Goyder South Hybrid Renewable Energy Facility

Stage 1A and Stage 1B Bird Adaptive Management Plan

Goyder South Hybrid Renewable Energy Facility Stage 1A and Stage 1B Bird Adaptive Management Plan

25 January 2024

Version 5 - Final

Prepared by EBS Ecology for Neoen Australia Pty Ltd

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Cover photograph: A Wedge-tailed Eagle (Aquila audax) flying near wind turbine generator SG036, with Porter Lagoon in the background..

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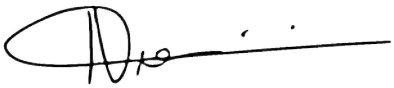
DECLARATION OF ACCURACY

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: Laurent Francisci
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Organisation: Goyder Wind Farm 1 Pty Ltd
EPBC Referral Number: 2021/8958
Name of Action Management Plan this document and declaration refers to: Goyder South Hybrid Renewable Energy Facility Stage 1A and Stage 1B Bird Adaptive Management Plan.
Date: 25 January 2024

Signed:

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Position: Director
Organisation: Goyder Wind Farm 1B Pty Ltd
EPBC Referral Number: 2021/8957
Name of Action Management Plan this document and declaration refers to: Goyder South Hybrid Renewable Energy Facility Stage 1A and Stage 1B Bird Adaptive Management Plan.
Date: 25 January 2024

GLOSSARY AND ABBREVIATION OF TERMS

(the) action	'Action' is defined broadly in the EPBC Act and includes: a project, a development, an undertaking, an activity or a series of activities, or any alteration of any of these things. Actions encompass site preparation and construction, operation and maintenance, and closure and completion stages of a project, as well as alterations or modifications to existing infrastructure.
BAMP	Bird Adaptive Management Plan
BDBSA	Biological Databases of South Australia
BUS	Bird Utilisation Survey(s)
CI	Confidence Interval
cm	centimetre(s)
Commission / commissioning	2021/8957 and 2021/8958: 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.
completion of the action	2021/8957 and 2021/8958: The date on which all specified activities associated with the action have permanently ceased.
Cth	Commonwealth
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Cth)
Department	2021/8957 and 2021/8958: The Australian Government agency responsible for administering the **EPBC Act**. At the time of writing this document, DCCEEW is the **Department**.
EBS Ecology	Environment and Biodiversity Services Pty Ltd – trading as EBS Ecology
Environmental Management Plan Guidelines	The *Environmental Management Plan Guidelines*, Commonwealth of Australia 2014.
EPBC Act	the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).
Featherspot	A collection of five or more feathers found grouped together in a manner that suggests a dead bird was once at the location.
g	grams
GPS	Global Positioning System (a satellite-based radionavigation system)

Goyder South Hybrid Renewable Energy Facility	A renewable energy development located between Burra and Robertstown in the Mid North of South Australia. The Goyder South Hybrid Renewable Energy Facility includes the proposed actions described in EPBC Act referrals 2021/8957 (Stage 1B), 2021/8958 (Stage 1A), 2021/8959 (Overhead Transmission Line and Substation) and 2021/8960 (Battery) (as shown in Figure 1).
Goyder South / Goyder South Project	Goyder South Hybrid Renewable Energy Facility
Guidelines for Biological Survey and Mapped Data	2021/8957 and 2021/8958: *Guidelines for Biological Survey and Mapped Data*, Commonwealth of Australia 2018.
ha	hectare(s)
IBRA	Interim Biogeographical Regionalisation of Australia. IBRA is a landscape-based approach to classifying the land surface across a range of environmental attributes, which is used to assess and plan for the protection of biodiversity
Impact(s)	2021/8957: To cause any measurable direct or indirect disturbance or harmful change as a result of any activity associated with the action. 2021/8958: Any event which has the potential to, or does, impact on one or more protected matter.
km	kilometre(s)
listed bird species	2021/8957 and 2021/8958: All bird species listed under the EPBC Act as a listed threatened species or as a listed migratory species.
m	metre(s)
Minister	2021/8957 and 2021/8958: The Australian Government Minister administering the **EPBC Act** including any delegate thereof.
MW	Megawatt
MWh	Megawatt hours
NEOEN	NEOEN Australia Pty Ltd
OEMP	Operational Environmental Management Plan
Operation	2021/8957 and 2021/8958: All activities that occur after the components of the final wind turbine generator are installed.
OTL	Overhead Transmission Line
PDI Act	*Planning, Development and Infrastructure Act 2016* (South Australia)
Plan(s)	2021/8957 and 2021/8958: Any of the documents required to be prepared, approved by the **Minister**, implemented by the approval holder and published on the **website** in accordance with the EPBC Act conditions of approval for 2021/8957 and 2021/8958 (includes action management plans and/or strategies).

PMST	Protected Matters Search Tool
Project	The Goyder South Hybrid Renewable Energy Facility Project (incorporating Stage 1A, Stage 1B and the OTL and Substation).
Project Area	The area (or boundary) in which the Project will be located, as shown in mapping.
Protected matter(s)	2021/8957 and 2021/8958: A matter protected under a controlling provision in Part 3 of the **EPBC Act** for which the 2021/8957 and 2021/8958 approvals have effect.
Residual impact	The remaining, unavoidable impacts (DSEWPC 2012a).
RSA	Rotor-swept area
SA	South Australia / South Australian
Significant impact(s)	2021/8957 and 2021/8958: **Impacts** which are important, notable, or of consequence, having regard to their context or intensity, and assessed within the framework of the *Matters of National Environmental Significance – Significant Impact Guidelines 1.1*, Commonwealth of Australia 2013.
sp.	species
spp.	species (plural)
ssp.	subspecies
Std. Dev.	Standard Deviation
Std. Err.	Standard Error
Suitably qualified bird expert	2021/8957 and 2021/8958: 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.
VA(s)	Vegetation Association(s)
website	2021/8957 and 2021/8958: A set of related web pages located under a single domain name attributed to the approval holder and available to the public.
WTE	Wedge-tailed Eagle (*Aquila audax*)
WTG(s)	Wind Turbine Generator(s)
µ	Mean
%	Percent

Table of Contents

List of Tables

List of Figures

1 INTRODUCTION

NEOEN Australia Pty Ltd (NEOEN) is developing the Goyder South Hybrid Renewable Energy Facility (the Goyder South Project; the 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 propose to implement the Project in stages, with each stage having its own legal entity, construction contracts and financing packages. Currently, four separate stages are proposed for development, including Stage 1A, with 38 wind turbine generators (WTGs), Stage 1B, with 37 WTGs, the Overhead Transmission Line (OTL) and the Battery, as shown in Figure 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 propose to implement a Bird Adaptive Management Plan (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.

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, 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 action, and that potential impacts to other bird species (such as raptors) are minimised and mitigated, where practicable.

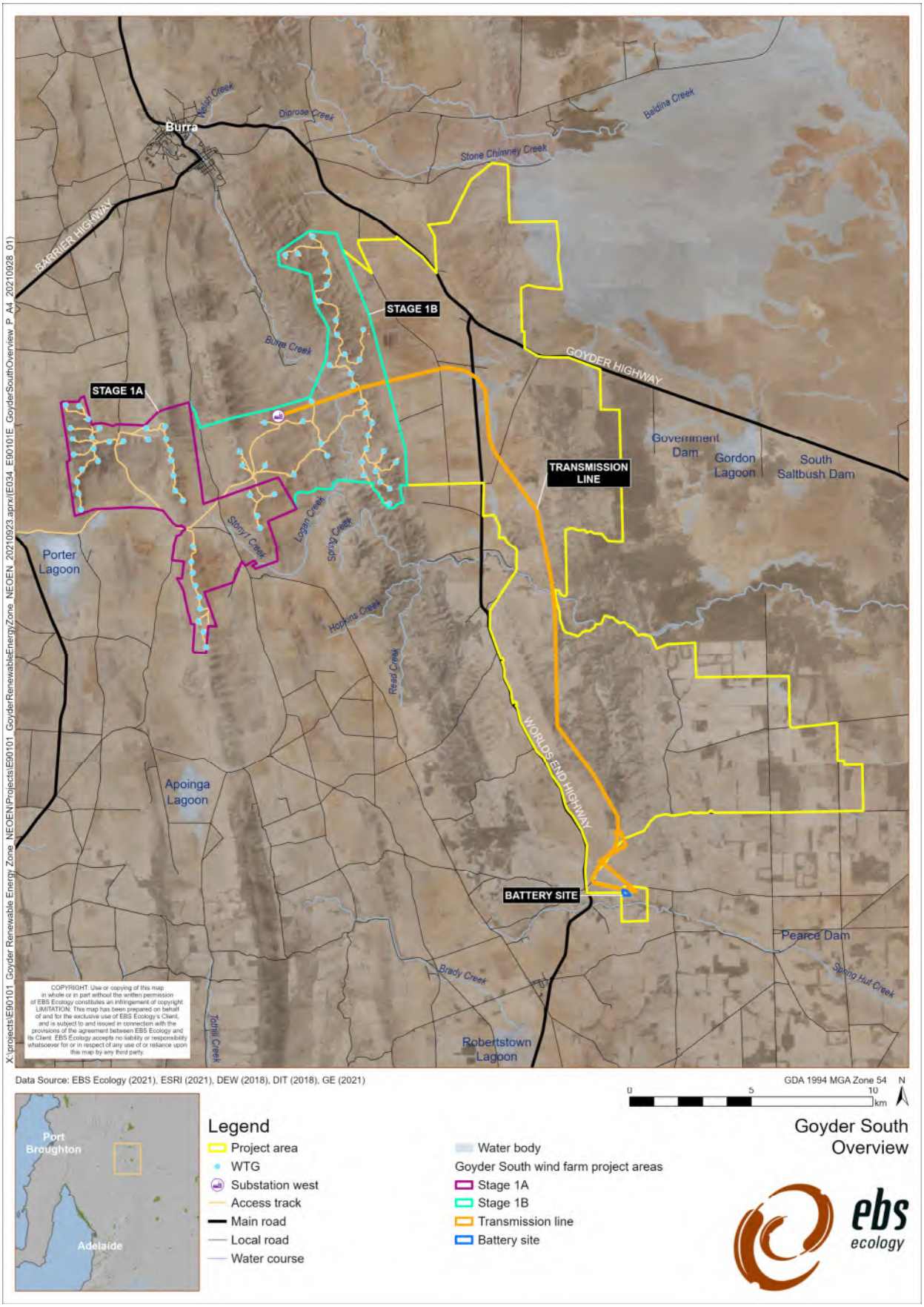

Figure 1. Stage 1A and Stage 1B of the Goyder South Project (along with the Overhead Transmission Line and Battery site).

2 OBJECTIVES

The overall environmental objectives of this BAMP are to effectively monitor for any impacts to *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed bird species, during the operation of the wind farm 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 the 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. To achieve these objectives, various actions will be undertaken within five main tasks:

- Monitor;
- Analyse;
- Manage, Mitigate and Adapt;
- Report; and
- Review and improve.

NEOEN is committed to implementing the BAMP for the duration of the Stage 1A and Stage 1B wind farms and until completion of each action. A table of commitments to achieve the BAMP's environmental objectives and a reference to where the commitments are detailed in the BAMP is provided in Table 1.

NEOEN will not commission the Stage 1A and Stage 1B wind farms, unless the BAMP has been approved by the Australian Government Minister administering the EPBC Act, in writing.

Table 1. Commitments to achieve the BAMP's environmental objectives.

Task	Commitment	Reference (linked)
Monitor	Implement a post-commissioning, long-term WTG collision monitoring program to identify and document any impacts to EPBC Act listed bird species and other bird species from (but not limited to) wind turbine strikes, during operation of the Stage 1A and Stage 1B wind farms.	Section 8 (page 51)
	Monitor EPBC Act listed bird species and other bird species occurrence within the Goyder South Project Area, as well as Porter Lagoon.	
	Monitor WTE nesting activity.	
	Monitor environmental/meteorological conditions.	
	Undertake further periodic carcass persistence and searcher efficiency trials to check if correction factors necessary to estimate total fatalities need revision.	
Analyse	Analyse EPBC Act listed bird species and other bird species occurrence records within the Goyder South Project Area, as well as Porter Lagoon.	Section 8.4 (page 69)
	Analyse WTE nesting activity.	
	Analyse environmental/meteorological conditions.	
	Analyse bird strike data for each WTG monitored.	
	Analyse data from further periodic carcass persistence and searcher efficiency trials to check if assumptions need revision.	
	Estimate annual mortality rate for each EPBC Act listed bird species and other bird species.	

Task	Commitment	Reference (linked)
	DNA test carcasses that cannot be otherwise identified by a suitably qualified bird expert.	Section 8.3.7 (page 68)
	Determine if a significant impact to an EPBC Act listed bird species has occurred or is likely to have occurred, as a result of the action, via completion of a Significant Impact Self-Assessment in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1* (Commonwealth of Australia 2013) for each EPBC Act listed bird species recorded to have been struck by a WTG.	Section 5 (page 41) and Section 8.4 (page 69)
Manage, mitigate and adapt	Implement corrective actions if triggers are reached.	Section 9 (page 72) and sub-sections
Report	Report EPBC Act listed bird species and other bird species occurrence within the Goyder South Project Area, as well as Porter Lagoon.	Section 8.5 (page 70) and Section 9.5 (page 86)
	Report WTE nesting activity.	
	Report environmental/meteorological conditions.	
	Report bird strike data for each WTG monitored.	
	Report on further periodic carcass persistence and searcher efficiency trials to check if assumptions need revision.	
	Report on estimated annual mortality rate for each EPBC Act listed bird species and other bird species.	
	Report on triggers reached.	
	Report on corrective actions undertaken (if corrective actions are required).	
Review and improve	Review this BAMP periodically to ensure the environmental objectives are being achieved and identify any improvements that might be required.	Section 5.4 (page 43)
	If significant impacts to EPBC Act listed bird species occur, or are likely to have occurred, as a result of the action, NEOEN will, within 3 months of becoming aware of any actual or likely significant impact, submit to the Department for the approval of the Minister a revised BAMP responding to, and accompanied by, an evaluation prepared by a suitably qualified bird expert of the effectiveness of the BAMP in preventing significant impacts to EPBC Act listed bird species.	

2.1 Approval 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 following sub-sections.

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.

2.1.1 EPBC Act approval conditions

The Stage 1A (EPBC 2021/8958) and Stage 1B (EPBC 2021/8957) EPBC approvals have specific conditions of approval, including the requirement for a BAMP to effectively monitor for any impacts to listed bird species during the operation of the wind farm 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 the impacts are accurately measured, reported and remain insignificant. As such, this document has been prepared to satisfy the requirement for a BAMP associated with Stage 1A and Stage 1B of the Goyder South Project. The conditions of approval associated with the BAMP are presented in Table 2, along with references to sections within this report with corresponding information. The Stage 1A and Stage 1B EPBC approvals have effect until 31 December 2057.

Table 2. Relevant conditions of Approval for Stage 1A (2021/8958) and Stage 1B (2021/8957).

Conditions of Approval	Demonstration of how the plan addresses condition requirements and commitments made in the plan to address condition requirements.	Reference (linked)
Environmental Management Plans ***Stage 1A (2021/8958) EPBC Approval Condition 5; and Stage 1B (2021/8957) EPBC Approval Condition 4:*** *Bird Adaptive Management Plan* The approval holder must submit to the **Department** for the **Minister's** approval a Bird Adaptive Management Plan (BAMP) within 12 months of the date of this approval. The environmental objectives of the BAMP are to effectively monitor for any **impacts** to **listed bird species** during the **operation** of the wind farm 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 the **impacts** are accurately measured, reported and remain insignificant. The BAMP must:		This document
a. be consistent with the **Environmental Management Plan Guidelines**;	This BAMP has been prepared in accordance with the Environmental Management Plan Guidelines.	Section 3.3 (page 13)
b. specify relevant **protected matters**, and reference to the **EPBC Act** approval conditions to which the BAMP refers;	A total of 11 relevant EPBC Act listed threatened and/or migratory bird species have been identified as species of concern. This table specifies the relevant EPBC Act approval conditions to which the BAMP refers.	Section 4.1 (page 26) and this table.
c. include a table of commitments to achieve the BAMP's environmental objectives and a reference to where the commitments are detailed in the BAMP;	This BAMP includes a table of commitments which focus on five main tasks including Monitor; Analyse; Manage, Mitigate and Adapt; Report; and Review and improve, to achieve the BAMP's environmental objectives. The table of commitments includes references to where the commitments are detailed in the BAMP.	Table 1 in Section 2 (page 3)
d. include an assessment of risks to achieving the BAMP's environmental objectives and risk management strategies that will be applied;	Eight potential risks to achieving the BAMP's environmental objectives have been identified and assessed, and addressed with risk management strategies.	Section 6 (page 44)
e. include a post-**commissioning** long-term wind turbine generator collision monitoring program to detect and manage potential **impacts** to **listed bird species** as a result of collision, which must:	A WTG collision monitoring program is proposed to be implemented during the bird monitoring program (and as soon as practicable upon the commencement of commissioning) to detect and manage potential impacts to listed bird species as a result of collision. The bird monitoring program is proposed to be implemented for the life of the Goyder South Project, while the Stage 1A and Stage 1B wind farms are operational, which is expected to be 30 years.	Section 8.3.3 (page 59)
i. contain details of the nature, timing and frequency of monitoring to inform progress against achieving the environmental outcomes and be sufficient to determine whether the BAMP is	Twenty-six (26) WTGs, (13 in Stage 1A and 13 in Stage 1B), are proposed to be monitored each month for the duration of the bird monitoring program. Analysis of the results of the proposed monitoring is expected to inform progress against achieving the environmental outcomes and be sufficient to determine whether the	Section 8.3.3.1 (page 59) and Section

Conditions of Approval	Demonstration of how the plan addresses condition requirements and commitments made in the plan to address condition requirements.	Reference (linked)
likely to achieve those environmental outcomes in adequate time to implement all necessary corrective actions;	BAMP is likely to achieve those environmental outcomes in adequate time to implement all necessary corrective actions.	8.3.3.2 (page 65)
ii. include the findings of exhaustive pre-**commissioning** scavenger activity and searcher efficiency trials;	Results of scavenger activity and searcher efficiency trials undertaken in March 2023 suggest that small bird carcasses are removed later than large bird carcasses and there is an overall carcass detection rate at the Goyder South Project of 93.1 %.	Section 8.2.1 (page 52)
iii. demonstrate how site-specific and species-specific risks and uncertainties (for example, findings of the pre-**commissioning** scavenger activity and searcher efficiency trials) have informed the design of the monitoring program; and	Results of scavenger activity and searcher efficiency trials undertaken in March 2023 have been used to inform the design of the monitoring program and will be used to assist with interpretation of data collected during the long-term WTG collision monitoring program and estimation of annual mortality rates. Furthermore, additional scavenger activity and searcher efficiency trials are proposed to be undertaken during the bird monitoring program to ensure site-specific and species-specific risks and uncertainties continue to be appropriately considered during implementation of the monitoring program, including data analysis and estimation of annual mortality rates.	Section 8.3.3.1 (page 59)
iv. contain commitments to DNA test carcasses that cannot be otherwise identified by a **suitably qualified bird expert**, to undertake further periodic carcass persistence and searcher efficiency trials to check if assumptions need revision, to maximise turbine collision detection in a timely manner, and to maximise carcass detection in a timely manner.	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. In addition to the pre-commissioning scavenger activity trial undertaken in March 2023, two persistence trials are proposed to be undertaken in the first year of the bird monitoring program to account for different site conditions (scavenger activity in Spring and in Winter). If site conditions and/or seasonal conditions change significantly then the requirement for additional scavenger activity trials will be assessed by a suitably qualified and experienced ecological consultancy and undertaken if required. The results of these trials will permit average carcass persistence times to be determined. The resulting persistence rates will be used in analyses to estimate total numbers of collisions.	Section 8.3.7 (page 68)
f. include reporting commitments and timeframes for the provision of site-specific and species-specific information, which must:	NEOEN propose to include reporting for the bird monitoring program within the annual BAMP Monitoring and Implementation Report, which is proposed to be published as an attachment to the annual EPBC approval compliance report required as a condition of approval for each of Stage 1A and Stage 1B EPBC approvals for the Goyder South Project. The following information will be included in the annual BAMP Monitoring and Implementation Report: • BUS survey methodology and results; • raptor nest activity survey methodology and monitoring results; • WTG collision (bird strike) monitoring survey methodology and results (including raw data and strike records);	Section 8.5 (page 70)
i. contain annual turbine strike reports comprising raw data and strike notifications, survey methodologies, results of detection/persistence trials, environmental/meteorological conditions, and associated statistical analysis; and		
ii. contain estimation of annual mortality rate for each **listed bird species** comprising supporting evidence from case studies of **listed bird species** carcass size classes, results of persistence trials and searcher efficiency trials, annual probability of detection and monthly strike monitoring, and collision monitoring protocol and survey effort; and		

Conditions of Approval	Demonstration of how the plan addresses condition requirements and commitments made in the plan to address condition requirements.	Reference (linked)
iii. contain species occurrence records prepared in accordance with the **Guidelines for Biological Survey and Mapped Data**.	• carcass persistence (scavenger activity) and searcher efficiency (detection) trials methodology and results; • additional monitoring undertaken as per Section 9.1.1; • Opportunistic observations of agricultural practices and pest species; • environmental/meteorological conditions; • associated descriptive and statistical analysis (when sufficient data is collected to complete meaningful analysis); • an estimate of annual mortality rate for each EPBC Act listed bird species and other bird species (i.e., species of concern) (comprising supporting evidence from case studies of EPBC Act listed bird species carcass size classes (where available), results of persistence trials and searcher efficiency trials, annual probability of detection and quarterly strike monitoring, and collision monitoring protocol and survey effort); • species occurrence records prepared in accordance with the Guidelines for Biological Survey and Mapped Data (Commonwealth of Australia 2018); and • corrective actions undertaken (i.e., adaptive management undertaken) (refer to the next section for proposed adaptive management framework).	
g. include an adaptative management framework designed to:	This BAMP includes an adaptive management framework which is designed to:	Section 9 (page 72) and sub-sections; and Section 8 (page 51) and sub-sections.
i. ensure that no **significant impacts** to **listed bird species** are likely to occur as a result of the action;	Part of the overall environmental objective of this BAMP is to implement measures and procedures necessary to ensure that no significant impacts to listed bird species occur as a result of operation of the wind farms. The adaptive management framework includes an adaptive management protocol to investigate and respond to a carcass find (which includes implementation of adaptive management measures to prevent further collisions); and to determine if a significant impact has occurred or is likely to have occurred.	
ii. clearly demonstrate the linkages between environmental outcomes, implementation and management measures, monitoring, reporting and investigations, and implementation of corrective actions to ensure the environmental outcomes will be achieved;	To achieve the objectives of the BAMP, various actions will be undertaken within five main tasks: • Monitor; • Analyse; • Manage, Mitigate and Adapt; • Report; and • Review and improve. Commitments to achieve the BAMPs environmental objectives are associated with each of these tasks. All data collected during the bird monitoring program will be analysed to understand bird activity and potential impacts (WTG collisions) across the wind farms, and inform assessment to determine the most appropriate management action(s) to implement to minimise further impacts. The adaptive management framework includes monitoring to determine the effectiveness of	

Conditions of Approval	Demonstration of how the plan addresses condition requirements and commitments made in the plan to address condition requirements.	Reference (linked)
	implemented adaptive management action(s) and whether further actions are required. Data analysis also includes estimation of annual mortality rates, which will be used to assist with determining if a significant impact has occurred or is likely to have occurred. All data, analysis and results associated with the bird monitoring program and implementation of the adaptive management framework will be presented in an annual report, with information and knowledge expanding cumulatively each year during implementation of the BAMP. Furthermore, annual review of the BAMP will identify any improvements that might be required and will ensure the environmental objectives are being achieved.	
iii. incorporate site-specific data collected through ongoing monitoring activities, and to take into account changes to turbine risk ratings;	All site-specific data collected during the bird monitoring program (including bird utilisation surveys, WTG collision monitoring, periodic carcass persistence (scavenger activity) and searcher efficiency trails, and opportunistic observations) will be analysed to review, adjust, and if required, assign WTG high risk ratings.	
iv. propose corrective actions if triggers are reached, such as bird and insect deterrents, low wind speed curtailments, wind turbine generator temporary or permanent shutdown, and/or permanent decommissioning of specific wind turbine generators; and	The adaptive management framework includes implementation of corrective actions (i.e., adaptive management actions) such as management of WTG(s) during seasonal nesting, management of WTG(s) during periodic environmental conditions and/or events, temporary shut down specific WTG(s), permanently shut down specific WTG(s) and permanently decommission specific WTG(s). Other potential adaptive management aspects including insect deterrents, lighting and low wind speed curtailment, have been considered as part of the adaptive management framework but are not relevant to this BAMP as they are usually considered to reduce impacts to bats and bats are not of concern for this BAMP.	
h. commit that, if **significant impacts** to **listed bird species** occur, or are likely to have occurred, as a result of the action, the approval holder will, within 3 months of becoming aware of any actual or likely **significant impact**, submit to the **Department** for the approval of the **Minister** a revised BAMP responding to, and accompanied by, an evaluation report prepared by a **suitably qualified bird expert** of the effectiveness of the BAMP in preventing **significant impacts** to **listed bird species**.	The adaptive management protocol (within the adaptive management framework) includes a process to determine if a significant impact has occurred or is likely to have occurred. If a significant impact has occurred or is likely to have occurred, as a result of the action, a revised BAMP will be submitted to the Department for approval of the Minister within 3 months of becoming aware of the significant impact. The revised BAMP will be accompanied by an evaluation report prepared by a suitably qualified bird expert of the effectiveness of the BAMP in preventing significant impacts to EPBC Act listed bird species.	Section 5.4 (page 43); and Section 9.1.2 (page 76)
The approval holder must not **commission** unless the BAMP has been approved by the **Minister** in writing. The approval holder must commence implementing the approved BAMP before **commissioning** and continue implementing the approved BAMP until the **completion of the action**.	NEOEN will not commission the Stage 1A and Stage 1B wind farms, unless the BAMP has been approved by the Australian Government Minister administering the EPBC Act, in writing.	Section 2 (page 3)

2.1.2 PDI Act conditions of approval

The Goyder South Project has also sought and obtained Development Approval in accordance with the PDI Act. Condition 13 of the Development Approval (Development Application 422/V009/20 R1) outlines the requirement for an on-going monitoring and mitigation protocol in respect to raptor and other bird species that may be impacted by the development, as detailed and highlighted in Table 3.

Table 3. Relevant Conditions of Development Approval (Development Application 422/V009/20 R1).

Conditions of Development Approval:
13. An Operational Environmental Management Plan (OEMP) shall be prepared to the reasonable satisfaction of the Minister for Planning and Local Government prior to the commencement of commercial operations***. Operation of the development must be in accordance with the approved OEMP, which as a minimum shall include specific management measures or plans for the following environmental aspects: • Noise and vibration • Air quality and dust • Native flora and fauna* • Revegetated areas • Aboriginal and European heritage • Weeds and pests • Traffic and access • Erosion and stormwater management • Site rehabilitation (post construction) • Waste management • Storage and handling of hazardous substances • Water quality • Fire risk • Contamination • Public safety • Emergency response planning • Complaints management *This plan shall also include an on-going monitoring and mitigation protocol in respect to raptor and other bird species that may be impacted by the development.

***Refer to GLOSSARY AND ABBREVIATION OF TERMS for definition of commencement of commercial operations.**

As such, and in addition to EPBC Act listed bird species, this 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.

3 BACKGROUND

3.1 The Goyder South Project

The Goyder South Project will generate more than 4,800,000 Megawatts hours (MWh) of power annually and is comprised of:

- A wind farm of up to 163 turbines with a capacity of up to 1200 Megawatts (MW), a maximum hub height of 121 metres (m), a maximum blade length of 78 m and an overall maximum height (tip height) of 199 m;
- A solar farm (across two sites) of up to 3000 hectares (ha) of solar panels with a capacity of up to 600 MW;
- An energy storage facility (lithium-ion battery) with a capacity of up to 900 MW / 1,800 MWh (2 hours);
- Associated infrastructure for connection to the electricity grid including three substations, access tracks, underground connection cabling and Overhead Transmission Lines (OTLs);
- Permanent operations and maintenance compounds;
- Temporary construction compounds for both wind and solar components, including concrete batching plants; and
- A number of meteorological masts (in addition to those already on the site) to record wind speed and other meteorological data, both pre- and post- construction.

As the Goyder South Project will total up to $3 billion in investment, NEOEN propose to implement the Project in stages, with each stage having its own legal entity, construction contracts and financing packages. Each stage currently proposed for development is outlined in Table 4 and shown in Figure 1.

Table 4. Current proposed stages and corresponding EPBC Act approvals for the Goyder South Project.

Project Stage / Proposed Action	Legal Entity
Stage 1A (38 WTGs and associated infrastructure)	Goyder Wind Farm 1A Pty Ltd
Stage 1B (37 WTGs and associated infrastructure)	Goyder Wind Farm 1B Pty Ltd
OTL and Substation	Goyder Wind Farm Common Asset Pty Ltd
Battery	NEOEN Australia Pty Ltd

Other components of the Goyder South Project, including the remaining wind farm areas, the two solar farms, OTLs and substations are considered to be potential future stages as they are not currently commercially viable and there is currently no immediate prospect of these components/stages proceeding to construction.

