to a leg of each carcass. Individual marking allows trial carcasses to be identified if they are moved by scavengers, and to differentiate them from turbine-struck carcasses in the case of feral pigeons, which occur as wild birds at GSWF.

Four or five carcasses were placed within each of the ten survey quadrats (**Table 8.2**). Carcasses chosen for placement at each site were initially selected to ensure that each site contained at least one of each of the three carcass sizes. Then, one or two extra birds were selected by cycling through the sizes in the following order: large, medium, small.

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Table 8.2 Number of Carcasses Used at Each Sampling Quadrat

Survey Site (WTG ID)	DOC		Pigeon		Chicken	
	Winter	Spring	Winter	Spring	Winter	Spring
B001	1	1	1	1	2	3
B004	1	2	2	1	1	2
B021	1	2	1	1	2	2
B025	2	1	1	1	1	3
B037	1	2	2	1	1	2
SG014	1	2	2	1	1	1
SG025	2	1	1	1	1	2
SG027	2	1	1	2	1	1
SG056	1	1	1	2	2	1
SG50	1	2	1	1	2	1
TOTAL	**13**	**15**	**13**	**12**	**14**	**18**

Photo 8.1 Example of Marker Installed at Sampling Quadrat Corners

Photo 8.2 Example of DOC Showing Tag Attached to Leg for Identification

Photo 8.3 Example of Feral Pigeon Carcass

Photo 8.4 Example of Adult Chicken Carcass

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8.3.1.5 Data Collection

Carcasses were deployed on the first day of the trial ('Day 1') and monitored until removed by scavengers or until the end of the 30-day trial period. Carcasses were checked for scavenger activity in the morning and afternoon on Day 2 to Day 5 of each trial. Carcasses remaining on Day 5 were subsequently monitored with camera traps. The carcasses were also checked once on each of the subsequent dates listed in **Table 8.3** (winter) and **Table 8.4** (spring).

Table 8.3 Dates of Carcass Checks for Winter 2024 Scavenger Trial

Day 1	Day 2	Day 3	Day 4	Day 5	Day 9	Day 15	Day 19	Day 23	Day 30
19/8/24	20/8/24	21/8/24	22/8/24	23/8/24	27/8/24	02/09/24	06/09/24	10/09/24	17/9/24
Set up	Checked	Checked	Checked	Checked	Checked	Checked	Checked	Checked	Checked

Table 8.4 Dates of Carcass Checks for Spring 2024 Scavenger Trial

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
11/11/24	12/11/24	13/11/24	14/11/24	15/11/24	16/11/24	17/11/24	18/11/24	19/11/24	20/11/24
Set up	Checked	Checked	Checked	Checked	-	-	-	-	Checked

Each camera trap was mounted to a stake, approximately 50 cm above the ground, facing the carcass (**Photo 8.5**). Cameras were set to one of two modes, depending on conditions at the site (presence or absence of long grass which would continuously trigger the camera):

- Motion triggered, 3 photos per trigger, or
- Single photo taken at hourly intervals.

The motion triggered setting allowed for the identity of the scavenger to be recorded. However, at sites with long grass, the hourly photo interval allowed for the date of scavenging to be recorded without filling memory cards with photos of moving grass and draining camera batteries before the next carcass check.

Photo 8.5 Umwelt Ecologist Installing a Camera Trap at a Scavenger Trial Site

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The nature of scavenger activity was recorded during each carcass visit and photos were taken when there were signs of scavenger activity. Observers would record the status of the carcass during each check as uneaten (U), decapitated (D), partially eaten in situ (P), moved (M), or not present (X). For moved or not present carcasses, the presence of a feather-spot (FS) was recorded, if applicable.

If a carcass was not found in its original location, a rapid search (approximately 10 minutes) was conducted of the surrounding area (50 m radius) to determine if the carcass had potentially been moved from its original location. If the carcass was found nearby during the search, its new location was recorded via electronic waypoint and the scavenger activity monitoring continued. If the carcass was not found during the rapid search, it was recorded as 'not present' and presumed to be removed by a scavenger.

All data collected was then analysed to provide the average estimated carcass persistence, their Confidence Interval (CI), Standard Error (Std. Err.) (variability), Standard Deviation (Std. Dev.) and ranges (minimum and maximum).

8.3.2 Searcher Efficiency Trials

Searcher efficiency trials were conducted in conjunction with the scavenger activity trials in both winter and spring. These trials were performed at five of the sites selected for scavenger trials on Day 1 when carcasses were first placed in the field. Sites selected for searcher efficiently trials were chosen to represent variation in the vegetation conditions and visibility across the GSWF and are listed in **Table 8.5**. Additional sites were not considered necessary due to the similar visibility conditions and vegetation types across the survey sites.

Table 8.5 Searcher Efficiency Trial Sites

WTG	Winter	Spring
B001		✓
B037	✓	
SG014	✓	✓
SG027		✓
SG056	✓	

A blind study methodology was employed, where one surveyor placed bird carcasses randomly in the one-metre square plots within the sampling quadrat using a random number generator, for the other surveyor (the searching surveyor) to find. Identification tags were hidden underneath the carcass when placed in the field, to avoid attracting the attention of the searching surveyor. The carcasses used were the same ones that had been selected for the scavenger trial at that site.

The searching surveyor then walked transect lines at 5 m intervals within the sampling quadrat to search the ground for carcasses, replicating the searching method for long-term WTG collision monitoring surveys. The corner markers set up for the scavenger trial assisted the searching surveyor to maintain an accurate transect route and avoid re-searching the same area. Once the search was completed, the success and/or failure of the searcher to detect carcasses present within the quadrat searched was documented (as per Anderson *et al.* 2004) and the carcasses were left in situ as part of the scavenger activity trial.

A total of 24 bird carcasses, including seven small, nine medium and eight large bird carcasses were used during the searcher efficiency trials.

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8.3.3 Limitations

At the time of the scavenger activity and searcher efficiency trial surveys, the GSWF was an active construction site, which influenced where sampling quadrats could be placed. The need to have sites spread across Stage 1A and Stage 1B and to avoid WTGs that had already been selected for long-term WTG collision monitoring also restricted the variability of sites that were included in these trials. Due to these constraints, only *Austrostipa* sp. grassland sites were selected, and other vegetation types were not able to be surveyed. Of the 26 WTGs which have been selected for long-term WTG collision monitoring, 21 are wholly within *Austrostipa* sp. grassland, and will be adequately represented by the scavenger and searcher data collected in these trials. However, the remaining five WTGs fall partially within other vegetation associations (*Eucalyptus leucoxylon* or *E. porosa* open woodland and *Lomandra* sp. open grassland) or cropping land (**Figure 8.1**). These differences in vegetation may affect the detectability of carcasses by scavengers and searchers.

Due to similar conditions at different sites and time constraints during the surveys, the searcher efficiency trials were not repeated by a second searcher at each site as has been done previously (EBS 2023). This may result in a less robust estimate of detectability due to the small sample size.

In a large majority of cases, the identity of scavengers was unable to be identified due to not having enough cameras available to monitor all carcases for the duration of the trial, and the need to use the hourly photo setting to minimise the number of camera triggers by moving vegetation. However, this does not impact on scavenging activity rates or searcher efficiency.