3.1.1 Stage 1A and Stage 1B WTGs

The Stage 1A and Stage 1B wind farms include 38 and 37 WTGs (respectfully), with a maximum hub height of 121 m, a maximum blade length of 78 m, an overall maximum height (blade tip height) of 199 m and a maximum rotor diameter of 156 m, as summarised in Table 5. The rotor-swept area (RSA) will be within the rotor diameter, from approximately 43 m above ground to 199 m above ground, as summarised in Table 5 and illustrated in Figure 2.

Table 5. Summary of WTG specifications and RSA.

WTG Specifications	
Hub height	121 m
Maximum blade length	78 m
Maximum rotor diameter	156 m
Maximum WTG height (at blade tip)	199 m
Rotor-swept area (height above ground)	43 - 199 m

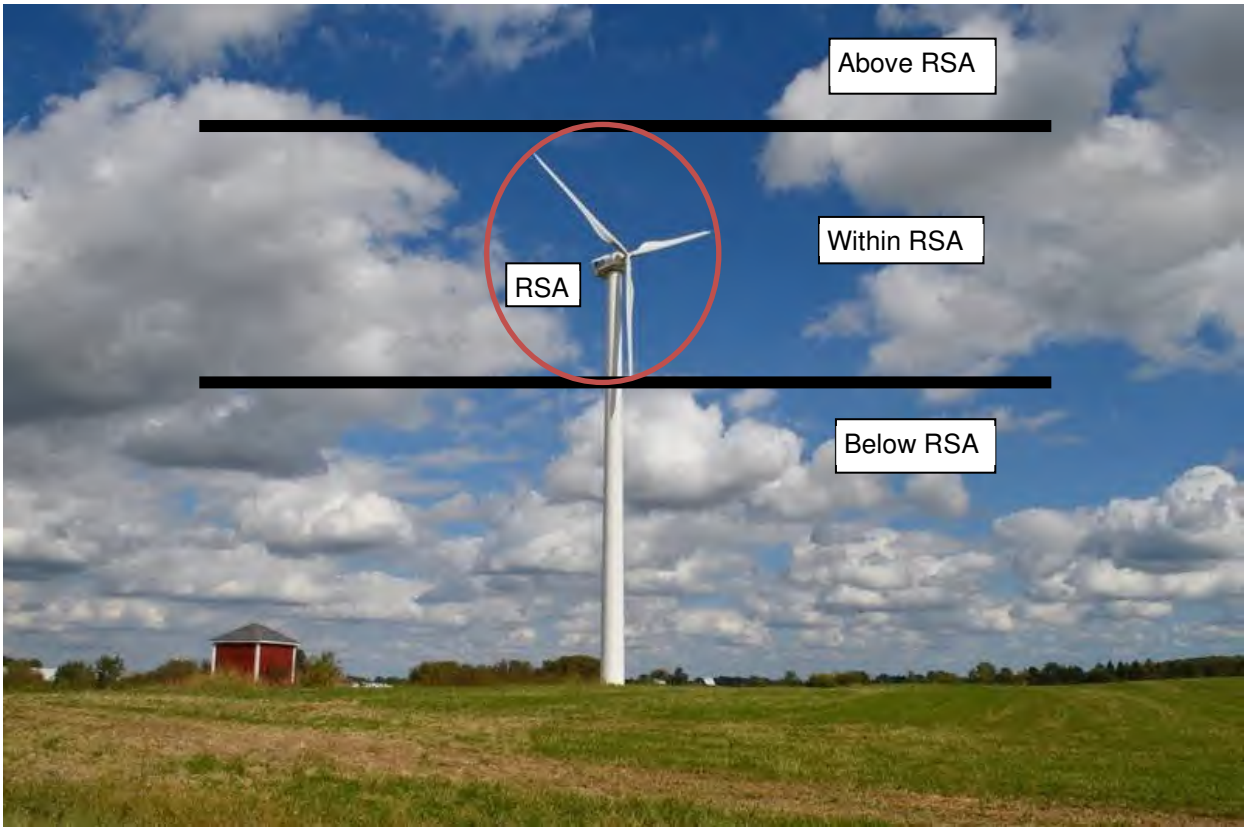

Figure 2. Schematic diagram providing a visual representation of the rotor-swept area (RSA).

3.2 Previous reports

The following reports and documentation should be referred to for important background and supporting information:

- *Goyder South Hybrid Renewable Energy Facility Flora and Fauna Assessment* (EBS Ecology 2020) (referred to herein as the initial flora and fauna assessment).
- EPBC Referral: *2021/8958 – Goyder South Hybrid Renewable Energy Facility – Wind Farm 1A, 10km south Burra SA* (EBC Ecology 2021a).
- EPBC Referral: *2021/8957 – Goyder South Hybrid Renewable Energy Facility – Wind Farm 1B, 5km south Burra SA* (EBS Ecology 2021b).
- *Goyder South Hybrid Renewable Energy Facility: Stage 1A Preliminary Documentation* (EPBC 2021/8958) (EBS Ecology 2022a).
- *Goyder South Hybrid Renewable Energy Facility: Stage 1B Preliminary Documentation* (EPBC 2021/8957) (EBS Ecology 2022b).
- *Goyder South Hybrid Renewable Energy Facility: Scavenger Activity and Searcher Efficiency Trials* (EBS Ecology 2023).

3.3 Relevant policies and documents

This BAMP has been prepared in accordance with the following relevant policies and documents:

- *Environmental Management Plan Guidelines* (Commonwealth of Australia 2014);
- *EPBC Act Policy Statement 2.3: Wind farm industry* (Commonwealth of Australia 2009);
- *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);
- *Draft referral guideline for 14 birds listed as migratory species under the EPBC Act* (Commonwealth of Australia 2015);
- *Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al. 2016);
- *Onshore Wind Farms – interim guidance on bird and bat management (Commonwealth of Australia 2021);*
- *EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (Department of the Environment, Water, Heritage and the Arts 2013);
- *EPBC Act Policy Statement 3.21 Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species* (Commonwealth of Australia 2017);
- *Wildlife Conservation Plan for Migratory Shorebirds* (Commonwealth of Australia 2015);
- The Department's Species Profile and Threats Database and Conservation Advice for individual species (where available);
- *Guidelines for Biological Survey and Mapped Data* (Commonwealth of Australia 2018);
- *Guide to providing maps and boundary data for EPBC Act projects* (DAWE 2021).

3.4 Site characteristics and ecological values

The Stage 1A Project Area is approximately 3714.56 ha in size and located in the north-western extent of the Goyder South Project (Figure 1). The northern extent of the Stage 1A Project Area begins approximately 10 km south of Burra and is located on the eastern side of the Barrier Highway. It is approximately 11 km long (north-south) and 8.5 km wide (west-east) and located across the suburbs of Burra, Hanson, Porter Lagoon, Koonoona and Apoinga.

The Stage 1B Project Area is approximately 4448.59 ha in size and located in the centre of the northern extent of the Goyder South Project (Figure 1). It is approximately 5.5 km south of Burra and located between Koonoona Road and Top Road. It is approximately 11 km long (north-south) and 7 km wide (west-east) and located across the suburb of Burra.

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. There are no protected areas within the Goyder South Project Area. Focal habitat features of the site are described below.

3.4.1 Topography

The *Burra Hill* and *Hansen* Interim Biogeographical Regionalisation of Australia (IBRA) environmental associations of which the site is within are characterised by steep strike ridges on metasediments and alluvium. The soil consists of reddish powdery calcareous loams, red duplex soils and red calcareous earths. The vegetation is characterised by woodland of SA Blue Gum (*Eucalyptus leucoxylon*) and Peppermint Box (*Eucalyptus odorata*).

3.4.2 Weather patterns and prevailing winds

Weather pattern data was sourced from the Eudunda Weather Station located south of the southern extent of the Project Area. The area surrounding Burra reaches relatively hot maximum temperatures in summer with mean temperatures of approximately 29.3 degrees. The wettest months are in August, June and July where mean rainfall is approximately 52.9 millimetres per month. Wind speed in the project area typically averages 11.8 km/h in the morning and 14.3 km/h in the afternoon. Wind speed is at its highest in the spring months of August and September.

3.4.3 Vegetation Associations

Vegetation Associations (VAs) for the entire Goyder South Project Area were mapped by EBS Ecology in 2020 (EBS Ecology 2020) and further refined in 2021 (EBS Ecology 2021c and EBS Ecology 2021d) and during construction works in 2022-2023. Vegetation Associations of the Stage 1A and Stage 1B Project Areas are outlined in Table 6 and shown in Figure 3 and Figure 4. Site representative photos of each VA are presented in Figure 5 to Figure 16.

The majority of vegetation within the Stage 1A and Stage 1B Project Areas has been modified as a result of historic agricultural practices. Whilst patches of native vegetation remain, the majority of the Project

Areas consist of *Austrostipa* spp. (Spear Grass) Mixed Grassland (43.35 % of Stage 1A and 74.34 % of Stage 1B) as outlined in Table 6. Further, 57.82 % of vegetation in Stage 1A is grassland and 37.02 % is cropping, while only 4.88 % is woodland, as outlined in Table 7. Similarly, 76.98 % of vegetation in Stage 1B is grassland and 11.68 % is cropping, while only 10.52 % is woodland (Table 7). Native grasslands are generally in poor condition and vary little throughout the Project Areas. All vegetation in the Project Areas is impacted by grazing and weed encroachment. Grassland associations appear heavily grazed, with palatable emergent shrubs often over-utilised with little or no regeneration occurring.

Table 6. Vegetation Associations (VAs) within the Stage 1A and Stage 1B Project Areas.

VA	VA Description	Stage 1A		Stage 1B		Figure reference
		Extent within Project Area (ha)	% of Project Area	Extent within Project Area (ha)	% of Project Area	
VA2	*Lomandra multiflora* ssp. *dura* (Hard Mat-rush) / *Lomandra effusa* (Scented Mat-rush) Mixed Open Grassland.	365.61	9.85	0	0	Figure 5
VA3	Eucalyptus porosa (Mallee Box) Open Woodland.	0	0	339.29	7.61	Figure 6
VA4	*Eucalyptus odorata* (Peppermint Box) Closed Woodland	0.06	0.002	38.73	0.87	Figure 7
VA6	*Eucalyptus leucoxylon* ssp. *pruinosa* (Inland South Australian Blue Gum) Open Woodland.	175.89	4.74	87.12	1.95	Figure 8
VA7	*Eucalyptus camaldulensis* ssp. *camaldulensis* (River Red Gum) Woodland.	0	0	1.11	0.02	Figure 8
VA8	*Austrostipa* spp. (Spear Grass) Mixed Grassland.	1609.00	43.35	3314.30	74.34	Figure 10
VA9	Exotic Grassland.	171.50	4.62	8.71	0.20	Figure 11
VA10	*Callitris gracilis* (Southern Cypress Pine) Low Open Woodland.	4.35	0.12	2.89	0.06	Figure 12
VA11	*Juncus* sp. (Rush) / *Cyperus gymnocaulos* (Spiny Flat-sedge) Mixed Low Closed Sedgeland.	4.22	0.11	6.73	0.15	Figure 13
VA14	*Triodia irritans* (Spinifex) Grassland +/- Emergent *Eucalyptus oleosa* ssp. *oleosa* (Red Mallee).	0	0	109.03	2.45	Figure 14
VA17	*Phragmites australis* (Common Reed) Grassland.	0	0	21.19	0.48	Figure 15
VA24	*Allocasuarina verticillata* Open Woodland over *Bursaria spinosa* ssp. *spinosa* and *Austrostipa* spp.	0.74	0.02	0	0	Figure 16
N/A	Cropping	1374.09	37.02	520.84	11.68	N/A
N/A	Amenity / urban	5.94	0.16	8.22	0.18	N/A
	Totals	**3711.40**	**100**	**4458.16**	**100**	N/A

Source: EBS Ecology 2021c; EBS Ecology 2021d.

Table 7. 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 (VA2; VA8; VA9; VA14)	2146.11	57.82	3432.04	76.98
Cropping	1374.09	37.02	520.84	11.68
Woodland (VA3; VA4; VA6; VA7; VA10; VA24)	181.04	4.88	469.14	10.52
Other (VA11; VA17; Amenity / urban)	10.16	0.27	36.14	0.81
Totals	**3711.40**	**100 %**	**4458.16**	**100 %**

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 3). 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). Refer to Appendix 1 for more information.

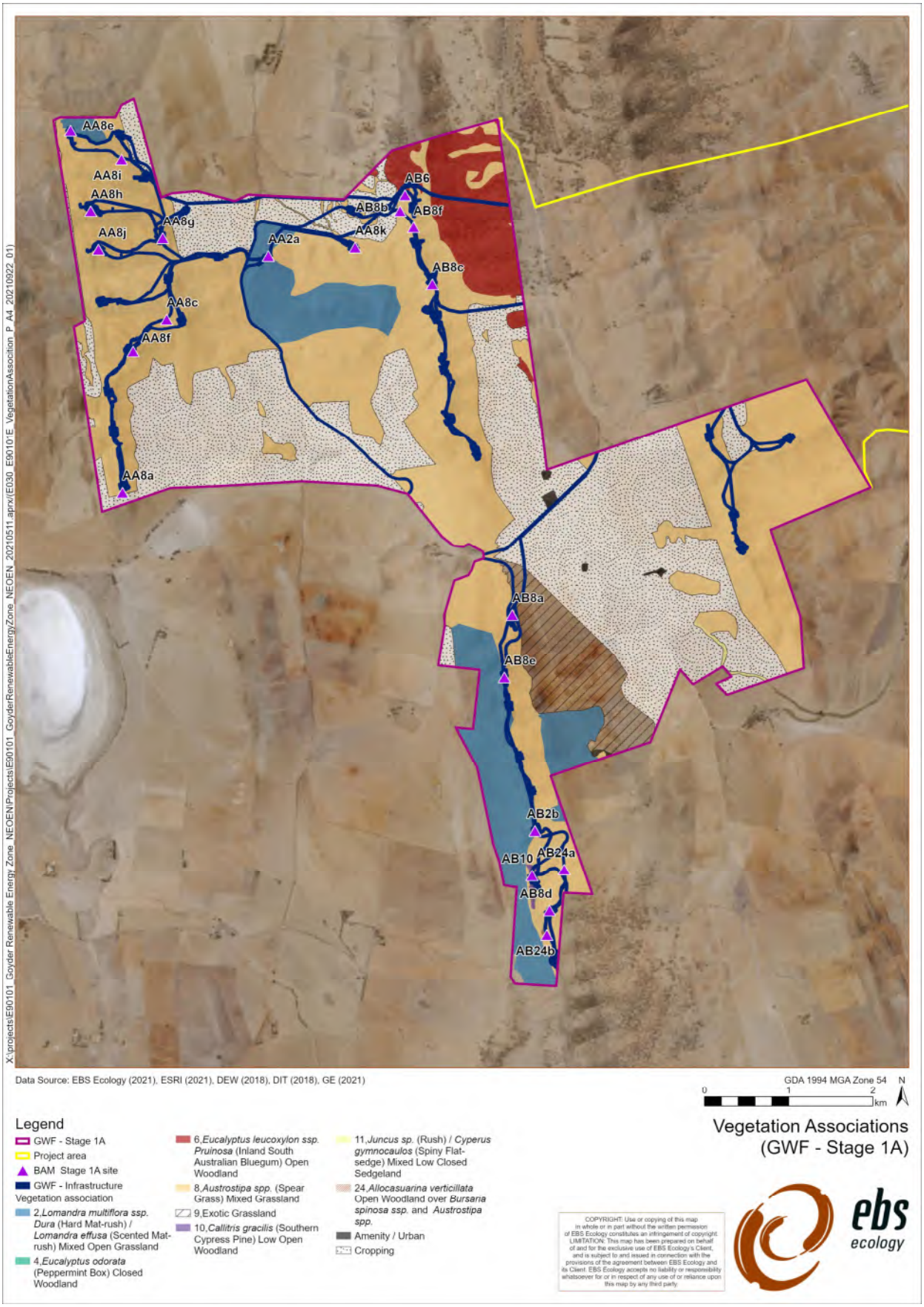

Figure 3. VAs in the Stage 1A Project Area, with the infrastructure footprint also shown.

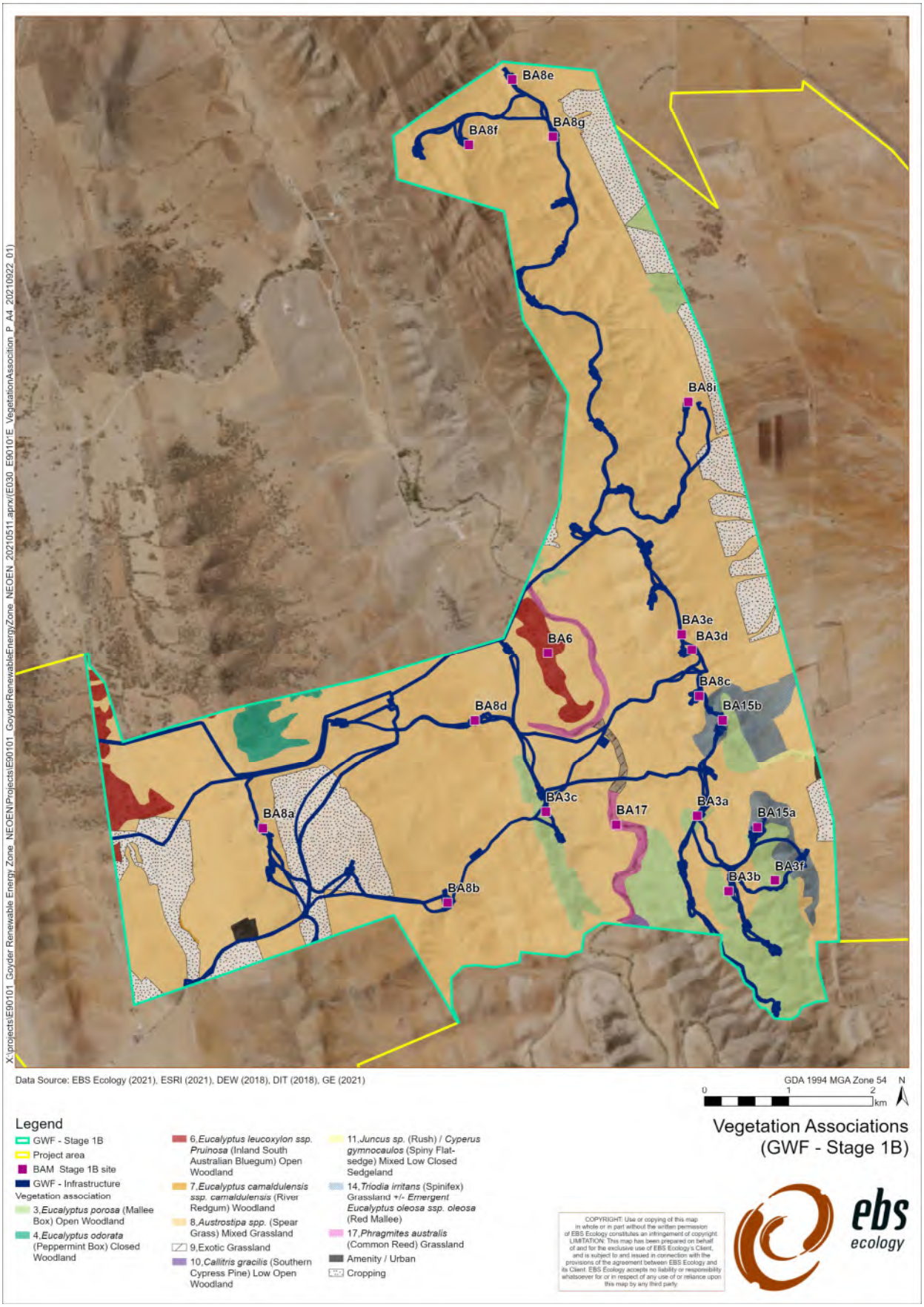

Figure 4. VAs in the Stage 1B Project Area, with the infrastructure footprint also shown.

Figure 5. VA 2: *Lomandra multiflora* ssp. *dura* (Hard Mat-rush) / *Lomandra effusa* (Scented Mat-rush) Mixed Open Grassland.

Figure 6. VA 3: *Eucalyptus porosa* (Mallee Box) Open Woodland.

Figure 7. VA 4 *Eucalyptus odorata* (Peppermint Box) Closed Woodland.

Figure 8. VA 6: *Eucalyptus leucoxylon* ssp. *pruinosa* (Inland South Australian Blue Gum) Open Woodland.

Figure 9. VA 7: *Eucalyptus camaldulensis* ssp. *camaldulensis* (River Red Gum) Woodland.

Figure 10. VA 8: *Austrostipa* spp. (Spear Grass) Mixed Grassland.

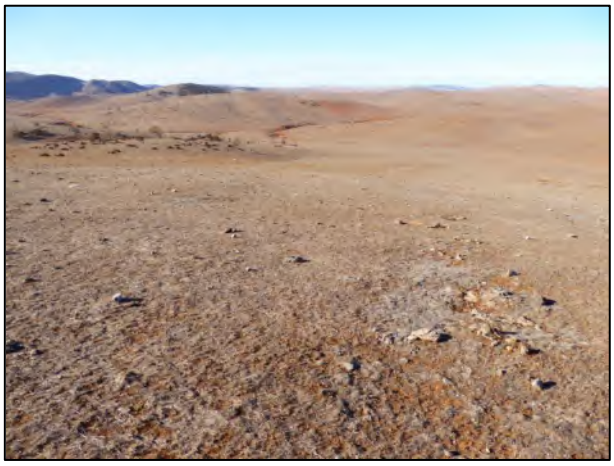

Figure 11. VA 09: Exotic Grassland.

Figure 12. VA 10 *Callitris gracilis* (Southern Cypress Pine) Low Open Woodland.

Figure 13. VA11 *Juncus* sp. (Rush) / *Cyperus gymnocaulos* (Spiny Flat-sedge) Mixed Low Closed Sedgeland.

Figure 14. VA 14 *Triodia irritans* (Spinifex) Grassland +/- Emergent *Eucalyptus oleosa* ssp. *oleosa* (Red Mallee).

Figure 15. VA 17: *Phragmites australis* (Common Reed) Grassland.

Figure 16. VA 24: *Allocasuarina verticillata* Very Open Woodland over *Bursaria spinosa* and *Austrostipa* spp.

3.4.4 Floodplains, wetlands, lakes and watercourses within 25 km of the Project site

Floodplains, wetlands, lakes and watercourses provide important habitat for some bird species. There are numerous watercourses and low-lying areas within the Project Area that provide ephemeral water and pooled water which is likely to be utilised by some bird species, with the Burra Creek perhaps being the most notable. There are no wetlands or lakes within the Project Area. However, there are four saline wetlands within 22 km of the Project Area, including Porter Lagoon, Apoinga Lagoon, Gordon Lagoon and Robertstown Lagoon, as shown in Figure 17.

Porter lagoon

Porter Lagoon is the most significant of the four saline wetlands as it is located approximately 1.17 km west of Stage 1A, with the closest turbine being approximately 1.5 km from the lagoon. It is located approximately 6.14 km west of Stage 1B, with the closest turbine being approximately 8 km from the lagoon. When filled with water this site can provide refuge for waterbirds. The lagoon is filled from surface water and does not contain water all the time or every year.

Over the years (1982, 1983, 1996, 2002, 2003) there have been a number of species identified in and around the lagoon, including EPBC Act listed Sharp-tailed Sandpipers (*Calidris acuminata*). In 1982, 300 Sharp-tailed Sandpipers were sighted and in 2003, 60 individuals were sighted (NatureMaps BDBSA Supertable data, NatureMaps 2021).

Anecdotal evidence obtained from a landholder living adjacent to Porter Lagoon is provided in Table 8 and provides insight into how often the lagoon fills, with its filling attributed to something like Lake Eyre, in that the event is not a common occurrence (Bill Piggot, *pers. comm*, 2022). At the time of writing this BAMP (June/July 2023), the lagoon is considered by EBS Ecology to be semi-filled. In 1992, when Porter Lagoon last fully filled, the lagoon held its water for 12-18 months and became stagnant after 12 months. The lagoon will only fill after a major rainfall event upwards of 508 mm of rain and is assisted by run-off from surrounding areas (Bill Piggot, *pers. comm*, 2022). The area typically receives approximately 430 mm of rainfall a year and changed farming practices have most likely changed the frequency of which Porter Lagoon fills with water (Bill Piggot, *pers. comm*, 2022).

Table 8. Frequency of water in Porter Lagoon since 1974 to current (Bill Piggot, *pers. comm*, 2022).

Year	Status
Mid 2023	*Semi-filled due to recent winter rainfall
Mid 2007	Semi-filled with water – could water ski on it for a few months
1992	Last big major fill of water – this was an extremely wet rainfall year
1980s	Half-filled of water
1974	Semi-filled with water

***EBS inference based on recent rainfall and observations on site.**

Sharp-tailed Sandpipers are known to typically eat mosquito larvae and other invertebrates, including crustaceans. At no stage have fish or crustaceans been observed within the water of Porter Lagoon (Bill Piggot, *pers. comm*, 2022), and it remains salty approximately 90% of the time. As such, Porter Lagoon does not support the diet of this species.

Apoinga Lagoon

This lagoon is located approximately 5.24 km south of Stage 1A and approximately 11.94 km south-west of Stage 1B. This site can on occasion provide minor refuge for water birds, when filled with water. Over the years there have been a number of species identified in and around the lagoon (in 1996 and 1998), but numbers of observed waders are considered low and there are no records of any of the relevant species. The last records of waterbirds (ducks, tern and heron) are dated 1998 (NatureMaps BDBSA Supertable data, NatureMaps 2021).

Gordon Lagoon

Gordon Lagoon is located approximately 18.19 km east of Stage 1A and approximately 12.92 km east of Stage 1B and may also provide minor refuge for water birds very occasionally when filled with water. However, there are no records of waterbird species identified in and around the lagoon and there are no records of any of the relevant threatened and migratory avian species (NatureMaps BDBSA Supertable data, NatureMaps 2021).

Robertstown Lagoon

Robertstown Lagoon is located approximately 19.54 km south-east of Stage 1A and approximately 21.92 km south of Stage 1B and can very occasionally provide minor refuge for water birds when filled with water. There has not been many species identified in and around the lagoon and there are no records of any of the relevant threatened and migratory avian species. The only records of waterbirds (ducks and shovelers) are dated 1993 (NatureMaps BDBSA Supertable data, NatureMaps 2021).

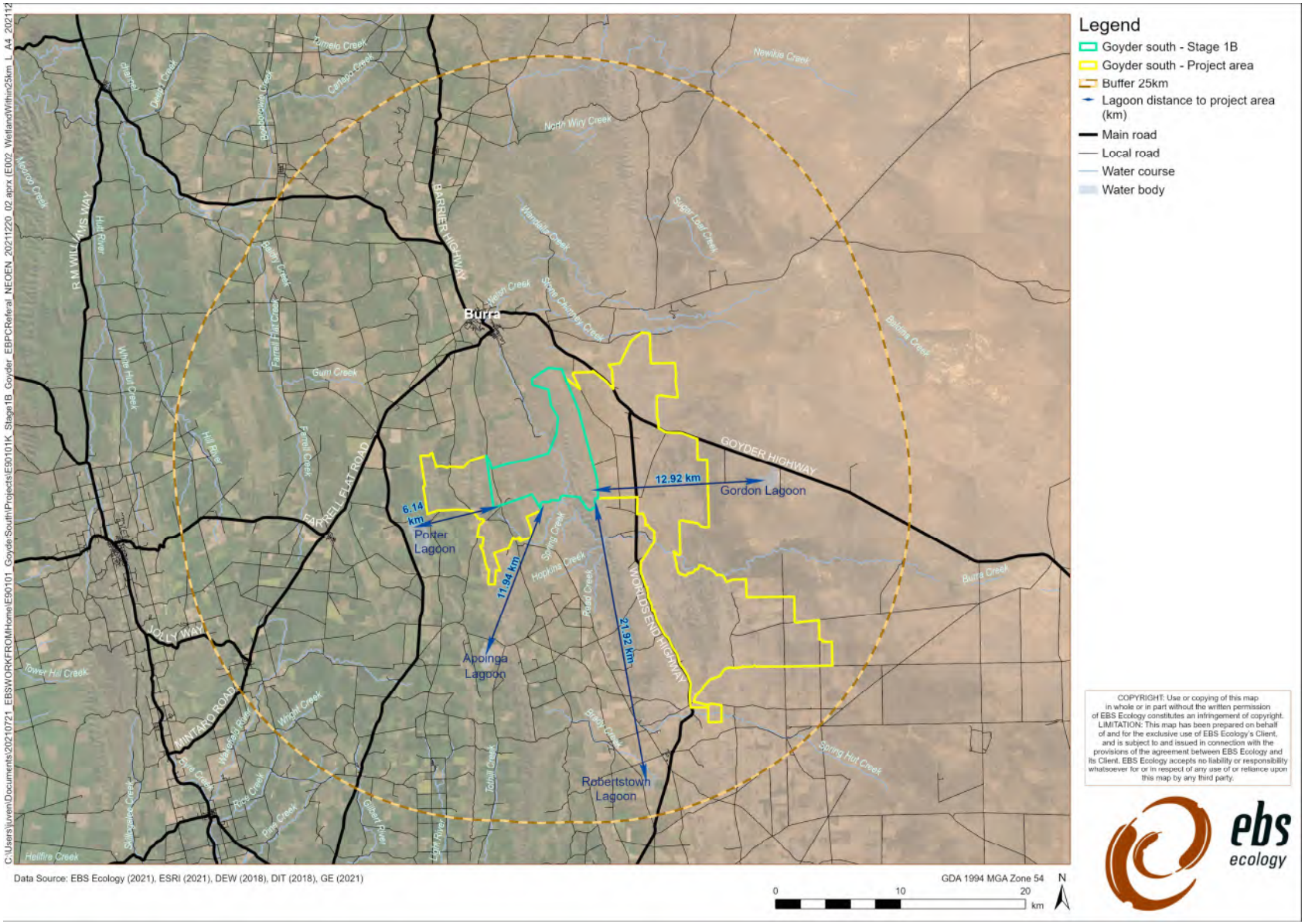

Figure 17. Location of floodplains, wetlands, lakes and watercourses within 25 km of the Project site.