Use of different carcass species in this scavenger trial than in previous scavenger trials may limit comparison of this data to that collected in previous studies. Adult chickens have been used as the large carcass model previously, however only one other size class was used, a small model represented by quail carcasses (EBS 2023). This was not done in the current trial due to the requirement for three different size classes in accordance with the BAMP. Quails were not readily available and were expensive compared to DOC and feral pigeons, therefore the latter were ultimately selected as the small and medium carcass models respectively.

8.4 Results

8.4.1 Scavenger Activity Trials

All of the small and medium carcasses were scavenged by the end of the winter trial. All large carcasses were completely scavenged except for one at SG056, which was partially scavenged in situ. Of the carcasses that were completely removed, 100% of small carcasses, 62% of medium carcasses and 71% of large carcasses were removed from sampling quadrats without a trace (**Table 8.6**). The remainder were removed with a feather-spot remaining (**Photo 8.6**). Small carcasses were all removed without a trace, except for one DOC which was partially scavenged before later being completely removed (**Photo 8.7**).

In spring, all carcasses were scavenged within ten days, well before the end of the 30-day trial period. Of these, 100% of small carcasses, 67% of medium carcasses and 31% of large carcasses were removed from sampling quadrats without a trace, while other carcasses were removed leaving a feather spot (**Table 8.6**).

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Two carcasses have been removed from the spring analysis due to malfunctioning of the remote camera that was being used to monitor both carcasses. These were two chickens at B004 which were taken between 16/11 and 22/11.

Table 8.6 Scavenging Activity of Bird Carcasses in Winter and Spring 2024

Bird Model	Scavenging Traces and Characteristics	Number of Carcasses
Winter		
Small carcass	Removed, no trace	12
	Partially scavenged	1
	Total	**13**
Medium carcass	Removed, no trace	**8**
	Removed with feather-spot	**5**
	Total	**13**
Large carcass	Removed, no trace	10
	Removed with feather-spot	3
	Partially scavenged	1
	Total	**14**
Spring		
Small carcass	Removed, no trace	15
	Total	**15**
Medium carcass	Removed, no trace	8
	Removed with feather-spot	4
	Total	**12**
Large carcass	Removed, no trace	5
	Removed with feather-spot	11
	Total	**16**

Photo 8.6 Example of a Feather-spot From a Pigeon Carcass

Photo 8.7 Partially Scavenged DOC

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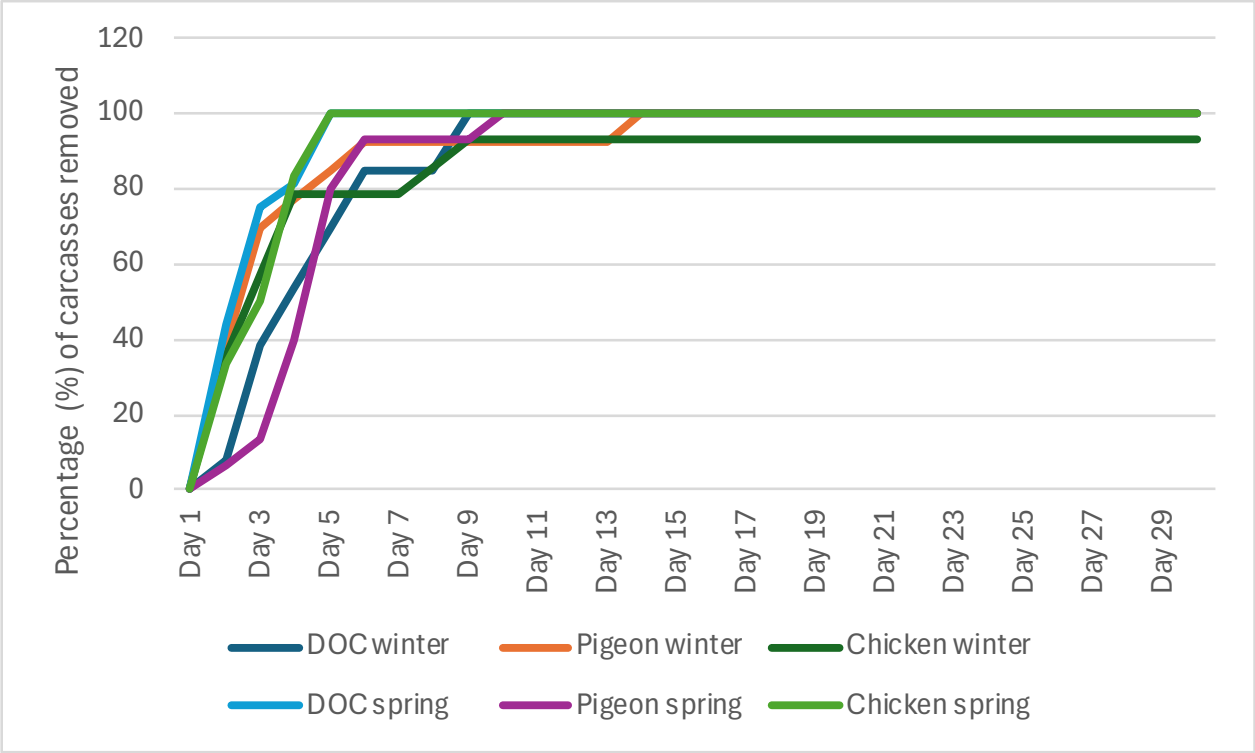
In both winter and spring, most of the carcasses were scavenged within the first five days, with only 22% remaining at this time in winter (four small, two medium, three large) and 12% at this time in spring (all small) (**Graph 8.1**). The mean time of carcass removal varied slightly between seasons, with small carcasses removed slightly faster in winter (3.8 days) than spring (3.9 days), and medium carcasses slightly faster in spring (2.3 days) than in winter (2.8 days). Large carcasses were removed on average considerably faster in spring (2.0 days) than in winter (4.6 days). Overall, carcass removal was considerably faster in spring (2.7 days) than in winter (3.8 days). Mean times until scavenging as well as confidence interval (CI), Standard Deviation and Standard Error are provided in **Table 8.7**. Overall mean time until scavenging across all carcass sizes and both seasons was 3.2 days.