3.4.5 Woodland habitats within the Project Area

Woodland habitats provide important habitat for some bird species. There are numerous patches of woodland within the Project Area (as shown in Figure 3 and Figure 4), including:

- VA3 *Eucalyptus porosa* (Mallee Box) Open Woodland
- VA4 *Eucalyptus odorata* (Peppermint Box) Closed Woodland
- VA6 *Eucalyptus leucoxylon* ssp. *pruinosa* (Inland South Australian Blue Gum) Open Woodland
- VA7 *Eucalyptus camaldulensis* ssp. *camaldulensis* (River Red Gum) Woodland
- VA10 *Callitris gracilis* (Southern Cypress Pine) Low Open Woodland
- VA14 *Triodia irritans* (Spinifex) Grassland +/- Emergent *Eucalyptus oleosa* ssp. *oleosa* (Red Mallee)
- VA24 *Allocasuarina verticillata* Open Woodland over *Bursaria spinosa ssp. spinosa* and *Austrostipa* spp.

However, as outlined previously in Table 7, woodland only makes up 4.88 % and 10.52 % of Stage 1A and Stage 1B, respectively.

Raptors, in particular, are known to use woodland habitats within the Goyder South Project Area. At least five WTE nests have been observed within the Project Area, with additional nests also observed outside of the Project Area, as shown in Figure 18.

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 1000 m buffer on known WTE nests, where practicable. However, two WTE nests were found late in the design process and do not have a 1000 m buffer, with one of these WTE nests located approximately 470 m east of SG072 and outside of the Stage 1A Project Area, and the other located approximately 480 m south-west of B049 in Stage 1B (Figure 18).

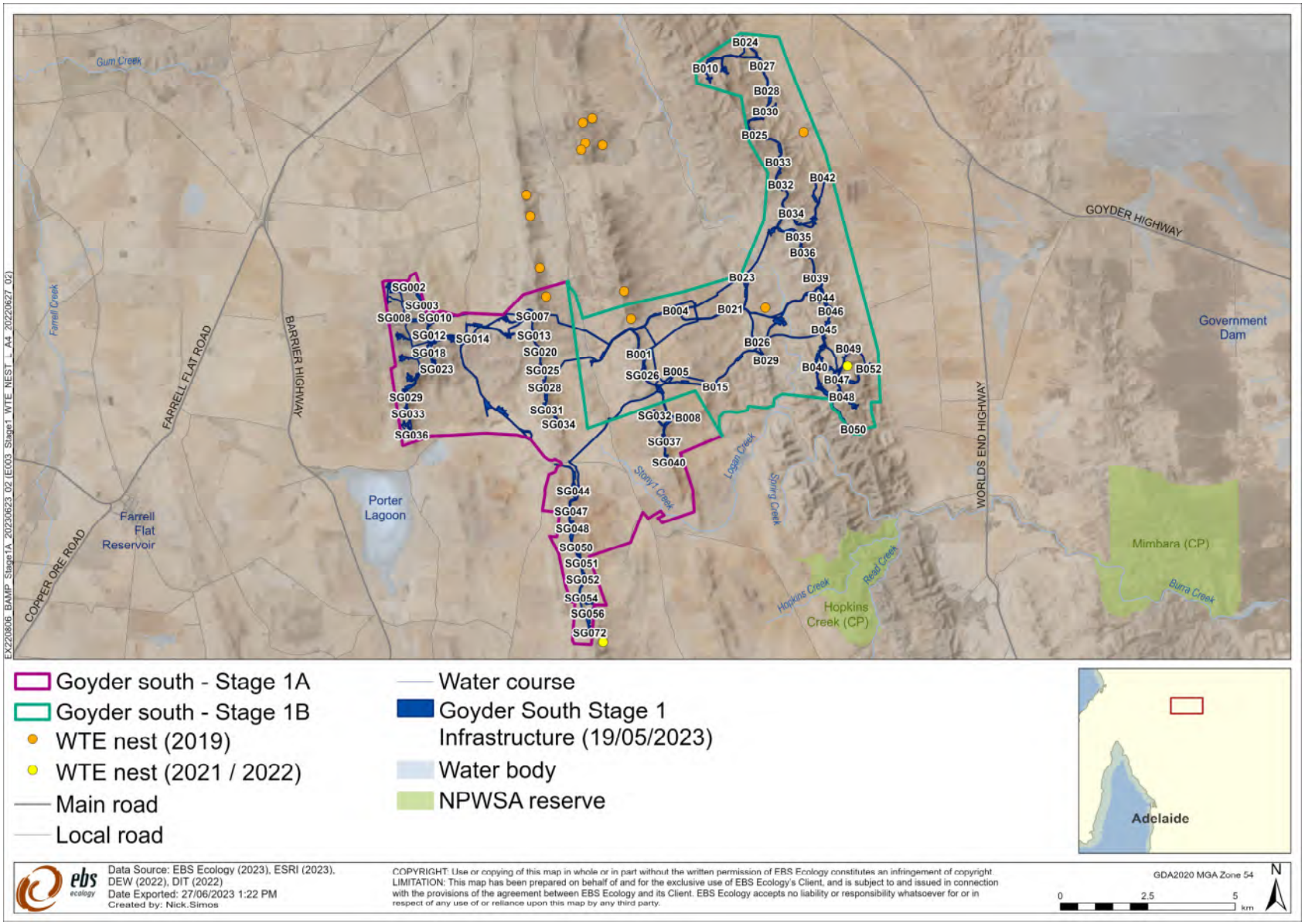

Figure 18. WTE nests observed within and adjacent to the Goyder South Project Area.

4 BIRDS AT THE GOYDER SOUTH PROJECT

4.1 Relevant EPBC Act listed bird species

EPBC Act listed bird species potentially relevant to the Goyder South Project were first identified via desktop assessment and field assessment completed for the initial flora and fauna assessment for the Project (EBS Ecology 2020) and are listed in Table 9. The desktop assessment included a search of the Biological Databases of South Australia (BDBSA) and use of the Department's Protected Matters Search Tool (PMST) (refer to EBS Ecology 2020 for more detail).

The following EPBC Act listed bird species (including some that were identified during the initial flora and fauna assessment (EBS Ecology 2020)) were identified by the Department for significant impact assessment during the EPBC Referral process (as outlined in the relevant Preliminary Documentation requirements for each EPBC Referral (EBS Ecology 2022a; 2022b)) and are also listed in Table 9:

- Grey Falcon (*Falco hypoleucos*) – vulnerable
- Fork-tailed Swift (*Apus pacificus*) – migratory
- Satin Flycatcher (*Myiagra cyanoleuca*) – migratory
- Sharp-tailed Sandpiper (*Calidris acuminata*) – migratory
- Curlew Sandpiper (*Calidris ferruginea*) – critically endangered / migratory
- Painted Honeyeater (*Grantiella picta*) – vulnerable

However, since EPBC approval for Stage 1A and Stage 1B was obtained, additional bird species have been listed (threatened and/or migratory) under the EPBC Act. As such, a new PMST report was undertaken on 22/06/2023 to identify EPBC Act listed bird species potentially relevant to the Project that may not have been identified previously, with these bird species also listed in Table 9.

Table 9. EPBC Act listed bird species potentially relevant to the Goyder South Project identified via desktop assessment and/or field survey.

Scientific name	Common name	Conservation Status		Source	Last BDBSA record (year)	Observed by EBS during field survey?
		Aus	SA			
Actitis hypoleucos	Common Sandpiper	Mi	R	1		
Aphelocephala leucopsis	Southern Whiteface	VU		1; 2	2015	Yes
Apus pacificus	Fork-tailed Swift	Mi		1; 2	2006	
Botaurus poiciloptilus	Australasian Bittern	EN	E	1		
Calidris acuminata	Sharp-tailed Sandpiper	Mi		1; 2	2003	
Calidris ferruginea	Curlew Sandpiper	CE, Mi		1		
Calidris melanotos	Pectoral Sandpiper	Mi	R	1		
Falco hypoleucos	Grey Falcon	VU	R	1		
Gallinago hardwickii	Latham's Snipe	Mi		1		
Grantiella picta	Painted Honeyeater	VU		1; 2	2000	
Leipoa ocellata	Malleefowl	VU	V	1		
Lophochroa leadbeateri leadbeateri	Major Mitchell's Cockatoo (eastern)	EN	R	1		
Manorina melanotis	Black-eared Miner	EN	E	1		

Scientific name	Common name	Conservation Status		Source	Last BDBSA record (year)	Observed by EBS during field survey?
		Aus	SA			
Melanodryas cucullata cucullata	South-eastern Hooded Robin	EN	R	1; 2	2010	Yes
Motacilla cinerea	Grey Wagtail	Mi		1		
Motacilla flava	Yellow Wagtail	Mi		1		
Myiagra cyanoleuca	Satin Flycatcher	Mi	E	1; 2	1998	Yes
Neophema chrysostoma	Blue-winged Parrot	VU	V	1; 2	2001	
Numenius madagascariensis	Far Eastern Curlew	CE, Mi	V	1		
Pandion haliaetus	Osprey	Mi	R	1		
Pedionomus torquatus	Plains-wanderer	CE		1		
Pezoporus occidentalis	Night Parrot	EN	E	1		
Polytelis anthopeplus monarchoides	Regent Parrot (eastern)	VU	V	1; 2	2013	
Rostratula australis	Australian Painted Snipe	EN	V	1; 2	2001	
Stagonopleura guttata	Diamond Firetail	VU	V	1; 2	2010	Yes
Tringa nebularia	Common Greenshank	Mi		1		

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 record.

Specific individual records of occurrence (i.e., location) for the EPBC Act listed bird species listed in Table 9 have been sourced from the BDBSA (i.e., "Source: 2"), but are not available from the PMST (i.e., "Source: 1"). Records of occurrence of non-migratory and migratory EPBC Act listed birds, located within approximately 25 km of the Goyder South Stage 1A and Stage 1B Project Areas, are shown in Figure 19 and Figure 20, respectively. As there is a lack of records within 25 km of the Goyder South Stage 1A and Stage 1B Project Areas, records within approximately 100 km have also been mapped and are shown in Figure 21. However, not all 26 EPBC Act listed bird species listed in Table 9 are shown in the figures as no relevant individual location records are available for some species.

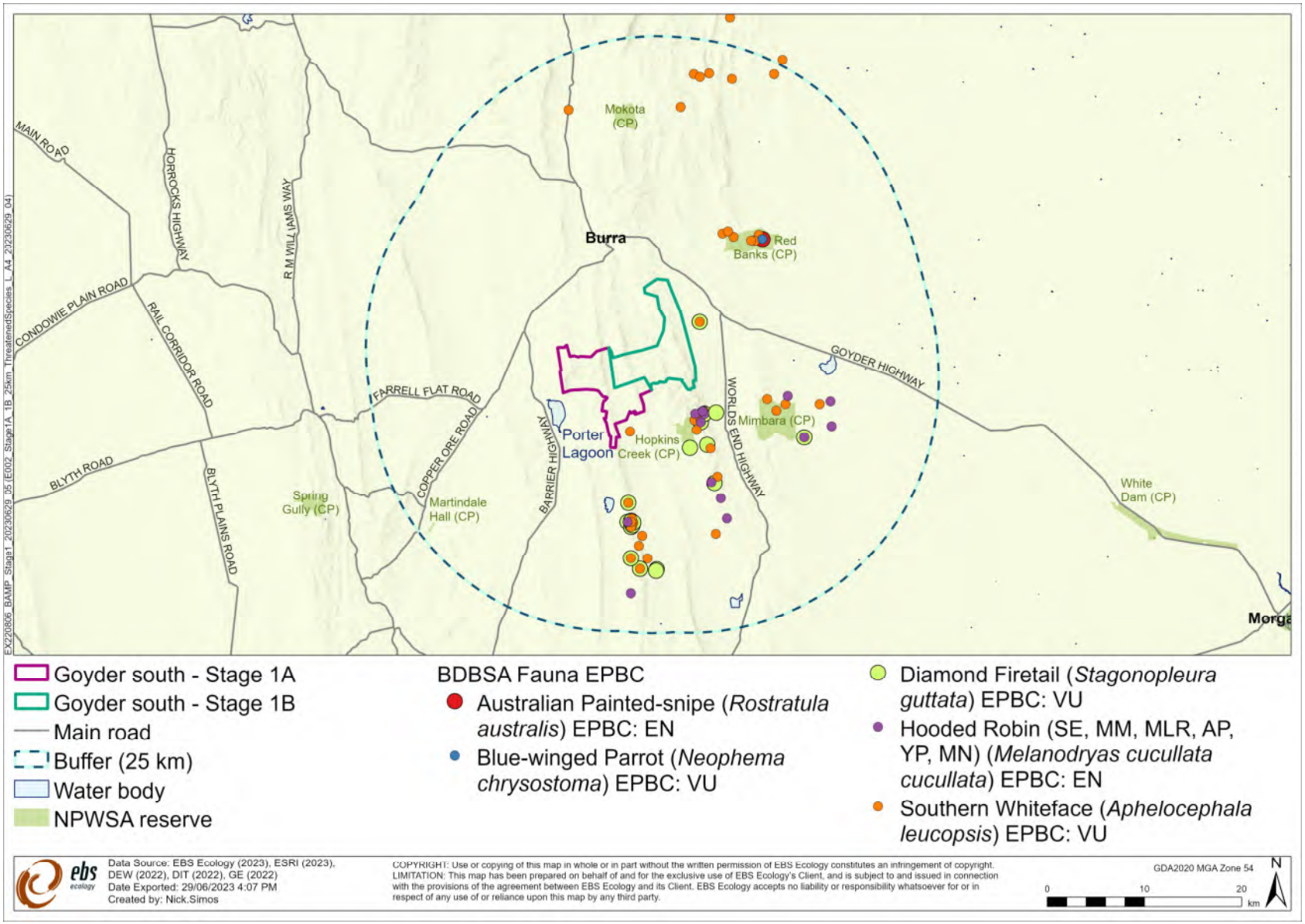

Figure 19. Records of EPBC Act listed bird species (non-migratory) within and adjacent to the Goyder South Stage 1A and Stage 1B Project Areas.

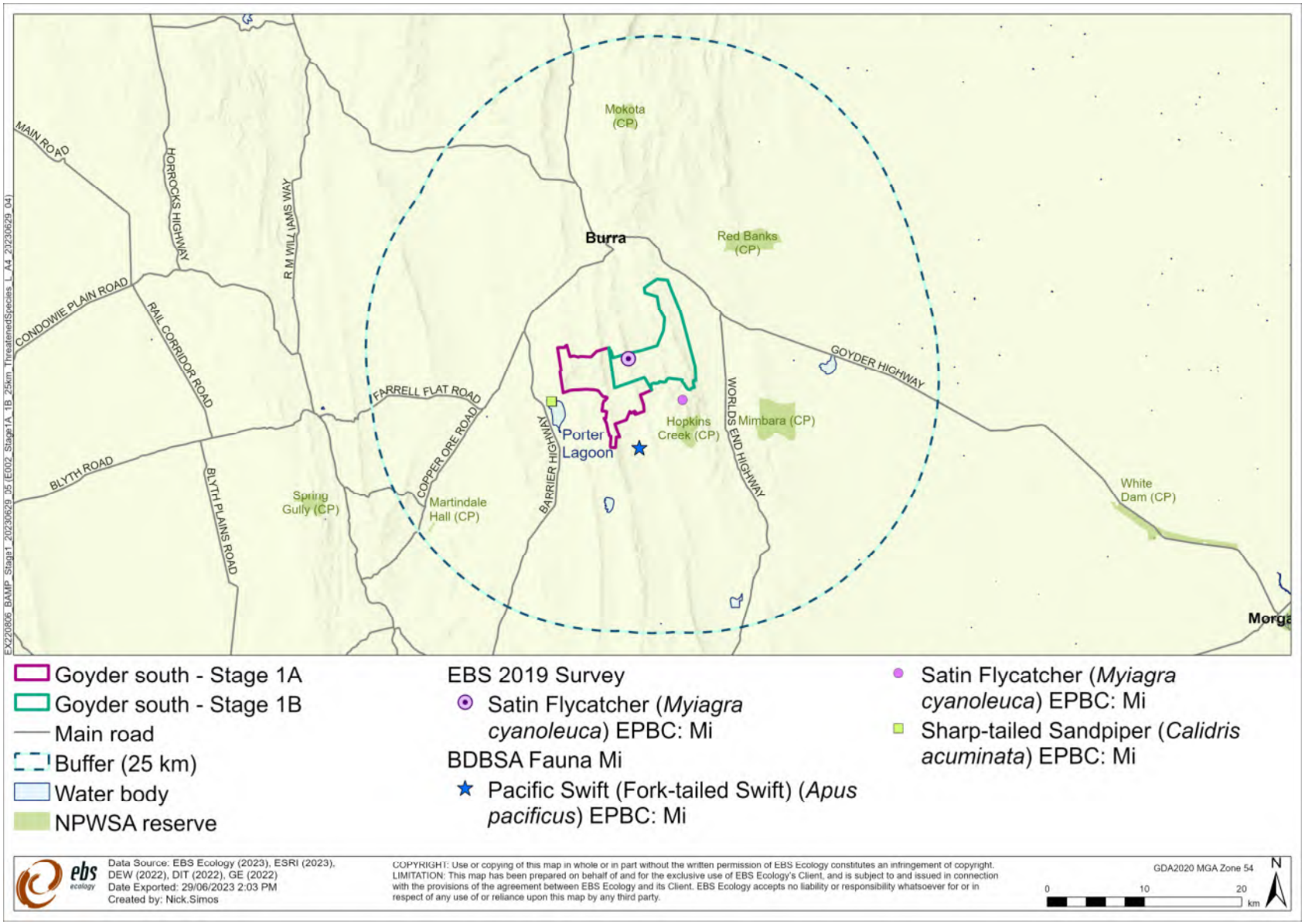

Figure 20. Records of EPBC Act migratory listed bird species within and adjacent to the Goyder South Stage 1A and Stage 1B Project Areas.

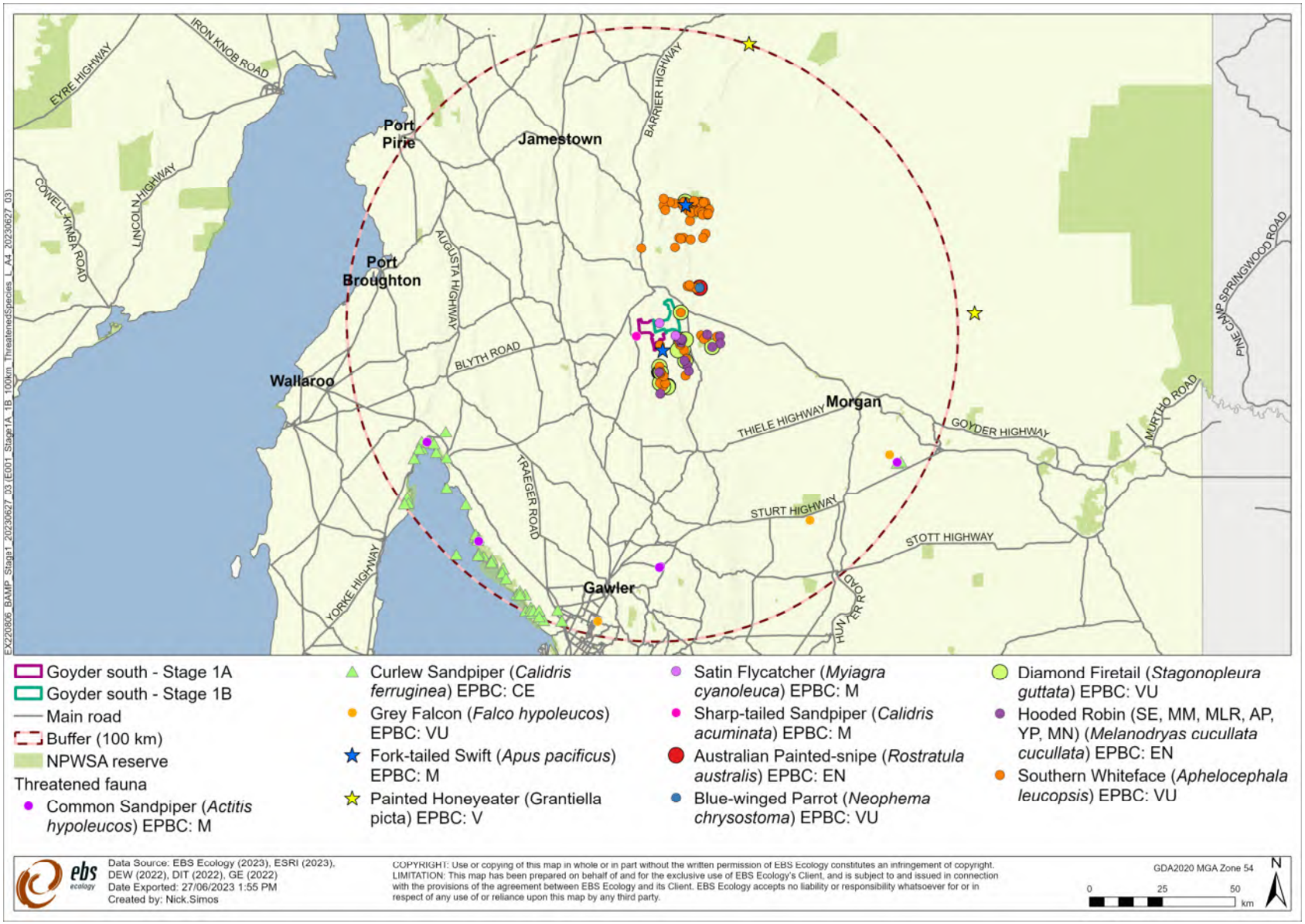

Figure 21. Records of EPBC Act listed bird species within 100 km of the Goyder South Stage 1A and Stage 1B Project Areas.

4.1.1 Likelihood of occurrence within the Goyder South Stage 1A and Stage 1B Project Areas

The initial flora and fauna assessment (EBS Ecology 2020) included a likelihood assessment to determine the likelihood of each threatened species to occur within the Project Area. Each of the threatened species identified by desktop assessment was assigned a rating (highly likely/known, likely, possible and unlikely), to describe their likelihood of occurrence within the Goyder South Project Area (based on specific criteria outlined in Appendix 2). The likelihood assessment was updated, where appropriate, post field survey, particularly for species that were observed during the field surveys for the initial flora and fauna assessment. These likelihood of occurrence ratings are presented in Table 10.

Any EPBC Act listed bird species potentially relevant to the Goyder South Project that have been identified by the new PMST report have also been assessed for their likelihood of occurrence within the Goyder South Stage 1A and Stage 1B Project Areas, as presented in Table 10. Some species such as Southern Whiteface (*Aphelocephala leucopsis*), South-eastern Hooded Robin (*Melanodryas cucullata cucullata*) and Diamond Firetail (*Stagonopleura guttata*) were observed during the field surveys for the initial flora and fauna assessment but were not listed under the EPBC Act at the time.

Out of the 26 EPBC Act listed bird species identified as potentially relevant to the Goyder South Project, only four species are 'known' to occur within the Goyder South Stage 1A and Stage 1B Project Areas:

- Southern Whiteface (*Aphelocephala leucopsis*)
- South-eastern Hooded Robin (*Melanodryas cucullata cucullata*)
- Satin Flycatcher (*Myiagra cyanoleuca*)
- Diamond Firetail (*Stagonopleura guttata*)

Out of the 22 EPBC Act listed bird species remaining, only the following seven are considered 'Possible' to occur within the Project Areas:

- Common Sandpiper (*Actitis hypoleucos*)
- Fork-tailed Swift (Apus pacificus)
- Sharp-tailed Sandpiper (*Calidris acuminata*)
- Curlew Sandpiper (*Calidris ferruginea*)
- Pectoral Sandpiper (*Calidris melanotos*)
- Blue-winged Parrot (*Neophema chrysostoma*)
- Common Greenshank (*Tringa nebularia*)

The remaining 17 EPBC Act listed bird species are considered 'Unlikely' to occur within the Goyder South Stage 1A and Stage 1B Project Areas.

Table 10. EPBC Act listed bird species likelihood of occurrence within the Stage 1A and/or Stage 1B Project Areas.

Scientific name	Common name	Conservation Status		Source	Last BDBSA record (year)	Observed by EBS during field survey?	Likelihood of occurrence within the Stage 1A and/or Stage 1B Project Areas
		Aus	SA				
Actitis hypoleucos	Common Sandpiper	Mi	R	1			**Possible** (flyover only)
Aphelocephala leucopsis	Southern Whiteface	VU		1; 2	2015	Yes	**Known** (observed within scattered trees / woodland)
Apus pacificus	Fork-tailed Swift	Mi		1; 2	2006		**Possible** (flyover only)
Botaurus poiciloptilus	Australasian Bittern	EN	E	1			Unlikely
Calidris acuminata	Sharp-tailed Sandpiper	Mi		1; 2	2003		**Possible** (flyover only)
Calidris ferruginea	Curlew Sandpiper	CE, Mi		1			**Possible** (flyover only)
Calidris melanotos	Pectoral Sandpiper	Mi	R	1			**Possible** (flyover only)
Falco hypoleucos	Grey Falcon	VU	R	1			Unlikely
Gallinago hardwickii	Latham's Snipe	Mi		1			Unlikely
Grantiella picta	Painted Honeyeater	VU		1; 2	2000		Unlikely
Leipoa ocellata	Malleefowl	VU	V	1			Unlikely
Lophochroa leadbeateri leadbeateri	Major Mitchell's Cockatoo (eastern)	EN	R	1			Unlikely
Manorina melanotis	Black-eared Miner	EN	E	1			Unlikely
Melanodryas cucullata cucullata	South-eastern Hooded Robin	EN	R	1; 2	2010	Yes	**Known** (observed on site)
Motacilla cinerea	Grey Wagtail	Mi		1			Unlikely
Motacilla flava	Yellow Wagtail	Mi		1			Unlikely

Scientific name	Common name	Conservation Status		Source	Last BDBSA record (year)	Observed by EBS during field survey?	Likelihood of occurrence within the Stage 1A and/or Stage 1B Project Areas
		Aus	SA				
Myiagra cyanoleuca	Satin Flycatcher	Mi	E	1; 2	1998	Yes	**Known** (observed within woodland)
Neophema chrysostoma	Blue-winged Parrot	VU	V	1; 2	2001		**Possible**
Numenius madagascariensis	Far Eastern Curlew	CE, Mi	V	1			Unlikely
Pandion haliaetus	Osprey	Mi	R	1			Unlikely
Pedionomus torquatus	Plains-wanderer	CE		1			Unlikely
Pezoporus occidentalis	Night Parrot	EN	E	1			Unlikely
Polytelis anthopeplus monarchoides	Regent Parrot (eastern)	VU	V	1; 2	2013		Unlikely
Rostratula australis	Australian Painted Snipe	EN	V	1; 2	2001		Unlikely
Stagonopleura guttata	Diamond Firetail	VU	V	1; 2	2010	Yes	**Known** (observed at riparian area adjacent Mixed Open Mallee)
Tringa nebularia	Common Greenshank	Mi		1			**Possible** (flyover only)

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.

4.2 Other bird species

Other bird species (not listed under the EPBC Act) potentially relevant to the Goyder South Project and potentially at risk for collision with wind farm infrastructure are listed in Table 11. This includes species listed as threatened on schedules of the SA *National Parks and Wildlife Act 1974* (NPW Act) and non-threatened species of 'at risk' birds known to occur or considered likely to occur at the Goyder South Project site, such as raptors. However, note that this is not an exhaustive list of all 'at risk' bird species (not listed under the EPBC Act) at the Goyder South Wind Farm that are potentially at risk of collision with wind farm infrastructure. Monitoring during operation of the Stage 1A and Stage 1B wind farms will identify any additional species at risk of collisions (Section 8.3.1).

Some of the species listed in Table 11 are likely to be resident and present all year round, while some others are nomadic or migratory and are likely to only be present episodically or for regular (seasonal) portions of the year. Records available for the bird species listed as threatened on schedules of the NPW Act are shown in Figure 22.

Table 11. Other bird species that may be relevant to the Project WTG collision monitoring program.