Graph 8.1 Percentage (%) of Small, Medium and Large Bird Carcasses Removed from Sampling Quadrats Over Time

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Table 8.7 Mean Time Until Scavenging for Small, Medium and Large Bird Carcasses

Bird Model	Mean Time until Signs of Scavenging (Days)	Standard Deviation	Standard Error	Confidence Interval (Days)
		Winter		
Small	3.8	2.15	0.60	2.6-6.4
Medium	2.8	3.18	0.88	1.1-4.0
Large	4.6	7.34	1.96	0.8-5.4
All sizes	**3.8**	**4.92**	**0.78**	**2.2-5.3**
		Spring		
Small	3.9	1.71	0.47	3.0-4.7
Medium	2.3	11.11	0.31	1.7-3.0
Large	2.0	1.12	0.30	1.5-2.5
All sizes	**2.7**	**1.59**	**0.24**	**2.3-3.2**
		Both Seasons		
Small	3.8	1.93	0.36	3.1-4.5
Medium	2.6	2.43	0.49	1.6-3.6
Large	3.2	5.25	0.96	1.4-5.1
All sizes	**3.2**	**3.64**	**0.40**	**2.5-4.0**

8.4.1.1 Scavenger Identity

As most of the carcasses were removed before the camera traps were deployed, it was difficult to ascertain the identity of the scavengers. Of the nine carcasses that were monitored by camera traps after the fifth day of the winter trial, six were taken by Red Fox (**Photo 8.8**), one was taken by an Australian Magpie (**Photo 8.9**), and one by a Feral Cat. Cat and fox were recorded feeding on the last remaining chicken carcass in the winter trial, but did not completely remove it before the end of the trial period. Two different cats were recorded visiting this carcass (**Photo 8.10** and **Photo 8.11**).

In the spring trial all cameras were programmed to take hourly photo rather than being set to motion triggered mode, due to movement of longer grass. Therefore, the identity of the scavengers during the spring trials was not ascertained.

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Photo 8.8 Red Fox Removing Pigeon Carcass

Photo 8.9 Australian Magpie Removing DOC

Photo 8.10 Feral Cat (1) Visting Last Remaining Chicken Carcass

Photo 8.11 Feral Cat (2) With Extensive White Markings Visting Last Remaining Chicken Carcass

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8.4.2 Searcher Efficiency Trials

Across winter and spring, a total of seven small carcasses were searched for by surveyors, across five sampling quadrats, with four of these found by the surveyors, resulting in a surveyor detection rate of 50.0% for the small bird model. A total of nine medium carcasses were searched for by surveyors, across all five sampling quadrats, with eight of these found by the surveyors, resulting in a surveyor detection rate of 83.3% for the medium bird model. All of the eight large bird carcasses used were found by surveyors, resulting in a surveyor detection rate of 100%. The overall carcass detection rate at the Goyder South Project was 77.8% (**Table 8.8** and **Graph 8.2**).

Between winter and spring, there were no differences in detectability of large carcasses. In winter, detectability of medium carcasses was higher (100%) than in spring (66.7%). The opposite was true for small carcasses with more detected in spring (66.7%) than winter (33.3%). Overall carcass detectability was the same in winter and spring (77.8%).

Table 8.8 The Detection Efficiency of Small, Medium and Large Bird Models

Model	Number of Trials	Number of Carcasses Used	Number of Carcasses Detected	Estimated Probability (%) of Detection	Standard Deviation	Standard Error
Winter						
Small bird	3	3	1	33.3	47.1	27.2
Medium bird	3	5	5	100	-	-
Large bird	3	4	4	100	-	-
Total	**9**	**12**	**10**	**77.8**	**44.1**	**14.7**
Spring						
Small bird	3	4	3	66.7	47.1	27.2
Medium bird	3	4	3	66.7	47.1	27.2
Large bird	3	4	4	100	0	0
Total	**9**	**12**	**10**	**77.8**	**41.6**	**13.9**
Combined						
Small bird	6	7	4	50.0	50.0	20.4
Medium bird	6	9	8	83.3	37.3	15.2
Large bird	6	8	8	100.0	0	0
Total	**18**	**24**	**20**	**77.8**	**41.6**	**9.8**

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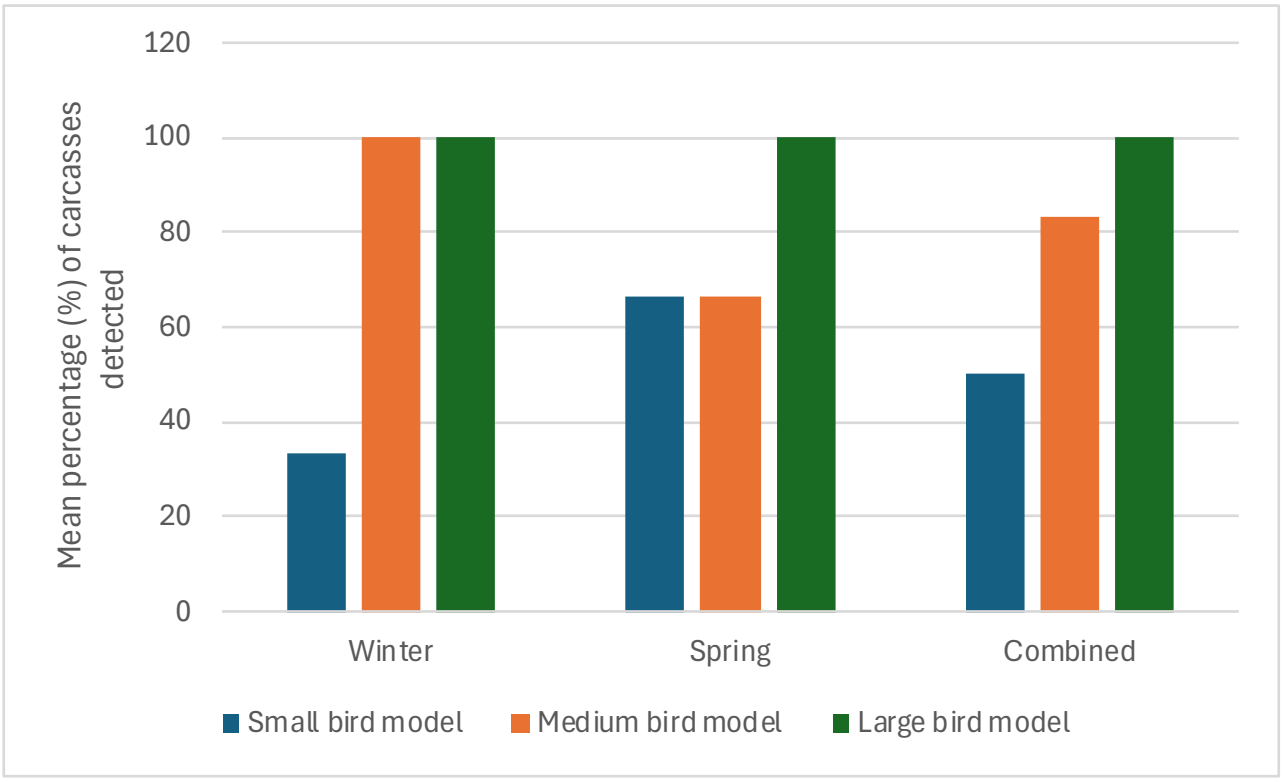

Graph 8.2 The Mean Percentage (%) of Small, Medium and Large Bird Models Detected in 2024 Searcher Efficiency Trials

8.5 Discussion

8.5.1 Scavenger Trials

Scavenging activity at GSWF was moderate to high, with respect to scavenger studies at other windfarms in south-eastern Australia (EBS Ecology 2008; Wood 2015). The mean time until carcasses were removed was 3.2 days for large birds, 2.6 days for medium birds and 3.9 days for small birds, with an overall mean time of 3.2 days until removal. These results differ from the previous scavenger trials at GSWF (EBS Ecology 2023), when the removal rate of small birds was slower (7.8 days) and large birds was faster (2.7 days). It should be noted however, that the small birds used in 2023 were quails, and that pigeons and DOC were not used, so these results may not be directly comparable. Or other factors, such as populations of scavengers, food demand and availability may also have been different in 2023, possibly due to different annual seasonal conditions.