Scientific name	Common name	SA Conservation status (NPW Act)	Source	Last BDBSA record (year)	Observed by EBS during field survey?	Likelihood of occurrence within the Stage 1A and/or Stage 1B Project Areas
Accipiter cirrocephalus cirrocephalus	Collared Sparrowhawk		1; 2	2010	Y	Known
Anhinga novaehollandiae	Australasian Darter	R	2	2000		Possible
Anseranas semipalmata	Magpie Goose	E	2	1983		Unlikely
Ardeotis australis	Australian Bustard	V	2	2000		Unlikely
Aquila audax	Wedge-tailed Eagle		1; 2	2008	Y	Known
Cladorhynchus leucocephalus	Banded Stilt	V	2	2003		Possible
Circus approximans	Swamp Harrier		1		Y	Known
Corcorax melanorhamphos	White-winged Chough	R	1; 2	2015	Y	Known
Coturnix ypsilophora	Brown Quail	V	2	2015		Possible
Falco berigora	Brown Falcon		1; 2	2015	Y	Known
Falco cenchroides	Nankeen Kestrel		1; 2	2015	Y	Known
Falco peregrinus	Peregrine Falcon	R	1; 2	2010	Y	Known
Melithreptus gularis	Black-chinned Honeyeater	R	2	2006		Possible
Myiagra inquieta	Restless Flycatcher	R	2	2010		Likely
Neophema elegans	Elegant Parrot	R	1; 2	2006	Y	Known
Pachycephala inornata	Gilbert's Whistler	R	2	1986		Unlikely
Plectorhyncha lanceolata	Striped Honeyeater	R	2	1986		Unlikely
Porzana tabuensis	Spotless Crake	R	2	2002		Unlikely
Turnix varius	Painted Buttonquail	R	2	2015		Possible

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

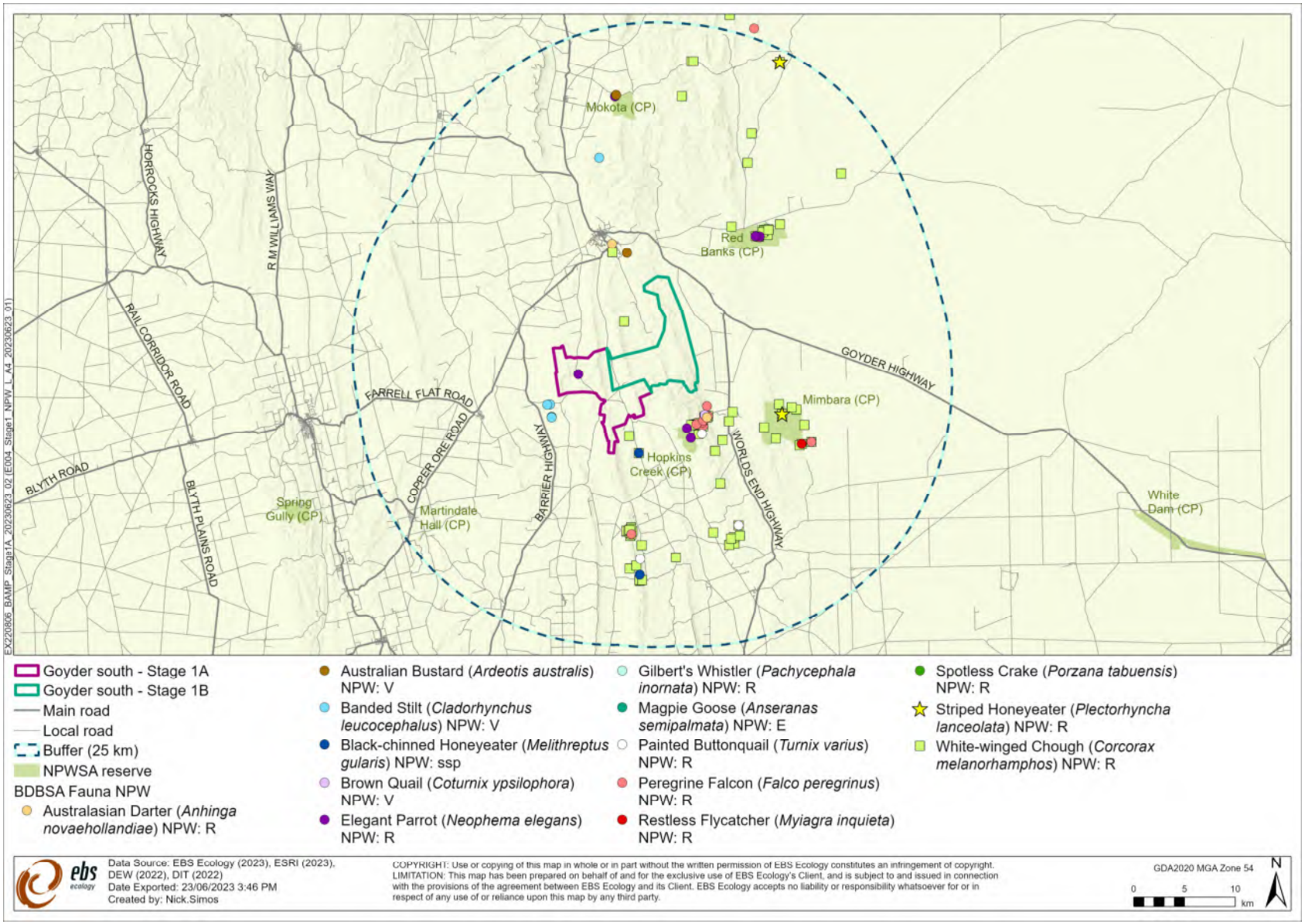

Figure 22. Records of NPW Act listed bird species within 25 km of the Goyder South Stage 1A and Stage 1B Project Areas.

4.3 Species of concern

This BAMP is applicable to all the bird species listed in Table 10 and Table 11, but focuses on the species that have been identified as Known, Likely or Possible to occur within the Stage 1A and Stage 1B Project Areas. It 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 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.

For the purposes of this BAMP, these are collectively termed 'species of concern'. Introduced / non-native species are not included as a 'species of concern'.

4.4 Potential impacts and risks for turbine collision

Birds that fly at RSA are at risk of collision with WTG blades, which is likely to result in mortality. Majority of fatalities involve small passerines, but this is likely to be an overrepresentation due to their abundance, biology or behaviour (Allison et. al. 2019; AWWI 2019). However, long-term impacts for most species are not thought to be significant at population level due to their population size and life cycle (Bennun et al. 2021). Large soaring birds and species with high wing loading such as raptors are more at risk of WTG collision as they are less agile and have restricted forward field of view (Bennun et al. 2021). While migratory birds are more prone to collision with WTGs than more sedentary birds, total fatalities tend to be higher for resident birds as they undertake more flights in the RSA (Bennun et al. 2021; Thaxter et al. 2017).

As outlined in Section 3.1.1, WTGs in the Stage 1A and Stage 1B wind farms will have a maximum hub height of 121 m and a maximum blade length of 78 m, which provides a collision free zone of approximately 40-42 m above grassland vegetation (1 m in height) and approximately 30-32 m above woodland vegetation (10 m in height).

4.4.1 Potential likelihood of collision with wind farm infrastructure

The potential likelihood of collision with wind farm infrastructure for the identified species of concern is presented in Table 12 and has been assessed based on the following parameters:

- their likelihood of occurrence within the Stage 1A and Stage 1B Project Areas (Table 10; Table 11);
- their individual species characteristics (Appendix 3 for EPBC Act listed birds);
- their individual habitat requirements (Appendix 3 for EPBC Act listed birds) and Stage 1A and Stage 1B site characteristics and ecological values (Section 3.4 including sub-sections);
- their behaviour (including flight heights) (Appendix 3 for EPBC Act listed birds); and
- WTG rotor swept area (Section 3.1.1).

Table 12. Potential likelihood of collision with wind farm infrastructure for identified species of concern.

Common name	EPBC Act / NPW Act Listing Status	Likelihood of occurrence within the Stage 1A and/or Stage 1B Project Areas	Potential likelihood of collision with wind farm infrastructure
EPBC Act listed species			
Common Sandpiper	Migratory	Possible (flyover only)	Possible Migratory shorebird
Southern Whiteface	Vulnerable	Known (observed within scattered trees / woodland)	Possible Resident / sedentary species
Fork-tailed Swift	Migratory	Possible (flyover only)	Possible Migratory species
Sharp-tailed Sandpiper	Migratory	Possible (flyover only)	Possible Migratory shorebird
Curlew Sandpiper	Critically Endangered; Migratory	Possible (flyover only)	Possible Migratory shorebird
Pectoral Sandpiper	Migratory	Possible (flyover only)	Possible Migratory shorebird
South-eastern Hooded Robin	Endangered	Known (observed on site)	Possible Resident / sedentary species
Satin Flycatcher	Migratory	Known (observed within woodland)	Possible Migratory species
Blue-winged Parrot	Vulnerable	Possible	Possible Migratory species
Diamond Firetail	Vulnerable	Known (observed at riparian area adjacent Mixed Open Mallee)	Possible Resident / sedentary species
Common Greenshank	Migratory	Possible (flyover only)	Possible Migratory shorebird
Other bird species			
Collared Sparrowhawk		Known (observed on site)	Likely Resident / sedentary species
Australasian Darter	NPW: Rare	Possible	Possible
Wedge-tailed Eagle		Known (observed on site)	Likely Resident / sedentary species
Banded Stilt	NPW: Vulnerable	Possible	Possible
Swamp Harrier		Known (observed on site)	Likely Resident / sedentary species
White-winged Chough	NPW: Rare	Known (observed on site)	Possible Resident / sedentary species
Brown Quail	NPW: Vulnerable	Possible	Unlikely (ground dwelling)
Brown Falcon		Known (observed on site)	Likely Resident / sedentary species
Nankeen Kestrel		Known (observed on site)	Likely Resident / sedentary species
Peregrine Falcon	NPW: Rare	Known (observed on site)	Likely Resident / sedentary species

Common name	EPBC Act / NPW Act Listing Status	Likelihood of occurrence within the Stage 1A and/or Stage 1B Project Areas	Potential likelihood of collision with wind farm infrastructure
Black-chinned Honeyeater	NPW: Rare	Possible	Possible
Restless Flycatcher	NPW: Rare	Likely	Possible
Elegant Parrot	NPW: Rare	Known (observed on site)	Possible
Painted Buttonquail	NPW: Rare	Possible	Unlikely (ground dwelling)

Out of the 11 EPBC Act listed species of concern, only three species, including Southern Whiteface, South-eastern Hooded Robin and Diamond Firetail are resident / sedentary species that have an ongoing presence throughout the year (if they are present within the Stage 1A and Stage 1B Project Areas). The Blue-winged Parrot is a partial migrant and unlikely to have an ongoing presence throughout the year (if they are present within the Stage 1A and Stage 1B Project Areas).

The remaining seven EPBC Act listed species are migratory and therefore, the risk of collision with wind farm infrastructure is limited to when they are present episodically or for regular (seasonal) portions of the year. Information is lacking on when these migratory species may specifically be present within the vicinity of the Stage 1A and Stage 1B Project Areas. However, these migratory bird species generally arrive in Australia in Winter and/or Spring (July to October/November) and depart in Autumn (March-May), with their presence within Australia outlined in Table 13. As such, these migratory species are generally not expected to be present within the Stage 1A and Stage 1B Project Areas during Autumn or Winter.

Table 13. Presence within Australia for migratory species with potential for collision with wind farm infrastructure.

Bird	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Common Sandpiper												
Fork-tailed Swift												
Sharp-tailed Sandpiper												
Curlew Sandpiper												
Pectoral Sandpiper												
Satin Flycatcher												
Common Greenshank												

Shading indicates that the species is present within Australia during the corresponding month.

4.5 Thresholds for significant impacts

Thresholds for significant impacts have been set based on the concept that an annual fatality rate of >0.1% of the population would cause serious disruption to an ecologically significant proportion of that population and would therefore be significant, which is consistent with the approach adopted at other wind farms (Table 14). If these thresholds are reached, impacts are deemed significant and both offsets and additional management measures will be required.

Table 14. Population estimates for the EPBC Act listed species of concern considered as possible for potential likelihood of collision with wind farm infrastructure.

Common name	EPBC Act Listing Status	Population estimate*	Population estimate source	Threshold based on 0.1% of population
Common Sandpiper	Migratory	190 000	*Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016).	190
Southern Whiteface	Vulnerable	477 000	Conservation Advice for Southern Whiteface (DCCEEW 2023a).	477
Fork-tailed Swift	Migratory	~100 000	Draft referral guideline for 14 birds listed as migratory species under the EPBC Act (Commonwealth of Australia 2015a).	100
Sharp-tailed Sandpiper	Migratory	85 000	*Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016).	85
Curlew Sandpiper	Critically Endangered; Migratory	90 000	*Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016).	90
Pectoral Sandpiper	Migratory	1 220 000 – 1 930 000	*Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016).	1220
South-eastern Hooded Robin	Endangered	68 000	Conservation Advice for South-eastern Hooded Robin (DCCEEW 2023b).	68
Satin Flycatcher	Migratory	1,700 000	Draft referral guideline for 14 birds listed as migratory species under the EPBC Act (Commonwealth of Australia 2015a).	1700
Blue-winged Parrot	Vulnerable	10 000	Conservation Advice for Blue-winged Parrot (DCCEEW 2023c).	10
Diamond Firetail	Vulnerable	136 000	Conservation Advice for Diamond Firetail (DCCEEW 2023d).	136
Common Greenshank	Migratory	110 000	*Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016).	110

***Refer to individual species characteristics in Appendix 3 for information on population estimates.**

Refer to Appendix 3 for more information on individual species characteristics, population estimates, habitat requirements and behaviour.

5 IMPLEMENTATION OF THIS BAMP

Implementation of this BAMP will commence before commissioning of the Stage 1A and Stage 1B wind farms and will continue until completion of operation.

The long-term WTG collision monitoring program (outlined in Section 8.3.3) is proposed to commence as soon as practicable upon the commencement of commissioning. However, the WTGs proposed to be monitored must be commissioned for WTG collision monitoring to be able to commence. Commissioning of WTGs in Stage 1A is anticipated to commence in December 2023. However, commissioning of WTGs in Stage 1B is not anticipated to commence until April 2024. As such, the commencement of the WTG collision monitoring program is likely to involve a staggered approach, where monitoring at each WTG proposed to be monitored, does not commence until after commissioning of the WTG has been undertaken.

The sub-sections below outline roles and responsibilities, environmental training requirements, and review of this BAMP. An assessment of potential risks to achieving the BAMP's environmental objectives is presented in Section 6, while birds of relevance to this BAMP are identified in Section 4; impact significance and trigger levels are outlined in Section 5; the proposed bird monitoring program is outlined in Section 8; and an adaptive management framework is outlined in Section 9.

5.1 BAMP roles and responsibilities

It is anticipated that there will be two main roles associated with implementation of this BAMP, the Construction Project Manager / Asset Manager (NEOEN); and an Ecological Consultancy. The specific personnel fulfilling these roles may change over time, particularly across the lifetime of the Stage 1A and Stage 1B wind farms. The aspects and/or tasks that each role is likely to be responsible for are outlined in Table 15. Project employees, contractors and sub-contractors will also have a role, which is also outlined in Table 15.

Table 15. Roles and responsibilities associated with implementation of this BAMP.

Role	Aspects and/or tasks the role is responsible for
Construction Project Manager / Asset Manager (NEOEN)*	Currently NEOEN is the project developer and is responsible for the planning of the entire Goyder South Project, including seeking and obtaining relevant planning and environmental approvals under State and Federal legislation, as well as construction and operation of the Project. NEOEN intends to own and operate the Goyder South Project in the future and does not intend to sell the Project. The Construction Project Manager / Asset Manager (NEOEN)* will be responsible for implementing this BAMP, including all the objectives outlined in Section 2. In particular, the Construction Project Manager / Asset Manager (NEOEN)* is responsible for implementing the long-term WTG collision monitoring program, analysing data collected, estimating annual mortality rates, determining whether any significant impacts have occurred, adapting management (where required) and reporting. If significant impacts to EPBC Act listed bird species occur, or are likely to have occurred, as a result of the action (i.e., The Project), the approval holder (i.e., the Construction Project Manager / Asset Manager (NEOEN)*) will, within 3 months of becoming aware of any actual or likely significant impact, submit to the Department for the approval of the Minister a revised BAMP responding to, and accompanied by, an evaluation report prepared by a suitably qualified bird expert of the effectiveness of the BAMP in preventing significant impacts to listed bird species. It is anticipated that the Construction Project Manager / Asset Manager (NEOEN)* will engage a suitably qualified and experienced Ecological Consultancy to assist

Role	Aspects and/or tasks the role is responsible for
	with implementation of this BAMP, including undertaking the long-term WTG collision monitoring program, analysing data collected, estimating annual mortality rates, determining whether any significant impacts have occurred, adapting management (where required) and reporting. However, implementation of this BAMP will remain the responsibility of the Construction Project Manager / Asset Manager (NEOEN)*. The Construction Project Manager / Asset Manager (NEOEN)* must ensure that they do not commission* the Project unless the BAMP has been approved by the Minister in writing. The Construction Project Manager / Asset Manager (NEOEN)* must commence implementing the approved BAMP before commissioning* and continue implementing the approved BAMP until the completion of the action (i.e., The Project). Should the Construction Project Manager / Asset Manager (NEOEN)* change in future, implementation of this BAMP will remain the responsibility of whoever is the Construction Project Manager / Asset Manager (NEOEN)*.
Project employees, contractors and sub-contractors	All Project employees, contractors and sub-contractors will be responsible for reporting any bird carcass or feather spot observed on site (regardless of location) to their supervisor/manager or directly to the Construction Project Manager / Asset Manager (NEOEN)*. Any supervisor/manager who receives a report of a bird carcass or feather spot observed on site must report it to the Construction Project Manager / Asset Manager (NEOEN)*.
Ecological Consultancy	It is proposed that a suitably qualified and experienced Ecological Consultancy will be responsible for assisting the Construction Project Manager / Asset Manager (NEOEN)* to implement this BAMP. The same Ecological Consultancy is likely to be required to undertake monitoring and reporting activities and likely to be responsible for reviewing and analysing monitoring data and results to determine the success (or failure) of management actions and recommending refinement/improvement, if required.

***The Construction Project Manager (NEOEN) will change to Asset Manager (NEOEN) once Practical Completion is achieved under the Engineering, Procurement and Construction Contract.**
****Refer to the GLOSSARY AND ABBREVIATION OF TERMS for a definition of 'commission' / 'commissioning'.**

5.2 Environmental training

Upon commencement of implementation of this BAMP, the Construction Project Manager / Asset Manager (NEOEN) will be inducted into this BAMP to ensure that they understand the objectives and are aware of the commitments contained within this BAMP, particularly the long-term WTG monitoring program.

All Project employees, contractors and sub-contractors working on site will be informed, before they commence work, of the potential for birds to be struck by WTGs and that they must report any bird carcass or feather spot observed on site (regardless of location) to their supervisor/manager or directly to the Construction Project Manager / Asset Manager (NEOEN). Any supervisor/manager who receives a report of a bird carcass or feather spot observed on site must report it to the Construction Project Manager / Asset Manager (NEOEN).

5.3 Monitoring and Reporting

NEOEN propose to prepare an annual BAMP Monitoring and Implementation Report (or similar), which includes reporting on the bird monitoring program (outlined in Section 8) and implementation of adaptive management actions (outlined in Section 9).

The annual BAMP Monitoring and Implementation Report is proposed to be published as an attachment to the annual EPBC approval compliance report required as a condition of approval for each of the Stage 1A and Stage 1B EPBC approvals for the Goyder South Project. Each annual EPBC approval compliance report is required to be prepared for each 12-month period following the date of commencement of the action (or otherwise in accordance with an annual date that has been agreed to in writing by the Minister). Each annual EPBC approval compliance report must be published on the Project's website within 60 business days following the relevant 12-month period. The date of commencement, 12-month anniversary date and associated annual EPBC approval compliance report publication due dates for the first three years for Stage 1A and Stage 1B are presented in Table 16.

Table 16. Overview of EPBC approval compliance report due dates.

Project Stage (EPBC Referral)	Date of commencement	12-month anniversary	EPBC approval compliance report publication due date
Stage 1A (2021/8958)	7 July 2022	7 July 2023	29 September 2023
		7 July 2024	29 September 2024
		7 July 2025	29 September 2025
Stage 1B (2021/8957)	15 August 2022	15 August 2023	8 November 2023
		15 August 2024	8 November 2024
		15 August 2025	8 November 2025

As such, the annual BAMP Monitoring and Implementation Report (for both Stage 1A and Stage 1B) is proposed to be published by 29 September each year, during implementation of the BAMP.

5.4 Review of this BAMP

This BAMP will be reviewed annually during implementation of the bird monitoring program (Section 8) to ensure the environmental objectives are being achieved and to identify any improvements that might be required. This BAMP document will be updated if improvements have been identified.

Furthermore, in accordance with the conditions of approval associated with the EPBC approvals (Table 2) a revised BAMP must be submitted to the Department for approval of the Minister within 3 months of becoming aware of any actual or likely significant impact to EPBC Act listed bird species as a result of the action (i.e., The Project). The revised BAMP must be accompanied by an evaluation report prepared by a suitably qualified bird expert of the effectiveness of the BAMP in preventing significant impacts to EPBC Act listed bird species.

6 RISK ASSESSMENT

There are a number of potential risks to achieving the BAMP's environmental objectives, including the following:

- Indifference and/or lack of understanding of requirement for the BAMP (EPBC Act and DPI Act approval conditions) leading to poor implementation of this BAMP, including the monitoring, analysis, adaptive management and reporting proposed within it;
- Change of wind farm owner and/or operator (potentially leading to poor implementation of this BAMP);
- Change of staff responsible for implementation of this BAMP (i.e., Construction Project Manager / Asset Manager (NEOEN)) and lack of understanding of requirements within this BAMP;
- Change of Ecological Consultancy assisting NEOEN to implement this BAMP and lack of understanding of requirements within this BAMP;
- Insufficient monitoring to determine accurate mortality estimates and impact;
- Low confidence in results;
- Low likelihood of detecting significant impact to EPBC Act listed species; and
- Adaptive management does not prevent a significant impact to an EPBC Act listed species.

These risks are outlined in Table 17, along with further commentary on each risk, the likelihood rating of each risk occurring, the consequence rating of each risk, the overall risk rating, risk management strategies and/or proposed contingency measures and who will be responsible for managing the risk. A qualitative risk assessment methodology was used to undertake the risk assessment, with the likelihood and consequence rating criteria, along with the corresponding risk rating matrix, provided in Appendix 4.

Table 17. Assessment of risks to achieving the BAMP's environmental objectives and associated risk management strategies that will be applied.

Potential risk	Comment on risk	Likelihood of risk occurring	Consequence rating	Risk rating	Risk management strategies / Proposed contingency measures	Responsibility
Indifference and/or lack of understanding of requirement for the BAMP (EPBC Act and DPI Act approval conditions) leading to poor implementation of this BAMP, including the monitoring, analysis, adaptive management and reporting proposed within it.	Poor implementation of this BAMP is likely to result in potential non-compliance with the EPBC Act approval conditions, which is undesirable for NEOEN.	Unlikely – Possible	Minor - Moderate	Medium	• Ensure the BAMP addresses all the EPBC Act approval conditions (Table 2). • EPBC Act Approvals Annual Compliance Reports (which must be published to the Project's website on an annual basis and available until the approvals expire).	Construction Project Manager / Asset Manager (NEOEN) (assisted by Ecological Consultancy)
Change of wind farm owner and/or operator (potentially leading to poor implementation of this BAMP).	NEOEN intend to own and operate Goyder South Stage 1A and Stage 1B wind farms as part of the Goyder South Hybrid Renewable Energy Facility and advise that they are unlikely to sell Goyder South wind farms.	Possible	Minor - Moderate	Medium	• EPBC Act approval (and conditions) and PDI Act Development Approval (and conditions).	Construction Project Manager / Asset Manager (NEOEN) (assisted by Ecological Consultancy)
Change of staff responsible for implementation of this BAMP (i.e., Construction Project Manager / Asset Manager (NEOEN)) and lack of understanding of requirements within this BAMP.	Given the ~35 year expected duration of operation of the Stage 1A and Stage 1B wind farms, (with EPBC Approvals having effect until 31 December 2057) it is likely that the Construction Project Manager / Asset Manager (NEOEN) will change at times during implementation of this BAMP.	Highly likely	Minor - Moderate	High	• Construction Project Manager / Asset Manager (NEOEN) to be inducted into this BAMP. • Construction Project Manager / Asset Manager (NEOEN) to be involved in review of all reporting associated with this BAMP. • Ecological Consultancy to ensure Construction Project Manager / Asset Manager (NEOEN) is invited to review all reporting associated with this BAMP and assist the Construction Project Manager / Asset Manager (NEOEN) to understand the requirements.	Construction Project Manager / Asset Manager (NEOEN) (assisted by Ecological Consultancy)

Potential risk	Comment on risk	Likelihood of risk occurring	Consequence rating	Risk rating	Risk management strategies / Proposed contingency measures	Responsibility
Change of Ecological Consultancy assisting NEOEN to implement this BAMP and lack of understanding of requirements within this BAMP.	Given the ~35 year expected duration of operation of the Stage 1A and Stage 1B wind farms, (with EPBC Approvals having effect until 31 December 2057) it is likely that the Ecological Consultancy will change at times during implementation of this BAMP.	Possible - Likely	Minor - Moderate	Medium	• NEOEN to ensure that they engage a suitably qualified and experienced Ecological Consultancy to assist with implementation of this BAMP. • NEOEN to ensure they maintain accurate records and files, including this BAMP and any reports associated with it.	Construction Project Manager / Asset Manager (NEOEN)
Insufficient monitoring to inform accurate mortality estimates and impact.	As not every WTG will be subject to collision monitoring, modelling is used to extrapolate data collected and estimate annual mortality. There is a risk that not enough data is collected for input into the modelling.	Possible	Moderate	Medium	• As the Stage 1A and Stage 1B Project Areas are considered to be largely vegetatively and geographically uniform, monitoring 34 % of WTGs in Stage 1A and 35 % of WTGs in Stage 1B is considered statistically adequate to ensure accurate detection of potential impacts to species of concern and monitoring is unlikely to under-estimate annual mortality across the wind farms. • A qualified and experienced statistician will be engaged to undertake statistical analysis and estimate annual mortality.	Construction Project Manager / Asset Manager (NEOEN) (assisted by Ecological Consultancy)
Low confidence in statistical results (for mortality estimate and impact).	As modelling is used to estimate annual mortality, there is a risk that there is low confidence in statistical results.	Possible	Moderate	Medium	• A qualified and experienced statistician will be engaged to undertake statistical analysis and estimate annual mortality.	Construction Project Manager / Asset Manager (NEOEN) (assisted by Ecological Consultancy)

Potential risk	Comment on risk	Likelihood of risk occurring	Consequence rating	Risk rating	Risk management strategies / Proposed contingency measures	Responsibility
Low likelihood of detecting significant impact to EPBC Act listed species.	As not every WTG will be subject to collision monitoring, there is a risk that a significant impact to EPBC Act listed species is not detected.	Possible	Moderate	Medium	• As the Stage 1A and Stage 1B Project Areas are considered to be largely vegetatively and geographically uniform, monitoring 34 % of WTGs in Stage 1A and 35 % of WTGs in Stage 1B is considered statistically adequate to ensure accurate detection of potential impacts to species of concern and modelling is unlikely to under-estimate annual mortality across the wind farms. • A qualified and experienced statistician will be engaged to undertake statistical analysis and estimate annual mortality. • WTG risk ratings will be continually reviewed and updated annually by a suitably qualified and experienced ecologist.	Construction Project Manager / Asset Manager (NEOEN) (assisted by Ecological Consultancy)
Adaptive management does not prevent a significant impact to an EPBC Act listed species.	Although adaptive management action(s) may have been implemented, there is a risk that a significant impact to an EPBC Act listed species still occurs.	Unlikely	Moderate	Low	• NEOEN to ensure they engage a suitably qualified and experienced Ecological Consultancy to advise on implementation of adaptive management actions. • NEOEN to ensure they maintain accurate records and files, including this BAMP and any reports associated with it. • Review BAMP on an annual basis and ensure adaptive management is improved where required. • If a significant impact is determined to have occurred, implement an appropriate offset (if required). • NEOEN will, within 3 months of becoming aware of any actual or likely significant impact, submit to the Department for approval a revised BAMP responding to, and accompanied by, an evaluation report prepared by a suitably qualified bird expert of the effectiveness of the BAMP in preventing significant impacts to EPBC Act listed bird species.	Construction Project Manager / Asset Manager (NEOEN) (assisted by Ecological Consultancy)

7 DETERMINING IMPACT SIGNIFICANCE & TRIGGER LEVELS

7.1 Guiding principles for determining significance of impacts

While the most desirable outcome for the Stage 1A and Stage 1B wind farms is that they will not cause detrimental impacts to EPBC Act listed bird species and other bird species, it is acknowledged that birds are known to be struck by WTGs and as such it is recognised that some level of impact is likely to occur. The principal environmental objective of this BAMP is to ensure that the Stage 1A and Stage 1B wind farms do not have a significant impact on any EPBC Act listed bird species. However, this BAMP also aims to minimise and mitigate impacts to all bird species (not just EPBC Act listed bird species) where practicable and it will be important that the wind farms do not have a substantial impact on the viability of the population of any bird species.

The significant impact guidelines for threatened and migratory species listed under the EPBC Act within the *Matters of National Environmental Significance: Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia 2013) will be used to determine whether a significant impact to EPBC Act listed bird species has occurred, or is likely to have occurred, as a result of the action (the Stage 1A and Stage 1B wind farms) as outlined in Section 4.5.

Should the Department revise the currently recognised population estimates, impact trigger levels for each species will be re-calculated and applied moving forward. Where carcasses of other EPBC listed species not listed in Table 14 are identified within the site, calculation of impact triggers will be determined using the method prescribed in in the *Draft – Referral guideline for 14 birds listed as migratory species under the EPBC Act* (Commonwealth of Australia 2015a).