The average time of carcass removal varied slightly between seasons, with small carcasses removed slightly faster in winter than spring, and medium carcasses slightly faster in spring than in winter. Large carcasses were removed considerably faster in spring than in winter. Overall, carcass removal was considerably faster in spring than in winter. This may be due to foxes being more active in spring and summer, with warm, fine weather possibly facilitating greater foraging activity than cold, inclement weather. There may be an increase in local population in spring, following the breeding season (July to October) (Carritt 1999). Wedge-tailed Eagle scavenging activity may also be higher during spring as nesting for this species occurs in July-August with fledging occurring at around 12 weeks of age. Furthermore, juveniles tend to stay in the area local to their parents for around 6 months

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before dispersing. During this time, they are highly likely to take advantage of carrion. Adult Wedge-tailed Eagles also feed on carrion but prefer to feed fresh prey to nestlings (Olsen 2005).

Mortality rate calculations and estimations are sensitive to the number and frequency of carcasses used in carcass persistence trials (e.g., Smallwood et al., 2010). For example, scavenger trials often place 10 carcasses at once within small areas, which may overwhelm scavengers, preventing them from processing and removing all the placed carcasses. This bias, known as 'scavenger swamping,' can lead to underestimates of mortality rates (Smallwood, 2007). However, a recent study on raptor carcass persistence by Wilson et al. (2022) found no significant relationship between the number of carcasses in the trial or the trial duration and estimated carcass persistence. To avoid potential scavenger swamping in this study, only 4–5 bird carcasses were placed at a time, at randomly selected locations (one-meter square plots) throughout the sampling quadrats, across ten proposed WTG sites.

8.5.2 Searcher Efficiency Trials

In scavenger trials on other wind farms, the height and type of vegetation as well as the size of the bird have been found to influence surveyor efficiency. Differences between vegetation types were not investigated in these trials, as previously discussed. It is difficult to conclude whether vegetation height would have an effect at GSWF. Although the grass was generally longer and in better condition in spring than in winter, it was not long enough to drastically change visibility and carcass detectability. One site (SG027) had significantly longer vegetation in spring compared with winter and all carcasses that were searched for at that site were found. Vegetation height and therefore carcass visibility was similar at other sites between winter and spring, with the overall detection rate being the same between seasons. Across both seasons, large birds were the easiest to find followed by medium and small birds.

Overall, 77.8% of carcasses were detected, which is high with respect to other windfarm carcass detectability studies (Morrison 2002), although lower than detectability in the 2023 trials at GSWF (93.1%) (EBS Ecology 2023).

8.6 Conclusions

The rate of removal of carcasses during scavenger activity trials at GSWF in winter and spring 2024 was high and will be incorporated into estimates of avian mortality. The value for *T* (the overall average time in days for carcasses to be removed from sample sites) was 3.2 days. The value for *p* (searcher efficiency) is 0.83. These figures can be used in conjunction with WTG collision monitoring data to calculate more accurate mortality estimates for the GSWF while accounting for these variables.

Due to the lack of variability in conditions between seasons and time constraints, only a small number of replicates were conducted for searcher efficiency trials in winter and spring 2024. Personnel conducting future strike monitoring surveys should monitor the condition of the vegetation during each survey. Based on this information, the need for additional scavenger and searcher trials will be assessed annually by a suitably qualified and experienced ecologist, and trials will be conducted if conditions change significantly. Additional trials may be required in vegetation other than *Austrostipa* spp. grassland when construction ends and accessibility to all WTGs is possible.

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9.0 Opportunistic Observations of Agricultural Practices and Pest Species

As outlined in the BAMP (Section 8.3.5), agricultural practices, such as feeding of grain and/or fodder to stock, lambing, or water points in close proximity to WTGs, and pest species, which are observed opportunistically during monitoring events, or during regular operation of the Project, will be recorded and included in reporting, as this information may be helpful when attempting to determine the cause of a trigger level impact.

The following opportunistic observations of agricultural practices and pest species were recorded in 2024:

- Young lambs were observed in some paddocks within Stage 1A during BUS surveys in June 2024.
- Two European Hares (*Lepus europaeus*) were observed at BUS Site 3 during BUS survey on 14/10/2024.

A greater focus will be placed on collecting opportunistic observations of agricultural practices and pest species during future monitoring events.

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10.0 Bird Monitoring Program Data Analysis

All data collected during the Bird Monitoring Program has been entered into a specific database and analysed to understand bird activity and WTG collisions across the Stage 1A and Stage 1B Project Areas.

10.1 Consideration of Trigger Levels

WTG collision monitoring results were assessed following each quarterly WTG collision monitoring event and compared to relative trigger levels for each species of concern. If a trigger level occurs, the adaptive management framework (outlined in Section 9 of the BAMP) will be followed, which includes undertaking a significant impact assessment to determine the level of impact on the bird species of concern.

While five feather-spots were observed during the 2024 WTG collision monitoring program (**Table 7.2**), and two carcasses and two feather-spots were observed incidentally (**Table 7.3**), none of the species observed are listed under the EPBC Act. As such, the trigger level for "EPBC Act listed threatened and migratory bird species" was not reached. Furthermore, the trigger for "Other non-threatened bird species" was not reached either, as more than four carcasses or feather-spots of a single species were not found under or close to a WTG during a WTG collision monitoring search, and/or incidentally by wind farm personnel. Refer to **Section 2.2.3** for trigger levels.

As no trigger level impact was detected in 2024, no adaptive management action was required or undertaken.

10.2 Annual Mortality Rate

As outlined in the BAMP (Section 8.4.1), after 12 months of WTG collision monitoring, the annual mortality rate for each EPBC Act listed bird species and other bird species (i.e. species of concern) will be estimated using current best practice science taking into account searched areas, carcass persistence times and searcher efficiency rates. Refer to BAMP Section 8.4.1 for more detailed information on estimating the annual mortality rate. Annual mortality rates will be compared to the thresholds set in BAMP Section 4.5 and the required response implemented.

As WTG collision monitoring only commenced in August 2024, 12 months of WTG collision monitoring has not yet occurred. As such, 12 months of WTG collision monitoring data is not yet available. Furthermore, no WTG collision monitoring was undertaken in Stage 1B as WTG commissioning did not commence until November 2024. Therefore, the annual mortality rate for each EPBC Act listed bird species and other bird species (i.e. species of concern), has not been estimated for 2024. However, it is anticipated that annual mortality rate will be estimated for the next annual report.

10.3 WTG Risk Ratings

As outlined in the BAMP (Section 8.4.2), after the initial 12 months of BUS and WTG collision monitoring, the results will be analysed to review, adjust, and if required, assign WTG high risk ratings. However, as outlined above, 12 months of WTG collision monitoring has not yet occurred and no WTG collision monitoring was undertaken in Stage 1B. As such, WTG risk ratings have not been reviewed or adjusted, nor assigned high risk ratings. It is anticipated that this task will be undertaken as part of the next annual report.

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11.0 Adaptive Management Framework

As outlined in Section 9 of the BAMP, results of the Bird Monitoring Program, including BUS, raptor nest activity monitoring, WTG collision monitoring, incidental finds of bird carcasses, carcass persistence (scavenger activity) and searcher efficiency trials, and opportunistic observations of agricultural practices and pest species, will be used to inform an adaptive management framework to ensure that no significant impacts to EPBC Act listed bird species are likely to occur as a result of the Project and that potential impacts to raptor and other bird species are minimised and mitigated, where practicable.

However, no trigger level impact was detected during the Bird Monitoring Program. As such, the adaptive management framework protocol was not required to be implemented.

11.1 Review of BAMP

As outlined in the BAMP (Section 5.4), the BAMP will be reviewed annually during implementation of the Bird Monitoring Program to ensure the environmental objectives are being achieved and to identify any improvements that might be required. However, as 12 months of WTG collision monitoring has not yet occurred, together with the fact that no trigger level requiring management responses occurred, the BAMP has not been reviewed on this occasion. It is anticipated that a review of the BAMP will be undertaken within the next 12 months and reported upon in the next BAMP implementation annual report.

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12.0 Conclusion

Neoen commenced implementing the BAMP, including its Bird Monitoring Program, with the first BUS survey undertaken in December 2023 and continued implementation throughout 2024. As such, this *Goyder South Hybrid Renewable Energy Facility – Stage 1: Stage 1A and Stage 1B Bird Adaptive Management Plan Annual Implementation Report 2024* covers implementation of the BAMP from December 2023 until December 2024 (inclusive).

Environmental and Meteorological Conditions

While there was above average rainfall in mid-late spring 2024 (October and November), there was significantly below average rainfall in all other months of 2024, resulting in an annual total of only 248.1 mm, much less than the long-term average annual rainfall of 418 mm at Burra. While it is possible that this may have impacted on bird utilisation and activity, as well as scavenger activity, within the Stage 1A and Stage 1B Project Areas, the extent of possible impact is unknown.

Bird Utilisation

A total of 7,329 individual birds were recorded across the four seasonal BUS surveys, including 6,419 individuals observed at BUS Sites and 910 individuals observed opportunistically. Bird abundance varied over the four seasonal surveys and was the greatest in summer (December 2023) and the lowest in spring (October 2024).

A total of 76 species (including 72 native and four introduced) were observed across the four seasonal BUS surveys, including 75 species at BUS Sites and one species only observed opportunistically. Bird species recorded were predominately common grassland and woodland bird species, which aligns with the available habitat that consists mainly of grassland and cropping paddocks with some remnant woodlands. The most abundant species were Grey Teal (*Anas gracilis*), Galah (*Eolophus roseicapilla*) and Australian Magpie (*Gymnorhina tibicen*), accounting for 47.3%, 7.9% and 5.7% of all sightings, respectively.

Only one EPBC Act listed species, the Southern Whiteface (*Aphelocephala leucopsis leucopsis*), was observed, with it recorded during all four BUS surveys. The most observations of Southern Whiteface occurred in the autumn 2024 survey when a total of 27 birds were observed across three BUS Sites. Overall, the species was observed at five of the 13 BUS sites, with the highest number observed at BUS Site 6 where a total of 22 individuals were observed over the four surveys. As the species is known to be sedentary, these observations are likely to include multiple observations of the same individuals.

Two species listed as Rare under the NPW Act were observed, including the Elegant Parrot (*Neophema elegans*) with two individuals observed during the autumn 2024 survey, and the Black Falcon (*Falco subniger*) with one individual observed during the summer 2023 survey. The Black Falcon is a raptor species, which is potentially at risk of collision with wind farm infrastructure. As it was not previously identified as potentially relevant to the Goyder South Project and potentially at risk of collision with wind farm infrastructure, it has been added to the species of concern (listed in **Appendix A**).

Only one non-threatened species, which was not previously known to occur or predicted to occur at the site, the Australian Reed Warbler (*Acrocephalus australis*), was recorded via BUS survey. This species is not listed as threatened or migratory under the EPBC Act, nor is it listed as threatened

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under the NPW Act. Furthermore, it is not considered to be a species potentially 'at risk' for collision with wind farm infrastructure. As such, it is not considered to be a species of concern.

Seven raptor species were recorded via BUS survey, including Nankeen Kestrel (*Falco cenchroides cenchroides*), Wedge-tailed Eagle (*Aquila audax audax*), Brown Falcon (*Falco berigora berigora*), Black Falcon (Falco subniger), Brown Goshawk (*Accipiter fasciatus fasciatus*), Black-shouldered Kite (*Elanus axillaris*) and Australian Hobby (*Falco longipennis*). However, none of these are EPBC Act listed species, while the Black Falcon is listed under the NPW Act.

A total of 877 birds from 15 different species were recorded at flight heights considered as being at-risk of collision with WTGs (i.e. at RSA height), which equates to 11.9% of the total number of birds recorded via BUS survey. Of these 15 species, four were raptors, three were waterbirds, five were native species commonly found in grasslands and three were introduced species. None of the 15 species are listed under the EPBC Act and only one species, the Black Falcon, is listed under the NPW Act.

The distribution of birds flying at RSA heights at each of the 13 BUS Sites was random during all four BUS surveys. Birds were not recorded flying at RSA heights at any one BUS site more than another, which may suggest that risk to birds is rather uniformly distributed over the Stage 1A and Stage 1B Project Areas. However, 12 months of data is too limited to draw conclusions and collection of more data during future BUS surveys will assist to understand risk.

The absence of EPBC Act listed bird species observed suggests that the risk of impact (i.e. via WTG collision) to these species by the Stage 1A and Stage 1B wind farms is low. However, it is also acknowledged that 12 months of seasonal BUS data, comprising 12 survey days, represents only a snapshot of bird activity during that 12-month period, and is therefore limited. Collection of more data during future BUS surveys will allow for statistical analysis and stronger conclusions.

Raptor Nest Activity

Of the five WTE nests known to occur within the Stage 1A and Stage 1B Project Areas, one was active, two were inactive and two were no longer present in 2024. The active nest was considered successful as it contained two large WTE chicks and is an early indication that WTEs are currently living and breeding within the Stage 1B Project Area.

Long-term WTG Collision Monitoring

Two quarterly WTG Collision monitoring surveys were completed in 2024, in August and November. However, the monitoring was limited to commissioned WTGs within Stage 1A, as commissioning of WTGs in Stage 1B did not commence until after the November 2024 survey.

While no bird carcasses were observed during the 2024 WTG collision monitoring program, five feather-spots were observed, including three Australian Magpie (*Gymnorhina tibicen*) and two Galah (*Eolophus roseicapilla*), neither of which are listed under the EPBC Act or NPW Act.

Incidental Finds of Bird Carcasses

Four incidental finds were recorded in 2024, including two carcasses (Brown Falcon and Nankeen Kestrel) and two feather-spots (Galah and Australian Magpie). All four were found at different WTGs and none of the species are listed under the EPBC Act or NPW Act.