7.2 Trigger levels for management responses to bird collisions at the Goyder South Stage 1A and Stage 1B Wind Farms

Determination of the impact trigger for species of concern are based on the *Draft – Referral guideline for 14 birds listed as migratory species under the EPBC Act* (Commonwealth of Australia 2015a) which prescribe impacts to 0.1% of a species total population to be nationally important (as outlined in Table 14). A trigger level could be set at half of the nationally significant proportion of each species population (0.05% as outlined in Table 18), which will allow for an early identification of potential significant impacts on the species.

Table 18. Population estimates for the EPBC Act listed species of concern considered as possible for potential likelihood of collision with wind farm infrastructure.

Common name	EPBC Act Listing Status	Population estimate*	Population estimate source	Threshold based on 0.1% of population	0.05% of population
Common Sandpiper	Migratory	190 000	*Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016).	190	95
Southern Whiteface	Vulnerable	477 000	Conservation Advice for Southern Whiteface (DCCEEW 2023a).	477	239
Fork-tailed Swift	Migratory	~100 000	Draft referral guideline for 14 birds listed as migratory species under the EPBC Act (Commonwealth of Australia 2015a).	100	50
Sharp-tailed Sandpiper	Migratory	85 000	*Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016).	85	43
Curlew Sandpiper	Critically Endangered; Migratory	90 000	*Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016).	90	45
Pectoral Sandpiper	Migratory	1 220 000 – 1 930 000	*Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016).	1220	610
South-eastern Hooded Robin	Endangered	68 000	Conservation Advice for South-eastern Hooded Robin (DCCEEW 2023b).	68	34
Satin Flycatcher	Migratory	170 000	Draft referral guideline for 14 birds listed as migratory species under the EPBC Act (Commonwealth of Australia 2015a).	1700	850
Blue-winged Parrot	Vulnerable	10 000	Conservation Advice for Blue-winged Parrot (DCCEEW 2023c).	10	5
Diamond Firetail	Vulnerable	136 000	Conservation Advice for Diamond Firetail (DCCEEW 2023d).	136	68
Common Greenshank	Migratory	110 000	*Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016).	110	55

***Refer to individual species characteristics in Appendix 3 for information on population estimates.**

However, the trigger levels nominated in this BAMP are less than the 0.05% population value, as outlined in Table 19 (further below). These trigger levels are similar to those adopted in other Bird and Bat Adaptive Management Plans / Programs (such as Silverton Wind Farm (Biosis 2018) and White Rock Wind Farm Stage 1 (Brett Lane & Associates 2017)). The levels will be used, if required, as triggers for implementation of adaptive management (refer to Section 9) aimed at reducing impacts to a level below the set trigger levels.

Trigger levels are for numbers of bird fatalities detected during carcass searches and/or incidental finds (refer to Section 8.3). The trigger levels will apply for all native avifauna that may use the site, regardless

of whether they are included in Table 12, and for any avifauna species that are listed as threatened in the future. No trigger level will apply to any introduced / non-native fauna species.

Table 19. Trigger levels for the species of concern.

Species group	Trigger-level details
EPBC Act listed threatened and migratory bird species (listed in Table 12)	• 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)	• 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 a WTG collision monitoring search, and/or incidentally by wind farm personnel, in any two consecutive months.

8 BIRD MONITORING PROGRAM

8.1 Objectives

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, will be an essential component of the BAMP.

The objectives of the bird monitoring program will be 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 (Section 7.2; Table 19);
- 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; and
- 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:

- Bird utilisation surveys
- 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

8.2 Background

8.2.1 Pre-commissioning scavenger activity and searcher efficiency trials

As the long-term WTG collision monitoring program for the Goyder South Project will 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.

A number of factors, such as scavenger removal (scavenger activity) and carcass detectability (searcher efficiency), can affect mortality rate estimates and must be measured and included in any estimate of overall mortality rates. As such, scavenger activity trials have been completed to determine the length of time before scavengers (such as Red Fox) would remove a carcass (i.e., a bird struck by a WTG) 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.

The scavenger activity and searcher efficiency trials undertaken in March 2023 involved both small bird and large bird models to represent small birds (such as migratory shorebirds and parrots), and large birds (such as Wedge-tailed Eagles and other raptors). Results of the scavenger activity trials suggest that small bird carcasses are removed later (μ = 7.8 days) than large bird carcasses (μ = 2.7 days) (Table 20), while results of the searcher efficiency trials included a detection rate of 90.0 % for the small bird model and 96.6 % for the large bird model, resulting in an overall carcass detection rate at the Goyder South Project of 93.1 % (Table 21).

Table 20. Scavenger activity trials at the Goyder South Project (March 2023).

Model	Scavenging traces and characteristics	Number of carcasses	Mean time until signs of scavenging observed	Confidence Interval	Standard Error	Standard Deviation
Small bird	Removed, no trace	13	7.8 days	7.1 – 8.5 days	1.37	1.37
	Removed with feather-spot	2				
	Remained at day 10 (but decaying)	5				
	Total	20				
Large bird	Removed with feather-spot	6	2.7 days	1.8 – 3.6 days	1.00	1.42
	Foraged in-situ prior to removal	2				
	Decapitated prior to removal	2				
	Total	10				

Source: EBS Ecology 2023a.

Table 21. The detection efficiency of small and large bird models at the Goyder South Project (March 2023).

Model	Number of trials	Number of carcasses used	Number of carcasses detected	Estimated probability (%) of detection	Standard Deviation	Standard Error
Small bird	8	40	36	90.0 %	10.7	7.6
Large bird	8	32	31	96.9 %	8.8	6.3
Total	**16**	**72**		**93.1 %**	**10.1**	**-**

Source: EBS Ecology 2023a.

Values for scavenger rates (i.e., scavenger activity) and the likelihood of carcass detection (i.e., searcher efficiency) that were collected for the Goyder South Project (EBS Ecology 2023a) will be used to assist with the interpretation of data collected during the long-term WTG collision monitoring program.

8.2.2 Case study: Hornsdale Wind Farm

Hornsdale Wind Farm is a 316 MW renewable electricity project consisting of 99 WTGs located north of Jamestown in the mid-north of South Australia. WTGs at Hornsdale Wind Farm are 150 m in height (at blade tip), with a hub of 95 m, a blade length of 55 m, and a rotor blade diameter of 112 m (giving a rotor swept area of 9852 m^2) (NEOEN 2023). As part of approval conditions, a bird monitoring program was developed. The 5-year (2018-2022) monitoring program included monthly bird strike monitoring at selected WTGs. Each of the 6 WTGs that were surveyed, were overlayed with a 200 × 200 m quadrat ('the search area'), which was sub-divided into four 100 × 100 m cells, with each cell traversed along parallel transects at 5 m intervals to ensure maximum detection of carcasses (EBS Ecology 2018). A circular search area (radius of 100m) was considered initially but it was determined to be difficult to maintain even spacing of transects and ensure sufficient coverage of the search area without almost continually looking at a handheld GPS and potentially missing a carcass / feather-spot. As such, the quadrat and parallel transect method described above was implemented.

The values of search efficiency (S) and scavenging rates (T) were determined by EBS Ecology during scavenger activity and searcher efficiency trials (EBS Ecology 2018).

Results of the 5-year bird strike program undertaken at Hornsdale Wind Farm found a total of 72 bird strikes (n = 31 carcasses, n = 41 feather-spots). Thirteen bird species were recorded as struck around monitored turbines, with the most commonly struck group being parrots and raptors. The average distance away from turbines that carcases / feather-spots were located was 69.0 m, while the minimum distance was 8.7 m and maximum distance was 133.3 m (EBS Ecology 2023b). This information has been used to help inform the design of the search area for the long-term WTG collision monitoring program in this BAMP.

8.3 Monitoring program

The bird monitoring program is proposed to be implemented for the life of the Goyder South Project, while the Stage 1A and Stage 1B wind farms are operational, which is expected to be 30 years. However, should sufficient evidence that supports an amendment to the bird monitoring program become available, then the BAMP may be revised and submitted for approval in accordance with section 143A of the EPBC Act and as per approval condition 23 (Stage 1A: 2021/8958) and condition 21 (Stage 1B: 2021/8957).

As stated previously the following surveys and monitoring activities are proposed to be undertaken:

- Bird utilisation surveys
- 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

These surveys and monitoring activities are outlined in Table 22, while more detail is provided in the sub-sections further below. The timeframe, responsibility, measurable outcome and corrective action associated with each survey or monitoring activity is also included in Table 22.

Table 22. Surveys / monitoring proposed to be undertaken, along with proposed timing, responsibility, measurable outcomes and corrective actions.

Survey / Monitoring Type	Action	Timeframe	Responsibility	Measurable outcome	Corrective action
Bird Utilisation Surveys (BUS)	Undertake BUS in accordance with Section 8.3.1.	Each season (Summer; Autumn; Winter; Spring) for the first two years; then as outlined in Section 8.3.1.	Construction Project Manager / Asset Manager (NEOEN) (delegate to ecological consultancy).	BUS completed each season and reported upon within annual BAMP Monitoring and Implementation Report.	Construction Project Manager / Asset Manager (NEOEN) to ensure BUS is scheduled to be undertaken as soon as possible, within 1 week of becoming aware that it has not yet been undertaken.
Raptor nest activity monitoring	Undertake raptor nest activity monitoring in accordance with Section 8.3.2.	Once a year in October / November (each year for twenty years); then once every second year for twenty years.	Construction Project Manager / Asset Manager (NEOEN) (delegate to ecological consultancy).	Raptor nest activity monitoring completed in July/August and October/November and reported upon within annual BAMP Monitoring and Implementation Report.	Construction Project Manager / Asset Manager (NEOEN) to ensure raptor nest activity monitoring is scheduled to be undertaken as soon as possible (when relevant), within 1 week of becoming aware that it has not yet been undertaken.
Long-term WTG collision monitoring	Undertake long-term WTG collision monitoring in accordance with Section 8.3.3.	Quarterly (i.e., once every three months) (for the duration of the bird monitoring program).	Construction Project Manager / Asset Manager (NEOEN) (delegate to ecological consultancy).	Long-term WTG collision monitoring completed quarterly and reported upon within annual BAMP Monitoring and Implementation Report.	Construction Project Manager / Asset Manager (NEOEN) to ensure long-term WTG collision monitoring is scheduled to be undertaken as soon as possible, within 1 week of becoming aware that it has not yet been undertaken.
Periodic carcass persistence (scavenger activity) and searcher efficiency trials	Undertake periodic carcass persistence (scavenger activity) and searcher efficiency trials in accordance with Section 8.3.4.	Two carcass persistence trials in the first year of the bird monitoring program as outlined in Section 8.3.4.1. Two searcher efficiency trials in the first year of the bird monitoring program as outlined in Section 8.3.4.2.	Construction Project Manager / Asset Manager (NEOEN) (delegate to ecological consultancy).	Periodic carcass persistence (scavenger activity) and searcher efficiency trials completed as required and reported upon within relevant annual BAMP Monitoring and Implementation Report.	Construction Project Manager / Asset Manager (NEOEN) to ensure periodic carcass persistence (scavenger activity) and searcher efficiency trials are scheduled to be undertaken as soon as possible, within 1 week of becoming aware that they have not yet been undertaken.

Survey / Monitoring Type	Action	Timeframe	Responsibility	Measurable outcome	Corrective action
Opportunistic observations of agricultural practices and pest species	Record and report on agricultural practices and pest species observed opportunistically in accordance with Section 8.3.5.	Opportunistically (during other monitoring events and regular Project operations).	Construction Project Manager / Asset Manager (NEOEN) (delegate to ecological consultancy).	Opportunistic observations of agricultural practices and pest species recorded and reported upon within annual BAMP Monitoring and Implementation Report.	Construction Project Manager / Asset Manager (NEOEN) to ensure opportunistic observations of agricultural practices and pest species are recorded and reported as soon as possible, within 1 week of becoming aware that they have not yet been recorded and/or reported.
Incidental finds of bird carcasses	Report incidental finds of bird carcasses in accordance with Section 8.3.6.	Within 2 business days of finding bird carcass.	All site personnel.	All incidental finds of bird carcasses are reported within 2 business days of being found and reported upon within annual BAMP Monitoring and Implementation Report.	Construction Project Manager / Asset Manager (NEOEN) to remind all site personnel to report all incidental finds of bird carcasses (within 2 business days), within 1 week of becoming aware that they have not yet been reported.
DNA testing	Undertake DNA testing in accordance with Section 8.3.7.	Commence process within 1 week of identifying the need for DNA testing.	Construction Project Manager / Asset Manager (NEOEN) (delegate to ecological consultancy).	Any bird carcass that cannot be identified by a suitably qualified bird expert is subject to DNA testing and reported upon within annual BAMP Monitoring and Implementation Report.	Construction Project Manager / Asset Manager (NEOEN) to ensure DNA testing is undertaken within required timeframe, within 1 week of becoming aware that it has not yet been undertaken.

8.3.1 Bird Utilisation Surveys (BUS)

Standardised protocols for BUS at the Stage 1A and Stage 1B wind farms will be developed. Data collected from these surveys will be used to determine the presence of EPBC Act listed threatened and migratory birds and record and identify potential additional species or species groups that may be at risk from Stage 1A and Stage 1B wind farm operations. Furthermore, the results will contribute to informing WTG risk ratings (Section 8.4.2) and adaptive management strategies (Section 9).

To record which EPBC Act listed bird species, state listed species, and species of concern (e.g. raptors) occur on site, bird surveys will be undertaken using a standard methodology (e.g. 5-minute point counts or 20 minutes per 2 hectares (Birdlife Australia 2023, https://birdata.birdlife.org.au/help/survey-techniques), whilst also implementing *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 BUS protocol will be designed to collect data on all bird species and to provide results that are comparable with other studies at wind farms rather than to target specific taxa. They will not be designed to establish or assess species abundance or other measures such as quantified flight rates of different species.

For each bird observed, the following should be recorded:

- Location (via GPS waypoint);
- Species;
- Number of individuals;
- Distance from observer;
- Height above ground (m) (minimum and maximum);
- Activity/Behaviour:
    - Flying in a single direction – FLM;
    - Flying (hovering or circling) over or around a single point – FLH;
    - Foraging (feeding) on ground – FOG;
    - Perching/resting/walking on ground – ROG; and
    - Perching/resting/climbing on trees or shrubs – ROT; and
- Flight details: height (in metres) and direction flown, where possible.

Estimated flight heights and distances will be determined by using existing meteorological masts, wind turbines, buildings, and mapping for reference.

Incidental observations will be collected on separate datasheets, including observations that occur:

1. during travel between sites;
2. before or after the survey period, and
3. outside of a survey site.

BUS monitoring is proposed to be undertaken at the following intervals:

- Each season (Summer; Autumn; Winter; Spring) for the first two years of operation;

- Then twice a year, (once in Summer (to detect migratory species) and once in Spring (optimal survey time for birds) for years 3 – 10 (inclusive);
- Then twice a year (once in Summer and once in Spring) for years 12, 14, 16, 18 and 20;
- Then twice a year (once in Summer and once in Spring) for years 23, 26 and 29.

8.3.1.1 BUS site selection

The site selection process for survey sites will be aimed to ensure an even spread across the Project Area and within the different vegetation associations, while expanding greater search effort within areas with a higher potential for threatened bird species to occur.

The survey site location and intensity will be representative of the particular habitat that is being surveyed, and where possible, habitat types within a survey site will not be mixed (e.g., half grassland/half woodland, or half grazed/half un-grazed). Reference locations within the Project Area could be considered as part of the survey design, to compare bird diversity and abundance between control and impact sites.

Based on previous baseline and ongoing monitoring surveys from other wind farms, Impact and Control zones may be established as follows:

- Impact Zone is defined as the entire area within a 500 m radius around each turbine location;
- Control Zone is defined as all areas located more than 1,000 m from each turbine.

An additional layer of the survey stratification is the seasonality of the surveys to account for possible changes in bird species occurrences and habitat use throughout the year based on seasonal influences. To account for seasonal difference, the BUS will be conducted over different seasons, including summer, autumn, winter and spring. As part of the initial flora and fauna assessment, autumn (March/April 2019) and spring (September 2019) bird surveys were undertaken at a selection of point count sites across the broader Goyder South Project Area (EBS Ecology 2020).

It is anticipated that a minimum of 10 BUS sites will be established across the Stage 1A and Stage 1B Project Areas. The location of point count sites used during the autumn and spring 2019 surveys (EBS Ecology 2020) will be re-assessed for their location in relation to infrastructure, and existing sites will be incorporated in the monitoring program, where practicable. At least one survey site will be located at Porter Lagoon (approximately 2 km west of the Project Area), to survey specifically for migratory wader species.

8.3.2 Raptor nest activity monitoring

Known WTE nest locations within the Stage 1A and Stage 1B wind farms (Section 3.4.5; Figure 18) 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.

The first raptor nest activity monitoring event is proposed to be undertaken in October/November 2024. To determine the condition and activity of each WTE and/or raptor nest, the following data should be recorded:

- 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 around 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);
    - Whether whitewash (areas covered in droppings) and nesting material (e.g., fresh branches and/or leaves) are present or absent;
    - Species of raptor incubating or located near the nest.
- Nesting success: nests that contained a large-feathered nestling in the second survey period are considered successful (i.e., nestling(s) likely to fledge).

8.3.3 Long-term WTG collision monitoring

A WTG collision monitoring program is proposed to be implemented during the bird monitoring program. Monitoring is proposed to be undertaken on a quarterly basis (i.e., once every three months). Details on the WTGs proposed to be monitored and the proposed methodology are provided in the following sub-sections.

The long-term WTG collision monitoring program is proposed to commence as soon as practicable upon the commencement of commissioning. However, the WTGs proposed to be monitored must be commissioned for WTG collision monitoring to be able to commence. Commissioning of WTGs in Stage 1A is anticipated to commence in February 2024. However, commissioning of WTGs in Stage 1B is not anticipated to commence until April 2024. As such, the commencement of this WTG collision monitoring program is likely to involve a staggered approach, where monitoring at each WTG proposed to be monitored, does not commence until after commissioning for the WTG has been undertaken.

8.3.3.1 WTGs proposed to be monitored

A total of 26 WTGs are proposed to be monitored, including 13 in Stage 1A and 13 in Stage 1B, which equates to 34% of Stage 1A WTGs and 35% of Stage 1B WTGs. A random list generator (RANDOM.ORG 2024) has been used to randomly list the 38 WTGs in Stage 1A and 37 WTGs in Stage 1B, and then the first 13 WTGs in each list have been selected as the WTGs proposed to be subject to WTG collision

monitoring. Each WTG proposed to be monitored is listed in Table 23 along with vegetation association information.

Table 23. WTGs proposed to be monitored in Stage 1A and Stage 1B, along with vegetation association information.

Stage 1A		Stage 1B	
WTG	**Vegetation association information**	**WTG**	**Vegetation association information**
SG07	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland. (Also adjacent to **VA6:** *Eucalyptus leucoxylon* ssp. *pruinosa* (Inland South Australian Blue Gum) Open Woodland.)	B005	Cropping
SG08	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland	B015	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland
SG012	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland	B024	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland
SG013	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland	B026	**VA3:** *Eucalyptus porosa* (Mallee Box) Open Woodland **VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland.
SG015	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland	B027	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland
SG022	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland	B029	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland. **VA3:** *Eucalyptus porosa* (Mallee Box) Open Woodland
SG023	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland	B031	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland
SG032	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland	B032	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland
SG034	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland	B033	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland
SG040	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland	B034	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland
SG044	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland	B036	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland
SG048	**VA2:** *Lomandra multiflora* ssp. *dura* (Hard Mat-rush) / *Lomandra effusa* (Scented Mat-rush) Mixed Open Grassland. **VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland.	B039	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland
B008	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland	SG026	**VA8:** *Austrostipa* spp. (Spear Grass) Mixed Grassland

Each WTG proposed to be monitored will need to be ground-truthed for accessibility and survey practicality limitations (i.e., very steep slopes and/or highly dissected rocky ground which will be difficult to survey). If a WTG is considered unable to be surveyed, an alternate WTG will be proposed. The location of each of the 13 WTGs proposed to be monitored in each of Stage 1A and Stage 1B is shown in Figure 23 and Figure 24 respectively.

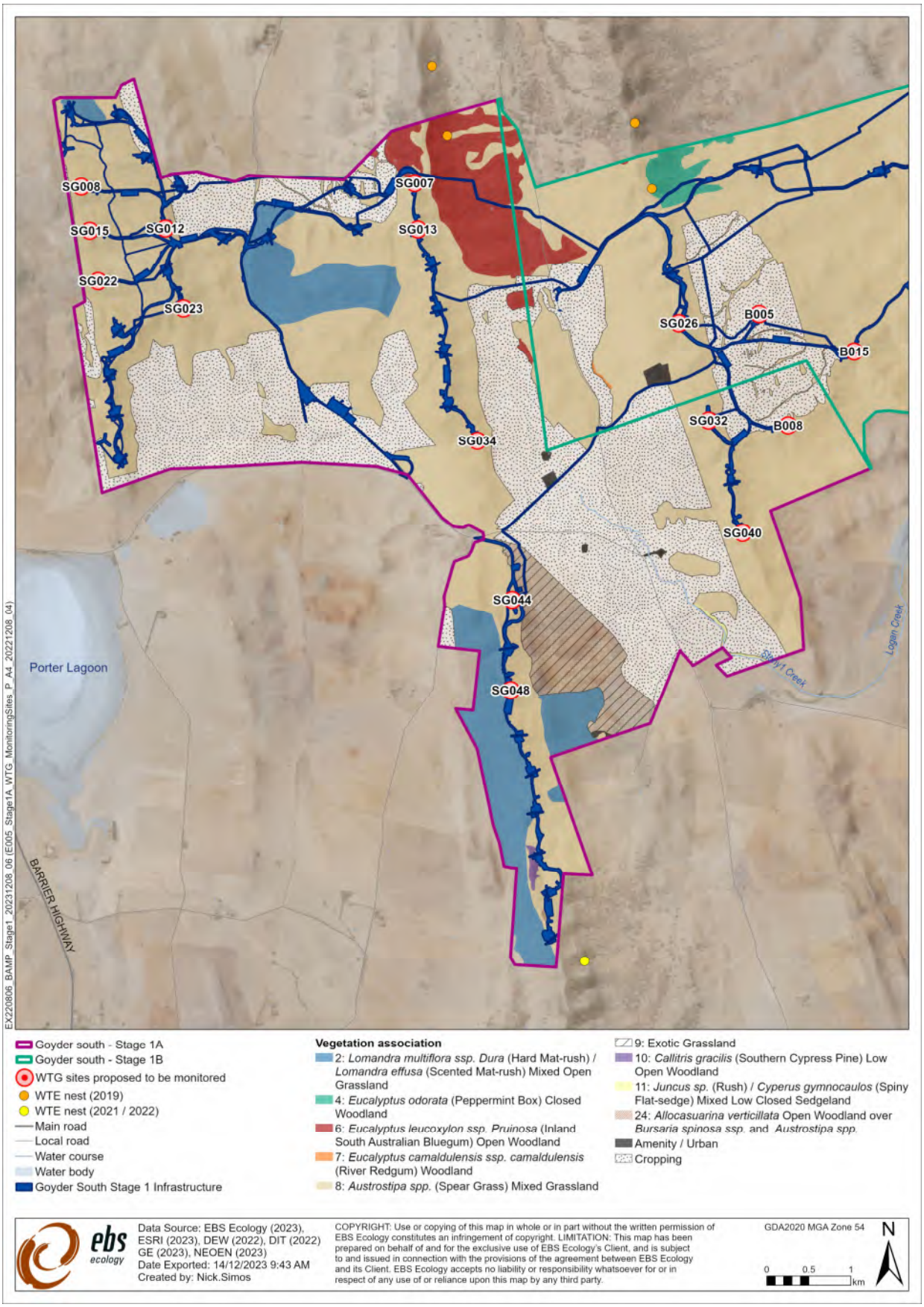

Figure 23. WTGs proposed to be monitored in Stage 1A (with some WTGs in Stage 1B also shown).

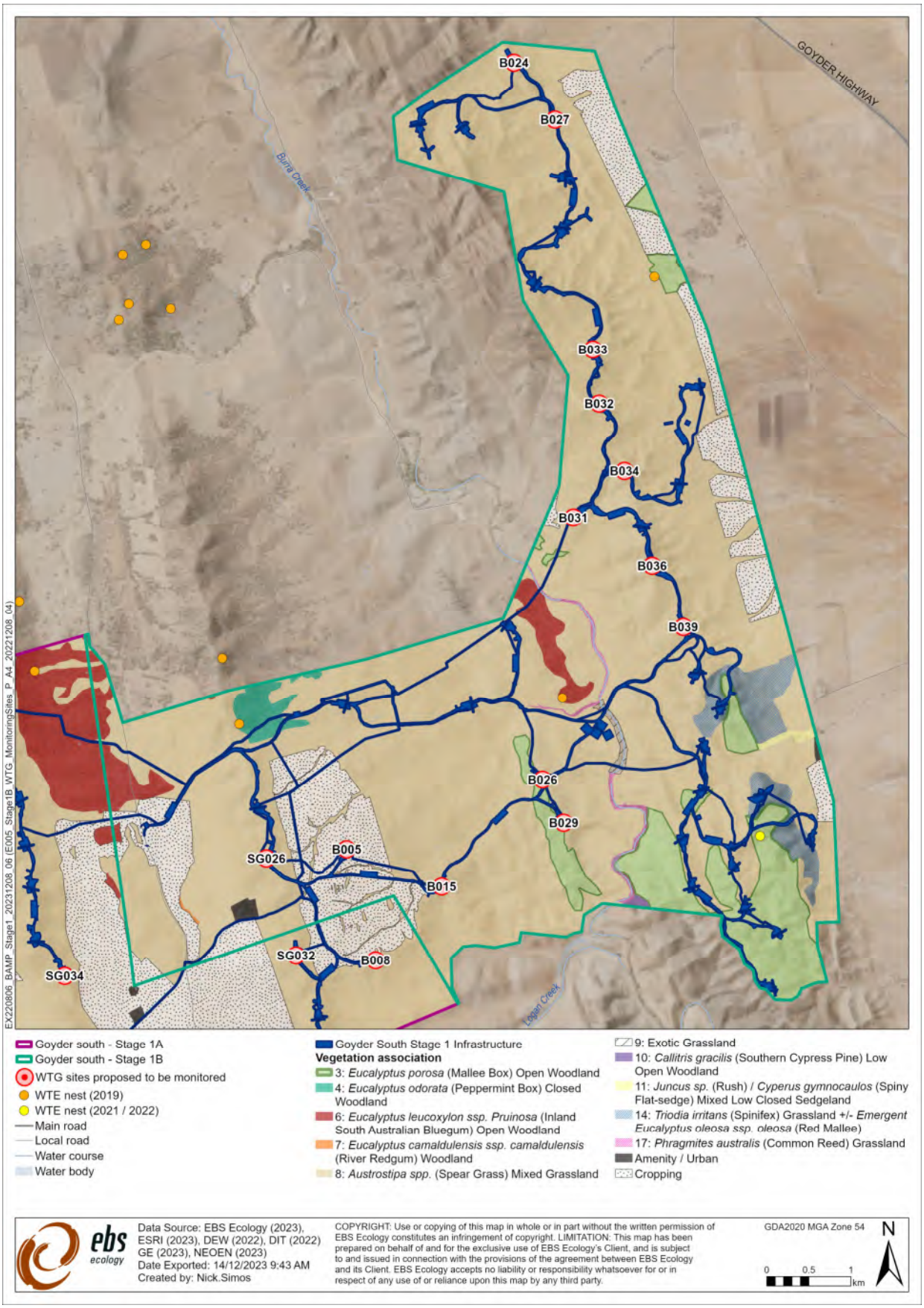

Figure 24. WTGs proposed to be monitored in Stage 1B (with some WTGs in Stage 1A also shown).

All 13 WTGs proposed to be monitored in Stage 1A are located within *Austrostipa* spp. (Spear Grass) Mixed Grassland, with part of WTG SG048 also located within *Lomandra* spp. Mixed Open Grassland. Similarly, apart from two WTGs which are located across both grassland and woodland vegetation (B026 and B029), all other WTGs proposed to be monitored in Stage 1B are located wholly within grassland vegetation, consisting mainly of *Austrostipa* spp. (Spear Grass) Mixed Grassland (10 WTGs) and to a lesser extent, cropping (1 WTG).

As outlined in Table 7 and Section 3.4.3, majority of the vegetation within Stage 1A and Stage 1B is grassland (57.82 % and 76.98 % respectively) and cropping (37.02 % and 11.68 % respectively), while only a minor amount is woodland (4.88 % and 10.52 % respectively). Furthermore, the land within Stage 1A and Stage 1B is geographically uniform, consisting of rolling hills and ridgelines. As such, the Stage 1A and Stage 1B Project Areas are considered to be largely vegetatively and geographically uniform, and monitoring 34 % of WTGs in Stage 1A and 35 % of WTGs in Stage 1B is considered statistically adequate to ensure accurate detection of potential impacts to species of concern. Furthermore, although the WTGs proposed to be monitored have been randomly selected 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, which are dominated by grassland and cropping, with a minor amount of woodland.

In the specific context of the Stage 1A and Stage 1B wind farms, the WTGs proposed to be monitored are considered to consist of Low (21 WTGs), Low to Moderate (2 WTGs), Moderate (2 WTGs), and Moderate to High (1 WTG) risk for collision, due to their location within the wind farms and proximity to potential habitat, such as Porter Lagoon, woodland vegetation and/or known WTE nest sites (Table 24). However, the overall risk of collision is not considered to be high, particularly for the EPBC Act listed species which are migratory and rarely present within the Project Areas or surrounding area.

Table 24. Commentary on the collision risk level of WTGs proposed to be monitored.