Carcass Persistence (Scavenger Activity) and Searcher Efficiency Trials

Results of the first scavenger activity and searcher efficiency trial undertaken previously within the Stage 1A and Stage 1B Project Areas in March 2023 suggest that small bird carcasses are removed

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later (7.8 days) than large bird carcasses (2.7 days), while a detection rate of 90.0% for the small bird model and 96.6% for the large bird model resulted in an overall carcass detection rate at the Project of 93.1%.

Results of the two scavenger activity and searcher efficiency trials undertaken in winter (19 August to 17 September 2024) and spring (11-22 November 2024), are slightly different, with small bird carcasses removed in 3.9 days, medium bird carcasses removed in 2.6 days and large bird carcasses removed in 3.2 days, while the overall carcass detection rate was 77.8%. These results will be used in conjunction with WTG collision monitoring data to calculate mortality estimates for the GSWF.

Bird Monitoring Program Data Analysis and Adaptive Management

While a total of two carcasses and seven feather-spots have been recorded during the Bird Monitoring Program in 2024, no trigger level impact was detected. As such, the adaptive management framework protocol was not required to be implemented, and no adaptive management action was required or undertaken.

As 12 months of WTG collision monitoring data is not yet available and no collision monitoring was undertaken in Stage 1B, the annual mortality rate for each EPBC Act listed bird species and other bird species (i.e. species of concern) has not been estimated for 2024. Similarly, as 12 months of WTG collision monitoring has not yet occurred and no WTG collision monitoring was undertaken in Stage 1B, WTG risk ratings have not been reviewed or adjusted yet.

In accordance with the BAMP, the Bird Monitoring Program will continue to be implemented throughout 2025 and the data collected will continue to be used to inform the adaptive management framework to ensure that no significant impacts to EPBC Act listed bird species are likely to occur as a result of the Project and that potential impacts to other bird species (such as raptors) are minimised and mitigated, where possible.

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Appendix A

Species of Concern

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Appendix Table A.1 BAMP Table 10: EPBC Act Listed Bird Species Likelihood of Occurrence Within the Stage 1A and/or Stage 1B Project Areas (Updated To Include Observations via BUS 2023-2024)

Scientific Name	Common Name	Conservation Status		Source	Last BDBSA Record (Year)	Observed During Initial Flora and Fauna Assessment Field Surveys (2019) (EBS Ecology 2020)?	Likelihood of Occurrence Within the Stage 1A and/or Stage 1B Project Areas	Observed Via BUS (2023-2024)
		Aus	SA					
Actitis hypoleucos	Common Sandpiper	Mi	R	1			**Possible** (flyover only)	No
Aphelocephala leucopsis	Southern Whiteface	VU		1; 2	2015	Yes	**Known** (observed within scattered trees / woodland)	**Yes**
Apus pacificus	Fork-tailed Swift	Mi		1; 2	2006		**Possible** (flyover only)	No
Botaurus poiciloptilus	Australasian Bittern	EN	E	1			Unlikely	No
Calidris acuminata	Sharp-tailed Sandpiper	Mi		1; 2	2003		**Possible** (flyover only)	No
Calidris ferruginea	Curlew Sandpiper	CE, Mi		1			**Possible** (flyover only)	No
Calidris melanotos	Pectoral Sandpiper	Mi	R	1			**Possible** (flyover only)	No
Falco hypoleucos	Grey Falcon	VU	R	1			Unlikely	No
Gallinago hardwickii	Latham's Snipe	Mi		1			Unlikely	No
Grantiella picta	Painted Honeyeater	VU		1; 2	2000		Unlikely	No
Leipoa ocellata	Malleefowl	VU	V	1			Unlikely	No
Lophochroa leadbeateri leadbeateri	Major Mitchell's Cockatoo (eastern)	EN	R	1			Unlikely	No
Manorina melanotis	Black-eared Miner	EN	E	1			Unlikely	No
Melanodryas cucullata cucullata	South-eastern Hooded Robin	EN	R	1; 2	2010	Yes	**Known** (observed on site)	No

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Scientific Name	Common Name	Conservation Status		Source	Last BDBSA Record (Year)	Observed During Initial Flora and Fauna Assessment Field Surveys (2019) (EBS Ecology 2020)?	Likelihood of Occurrence Within the Stage 1A and/or Stage 1B Project Areas	Observed Via BUS (2023-2024)
		Aus	SA					
Motacilla cinerea	Grey Wagtail	Mi		1			Unlikely	No
Motacilla flava	Yellow Wagtail	Mi		1			Unlikely	No
Myiagra cyanoleuca	Satin Flycatcher	Mi	E	1; 2	1998	Yes	**Known** (observed within woodland)	No
Neophema chrysostoma	Blue-winged Parrot	VU	V	1; 2	2001		Possible	No
Numenius madagascariensis	Far Eastern Curlew	CE, Mi	V	1			Unlikely	No
Pandion haliaetus	Osprey	Mi	R	1			Unlikely	No
Pedionomus torquatus	Plains-wanderer	CE		1			Unlikely	No
Pezoporus occidentalis	Night Parrot	EN	E	1			Unlikely	No
Polytelis anthopeplus monarchoides	Regent Parrot (eastern)	VU	V	1; 2	2013		Unlikely	No
Rostratula australis	Australian Painted Snipe	EN	V	1; 2	2001		Unlikely	No
Stagonopleura guttata	Diamond Firetail	VU	V	1; 2	2010	Yes	**Known** (observed at riparian area adjacent Mixed Open Mallee)	No
Tringa nebularia	Common Greenshank	Mi		1			**Possible** (flyover only)	No

Conservation Status: Aus: Australia (EPBC Act). SA: South Australia (NPW Act).
Conservation codes: CR/CE: Critically Endangered. EN/E: Endangered. VU/V: Vulnerable. R: Rare. Mi: Migratory.
Source: 1: EPBC Protected Matters Search Tool. 2: BDBSA (Biological Databases of South Australia) record.

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Appendix Table A.2 BAMP Table 11: Other Bird Species That May Be Relevant To The Project WTG Collision Monitoring Program (Updated To Include Observations Via BUS 2023-2024)

Scientific name	Common name	SA Conservation Status (NPW Act)	Source	Last BDBSA Record (Year)	Observed During Initial Flora and Fauna Assessment Field Surveys (2019) (EBS Ecology 2020)?	Likelihood of occurrence within the Stage 1A and/or Stage 1B Project Areas	Observed Via BUS (2023-2024)
Accipiter cirrocephalus cirrocephalus	Collared Sparrowhawk		1; 2	2010	Y	Known	No
Anhinga novaehollandiae	Australasian Darter	R	2	2000		Possible	No
Anseranas semipalmata	Magpie Goose	E	2	1983		Unlikely	No
Ardeotis australis	Australian Bustard	V	2	2000		Unlikely	No
Aquila audax	Wedge-tailed Eagle		1; 2	2008	Y	Known	**Yes**
Cladorhynchus leucocephalus	Banded Stilt	V	2	2003		Possible	No
Circus approximans	Swamp Harrier		1		Y	Known	No
Corcorax melanorhamphos	White-winged Chough	R	1; 2	2015	Y	Known	No
Coturnix ypsilophora	Brown Quail	V	2	2015		Possible	No
Falco berigora	Brown Falcon		1; 2	2015	Y	Known	**Yes**
Falco cenchroides	Nankeen Kestrel		1; 2	2015	Y	Known	**Yes**
Falco peregrinus	Peregrine Falcon	R	1; 2	2010	Y	Known	No
Falco subniger	Black Falcon	R	1		N	Known	**Yes**
Melithreptus gularis	Black-chinned Honeyeater	R	2	2006		Possible	No
Myiagra inquieta	Restless Flycatcher	R	2	2010		Likely	No
Neophema elegans	Elegant Parrot	R	1; 2	2006	Y	Known	**Yes**
Pachycephala inornata	Gilbert's Whistler	R	2	1986		Unlikely	No
Plectorhyncha lanceolata	Striped Honeyeater	R	2	1986		Unlikely	No
Porzana tabuensis	Spotless Crake	R	2	2002		Unlikely	No
Turnix varius	Painted Buttonquail	R	2	2015		Possible	No

Conservation Codes: E: Endangered. V: Vulnerable. R: Rare.
Source: 1: Observed on site. 2: BDBSA record.

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Appendix B

Bird Species Occurrence, Richness and Abundance Across All BUS Surveys

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Scientific Name	Common Name	Conservation Status		BUS Site															
		EPBC Act	NPW Act	1	2	3	4	5	6	7	8	9	10	11	12	13	Opp.	Abundance^	Occupancy^
Acanthagenys rufogularis	Spiny-cheeked Honeyeater	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	2	1
Acanthiza apicalis	Inland Thornbill	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	6	4	1
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	-	-	2	-	53	-	67	36	3	22	23	-	-	-	-	-	206	7
Acanthiza reguloides	Buff-rumped Thornbill	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	6	1
Acanthiza uropygialis	Chestnut-rumped Thornbill	-	-	-	-	-	-	-	9	-	-	4	-	-	-	-	-	13	2
Accipiter fasciatus fasciatus	Brown Goshawk	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	1
Acrocephalus australis	Australian Reed Warbler	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	2	1
Aegotheles cristatus cristatus	Australian Owlet-nightjar	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	1
*Alauda arvensis arvensis**	Eurasian Skylark	-	-	4	13	1	18	1	3	20	-	-	20	22	4	12	-	118	11
Anas gracilis gracilis	Grey Teal	-	-	3037	23	-	-	-	-	-	-	-	-	-	-	63	-	3123	3
Anas superciliosa	Pacific Black Duck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	4	1
Anthochaera carunculata	Red Wattlebird	-	-	1	-	2	-	1	-	-	2	-	-	-	-	-	-	6	4
Anthus australis	Australian Pipit	-	-	-	9	-	14	-	-	44	3	1	12	20	8	25	-	136	9
Aphelocephala leucopsis leucopsis	Southern Whiteface	VU	-	-	-	-	-	12	22	5	21	16	-	-	-	-	-	76	5
Aquila audax audax	Wedge-tailed Eagle	-	-	-	1	-	1	2	-	-	5	-	1	-	2	-	6	12	6
Barnardius zonarius	Australian Ringneck	-	-	-	-	-	-	13	8	-	-	-	-	-	-	-	-	21	2

Docusign Envelope ID: CC1B9638-E757-4AAA-9EF4-5DDA2D3F7DDB

Scientific Name	Common Name	Conservation Status		BUS Site															
		EPBC Act	NPW Act	1	2	3	4	5	6	7	8	9	10	11	12	13	Opp.	Abundance^	Occupancy^
Chalcites basalis	Horsfield's Bronze Cuckoo	-	-	-	-	2	-	2	-		-	-	-	-	-	-	-	4	2
Charadrius ruficapillus	Red-capped Plover	-	-	94	-	-	-	-	-	-	-	-	-	-	-	-	-	**94**	**1**
Chenonetta jubata	Australian Wood Duck	-	-	-	22	9	-	-	-	-	-	-	-	-	-	-	-	**31**	**2**
Chroicocephalus novaehollandiae novaehollandiae	Silver Gull	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	**2**	**1**
Cincloramphus cruralis	Brown Songlark	-	-	2	-	-	3	-	-	1	-	-	-	-	1	2	-	**9**	**5**
Climacteris picumnus picumnus	Brown Treecreeper	-	-	-	-	-	-	22	-	-	-	2	-	-	-	-	-	**24**	**2**
Colluricincla harmonica	Grey Shrikethrush	-	-	-	-	-	-	5	5	-	-	3	-	-	-	-	-	**13**	**3**
*Columba livia**	Rock Dove	-	-	13	-	-	-	-	-	6	155	-	-	57	12	-	-	**243**	**5**
Coracina novaehollandiae	Black-faced Cuckoo-shrike	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	**2**	**2**
Corvus coronoides	Australian Raven	-	-	14	71	17	15	9	3	10	15	2	19	1	18	7	-	**201**	**13**
Corvus mellori	Little Raven	-	-	-	-	9	4	5	2	1	-	3	5	73	-	-	-	**102**	**8**
Corvus sp.	Crow	-	-	5	6	-	2	1		4	3	-	-	-	4	4	-	**29**	**8**
Coturnix pectoralis	Stubble Quail	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	**1**	**1**
Cracticus torquatus leucopterus	Grey Butcherbird	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	**1**	**1**
Dacelo novaeguineae novaeguineae	Laughing Kookaburra	-	-	-	-	3	-	1	-	-	-	-	-	-	-	-	-	**4**	**2**
Daphoenositta chrysoptera	Varied Sitella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-

Docusign Envelope ID: CC1B9638-E757-4AAA-9EF4-5DDA2D3F7DDB

Scientific Name	Common Name	Conservation Status		BUS Site															
		EPBC Act	NPW Act	1	2	3	4	5	6	7	8	9	10	11	12	13	Opp.	Abundance^	Occupancy^
Elanus axillaris	Black-shouldered Kite	-	-	-	-	-	1	-	-	2	-	-	-	-	-	-	9	**3**	**2**
Elseyornis melanops	Black-fronted Dotterel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	**5**	**1**
Eolophus roseicapilla	Galah	-	-	44	19	81	8	80	21	20	117	22	41	32	10	25	1	**520**	**13**
Epthianura albifrons	White-fronted Chat	-	-	-	-	-	-	-	-	2	-	-	-	-	-	7	2	**8**	**2**
Falco berigora berigora	Brown Falcon	-	-	-	-	-	1	-	-	1	1	1	2	-	2	-	7	**8**	**6**
Falco cenchroides cenchroides	Nankeen Kestrel	-	-	3	6	2	5	2	1	2	2	1	2	1	-	-	19	**27**	**11**
Falco longipennis	Australian Hobby	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	**2**	**1**
Falco subniger	Black Falcon	-	R	-	-	-	-	-	-	-	-	-	1	-	-	-	-	**1**	**1**
Gavicalis virescens	Singing Honeyeater	-	-	4	-	-	-	1	10	4	2	2	-	-	2	-	-	**25**	**7**
Grallina cyanoleuca cyanoleuca	Magpielark	-	-	1	-	3	-	-	-	-	-	1	-	-	-	2	-	**6**	**4**
Gymnorhina tibicen	Australian Magpie	-	-	36	93	66	49	37	7	12	21	14	11	8	12	9	1	**375**	**13**
Hirundo neoxena neoxena	Welcome Swallow	-	-	-	-	-	-	-	-	1	1	-	-	-	-	6	2	**8**	**3**
Lichenostomus leucotis	White-eared Honeyeater	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	**3**	**2**
Malurus assimilis assimilis	Purple-backed Fairywren	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	**6**	**1**
Malurus lamberti	Variegated Fairywren	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	**2**	**1**