WTG	Collision risk level	Comment on collision risk level
Stage 1A		
SG07	Moderate to high (particularly for WTEs)	Although this WTG is located within grassland vegetation, woodland vegetation (**VA3:** *Eucalyptus porosa* (Mallee Box) Open Woodland), which potentially provides habitat for some species of concern, is located within 40-100 m of the WTG and a WTE nest is located approximately 550 m from the WTG. Porter Lagoon is approximately 5.9 km south-west of this WTG.
SG08	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 4.5 km south of this WTG.
SG012	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 4.1 km south-west of this WTG.
SG013	Low to Moderate	Although this WTG is located within grassland vegetation, woodland vegetation (**VA6:** *Eucalyptus leucoxylon* ssp. *pruinosa* (Inland South Australian Blue Gum) Open Woodland), which potentially provides habitat for some species of concern, is located approximately 200 m from the WTG and a WTE nest is located approximately 1.0 km from the WTG. Porter Lagoon is approximately 5.5 km south-west of this WTG.
SG015	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 4.0 km south of this WTG.

WTG	Collision risk level	Comment on collision risk level
SG022	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 3.4 km south of this WTG.
SG023	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 3.2 km south-west of this WTG.
SG032	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 7.4 km west of this WTG.
SG034	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 4.6 km west of this WTG.
SG040	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 7.5 km west of this WTG.
SG044	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 4.7 km west of this WTG.
SG048	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 4.6 km west of this WTG.
B008	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 8.2 km west of this WTG.
Stage 1B		
B005	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 8.3 km south-west of this WTG.
B015	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 9.1 km south-west of this WTG.
B024	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 15.8 km south-west of this WTG.
B026	Moderate (particularly for WTEs)	Although this WTG is not located adjacent to Porter Lagoon, it is located across both grassland and woodland vegetation (**VA3:** *Eucalyptus porosa* (Mallee Box) Open Woodland), which potentially provides habitat for some species of concern, and a WTE nest is located approximately 1.0 km from the WTG. Porter Lagoon is approximately 10.7 km south-west of this WTG.
B027	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 15.5 km south-west of this WTG. A WTE nest is approximately 2.2 km south of this WTG.
B029	Moderate (particularly for WTEs)	Although this WTG is not located adjacent to Porter Lagoon, it is located across both grassland and woodland vegetation (**VA3:** *Eucalyptus porosa* (Mallee Box) Open

WTG	Collision risk level	Comment on collision risk level
		Woodland), which potentially provides habitat for some species of concern, and a WTE nest is located approximately 1.4 km from the WTG. Porter Lagoon is approximately 10.8 km west of this WTG.
B031	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 12.5 km south-west of this WTG. A WTE nest is approximately 2.1 km south of this WTG.
B032	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 13.5 km south-west of this WTG. A WTE nest is approximately 1.5 km north-east of this WTG.
B033	Low to Moderate (particularly for WTEs)	Although this WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation), a WTE nest is located approximately 1.1 km from this WTG. Porter Lagoon is approximately 13.9 km south-west of this WTG.
B034	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 13.4 km south-west of this WTG. A WTE nest is approximately 2.3 km north of this WTG.
B036	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 13.0 km south-west of this WTG. A WTE nest is approximately 1.9 km south-west of this WTG.
B039	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 13.0 km south-west of this WTG. A WTE nest is approximately 1.6 km south-west of this WTG.
SG026	Low	This WTG is located entirely within grassland vegetation and is not located within or adjacent to potential habitat for species of concern (such as Porter Lagoon or woodland vegetation). Porter Lagoon is approximately 7.4 km south-west of this WTG. A WTE nest is approximately 1.6 km south-west of this WTG.

8.3.3.2 Carcass search methods

The area on the ground where a bird struck by a WTG and fatally injured may land is commonly referred to as the fall zone. A range of literature that discusses the likely fall zone for different WTGs and sizes of birds is available (for example Hull & Muir 2010; Huso & Dalthorp 2014; Huso et al. 2017). In general, it is estimated that the fall zone extends from the WTG out to a radius of approximately 70 m (for small sized birds[1]), and approximately 120 m (for large sized birds[2]), with carcass densities declining with horizontal distance from the WTG (Hull & Muir 2010). Furthermore, strike data of a 5-year bird strike program undertaken at Hornsdale Wind Farm found that the average distance away from turbines that carcases / feather-spots were located was 69.0 m (minimum 8.7 m and maximum 133.3 m) (EBS Ecology 2023b).

[1] Such as a Silvereye (Zosterops *lateralis*) which is approximately 12 cm in length).

[2] Such as a Wedge-tailed Eagle (*Aquila audax*) which is approximately 87-91 cm in length).

Out of the 11 EPBC Act listed bird species relevant to this BAMP, four are considered to be small sized birds, six are considered to be medium sized birds and one is considered to be a large sized bird (refer to Appendix 6 for details).

As such, it is proposed to search a distance of 120 m from the WTG. A 240 m x 240 m monitoring quadrat, sub-divided into four 120 m x 120 m cells, will be set up at each of the ten WTGs proposed to be monitored, with the WTG in the centre of the quadrat (refer to Figure 26 in Appendix 5). A 240 m x 240 m quadrat covers an area that encompasses a 120 m radius from the WTG. Star-dropper posts are proposed to be installed at the outer corners of the monitoring quadrat.

To search for carcasses, it is proposed that an observer (searcher/surveyor) will traverse each 120 m x 120 m cell of the monitoring quadrat on foot along parallel transects at 5 m intervals (or higher if visibility is quite good). A handheld GPS device is proposed to be used to assist the observer to traverse parallel transects at 5 m (or similar) intervals and record the observer's tracks (which can then be downloaded later).

The *WTG monitoring datasheet* (Appendix 7) is proposed to be completed for each WTG surveyed for carcasses and if a bird carcass or feather-spot is observed the *Dead or injured bird datasheet* (Appendix 8) is proposed to be completed. Each bird carcass or feather-spot found will be 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.

Alternate carcass search method using dogs

Purpose-trained dogs have been shown to be highly efficient at detecting carcasses (Mathews *et al.* 2013) and have been used for this purpose at a number of wind farms in in Australia. Using purpose-trained dogs obviates the need for formal transects to be searched in the search zones around a WTG, as dogs use scent to detect carcasses and are permitted to roam to do so. The use of trained dogs will be investigated to determine the suitability for this project and whether appropriately trained dogs and handlers are available. An ecologist is likely to accompany the dog handler to ensure data collection and bird species identification is completed.

8.3.4 Periodic carcass persistence (scavenger activity) and searcher efficiency trials

8.3.4.1 Carcass persistence (scavenger activity) trials

Carcasses of birds that collide with WTGs may be removed by scavengers or will ultimately disappear due to decomposition. Carcass persistence affects the detection of dead birds that collide with WTGs and consequently influences estimation of the total number of fatalities for each species.

As such, trials to determine persistence time of carcasses are required to derive correction factors necessary to estimate total fatalities from the results of the carcass searches. In addition to the pre-commissioning scavenger activity trial undertaken in March 2023 (Section 8.2.1), two persistence trials are proposed to be undertaken in the first year of the bird monitoring program to account for different site

conditions (for example scavenger activity, with one undertaken in Spring (optimum survey time) and one undertaken in Winter (opposite to Spring)). If site conditions and/or seasonal conditions change significantly (for example, if they are exceptionally good/favorable or exceptionally poor/unfavorable conditions occur) then the requirement for additional scavenger activity trials will be assessed by a suitably qualified and experienced ecological consultancy and undertaken if required.

Remote cameras will likely be used to record persistence of carcasses placed on-site for the trials. It is vital that carcasses used are representative of the bird fauna at the Goyder South Project Area (including small-medium sized birds and large birds). Carcasses used for trials will be individually marked to ensure they are not confused with collision carcasses. Individual marking allows trial carcasses to be identified if they are simply moved by scavengers.

Cameras used for the purpose will be set to take a photograph every hour (day and night) and also when triggered by movement and infrared. This method has been demonstrated in Victoria to be highly efficient and substantially reduces potential influence on scavengers that may occur when human observers visit frequently to check carcasses. Cameras are deployed and left to operate for the duration of the trial and this entails substantially less effort than having people check carcasses daily. Cameras have the additional advantage of recording the precise time of carcass removal and the species of scavenger that removes a carcass. As a result of the precise documentation of the time of carcass removal there is no need to estimate the period of carcass persistence which is required when carcasses are checked only at intervals of several days.

As the field of view of a camera is limited and scavengers can simply move a carcass out of that view, each trial will commence approximately one week before the next routine search for carcasses as part of the long-term WTG collision monitoring program (Section 8.3.3), so that the use of cameras in the trial can be checked when surveyors are on site.

In each trial, it is proposed that a total of 45 carcasses of birds (15 small bird carcasses, 15 medium bird carcasses and 15 large bird carcasses) will be distributed under 10 randomly chosen WTGs across the Stage 1A and Stage 1B wind farms. Each trial will be run for up to one month, but cameras will be checked after approximately one week (as outlined above) and then again after approximately two weeks to check on their operation. During camera checks, the trial may be terminated at each carcass persistence survey site if the carcass has been removed.

The results of these trials will permit average carcass persistence times to be determined. The resulting persistence rates will be used in analyses to estimate total numbers of collisions (Section 8.4).

8.3.4.2 Searcher efficiency trials

As searchers (surveyors/observers) do not always find all carcasses, it is necessary to ascertain the efficiency of searchers in order to determine and apply appropriate correction factors for carcasses missed to inform estimation of total collision mortality for species of interest and/or concern.

The efficiency of each searcher (dog or person) undertaking searches will be determined by the use of blind trials. Without the prior knowledge of searchers, a known number of bird carcasses will be placed within search plots prior to routine searches. Carcasses will be placed in sufficient numbers, at a range of WTGs in different habitat to permit the rate of carcass detection to be adequately determined. In each trial,

it is proposed that a total of 45 carcasses (15 small carcasses, 15 medium carcasses and 15 large carcasses will be used, with each representing the small, medium and large bird sizes in Appendix 6).

After the trial the person who placed the carcasses will collect any that have not been detected and document whether any have been scavenged to ensure accuracy of the searcher efficiency trial. The number and type of carcasses found during the searcher efficiency trials will be compared with the known number of and type of carcasses placed under the WTGs. In addition to the pre-commissioning searcher efficiency trial undertaken in March 2023 (Section 8.2.1), two searcher efficiency trials are proposed to be undertaken in the first year of the bird monitoring program, to account for different site conditions (for example vegetation conditions, with one undertaken when the grass is long (which is likely to be in late Winter/early Spring) and one undertaken when the grass is short (which is likely to be in late Summer/early Autumn)). The potential requirement for additional trials will be assessed by a suitably qualified and experienced ecologist on an annual basis and undertaken if required, for example, if the surveyor/observer team changes.

It is vital that carcasses used are representative of the birds at the Goyder South Project. Carcasses used will be marked to ensure they are not confused with previously undetected collision carcasses, but in a manner that does not draw the attention of the searcher (i.e., identification labels will be hidden underneath carcasses).

The results of these trials will be taken into consideration for estimating annual mortality rates for each EPBC Act listed bird species and other bird species (i.e., species of concern) (Section 8.4).

8.3.5 Opportunistic observations of agricultural practices and pest species

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 other monitoring events outlined above, 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.

8.3.6 Incidental finds of bird carcasses

It is possible that during the life of the wind farms, bird carcasses will be discovered incidentally by site personnel. Therefore, all site personnel will be trained on procedures for the event in which they encounter dead or injured birds. Upon incidental discovery, carcasses and feather-spots must be photographed in situ. However, the carcass or feather-spot must be left where it was found in order not to introduce bias to detection rates of the official search regime. Any site personnel who find a bird carcass must complete the relevant carcass datasheet (Appendix 8). Copies of carcass datasheets must be available on site for use by all site staff.

8.3.7 DNA testing

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.

8.4 Data analysis

All data collected during the bird monitoring program (as outlined in Section 8.3), will be entered into a specific database and analysed to understand bird activity and WTG collisions across the Stage 1A and Stage 1B Project Areas.

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

8.4.1 Annual mortality rate

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. Along with the estimates, 95 % CI will be determined as a measure of variance around the estimates. Current best-practice for these analyses is provided by Huso *et al.* (2017) (see also Huso and Dalthorp 2014).

Using data from on-ground surveys and appropriately generated indices for key data inputs, estimates of annual mortality rates will be determined for threatened bird species using the following model (Smallwood 2007):

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

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. Estimates will be reported as the estimated mortality rate and 95% confidence intervals. If new methods/models for assessing mortality rates more accurately become available and/or technologies change over time, these will be considered and implemented in the future.

Annual mortality rates will be compared to the thresholds set in Section 4.5 and the required response implemented.

8.4.2 WTG risk rating

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, which will be based on the following criteria:

- WTG proximity (within 500 m) to observations of species of concern (particularly EPBC Act listed species);
- Number and density of species of concern observed in proximity (within 500 m) to WTG;
- Frequency of species of concern observations in proximity (within 500 m) to WTG (both within a survey period and over various seasons);

- Presence of nesting or roosting habitat for species of concern; and
- WTG strike rate data (collected during the long-term WTG collision monitoring – Section 8.3.3).

WTGs identified as high risk by a suitably qualified and experienced ecologist will be the focus of additional monitoring (outlined in Section 9.1.1). Depending on the results of the additional monitoring, high risk WTGs may need to be included in the long-term WTG collision monitoring (Section 8.3.3). WTG risk rating will be continually reviewed and updated annually by a suitably qualified and experienced ecologist based on all available monitoring data.

If a high risk continues, adaptive management (such as that outlined below in Section 9) will be implemented in a hierarchy where temporary WTG shut down is a last resort.

8.5 Reporting

8.5.1 Significant impact reporting

If a Significant impact, in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia 2013), is determined to have occurred or likely to have occurred, the Department will be notified as soon as possible and within 2 business days.

8.5.2 Annual reporting

NEOEN propose to include reporting for the bird monitoring program within the annual BAMP Monitoring and Implementation Report (outlined in Section 5.3). The following information will be included in the annual BAMP Monitoring and Implementation Report:

- BUS survey methodology and results;
- raptor nest activity survey methodology and monitoring results;
- WTG collision (bird strike) monitoring survey methodology and results (including raw data and strike records);
- carcass persistence (scavenger activity) and searcher efficiency (detection) trials methodology and results;
- additional monitoring undertaken as per Section 9.1.1;
- Opportunistic observations of agricultural practices and pest species;
- environmental/meteorological conditions;
- associated descriptive and statistical analysis (when sufficient data is collected to complete meaningful analysis);
- an estimate of annual mortality rate for each EPBC Act listed bird species and other bird species (i.e., species of concern) (comprising supporting evidence from case studies of EPBC Act listed bird species carcass size classes (where available), results of persistence trials and searcher efficiency trials, annual probability of detection and quarterly strike monitoring, and collision monitoring protocol and survey effort);

- species occurrence records prepared in accordance with *the Guidelines for Biological Survey and Mapped Data* (Commonwealth of Australia 2018); and
- corrective actions undertaken (i.e., adaptive management undertaken) (refer to the next section for proposed adaptive management framework).

9 ADAPTIVE MANAGEMENT FRAMEWORK

Results of the bird monitoring program (Section 8), including BUS (Section 8.3.1), raptor nest activity monitoring (Section 8.3.2), long-term WTG collision monitoring (Section 8.3.3), periodic carcass persistence (scavenger activity) and searcher efficiency trials (Section 8.3.4), opportunistic observations of agricultural practices and pest species (Section 8.3.5), and incidental finds of bird carcasses (Section 8.3.6), 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 action and that potential impacts to raptor and other bird species are minimised and mitigated, where practicable.

Broad categories of potential causes of increased collision risk may include the following:

- Agricultural practices undertaken by landholders:
    - feeding of grain and/or fodder to stock in close proximity to a WTG, that may result in concentrations of birds in close proximity to a WTG;
    - lambing in close proximity to a WTG;
    - artificial water points in close proximity to a WTG;
- Large animal carcasses attracting raptors and other scavenging birds;
- Pest animals such as rabbits inhabiting areas in close proximity to a WTG and attracting raptors;
- Seasonal nesting in close proximity to a WTG;
- Periodic environmental conditions, such as localised high densities of natural food resources or availability of surface water (including Porter Lagoon outside the Project Area); and periodic seasonal environmental events such as migration (particularly for EPBC Act migratory bird species).

If a trigger level impact is detected, then the adaptive management protocol and appropriate adaptive management action, as outlined in the following sub-sections, will be implemented. The trigger levels identified in Section 7.2 are provided again in Table 25 for easy reference.

Table 25. Trigger levels for the species of concern.

Species group	Trigger-level details
EPBC Act listed threatened and migratory bird species (listed in Table 12)	• 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 bird species (including non EPBC Act listed bird species listed in Table 12)	• 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 a WTG collision monitoring search, and/or incidentally by wind farm personnel, in any two consecutive months.

9.1 Adaptive management protocol

If a trigger level impact is detected, the following protocol will be implemented:

1. Investigate and respond to carcass find; and
2. Determine if a significant impact has occurred or is likely to have occurred.

An overview of this adaptive management protocol is provided in outlined in Table 26, while more specific detail is provided in the following sub-sections (9.1.1 and 9.1.2). The timeframe, responsibility, measurable outcome and corrective action associated with the adaptive management protocol are outlined in Table 27.

Table 26. Overview of adaptive management protocol to be implemented when a trigger level impact is detected.

Adaptive management protocol aspect	Details
Investigate and respond to carcass find	• If a trigger level impact is detected, investigate contributing factors including wind farm operation and other local or regional events, such as, but not limited to, agricultural practices, large animal carcasses, pest animals, seasonal nesting and periodic environmental conditions and/or events. • If the wind farm is not the most feasible cause (for example if a bird is suspected to have died from disease), or the cause cannot be attributed to local or regional events (such as those listed above), record the trigger level impact in accordance with Section 9.4, but no further action is required. • If the wind farm, or other local or regional events (such as those listed above), is the most feasible cause, or the cause cannot be determined, the following actions will be undertaken: o Review and assess adaptive management actions (Section 9.2 and sub-sections) to determine the most appropriate action(s) to implement o Implement the most appropriate adaptive management action(s) (Section 9.2 and sub-sections) o Undertake additional monitoring to determine the effectiveness of implemented adaptive management action(s) and identify whether a high risk continues or has resolved itself o If implemented adaptive management action(s) are not successful and/or a high risk continues, re-evaluate and implement further action(s) and monitoring to address collisions. o Record the trigger level impact, investigation and response undertaken in accordance with Section 9.4.
Determine if a significant impact has occurred, or is likely to have occurred	• If a trigger level impact is detected for an EPBC Act listed threatened and/or migratory bird species and the wind farm is the most feasible cause, or if the cause cannot be determined, undertake a significant impact assessment to determine whether a significant impact has occurred or is likely to have occurred (in accordance with Section 9.1.2). • If a significant impact has not occurred, or is not likely to have occurred, record the outcome in accordance with Section 9.4, but no further action is required. • If a significant impact is determined to have occurred, or is likely to have occurred, NEOEN will notify the Department as soon as possible and within 2 business days. o Record the significant impact determination in accordance with Section 9.4. o NEOEN will also engage with the Department to determine an appropriate offset. o Furthermore, within 3 months of becoming aware of any actual or likely significant impact, NEOEN will submit to the Department for approval of the Minister, a revised BAMP responding to, and accompanied by, an evaluation report prepared by a suitably qualified bird expert on the effectiveness of the BAMP in preventing significant impacts to EPBC Act listed bird species.

Table 27. Overview of proposed adaptive management protocol, including proposed timing, responsibility, measurable outcomes and corrective actions.

Adaptive management aspect	Management action	Reference	Timeframe	Responsibility	Measurable outcome	Corrective action
Investigate and respond to carcass find	All carcasses or feather-spots observed on site (regardless of location) are reported to the Construction Project Manager / Asset Manager (NEOEN), investigated, and responded to.	Section 9.1.1	All carcasses or feather-spots observed on site (regardless of location) are reported as soon as possible and within 24 hours of being observed. Investigation and response are commenced as soon as possible and within 24 hours of carcass / feather spot being reported.	Construction Project Manager / Asset Manager (NEOEN) / Project employees, contractors and sub-contractors / Ecological Consultancy undertaking monitoring	All carcasses or feather-spots observed on site are reported to the Construction Project Manager / Asset Manager (NEOEN) within 24 hours of being observed. Investigation and response are commenced within 24 hours of carcass / feather spot being reported.	Construction Project Manager / Asset Manager (NEOEN) to ensure investigation and response to carcass / feather-spot find is undertaken within 24 hours of becoming aware that it has not yet been undertaken.
Determine if significant impact thresholds have been met	If a trigger level impact is detected for an EPBC Act listed threatened and/or migratory bird species and the wind farm is the most feasible cause, or if the cause cannot be determined, a significant impact assessment will be undertaken to determine if a significant impact has occurred or is likely to have occurred.	Section 9.1.2	Commence significant impact assessment as soon as possible and within 10 business days of carcass / feather spot being reported.	Construction Project Manager / Asset Manager (NEOEN) and Ecological Consultancy	Significant impact assessment is completed within 3 business days of carcass / feather spot being reported.	Construction Project Manager / Asset Manager (NEOEN) to ensure significant impact assessment is completed within 3 business days of becoming aware that it has not yet been undertaken.

9.1.1 Investigate and respond to carcass find

If a trigger level impact is detected, investigate contributing factors which will include wind farm operation and other local or regional events, such as, but not limited to, agricultural practices, large animal carcasses, pest animals, seasonal nesting and periodic environmental conditions and/or events. A suitably qualified and experienced ecologist will be involved in the investigation and determining if adaptive management should be undertaken, including the details of the adaptive management required.

If the wind farm is not the most feasible cause, for example if a bird is suspected to have died from disease, or the cause cannot be attributed to local or regional events (such as those listed above), record the trigger level impact in accordance with Section 9.4, but no further action is required.

If the wind farm, or other local or regional events (such as those listed above), is the most feasible cause, or the cause cannot be determined, the following actions will be undertaken:

- NEOEN and a suitably qualified and experience ecologist will review and assess adaptive management actions (outlined in Section 9.2 and sub-sections) to determine the most appropriate action(s) to implement
- NEOEN will implement the most appropriate adaptive management action(s) (Section 9.2 and sub-sections) upon the advice of the suitably qualified and experienced ecologist and in a hierarchy where temporary WTG shutdown is a last resort
- NEOEN will continue the bird monitoring program (outlined in Section 8 and sub-sections) to determine effectiveness of implemented adaptive management actions
- NEOEN and a suitably qualified and experienced ecologist will undertake additional monitoring of bird activity (such as species-specific targeted surveys) and collision monitoring for the next two consecutive months as follows:
    - at the same WTG where the carcass was found; or
    - if the carcass was not found at a WTG, at the nearest WTG(s) to where the carcass was found; and
    - potentially at adjacent WTGs in similar habitat / conditions.

  Monitoring effort and duration will be commensurate with the species detected and will focus on determining effectiveness of implemented adaptive management action(s), as well as identifying whether a high risk continues or has resolved itself.
- If implemented adaptive management actions are not successful and/or a high risk continues, NEOEN and a suitably qualified and experienced ecologist will re-evaluate and implement further monitoring and adaptive management action(s) in a hierarchy where temporary WTG shutdown is a last resort, to address collisions.
- Record the trigger level impact, investigation and response undertaken in accordance with Section 9.4.

9.1.2 Determine if a significant impact has occurred or is likely to have occurred

If a trigger level impact is detected for an EPBC Act listed threatened and/or migratory bird species and the wind farm is the most feasible cause, or if the cause cannot be determined, a significant impact assessment will be commenced within 10 business days by a suitably qualified and experienced ecologist in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia 2013) and the thresholds outlined in Section 4.5 (an annual fatality rate of >0.1% of the population), to determine whether a significant impact has occurred or is likely to have occurred.

The assessment will be done each and every time a trigger level impact is detected for an EPBC Act listed threatened and/or migratory bird species.

The assessment will take into account the following:

- Level of conservation status;
- Relevant conservation and recovery actions outlined in species-specific conservation advice, such as:
    - *Draft Referral guideline for 14 birds listed as migratory species under the EPBC Act* (Commonwealth of Australia 2015a);
    - *Wildlife Conservation Plan for Migratory Shorebirds* (Commonwealth of Australia 2015b); and
    - *Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al. 2016)
- Ecology of the EPBC Act listed threatened and/or migratory bird species subject to the trigger level impact;
- Location of the carcass in relation to the WTG and habitat;
- Environmental factors (such as breeding season / migration season); and
- The thresholds outlined in Section 4.5.

As part of the assessment, an estimate of the potential number of carcasses for the whole site (Stage 1A and Stage 1B) will be made. For example, if a carcass is found outside of the species known preferred habitat (such as a Satin Flycatcher in open grassland vegetation), and/or there is no evidence of a potential cause (such as a breeding or migration event), then it is unlikely that another individual of the same species has been struck elsewhere (i.e., single species at single WTG) and therefore a significant impact is unlikely to have occurred.

However, if a carcass is found in the species known preferred habitat (such as a Satin Flycatcher in woodland vegetation), and/or there is evidence of a potential cause (such as breeding), then it may be possible that other individuals of the same species have been struck. As such, additional monitoring of bird activity (such as species-specific targeted surveys) and collision monitoring (i.e., at the nearest WTG(s) where the carcass was found) will be undertaken by a suitably qualified and experienced ecologist to estimate the number of carcasses on the whole site and the population as a whole (for example the likelihood that additional birds of the same species have been, or will be, struck elsewhere within the

Project Area). This information will be used in the assessment to determine if a significant impact has occurred or is likely to have occurred.

The severity of the impact (as assessed by the significant impact assessment) will be considered in determining the most appropriate adaptive management action(s) (such as those outlined in Section 9.2 and sub-sections) to be implemented.

Any additional trigger level impact for the same EPBC Act listed threatened and/or migratory bird species will be subject to significant impact assessment both independently and cumulatively over the annual reporting period (Section 5.3).

As outlined previously in Section 8.5.1, if a significant impact has occurred or is likely to have occurred, the Department will be notified as soon as possible and within 2 business days. Furthermore, NEOEN will engage with the Department to determine an appropriate offset to compensate for the significant impact.

Furthermore, as outlined in Section 5.4, if a significant impact has occurred or is likely to have occurred, as a result of the action, a revised BAMP will be submitted to the Department for approval of the Minister within 3 months of becoming aware of the significant impact. The revised BAMP will be accompanied by an evaluation report prepared by a suitably qualified bird expert of the effectiveness of the BAMP in preventing significant impacts to EPBC Act listed bird species.

9.2 Adaptive management aspects and actions

Based on the broad categories of potential causes of increased collision risk outlined above in Section 9, relevant adaptive management aspects include the following:

- Management of agricultural practices
- Management of large animal carcasses
- Management of pest animals
- Management of WTG(s) during seasonal nesting
- Management of WTG(s) during periodic environmental conditions and events
- Temporarily shut down specific WTG(s)
- Permanently shut down specific WTG(s)
- Permanent decommissioning of specific WTG(s)

These adaptive management aspects, together with actions associated with them, are outlined in Table 28, while more detail is provided on each in the sub-sections further below. The timeframe, responsibility, measurable outcome and corrective action associated with each management action is also included in Table 28. A flow chart summarising the process to be followed if a trigger level impact is detected and can be attributed to one or more of the broad categories of potential causes of increased collision risk outlined above is provided further below in Section 9.6.

Other potential adaptive management aspects including insect deterrents, lighting and low wind speed curtailment, have been considered as part of this adaptive management framework but are not relevant to this BAMP as they are usually considered to reduce impacts to bats (e.g. Adams *et al.* (2021), Smallwood and Bell 2020) and bats are not of concern for this BAMP. Furthermore, the WTGs will not have lighting

on top of the towers and while they will have lighting above the door into the tower (at ground level), this lighting is on a censor and shuts off a short time after it turns on. As such, there will be very minimal lighting and as such insects are not expected to be attracted to WTGs. Therefore, insect deterrents are not considered to be required.

Similarly, while low wind speed curtailment has been identified as an effective measure to reduce bat mortality (Smallwood and Bell 2020), there is little evidence to suggest that this is an effective measure to reduce bird mortality (Smallwood and Bell (2020), Fielding *et al*. (2021) but see McClure *et al.,* (2021)). As such, low wind speed curtailment is not currently considered to be required. If further studies suggest that low wind speed curtailment is an effective measure to reduce bird mortality, then it will be reconsidered as a potential adaptive management measure in the context of this BAMP in the future.

It is also possible that in the future, other adaptive management aspects and/or actions may be identified, considered and implemented, for example as further understanding of bird behaviour at the site develops. Any other adaptive management aspects and/or actions can be added to this adaptive management framework during the BAMP annual review process (Section 5.4).

Table 28. Proposed adaptive management aspects and actions to be implemented during adaptive management in the event of a trigger level impact being detected (along with proposed timing, responsibility, measurable outcomes and corrective actions).

Adaptive management aspect	Management action	Reference	Timeframe	Responsibility	Measurable outcome	Corrective action
Management of agricultural practices	Consult with the relevant landholder(s) to see if agricultural and/or land management practices can be altered, for example if feeding of grain and/or fodder to stock and/or lambing can be undertaken further away from WTG(s), or if alternate artificial water points can be installed further away from WTG(s), then these should be investigated and implemented where possible and practicable (and if the landholder(s) agree).	Section 9.2.1	Commence consultation, investigation, and implementation of management of agricultural practices within 1 week of attributing the cause of trigger level impact to agricultural practices.	Construction Project Manager / Asset Manager (NEOEN)	Action to manage agricultural practices undertaken within required timeframe and recorded in Trigger Level Impact and Adaptive Management Action database (refer to Section 9.4).	Construction Project Manager / Asset Manager (NEOEN) to ensure management of agricultural practices is undertaken within 1 week of becoming aware that it has not yet been undertaken.
Management of large animal carcasses	Remove large animal carcasses to avoid attracting birds.	Section 9.2.2	Within 24 – 48 hours of discovery of large animal carcass.	Construction Project Manager / Asset Manager (NEOEN) (but may be delegated to landholder(s) or others).	All large animal carcasses removed from with within 24-48 hours of discovery and action recorded in Trigger Level Impact and Adaptive Management Action database.	Construction Project Manager / Asset Manager (NEOEN) to ensure large animal carcasses are removed within 48 hours of becoming aware that they have not yet been removed.
Management of pest animals	Implement a targeted pest animal control program.	Section 9.2.3	Commence implementation of control program within 1 week of attributing the cause of trigger level impact to pest animals.	Construction Project Manager / Asset Manager (NEOEN) to initiate with landholder(s) to undertake or undertake alone (e.g., engage contractor to do).	Targeted pest animal control program implemented within required timeframe and action recorded in Trigger Level Impact and Adaptive Management Action database.	Construction Project Manager / Asset Manager (NEOEN) to ensure targeted pest animal control program is commenced within 1 week of becoming aware that it has not yet been undertaken.

Adaptive management aspect	Management action	Reference	Timeframe	Responsibility	Measurable outcome	Corrective action
Management of WTG(s) during seasonal nesting	Investigate and implement options, such as short-term management of WTG(s), to reduce collision risk and minimise further collisions.	Section 9.2.4	Commence investigation of options to reduce collision risk and minimise further collisions within 1 week of attributing the cause of trigger level impact to seasonal nesting. Implement option within 2 weeks of attributing the cause of trigger level impact to seasonal nesting.	Construction Project Manager / Asset Manager (NEOEN)	Action to manage WTG(s) during seasonal nesting undertaken within required timeframe and recorded in Trigger Level Impact and Adaptive Management Action database.	Construction Project Manager / Asset Manager (NEOEN) to ensure management of WTG(s) during seasonal nesting is undertaken within 1 week of becoming aware that it has not yet been undertaken.
Management of WTG(s) during periodic environmental conditions and/or events	Investigate and implement options, such as short-term management of WTG(s), to reduce collision risk and minimise further collisions.	Section 9.2.5	Commence investigation of options to reduce collision risk and minimise further collisions within 1 week of attributing the cause of trigger level impact to periodic environmental conditions and events. Implement option within 2 weeks of attributing the cause of trigger level impact to periodic environmental conditions and events.	Construction Project Manager / Asset Manager (NEOEN)	Action to manage WTG(s) during periodic environmental conditions and/or events undertaken within required timeframe and recorded in Trigger Level Impact and Adaptive Management Action database.	Construction Project Manager / Asset Manager (NEOEN) to ensure management of WTG(s) during periodic environmental conditions and/or events is undertaken within 1 week of becoming aware that it has not yet been undertaken.
Temporarily shut down specific WTG(s)	Temporarily shut down specific WTG(s).	Section 9.2.6	Temporarily shut down specific WTG(s) within 1 week of determining that it is required. The duration of the temporary shutdown will depend on the cause of the trigger level impact.	Construction Project Manager / Asset Manager (NEOEN)	Specific WTG(s) temporarily shut down within required timeframe and action recorded in Trigger Level Impact and Adaptive Management Action database.	Construction Project Manager / Asset Manager (NEOEN) to ensure specific WTG(s) are temporarily shut down within 1 week of becoming aware that it has not yet been undertaken.
Permanently shut down	Permanently shut down specific WTG(s).	Section 9.2.7	Commence process to permanently shut down specific WTG(s) within 1	Construction Project Manager / Asset Manager (NEOEN)	Specific WTG(s) permanently shut down within required timeframe	Construction Project Manager / Asset Manager (NEOEN) to ensure specific

Adaptive management aspect	Management action	Reference	Timeframe	Responsibility	Measurable outcome	Corrective action
specific WTG(s)			week of determining that it is required.		and action recorded in Trigger Level Impact and Adaptive Management Action database.	WTG(s) are permanently shut down within 1 week of becoming aware that it has not yet been undertaken.
Permanently decommission specific WTG(s)	Permanently decommission specific WTG(s).	Section 9.2.8	Commence process to decommission specific WTG(s) within 1 week of determining that it is required.	Construction Project Manager / Asset Manager (NEOEN)	Specific WTG(s) decommissioned within required timeframe and action recorded in Trigger Level Impact and Adaptive Management Action database.	Construction Project Manager / Asset Manager (NEOEN) to ensure decommissioning process is commenced within 1 week of becoming aware that it has not yet commenced.

9.2.1 Management of agricultural practices

If a trigger level impact is detected and suspected to be attributed to agricultural practices undertaken by landholders, for example feeding of grain and/or fodder to stock, lambing, or water points in close proximity to WTGs, which may result in concentrations of birds close to WTGs, then the Construction Project Manager / Asset Manager (NEOEN) will consult with the relevant landholder(s) to see if agricultural and/or land management practices can be altered. For example, it may be possible to feed stock, allow lambing and install artificial water points further away from WTGs. These alternatives should be investigated and implemented where possible and practicable (and if the landholders agree).

9.2.2 Management of large animal carcasses

If a trigger level impact is detected and suspected to be attributed to a large animal carcass attracting birds close to WTGs, particularly raptors such as WTEs, then management action will be undertaken where the carcass is removed within 24 – 48 hours of discovery (where possible).

NEOEN may negotiate an agreement with relevant landholder(s) to remove large animal carcasses, or alternatively, NEOEN may choose to organise removal of large animal carcasses. Either way, NEOEN must ensure that any large animal carcass found is removed within 24 – 48 hours of discovery (where possible).

9.2.3 Management of pest animals

If a trigger level impact is detected and suspected to be attributed to pest animals, such as rabbits, inhabiting areas around WTGs and attracting raptors such as WTEs, then management action will be required, most likely in the form of a targeted pest animal control program. As landholders are responsible for managing pest animals in accordance with the *Landscape South Australia Act 2019*, NEOEN may inform the landholder of the pest animal issue and request that they undertake targeted pest animal control. Alternatively, NEOEN may choose to undertake targeted pest animal control, if required. However, NEOEN's ability to undertake targeted pest animal control will be limited as NEOEN only leases the WTG areas and as such may not have access to areas beyond the WTGs and access tracks.

Regardless of who undertakes pest animal control, it must be commenced within 1 week of identifying the issue.

9.2.4 Management of WTG(s) during seasonal nesting

As explained in Section 3.4.5 at least five WTE nests have been observed within the Project Area, with additional nests also observed outside of the Project Area (Figure 18). 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 1000 m buffer on known WTE nests, where practicable. However, two WTE nests were found late in the design process and do not have a 1000 m buffer, with one of these WTE nests located approximately 470 m east of SG072 and outside of the Stage 1A Project Area, and the other located approximately 480 m south-west of B049 in Stage 1B (Figure 18).

If a trigger level impact is detected and suspected to be attributed to seasonal nesting, options to reduce collision risk and minimise further collisions will need to be investigated and implemented, such as (but not

limited to) short-term management such as temporary shutdown of WTG(s). Temporary shutdown of WTG(s) will be a last resort but will be used in the short-term if:

- a particular WTG is involved and the cause is likely to resolve itself, for example once the nesting event finishes; and
- a suitably qualified and experienced ecologist advises that temporary shutdown is required to reduce collision risk and minimise further collisions, after analysing the site-specific and species-specific conditions.

Temporary shutdown of WTG(s) is detailed further in Section 9.2.6.

9.2.5 Management of WTG(s) during periodic environmental conditions and/or events

If a trigger level impact is detected and suspected to be attributed to periodic environmental conditions, such as localised high densities of natural food resources or availability of surface water (including Porter Lagoon outside the Project Area), or periodic seasonal environmental events, such as migration (particularly for EPBC Act migratory bird species), options to reduce collision risk and minimise further collisions will need to be investigated, such as (but not limited to) short-term management such as temporary shutdown of WTG(s). Temporary shutdown of WTG(s) will be a last resort but will be used in the short-term if:

- a particular WTG is involved and the cause is likely to resolve itself, for example once the periodic environmental conditions and/or events, such as migration, finish; and
- a suitably qualified and experienced ecologist advises that temporary shutdown is required to reduce collision risk and minimise further collisions, after analysing the site-specific and species-specific conditions.

Temporary shutdown of WTG(s) is detailed further in the following section.

9.2.6 Temporarily shut down specific WTG(s)

If a trigger level impact is detected:

- for the same EPBC Act listed species; and
- at the same WTG; and
- within 1 month of an initial trigger level impact (for the same EPBC Act listed species at the same specific WTG); and
- after adaptive management actions, such as (but not limited to) those outlined above, have been implemented,

then further investigation into the likely cause of the trigger level impact will be undertaken by a suitably qualified and experienced ecologist, including analysis of site specific and species-specific conditions, and additional adaptive management actions will be implemented by NEOEN, based on the ecologist's advice, as soon as reasonably practicable to reduce collision risk.

If another (i.e., third) trigger level impact is detected:

- for the same EPBC Act listed species; and

- at the same specific WTG; and
- within 1 month of the second trigger level impact for the same EPBC Act listed species, (and it is within 2 months of the initial trigger level impact for the same EPBC Act listed species at the same specific WTG),

then that specific individual WTG will need to be temporarily shut down if a suitably qualified and experienced ecologist advises that temporary shutdown is required to reduce collision risk and minimise further collisions, after analysing site specific and species-specific conditions. For example, the WTG will need to be temporarily shut down for the duration of associated collision risk, such as the nesting season, a migration event or other environmental conditions or events. NEOEN will seek advice from the ecologist on the duration of temporary shutdown required to reduce collision risk and minimise further collisions. Once the nesting season, migration event or other environmental conditions or events have finished, or the ongoing risk of collision is considered to have reduced, the WTG will be made operational again.

The occurrence of nesting activities, migration events and other environmental conditions or events will vary each year based on favourable or unfavourable conditions (i.e., moderate to high rainfall or drought). As such, temporary shutdown of a specific individual WTG will not automatically be implemented again, for example, at the same time the following year. Rather, if a trigger level impact is detected at the same specific individual WTG, it will be investigated to determine the likely cause and adaptive management actions will be implemented as soon as reasonably practicable.

9.2.7 Permanently shut down specific WTG(s)

If a trigger level impact occurs at a specific individual WTG five times per year for five consecutive years and for the same EPBC Act listed bird species, then that WTG will be permanently shut down if a suitably qualified and experienced ecologist advises, after analysing site specific and species-specific conditions, that permanent shut down is required. The WTG will be shut down immediately (within 2 business days) upon determination that the specific individual WTG is required to be permanently shut down. The hub and blades of the WTG will be secured so that they don't rotate or otherwise move.

9.2.8 Permanently decommission specific WTG(s)

If a WTG which has been permanently shut down contributes to a trigger level impact five times per year for five consecutive years and for the same EPBC Act listed bird species (i.e., these birds are colliding with the stationary structure of the WTG), then it may be appropriate to permanently decommission the WTG, with the WTG structure, including the tower, nacelle, hub and blades being dismantled, if a suitably qualified and experienced ecologist advises, after analysing site specific and species-specific conditions, that permanent decommissioning is required. Alternatively, NEOEN may decide to decommission the WTG if considered appropriate (for example, the components may be reused for other WTGs). The process to dismantle a WTG structure is likely to take some time, as contractors with suitable equipment, including multiple cranes, will need to be procured and brought to site.

9.3 Monitoring of adaptive management

Monitoring undertaken as part of the bird monitoring program detailed in Section 8 (particularly bird numbers, flight heights and nesting activity) will help to understand bird presence, activity and behaviour

at the site, as well as potential collision risk. It will also help inform implementation of appropriate adaptive management actions after a trigger level impact. Furthermore, long-term WTG collision monitoring will also help determine the effectiveness of adaptive management actions implemented at the Project. For example, if no collisions with WTG(s) are observed for a length of time after adaptive management actions, such as (but not limited to) management of agricultural practices, large animal carcasses and/or pest animals, have been implemented, then it is likely that the management actions will be considered to have been successful. However, it is also important to note that the risk of collision may resolve itself (i.e., decline) if a seasonal nesting event finishes or if other periodic environmental conditions and/or events, such as migration, finish.

9.4 Record keeping

All trigger level impacts identified, and adaptive management actions undertaken, will be recorded within a specific Trigger Level Impact and Adaptive Management Action database so that the number and frequency of trigger level impacts can be recognised and understood, and management actions can be tracked. Information that is proposed to be recorded is outlined in Table 29.

Table 29. Information proposed to be recorded in a specific database for trigger level impacts identified and adaptive management action undertaken.

• WTG (or other location) where trigger level impact occurred (for example: SG036)
• Date trigger level impact identified (for example: 24/06/2024)
• Bird species involved in trigger level impact (for example: *Calidris ferruginea* (Curlew Sandpiper))
• Trigger level impact type / type of bird species involved (either: EPBC Act listed threatened and/or migratory bird species; or Other non-threatened bird species (including non-EPBC Act listed bird species))
• Level of impact on the bird species involved (result of suitably qualified and experienced ecologist's assessment)
• Is an EPBC Significant Impact Assessment required? (Yes / No) o If Yes: ▪ Result of EPBC Significant Impact Assessment (for example: Not a Significant Impact / Significant Impact). – If a Significant Impact has occurred, or is likely to have occurred, has the Department been notified (within 2 business days)? (Yes / No) • Date of notification – If a Significant Impact has occurred, or is likely to have occurred, has a revised version of the BAMP and evaluation report been submitted to the Department (within 3 months)? (Yes / No) • Date of submission
• Is a cause evident for the trigger level impact? (Yes / No) o If Yes: ▪ Identified/suspected cause (for example: agricultural practices; large animal carcass; pest animals; seasonal nesting; periodic environmental conditions and/or events; or other)

- Adaptive management undertaken (for example: additional monitoring of bird activity; change in agricultural practices; remove large animal carcass; targeted pest animal control; temporarily shut down specific WTG; or other).
- Date(s) adaptive management undertaken.
- Location of adaptive management undertaken (for example: Approximately 300m south-east of WTG SG036 – or similar).
- Names of people involved with undertaking the adaptive management.

- If No:
  - Details of additional monitoring undertaken (e.g., date; location; findings).
  - Do monitoring results suggest a high risk continues? (Yes / No)
    - If Yes:
      - Adaptive management proposed to be undertaken (for example: change agricultural practices; remove large animal carcass; targeted pest animal control; temporarily shut down specific WTG; or other).
    - If No:
      - Details of how high risk has resolved itself.

9.5 Reporting

All trigger level impacts identified, and adaptive management actions undertaken, will be reported within the annual bird monitoring program report outlined in Section 8.5, which is proposed to be published as an attachment to the annual EPBC approval compliance report.

9.6 Flowchart

A flowchart summarising the process to be followed if a trigger level impact is detected and can be attributed to one or more of the broad categories of potential causes of increased collision risk outlined in Section 9 is provided on the following page.

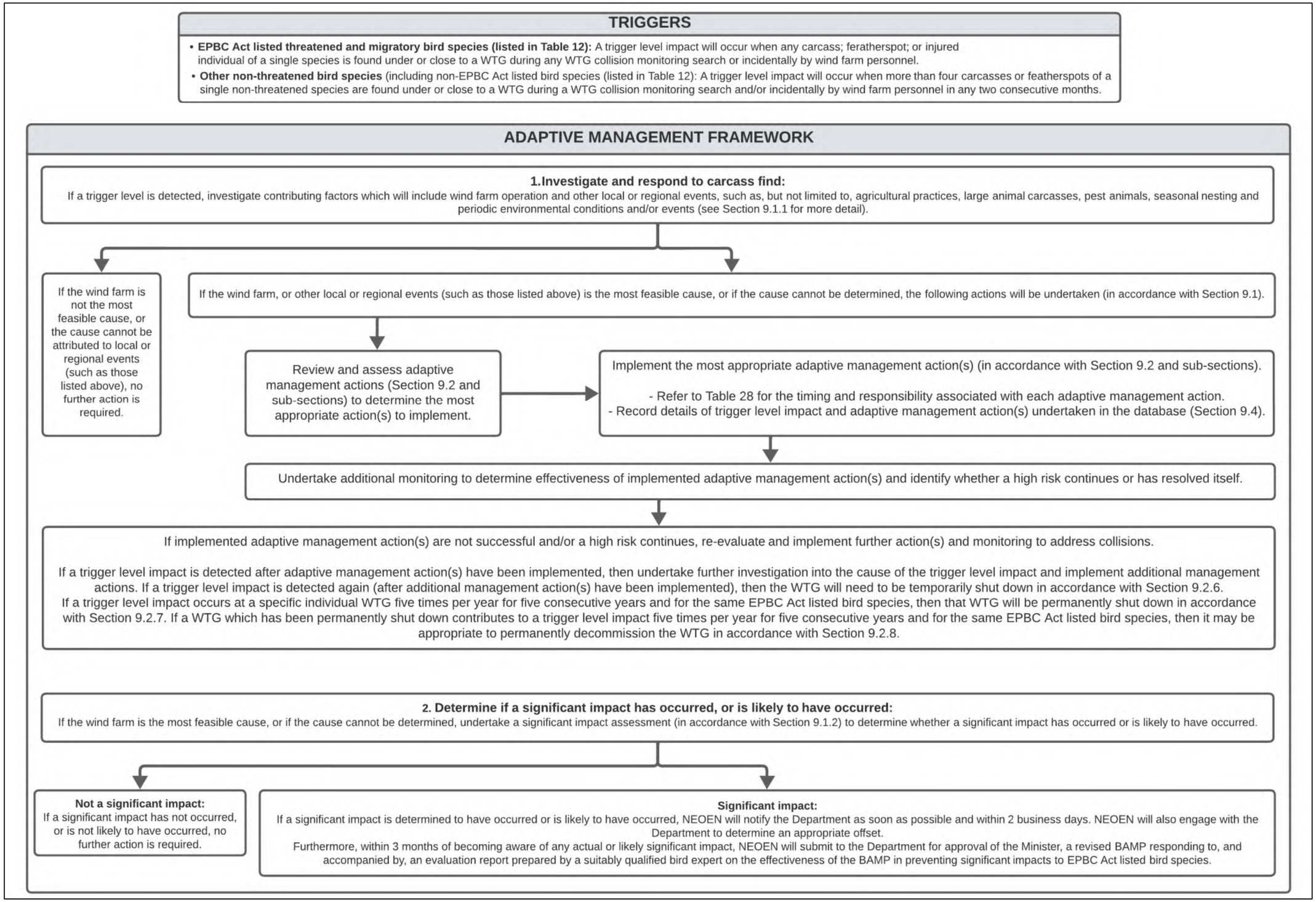

Figure 25. Trigger levels and adaptive management flowchart.

10 REFERENCES

Adams E.M., Gulka J., Williams K.A. (2021). A review of the effectiveness of operational curtailment for reducing bat fatalities at terrestrial wind farms in North America. PLoS ONE 16(11): e0256382. https://doi.org/10.1371/journal.pone.0256382.

Allison, T. D., Diffendorfer, J. E., Baerwald, E. F., Beston, J. A., Drake, D., Hale, A. M., Hein, C. D., Huso, M. M., Loss, S. R., Lovich, J. E. & Strickland, M. D., 2019. Impacts to wildlife of wind energy siting and operation in the United States. Issues in Ecology, 21(1): 2-18

American Wind Wildlife Institute (AWWI) (2014). Wind Turbine Interactions with Wildlife and their Habitats A Summary of Research Results and Priority Questions. Available at: http://www.energy.gov/eere/wind/articles/wind-turbine-interactions-birds-bats-and-their-habitats-summary-research-results.

American Wind Wildlife Institute (AWWI), 2019. Wind turbine interactions with wildlife and their habitats: a summary of research results and priority questions. Washington DC, USA: American Wind Wildlife Institute. American Wind Wildlife Institute [website]. Accessed 2022. https://rewi.org/wp-content/uploads/2019/05/Wind-Wildlife-Impacts-Summary-2019.pdf

Antos MJ, Bennett AF & White JG (2008) Where exactly do ground-foraging woodland birds forage? Foraging sites and microhabitat selection in temperate woodlands of southern Australia. Emu 108, 201–211.

Arnett, E.B., M.M.P. Huso, M.R. Schirmacher, and J.P. Hayes (2011) Altering turbine speed reduces bat mortality at wind-energy facilities. *Frontiers in Ecology and the Environment* **9**: pp. 209–214.

Arnett, E.B., W.K. Brown, W.P. Erickson, K.K. Fiedler, B.L. Hamilton, T.H. Henry, A. Jain, G.D. Johnson, J. Kerns, R.R. Koford, C.P. Nicholson, T.J. O'Connel, M.D. Piorkowski, and R.D. Tankersley, Jr. (2008) Patterns of bat fatalities at wind energy facilities in North America. *The Journal of Wildlife Management* **72**: pp. 61-78.

Arnett, E.B., D.B. Inkley, D.H. Johnson, R.P. Larkin, S. Manes, A.M. Manville, J.R. Mason, M.L. Morrison, M.D. Strickland, and R. Thresher (2007) Impacts of wind energy facilities on wildlife and wildlife habitat. Wildlife Society Technical Review 07-2. The Wildlife Society, Bethesda, MA.

Bamford M., D. Watkins, W. Bancroft, G. Tischler & J. Wahl (2008). *Migratory Shorebirds of the East Asian - Australasian Flyway: Population estimates and internationally important sites*. Canberra, ACT: Department of the Environment, Water, Heritage and the Arts, Wetlands International-Oceania. Available from: http://www.environment.gov.au/biodiversity/migratory/publications/shorebirds-east-asia.html.

Barrett G, Ford HA & Recher HF (1994) Conservation of woodland birds in a fragmented rural landscape. Pacific Conservation Biology 1, 245–256.

Bennun, L., van Bochove, J., Ng, C., Fletcher, C., Wilson, D., Phair, N. & Carbone, G., 2021. Mitigating biodiversity impacts associated with solar and wind energy development. Guidelines for project developers. IUCN, Gland, Switzerland and The Biodiversity Consultancy, Cambridge, UK.

Biosis (2018) Bird & bat adaptive management plan for Silverton Wind Farm. Report for GE Renewable Energy Onshore Wind - Projects and Services. Author: I. Smales, Biosis Pty Ltd, Melbourne. Project no. 26357.

Blakers, M., S.J.J.F. Davies & P.N. Reilly (1984). *The Atlas of Australian Birds*. Melbourne, Victoria: Melbourne University Press.

Brett Lane & Associates (2017) White Rock Wind Farm Stage 1 Bird and Bat Adaptive Management Program. Prepared for White Rock Wind Farm Pty Ltd.

Commonwealth of Australia (2009) EPBC Act Policy Statement 2.3 Wind Farm Industry. Australian Government Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia.

Commonwealth of Australia (2010) Survey Guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Australian Government Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia.

Commonwealth of Australia (2013) Significant impact guidelines 1.1: Matters of National Environmental Significance. Australian Government Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia.

Commonwealth of Australia (2014) Environmental Management Plan Guidelines. Australian Government Department of the Environment, Commonwealth of Australia.

Commonwealth of Australia (2015a) Draft Referral guideline for 14 birds listed as migratory species under the EPBC Act. Australian Government Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia.

Commonwealth of Australia (2015b) Wildlife Conservation Plan for Migratory Shorebirds. Commonwealth of Australia.

Commonwealth of Australia (2017) *EPBC Act Policy Statement 3.21 Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species.* Australian Government Department of the Environment, Commonwealth of Australia.

Commonwealth of Australia (2018) Guidelines for Biological Survey and Mapped Data. Australian Government Department of the Environment and Energy, Commonwealth of Australia.

Commonwealth of Australia (2021) Onshore Wind Farms – interim guidance on bird and bat management. Australian Government Department of Agriculture, Water and the Environment, Commonwealth of Australia.

Conkling T.J., McClure C. J.W., Cuadros S., Loss S.R., Katzner T.E. (2022). Limited rigor in studies of raptor mortality and mitigation at wind power facilities. *Biological Conservation* **275**. Https://doi.org/10.1016/j.biocon.2022.109707.

Cramp, S. & K.E.L. Simmons, eds. (1983). *Handbook of the Birds of Europe, the Middle East and North Africa. The Birds of the Western Palearctic. Volume 3, Waders to Gulls*. Oxford: Oxford University Press.

Department of Climate Change, Energy, the Environment and Water (2023a). Conservation Advice for Aphelocephala leucopsis (southern whiteface). Canberra: Department of Climate Change, Energy, the Environment and Water. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/529-conservation-advice-31032023.pdf. Accessed 5 December 2023.

Department of Climate Change, Energy, the Environment and Water (2023b) Conservation Advice for Melanodryas cucullata cucullata (hooded robin (south-eastern)). Canberra: Department of Climate Change, Energy, the Environment and Water. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/67093-conservation-advice-31032023.pdf. Accessed 5 December 2023.

Department of Climate Change, Energy, the Environment and Water (2023c). *Conservation Advice for* Neophema chrysostoma *(blue-winged parrot)*. Canberra: Department of Climate Change, Energy, the Environment and Water. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/726-conservation-advice-31032023.pdf. Accessed 5 December 2023.

Department of Climate Change, Energy, the Environment and Water (2023) *Conservation Advice for* Stagonopleura guttata *(diamond firetail)*. Canberra: Department of Climate Change, Energy, the Environment and Water. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/59398-conservation-advice-31032023.pdf. Accessed 5 December 2023.

Department of the Environment (2015) Conservation Advice Calidris ferruginea curlew sandpiper. Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/856-conservation-advice.pdf Accessed 5 December 2023.

Department of the Environment (2023a) *Actitis hypoleucos* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: https://www.environment.gov.au/sprat. Accessed 5 December 2023.

Department of the Environment (2023b) *Apus pacificus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: https://www.environment.gov.au/sprat. Accessed 5 December 2023.

Department of the Environment (2023c). *Calidris acuminata* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: https://www.environment.gov.au/sprat. Accessed 5 December 2023.

Department of the Environment (2023d) *Calidris ferruginea* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: https://www.environment.gov.au/sprat. Accessed 5 December 2023.

Department of the Environment (2023e). *Calidris melanotos* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: https://www.environment.gov.au/sprat. Accessed 5 December 2023.

Department of the Environment (2023f) *Myiagra cyanoleuca* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: https://www.environment.gov.au/sprat. Accessed 5 December 2023.

Department of the Environment (2023g). *Tringa nebularia* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: https://www.environment.gov.au/sprat. Accessed 5 December 2023.

EBS Ecology (2018) Hornsdale Wind Farm Stage 3 Scavenger and Detectability Trials. Report to NEOEN. EBS Ecology, Adelaide.

EBS Ecology (2020) Goyder South Hybrid Renewable Energy Facility Flora and Fauna Assessment. Report to NEOEN Australia Pty Ltd. EBS Ecology, Adelaide.

EBS Ecology (2021a) EPBC Referral: 2021/8958 - Goyder South Hybrid Renewable Energy Facility – Wind Farm 1A, 10km south Burra SA. Report to NEOEN Australia Pty Ltd. EBS Ecology, Adelaide.

EBS Ecology (2021b) EPBC Referral: 2021/8957 - Goyder South Hybrid Renewable Energy Facility – Wind Farm 1B, 5km south Burra SA. Report to NEOEN Australia Pty Ltd. EBS Ecology, Adelaide.

EBS Ecology (2021c) Goyder South Hybrid Renewable Energy Facility Stage 1A: Native Vegetation Clearance Data Report. Report to Neoen Australia Pty Ltd. EBS Ecology, Adelaide.

EBS Ecology (2021d) Goyder South Hybrid Renewable Energy Facility Stage 1B: Native Vegetation Clearance Data Report. Report to Neoen Australia Pty Ltd. EBS Ecology, Adelaide.

EBS Ecology (2022a) Goyder South Hybrid Renewable Energy Facility: Stage 1A Preliminary Documentation (EPBC 2021/8958). Report to NEOEN Australia Pty Ltd . EBS Ecology, Adelaide.

EBS Ecology (2022b) Goyder South Hybrid Renewable Energy Facility: Stage 1B Preliminary Documentation (EPBC 2021/8957). Report to NEOEN Australia Pty Ltd . EBS Ecology, Adelaide.

EBS Ecology (2023a) Goyder South Hybrid Renewable Energy Facility Scavenger Activity and Searcher Efficiency Trials. Report to NEOEN Australia Pty Ltd. EBS Ecology, Adelaide.

EBS Ecology (2023b) Bird Strike and Nest Monitoring Summary Report 2018-2022 Hornsdale Wind Farm. Report to NEOEN Australia Pty Ltd. EBS Ecology, Adelaide.

EBS Ecology (2023c) Goyder South Hybrid Renewable Energy Facility Pygmy Blue-tongue Lizard (PBTL) Management Plan. Report to NEOEN Australia Pty Ltd. EBS Ecology, Adelaide.

Fielding A.H., Anderson D., Benn S., Dennis R., Geary M., Weston E., Whitfield, D.P. (2021). Non-territorial GPS-tagged golden eagles *Aquila chrysaetos* at two Scottish wind farms: Avoidance influenced by preferred habitat distribution, wind speed and blade motion status. *PLoS ONE* **16**(8): e0254159. https://doi.org/10.1371/journal.pone.0254159

Ford HA, Walters JR, Cooper CB, Debus SJS & Doerr VAJ (2009) Extinction debt or habitat change? Ongoing losses of woodland birds in north-eastern New South Wales, Australia. Biological Conservation 142, 3182–3190.