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Scientific Name	Common Name	Conservation Status		BUS Site															
		EPBC Act	NPW Act	1	2	3	4	5	6	7	8	9	10	11	12	13	Opp.	Abundance^	Occupancy^
Malurus leucopterus leuconotus	White-winged Fairywren	-	-	-	-	-	-	-	4	4	-	-	-	-	-	17	-	**25**	**3**
Manorina flavigula	Yellow-throated Miner	-	-	3	-	-	-	7	2	-	1	-	-	-	-	-	4	**13**	**4**
Manorina melanocephala	Noisy Miner	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**	**1**
Melithreptus brevirostris	Brown-headed Honeyeater	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	**2**	**2**
Melithreptus lunatus	White-naped Honeyeater	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	**2**	**1**
Merops ornatus	Rainbow Bee-eater	-	-	-	-	-	-	-	2	2	4	-	-	-	-	-	-	**6**	**3**
Microcarbo melanoleucos melanoleucos	Little Pied Cormorant	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	**1**	**1**
Microeca fascinans	Jacky Winter	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	**1**	**1**
Mirafra javanica	Horsfield's Bushlark	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	**6**	**1**
Neophema elegans elegans	Elegant Parrot	-	R	-	-	-	-	2	-	-	-	-	-	-	-	-	-	**2**	**1**
Ocyphaps lophotes	Crested Pigeon	-	-	-	-	-	-	-	-	-	7	5	-	-	-	-	-	**12**	**2**
Pachycephala pectoralis	Australian Golden Whistler	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	**2**	**1**
Pardalotus punctatus	Spotted Pardalote	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	**1**	**1**
Pardalotus striatus	Striated Pardalote	-	-	3	-	10	-	5	15	-	6	6	-	-	-	-	-	**45**	**6**
*Passer domesticus domesticus**	House Sparrow	-	-	-	-	-	-	-	-	40	40	-	-	-	-	34	30	**114**	**3**

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Scientific Name	Common Name	Conservation Status		BUS Site															
		EPBC Act	NPW Act	1	2	3	4	5	6	7	8	9	10	11	12	13	Opp.	Abundance^	Occupancy^
Petrochelidon nigricans	Tree martin	-	-	-	-	-	-	4	-	-	2	-	-	-	-	-	-	**6**	**2**
Petroica goodenovii	Red-capped Robin	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-	**12**	**1**
Platycercus elegans	Crimson Rosella	-	-	-	-	23	-	10	2	-	7	9	-	-	-	-	4	**51**	**5**
Psephotus haematonotus	Red-rumped Parrot	-	-	-	-	2	-	12	-	-	13	-	-	-	-	-	-	**27**	**3**
Ptilotula penicillata	White-plumed Honeyeater	-	-	-	-	-	-	21	1	3	13	3	-	-	1	-	-	**42**	**6**
Rhipidura albiscapa	Grey Fantail	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	**4**	**1**
Rhipidura leucophrys leucophrys	Willie Wagtail	-	-	2	-	4	-	3	4	3	3	1	-	3	2	6	-	**31**	**10**
Smicrornis brevirostris	Weebill	-	-	-	-	5	-	7	58		28	18	-	-	-	-	-	**116**	**5**
Strepera versicolor	Grey currawong	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	**1**	**1**
*Sturnus vulgaris vulgaris**	Common Starling	-	-	19	-	61	14	15	-	-	86	6	41	-	-	13	740	**254**	**8**
Tadorna tadornoides	Australian Shelduck	-	-	29	-	-	-	-	-	-	-	-	-	-	-	-	64	**29**	**1**
Taeniopygia guttata castanotis	Zebra Finch	-	-	-	-	-	-	-	-	-	-	-	-	-	5	49	-	**54**	**2**
Vanellus miles	Masked Lapwing	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	**9**	**1**
Zosterops lateralis	Silvereye	-	-	-	-	-	-	-	58	-	-	-	-	-	-	-	-	**58**	**1**
Total Abundance per Site				**3330**	**264**	**355**	**142**	**353**	**308**	**191**	**589**	**144**	**155**	**217**	**83**	**288**	**910**	**6419**	
Total Species Richness per Site				**23**	**12**	**22**	**15**	**30**	**30**	**23**	**30**	**22**	**11**	**9**	**13**	**18**			

Conservation Codes: VU: Vulnerable; **R:** Rare. * Indicates introduced (non-native) species.
Opp.: Opportune Observations. ^ indicates BUS Site abundance/occupancy only (i.e., excluding opportune observations).

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Appendix C

WTG Collision Monitoring Site Photos

Docusign Envelope ID: CC1B9638-E757-4AAA-9EF4-5DDA2D3F7DDB

WTG	August 2024	November 2024
SG07		
SG08		

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WTG	August 2024	November 2024
SG012		
SG013	Not monitored.	

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WTG	August 2024	November 2024
SG015		
SG022		

Docusign Envelope ID: CC1B9638-E757-4AAA-9EF4-5DDA2D3F7DDB

WTG	August 2024	November 2024
SG023	Not monitored.	
SG032	Not monitored.	
SG034	Not monitored.	Not monitored.

Docusign Envelope ID: CC1B9638-E757-4AAA-9EF4-5DDA2D3F7DDB

WTG	August 2024	November 2024
SG040	Not monitored.	
SG044	Not monitored.	

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WTG	August 2024	November 2024
SG048	Not monitored.	
B008	Not monitored.	

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Appendix D

Scavenger Activity Trial Site Photos

Docusign Envelope ID: CC1B9638-E757-4AAA-9EF4-5DDA2D3F7DDB

B001 - Winter

B001 - Spring

B004 - Winter

B004 - Spring

B021 - Winter

B021 - Spring

Docusign Envelope ID: CC1B9638-E757-4AAA-9EF4-5DDA2D3F7DDB

B025 - Winter

B025 - Spring

B037 - Winter

B037 - Spring

SG027 - Winter

SG027 - Spring

Docusign Envelope ID: CC1B9638-E757-4AAA-9EF4-5DDA2D3F7DDB

SG014 - Winter

SG014 - Spring

SG025 - Winter

SG025 - Spring

SG050 - Winter

SG050 - Spring

Docusign Envelope ID: CC1B9638-E757-4AAA-9EF4-5DDA2D3F7DDB

SG056 - Winter

SG056 - Spring

Docusign Envelope ID: CC1B9638-E757-4AAA-9EF4-5DDA2D3F7DDB

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