Geering, A., L. Agnew, and S. Harding (2007). Shorebirds of Australia. CSIRO Publishing, Melbourne.

Hansen, B.D., Fuller, R.A., Watkins, D., Rogers, D.I., Clemens, R.S., Newman, M., Woehler, E.J. and Weller, D.R. (2016) Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species. Unpublished report for the Department of the Environment. BirdLife Australia, Melbourne.

Higgins, P.J. (1999) Handbook of Australian, New Zealand and Antarctic Birds, Volume 4 (Parrots to Dollarbirds). Melbourne, Vic: Oxford University Press.

Higgins, P. J., & Davies, S. J. J. F. (1996) Handbook of Australian, New Zealand and Antarctic Birds. Volume Three - Snipe to Pigeons (Oxford University Press (ed.)).

Higgins PJ & Peter JM (Eds) (2002) Handbook of Australian, New Zealand and Antarctic Birds. Volume 6: Pardalotes to Shrike-thrushes. Oxford University Press, Melbourne.

Hodder GV, Ford HA, Ehmke G, D Oliver, Tulloch AIT, Barnes MD & Garnett ST (2021) Diamond Firetail Stagonopleura guttata. In The Action Plan for Australian Birds 2020. (Eds ST Garnett and GB Baker). CSIRO Publishing, Melbourne.

Holdsworth M, Newman M, Menkhorst P, Morley C, Cooper R, Green B, Starks J, Baker GB, Garnett ST (2021) Blue-winged Parrot Neophema chrysostoma. In The Action Plan for Australian Birds 2020. (Eds ST Garnett and GB Baker) pp. XXX–XXX. CSIRO Publishing, Melbourne.

Hull, C. L. & Muir, S., 2010. Search areas for monitoring bird and bat carcasses at wind farms using a Monte-Carlo model. *Australasian Journal of Environmental Management*, 17: 77 – 87.

Huso, M.M.P., and Dalthorp D. (2014) Accounting for unsearched areas in estimating wind turbine-caused fatality. *The Journal of Wildlife Management* **78**(2): pp. 347–358 DOI 10.1002/jwmg.663.

Huso M., Dalthorp D., Korner-Nievergelt F. (2017) Statistical principles of post-construction fatality monitoring. In: Perrow M., ed. Wildlife and Wind Farms, Conflicts and Solutions. Exeter, UK: Pelagic Publishing.

Hydro Tasmania Consulting (2007) *Scavenger trials at the Musselroe Wind Farm: March 2007*. Unpublished report.

Marques, A.T., Batalha, H., Rodrigues, S., Costa, H., Pereira, M.J.R., Fonseca, C., Mascarenhas, M., Bernardino, J., (2014. Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies. *Biological Conservation* **179**, 40–52. https://doi.org/10.1016/j.biocon.2014.08.017

McClure, C.J.W., Rolek, B.W., Dunn, L., McCabe, J.D., Martinson, L., Katzner, T., (2021). Eagle fatalities are reduced by automated curtailment of wind turbines. *Journal of Applied Ecology* **58**, 446-452. https://doi.org/10.1111/1365-2664.13831

Mathews, F., Swindells, M., Goodhead, R., August, T.A., Hardman, P., Linton, D.M., Hosken, D.J., (2013) Effectiveness of search dogs compared with human observers in locating bat carcasses at wind-turbine sites: a blinded randomized trial. *Wildlife Society Bulletin* **37**: pp34–40.

Montague-Drake RM, Lindenmayer DB & Cunningham RB (2009) Factors affecting site occupancy by woodland bird species of conservation concern. Biological Conservation 142, 2896–2903.

Natural Resources South Australian Murray-darling Basin (NR SAMDB) (2012) Wedge-tailed Eagles in agricultural areas. Fact sheet 2012. Department of Environment, Water and Natural Resources, Government of South Australia.

NEOEN (2023). Hornsdale Wind Farm website. Available at: https://hornsdalewindfarm.com.au/ Accessed 26 June 2023.

Paton DC, Carpenter G & Sinclair RG (1994) A second bird atlas of the Adelaide region. Part 1: Changes in the distribution of birds: 1974–75 vs 1984–85. South Australian Ornithologist 31, 151–193.

Pizzey, G. and Knight, F. (2014) *The Field Guide to the Birds of Australia – 9th Edition*. CSIRO Publishing.

Priday SD (2010) Beyond the 'woody remnant' paradigm in conservation of woodland birds: habitat requirements of the Hooded Robin (Melanodryas cucullata cucullata). Emu 110, 118124.

Random.org (2024) List Randomizer. Website available at: https://www.random.org/lists/ Accessed 23 January 2024.

Renew Economy (2022) New study probes impact of blackened wind turbine blades. Joshua S Hill, Renew Economy, 7 February 2022. Available at: https://reneweconomy.com.au/new-study-probes-effect-of-blackened-turbine-blades-on-bird-collisions/ Accessed 30 June 2023.

Schodde R & Mason IJ (1999) *The Directory of Australian Birds: Passerines*. CSIRO Publishing, Melbourne.

Schofield, J. (2006) *Pygmy Bluetongue Lizards: Best Practice Management Guidelines for Landholders*. Report for the Department for Environment and Heritage, Adelaide.

Smales, I. (2005) Impacts of avian collisions with wind power turbines: An overview of the modelling of cumulative risks posed by multiple wind farms. Biosis Research report for Department of Environment and Heritage. Canberra. Retrieved from http://www.environment.gov.au/epbc/publications/wind-farm-bird-risk.html.

Smales, I. (2015) Fauna Collisions with Wind Turbines: Effects and Impacts, Individuals and Populations. What Are We Trying to Assess? In *Wind and Wildlife Proceedings from the Conference on Wind Energy and Wildlife Impacts, October 2012, Melbourne, Australia*. Springer Dordrecht Heidelberg New York London. DOI 10.1007/978-94-017-9490-9.

Smales, I., and S. Muir. (2005) Modelled cumulative impacts on the Tasmanian Wedge-tailed Eagle of wind farms across the species' range. Biosis Research report to Department. of Environment and Heritage.

Smales, I., S. Muir, C. Meredith, and R. Baird. (2013) A description of the Biosis model to assess risk of bird collisions with wind turbines. *Wildlife Society Bulletin* **37**(1): pp. 59–65.

Smallwood, K.S. (2007) Estimating wind turbine-caused bird mortality. *Journal of Wildlife Management* **71**: pp. 2781–2791.

Smallwood K.S., Bell D.A. (2020). Effects of wind turbine curtailment on bird and bat fatalities. *Journal of Wildlife Management* **84**: 685–696.

Thaxter, C. B., Buchanan, G. M., Carr, J., Butchart, S. H. M., Newbold, T., Green, R. E., Tobias, J. A., Foden, W. B., O'Brien, S. & Pearce-Higgins, J. W., 2017. 'Bird and bat species' global vulnerability to collision mortality at wind farms revealed through a trait-based assessment'. *Proceedings of the Royal Society B: Biological Sciences*, 284(1862): 20170829. https://doi.org/10.1098/rspb.2017.0829

Watson DM (2011) A productivity-based explanation for woodland bird declines: poorer soils yield less food. Emu 111, 10– 18.

11 APPENDICES

Appendix 1. Vegetation types at WTGs

Table 30. Vegetation types at WTGs.

Stage 1A WTGs	Vegetation Type	Stage 1B WTGs	Vegetation type
SG01	Grassland	B001	Grassland
SG02	Grassland	B004	Grassland
SG03	Grassland / Cropping	B005	Cropping
SG07	Grassland (with woodland approximately 100m from WTG tower)	B010	Grassland
SG08	Grassland	B015	Grassland
SG010	Cropping / Grassland	B017	Grassland
SG011	Grassland / Cropping	B021	Grassland
SG012	Grassland	B023	Grassland
SG013	Grassland	B024	Grassland
SG014	Grassland	B025	Grassland
SG015	Grassland	B026	Woodland / Grassland
SG016	Grassland	B027	Grassland
SG017	Grassland / Cropping	B028	Grassland
SG018	Grassland	B029	Woodland / Grassland
SG020	Grassland	B030	Grassland
SG022	Grassland	B031	Grassland
SG023	Grassland	B032	Grassland
SG025	Grassland	B033	Grassland
SG027	Grassland	B034	Grassland
SG028	Grassland	B035	Grassland
SG029	Grassland	B036	Grassland
SG031	Grassland	B037	Grassland
SG032	Grassland	B038	Grassland / Woodland
SG033	Grassland	B039	Grassland
SG034	Grassland	B040	Grassland / Woodland
SG036	Grassland	B042	Grassland
SG037	Grassland	B043	Grassland / Woodland
SG040	Grassland	B044	Grassland
SG044	Grassland	B045	Grassland
SG047	Grassland	B046	Grassland / Emergent Woodland
SG048	Grassland	B047	Grassland / Woodland
SG050	Grassland	B048	Woodland
SG051	Grassland	B049	Grassland / Emergent Woodland
SG052	Grassland	B050	Woodland
SG054	Grassland	B051	Woodland
SG056	Grassland	B052	Grassland / Emergent Woodland
SG072	Grassland	SG026	Grassland
B008	Grassland		

Appendix 2. Likelihood of occurrence criteria

The following criteria were considered when assigning a likelihood of occurrence rating:

- Date of the most recent record (taking into consideration the date of the last surveys conducted in the area);
- Proximity of the records (distance to the Project Areas);
- Landscape location of the records, vegetation remnancy and vegetation type of the record location (taking into consideration the landscape, remnancy and vegetation type of the Project Areas, with higher likelihood assigned to species that were found in similar locations/condition/vegetation associations); and
- Knowledge of the species; habitat preferences, causes of its decline, the conspicuousness of the species and local population trends.

Likelihood	Criteria
Highly Likely/Known	• Records in the last 10 years, the species does not have highly specific niche requirements, the habitat is largely intact and falls within the known range of the species distribution. • The species was recorded as part of project surveys.
Likely	• Records within the previous 20 years, the area falls within the known distribution of the species and the area provides species habitat which is largely intact.
Possible	• Records within the previous 20 years, the area falls inside the known distribution of the species, but the area does not provide species habitat which is largely intact. • Records within 20 -40 years, survey effort is considered adequate, habitat is present and intact, and species of similar habitat needs have been recorded in the area.
Unlikely	• Records within 20 -40 years, however, suitable habitat does not occur, and species of similar habitat requirements have not been recorded in the area. • No records within the previous 40 years despite suitable habitat being known to occur in the area. • No records despite adequate survey effort.

Appendix 3. EPBC Act listed bird species profiles

Table 31. Common Sandpiper (*Actitis hypoleucos*) characteristics.

EPBC Act Listing Status:		Listed marine Listed migratory
Description: (Source: Department of the Environment 2023a)		A small sandpiper of 19–21 cm in length with a wingspan of 32–35 cm. Breeding plumage of the Common Sandpiper is dark brown above, with a greenish gloss to feathers of cap, hindneck and mantle. Brown colouring is interspersed with irregular barring. Feathers are white underneath. The species has a prominent white eye-ring and indistinct dark eye-stripe from the bill to the rear of the ear coverts. White patches amongst darker feathers on the sides of the breast area are also notable. The species has a long tail that extends behind the wings when at rest, short legs, and a medium length bill (Higgins & Davies 1996). **Colouring** Non-breeding plumage of the species is duller and more uniform in colouration. The sexes are similar and juveniles are distinguishable only when close enough to identify faint buff-spotted fringes to the feathers of head, neck, breast, mantle and scapulars (Hayman et al. 1986; Higgins & Davies 1996).
Size:		19 – 21 cm in length
BAMP size category:		Medium
Population estimate:		There is no approved Conservation Advice for this species. The Species Profile and Threats Database profile for Common Sandpiper (Department of the Environment 2023a) states: *The total population of the Common Sandpiper is in the order of 2 455 000 – 4 030 000 individuals (Delany & Scott 2002, cited in Bamford et al. 2008). The East Asian-Australasian Flyway population is estimated to be 190 000 (Hansen et al. 2016).* *Individuals within Australia during the non-breeding period is estimated to be approximately 3000 (Geering et al. 2007).* The *Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016) estimates the population to be 190 000.
Behaviour:		The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. The Common Sandpiper has been recorded in estuaries and deltas of streams, as well as on banks further upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags (Geering et al. 2007; Higgins & Davies 1996).
Flight or demographic factors	**Species presence: general**	**Migratory** Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The population when in Australia is concentrated in northern and western Australia (Northern Territory, Western Australia and Queensland) (Blakers et al. 1984; Higgins & Davies 1996). Bamford and colleagues (2008) claim there are few important sites within Australia due to the amount of suitable habitat for this species, and that sites in the Philippines, Myanmar, China, Russia and south-east Asia are increasingly important for migration.
	Species presence: within the Project Areas	**Desktop:** The Common Sandpiper was identified in the EPBC PMST. However, no BDBSA records occur within 25 km of the Project Areas. Limited records (~3) occur within 100 km of the Project Areas (refer to Figure 21). **Field surveys:** The Common Sandpiper was not observed during any of the field surveys undertaken for the Project.

	Flight paths (including migratory flight paths)	The Common Sandpiper breeds in Eurasia and moves south for the boreal winter, with most of the western breeding populations wintering in Africa, and eastern breeding populations wintering in south Asia to Melanesia and Australia (Cramp & Simmons 1983). Some stay in south-east Asia during the breeding months (Higgins & Davies 1996). Post breeding, the southward migration usually begins July–November, with individuals arriving from July onwards in South Australia, Western Australia and the Northern Territory, and from August onwards in New South Wales and Queensland. Northward migration, pre-breeding, is from February-May or early June.
	Soaring / flocking	**Flocking:** Within Australia the Common Sandpiper is recorded either singularly or in loose groups of less than five birds (Blakers et al. 1984). Flocks are formed for migration, though even in migration individuals separate widely to feed at staging sites.
	Flight heights	The species was not observed during targeted survey works at the site, so there is no specific flight height data available for the species.
Project Area use:		**Transient:** Although the species may possibly fly over the Project Areas, it is unlikely to use terrestrial habitats within the Project Areas.
Proximity of Project to	**Nesting areas**	N/A – The Common Sandpiper breeds in Eurasia and is a non-breeding visitor to Australia.
	Roosting areas	Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. The species is known to perch on posts, jetties, moored boats and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks (Higgins & Davies 1996). There is no known Common Sandpiper roosting habitat within the Project Areas or within 25 km of the Project Areas.
	Foraging areas	Generally the species forages in shallow water and on bare soft mud at the edges of wetlands; often where obstacles project from substrate, e.g. rocks or mangrove roots. Birds sometimes venture into grassy areas adjoining wetlands (Higgins & Davies 1996). There is no known suitable Common Sandpiper foraging habitat within the Project Areas.

Table 32. Southern Whiteface (*Aphelocephala leucopsis*) characteristics.

EPBC Act Listing Status:		Listed as Vulnerable
Description: (Source: DCCEEW 2023a)		The southern whiteface is a small stocky thornbill-like bird with a brown dorsum, white belly, dark brown wings and a black tail with narrow white tip (Schodde & Mason 1999). A grey wash on the belly is sometimes present, along with a grey or rufous tinge to the flanks. The species displays the characteristic facial markings of the genus: a white band across the forehead, with a darker streak along the top edge. Adult birds are approximately 11.5 cm in length with a cream-coloured eye, grey legs and a stubby dark grey bill of finch-like appearance (Schodde & Mason 1999). Adults are sexually monomorphic, while juveniles are distinguishable due to a lack of black rear band on the face.
Size:		Approximately 11.5 cm in length.
BAMP size category:		Small
Population estimate:		The Conservation Advice for Southern Whiteface (DCCEEW 2023a) states: *There are currently estimated to be 477 000 (range 236 000 – 954 000) mature individuals in the wild (S Garnett pers. comm. 9 Nov 2021) with a declining trend (Ehmke et al. 2021)*,
Behaviour:		Southern whiteface live in a wide range of open woodlands and shrublands where there is an understorey of grasses or shrubs, or both. These areas are usually in habitats dominated by acacias or eucalypts on ranges, foothills and lowlands, and plains (Higgins & Peter 2002).
Flight or demographic factors	**Species presence: general**	**Ongoing** Southern Whiteface occur across most of mainland Australia south of the tropics, from the north- eastern edge of the WA wheatbelt, east to the Great Dividing Range (Schodde & Mason 1999). There is a broad hybrid zone between the two subspecies extending north from the western edge of the Nullarbor Plain. The northern boundary extends to about Carnarvon in the west, to the southern NT in central Australia, but is slightly further south in Queensland where the species is largely confined to the south-west of the Mitchell Grass Downs and along the southern state border (Schodde & Mason 1999).
	Species presence: within the Project Areas	**Desktop:** Southern Whiteface was identified in the PMST. Numerous BDBSA records occur within 25 km of the Project Areas (Figure 19). **Field surveys:** Southern Whiteface were recorded within the Project Areas during the initial flora and fauna assessment (in 2019), but prior to their listing under the EPBC Act.
	Flight paths (including migratory flight paths)	Southern Whiteface are considered sedentary; however, atlas records indicate that individuals may move into wetter areas outside of their normal range during drought years (Higgins & Peter 2002).
	Soaring / flocking	**Flocking:** Although the species typically forages in small groups of 2–8 individuals, birds may congregate in larger flocks during the non-breeding season, with as many as 70 birds recorded in foraging parties in winter (Higgins & Peter 2002). The species often participates in mixed species feeding flocks, particularly with other whiteface and thornbill species.
	Flight heights	Although Southern Whiteface were recorded during field surveys for the initial flora and fauna assessment, flight heights were not recorded at the time as the species was not listed under the EPBC Act at the time of the surveys (2019). As such, there is no specific flight height data available for the species.
Project Area use:		**Nesting, roosting and/or foraging** Habitat within the Project Areas is likely to be suitable for nesting, roosting and foraging (but limited to woodlands and shrublands).

Proximity of Project to	**Nesting areas**	Birds build large bulky domed nest of grass, bark and roots, usually in a hollow or crevice, although sometimes in low bushes (Higgins & Peter 2002). Southern Whiteface may nest within woodland located within the Project Areas.
	Roosting areas	Southern Whiteface are likely to roost within living and dead trees within the Project Areas.
	Foraging areas	Southern whiteface forage almost exclusively on the ground, favouring habitat with low tree densities and an herbaceous understorey litter cover. Birds mainly feed on insects, spiders, and seeds, largely gleaned from the bare ground or leaf litter (Higgins & Peter 2002; Antos & Bennett 2006; Antos et al. 2008). Southern Whiteface are likely to forage within the Project Areas.

Table 33. Fork-tailed Swift (*Apus pacificus*) characteristics.

EPBC Act Listing Status:		Listed marine Listed migratory
Description: (Source: Department of the Environment 2023b)		The Fork-tailed Swift is a medium to large member of the Apodidae Family. It has a length of 18–21 cm, a wingspan of 40–42 cm and weighs around 30–40 g. It is a medium-sized Swift, with a slim body with long scythe-shaped wings that taper to finely pointed tips. It is characterized by a long and deeply forked tail. It is smaller and slimmer than the White-throated Needletail, *Hirundapus caudacutus*, with much narrower wings and a longer, more deeply forked tail. It is much bigger than Swiftlets with much longer wings and a lower forked tail. The Fork-tailed Swift is mainly blackish with a white band across the rump. There is also a white patch on the chin and throat. The body, tail and upperwings are black-brown and they have a faint pale scaling to the saddle and white scalloping to the underbody. The sexes are alike with no seasonal variation, juveniles are also indistinguishable in the field (Higgins 1999).
Size:		18 – 21 cm in length and 30 – 40 g in weight.
BAMP size category:		Medium
Population estimate:		There is no approved Conservation Advice for Fork-tailed Swift. The Species Profile and Threats Database profile for Fork-tailed Swift (Department of the Environment 2023b) states: *The global population is still not quantified; however populations are believed to be stable throughout most of its range, except Pakistan (del Hoyo et al. 1996). There are no measures of abundance in Australia. The largest flocks recorded in Australia were 90 000 near Mildura, Victoria, during 1961 (Simpson 1961); 50 000 at Portland, south-west Victoria, during January 1960 (Anon. 1960); and 50 000 at Ivanhoe, NSW (Anon. 1972).*
Important habitat and ecologically significant proportion of a population		The draft Referral guideline for 14 birds listed as migratory species under the EPBC Act (Commonwealth of Australia 2015a) defines important habitat for the species as: '*Non-breeding habitat only: Found across a range of habitats, from inland open plains to wooded areas, where it is exclusively aerial*'. Based on this broad definition, the entire Project Area could be classified as 'important habitat'. As this species aggregates in flocks, 1% of the population is considered as an ecologically significant proportion of the international population and 0.1% as an ecologically significant proportion of the national population. This equates to 1,000 individuals (1%) and 100 individuals (0.1%). This species is known to move in large flocks which have the potential to occur on a temporal basis in the airspace above the Project Area. These flocks may include an ecologically significant proportion of the national population.
Behaviour:		The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. The species food items within Australia are not well known, however, the Fork-tailed Swift is known to be insectivorous. They probably roost aerially, but are occasionally observed to land. Sometimes they loaf in the air, by allowing strong winds to support them.
Flight or demographic factors	**Species presence: general**	**Migratory** The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia. In South Australia the Fork-tailed Swift is widespread from the Victorian border west to the Spencer Gulf. It is also common in coastal parts of Eyre Peninsula as far west as Franklin Island, off Streaky Bay and north to 32° S. There have been a few recently published records beyond these bounds, such as in Flinders Ranges and the Lake Eyre Drainage Basin from Billa Kallina Station, Lake Eyre South and Marree. Sightings have also been recorded north to Moorayepe and east to Innamincka and Moomba.
	Species presence: within the Project Areas	**Desktop:** this species was identified in the EPBC PMST. A BDBSA record occurs within 25 km of the Project Area, just South of the Proposed Project Area. There are 2 records within 100 km of the Project Areas (refer to Figure 21). **Field surveys:** Fork-tailed Swift was not observed during any of the field surveys undertaken for the Project.

	Flight paths (including migratory flight paths)	The Fork-tailed Swift leaves its breeding grounds in Siberia from August–September. On the south passage to Australia the birds have been recorded at Moluccas on Halmahera in late September, Ambon in late August and then Kasiruta in November. The Fork-tailed Swift usually arrives in Australia around October; some arrive early in September, however, this is rare. In southern Australia there are no significant differences in the arrival times of the Fork-tailed Swift and they are said to be highly mobile whilst in Australia. Large flocks often precede or follow low pressure systems as they cross the country in search of food. The species' movements in Australia are influenced by weather patterns. The gathering of many birds in open flocks, sometimes immense, may precede summer thunderstorms. The Fork-tailed Swift leaves southern Australia from mid-April and departs the Darwin area by the end of April.
	Soaring / flocking	**Flocking** Thousands have been seen over West Timor. The largest flocks recorded in Australia were 90,000 near Mildura, Victoria, during 1961; 50,000 at Portland, south-west Victoria, during January 1960; and 50,000 at Ivanhoe, NSW.
	Flight heights	The species was not observed during targeted survey works at the site, so there is no specific flight height data available for the species. The species is known to fly from 1 m to at least 300 m above ground and probably much higher.
Project Area use:		**Transient** This species is exclusively aerial in Australia. Although it may possibly occur over the Project Area, it is unlikely to use terrestrial habitats within the Project Areas.
Proximity of Project to	**Nesting areas**	N/A - The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia.
	Roosting areas	They probably roost aerially, but are occasionally observed to land and roost on cliffs and in large trees. There is no known Fork-tailed Swift roosting habitat within the Project Areas or within 25 km of the Project Areas.
	Foraging areas	There is no known suitable Fork-tailed Swift foraging habitat within the Project Areas. It is deemed possible that, on occasion, Fork-tailed Swift may utilise the aerial space above the Project Areas for foraging

Table 34. Sharp-tailed Sandpiper (*Calidris acuminata*) characteristics.

EPBC Act listing status:		Listed marine Listed migratory
Description: (Source: Department of the Environment 2023c)		The Sharp-tailed Sandpiper is a small-medium wader. The bird has a length of 17–22 cm, a wingspan of 36–43 cm and a weight of 65 g. It is a portly sandpiper with a flat back, pot belly and somewhat drawn-out rear end. It has a small flat head on a short neck with a short and slightly decurved bill. The species has medium length legs. At rest, the primaries are level with or slightly short of the tip of the tail. The primary projection is short in adults and moderately long in juveniles. The sexes are similar and there is marked seasonal variation (Higgins & Davies 1996).
Size:		17 – 22 cm in length and 65 g in weight.
BAMP size:		Medium
Population estimate:		There is no approved Conservation Advice for Sharp-tailed Sandpiper. The Species Profile and Threats Database profile for Sharp-tailed Sandpiper (Department of the Environment 2023c) states: *An estimated 85 000 Sharp-tailed Sandpipers occupy the East Asian-Australasian Flyway (EAAF) (Hansen et al. 2016). During the non-breeding season approximately 91% of the EAAF population occurs in Australia and New Zealand (Bamford et al. 2008).* The *Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016) estimates the population to be 85 000.
Behaviour:		They forage at the edge of the water of wetlands or intertidal mudflats, either on bare wet mud or sand, or in shallow water. Roosting mainly occurs at the edges of wetlands, on wet open mud or sand, in shallow water, or in short sparse vegetation, such as grass or saltmarsh. The Sharp-tailed Sandpiper breeds in northern Siberia and migrates to non-breeding areas south of the Equator. On migration, they forage and roost on rocky and sandy beaches, freshwater habitats and inland saltwater habitats
Flight or demographic factors	**Species presence: general**	**Migratory** The Sharp-tailed Sandpiper spends the non-breeding season in Australia. During the non-breeding season, most of the world population of Sharp-tailed Sandpipers occurs in Australia. Small numbers arrive in north-west Australia during mid-August, with large numbers in early September. In SA and Victoria, numbers are generally highest between January and early February.
	Species presence: within the Project Areas	**Desktop:** this species was identified in the EPBC PMST. There is one BDBSA record from 2003, within 25 km of the Project Area, at Porter Lagoon (refer to Figure 20). **Field surveys:** Sharp-tailed Sandpiper was not observed during any of the field surveys undertaken for the Project.
	Flight paths (including migratory flight paths)	Movements occur during the non-breeding period where birds appear to be dispersive, moving to temporary or flooded wetlands and leaving them when they dry. Numbers are generally not stable in southern Australia where they are found on intertidal mudflats between December to March, possibly because inland wetlands are dry. The Sharp-tailed Sandpiper departs non-breeding grounds in Australia by April, being one of the first waders to leave. They begin leaving southern mainland Australia during mid-February, most departing in March, with a few remaining till early May in the south-east. Many, apparently, cross inland with records from the arid inland region between February to April. At least some move north from south-east Australia via the coast of Queensland, during March and April. In south-west Australia they sometimes occur in large numbers between January and March.

	Soaring / flocking	**Flocking -** They move in flocks of less than a thousand individuals.
	Flight heights	The species was not observed during targeted survey works at the site, so there is no specific flight height data available for the species. Migrating shorebirds typically travel at relatively high altitudes, however, from 500 m to 5,000 m (Geering *et al.* 2007).
Project Area use:		**Transient -** No wetland habitat is present within the Project Area and this species is commonly found during the Australian winter and occurs throughout much of the Gulf regions in South Australia on passage from breeding grounds in Siberia. As such, the occurrence of this species within the Project Area is expected to be limited to flying birds transiting between areas of suitable habitat.
Proximity of Project to	**Nesting areas**	N/A - The Sharp-tailed Sandpiper breeds in the Northern Hemisphere and spends the non-breeding season in Australia.
	Roosting areas	There have been no records of Sharp-tailed Sandpiper within 25 km of the Project Area. Roosting mainly occurs at the edges of wetlands, on wet open mud or sand, in shallow water, or in short sparse vegetation, such as grass or saltmarsh. There is no known Sharp-tailed Sandpiper roosting habitat within the Project Area. The closest potential roosting habitat (Lagoons) is located approximately 1.17 km from the Project Area. Sharp-tailed Sandpiper may utilize this habitat for roosting, when conditions are right for foraging (i.e. the lagoons have water in them), which occurs sporadically.
	Foraging areas	There is no known suitable Sharp-tailed Sandpiper foraging habitat within the Project Area. None of the vegetation associations mapped are deemed suitable foraging habitat for this species (See Site Characteristic). The closest foraging habitat (Lagoons) is located approximately 1.17 km from the Project Area. Sharp-tailed Sandpiper may utilize this foraging habitat occasionally, when conditions are right (i.e., the lagoons have water in them), which occurs sporadically.

Table 35. Curlew Sandpiper (*Calidris ferruginea*) characteristics.

EPBC Act Listing Status:		Listed as Critically Endangered Listed marine Listed migratory
Description: (Source: Department of the Environment 2023d)		The Curlew Sandpiper is a small, slim sandpiper 18–23 cm long and weighing 57 g, with a wingspan of 38–41 cm. The legs and neck are long. The bill is also long, and is decurved with a slender tip. The bill is black, sometimes with a brown or green tinge at the base. The head is small and round, and the iris is dark brown. The legs and feet are black or black-grey. When at rest, the wing-tips project beyond the tip of the tail. The sexes are similar, but females have a slightly larger and longer bill and a slightly paler underbelly in breeding plumage (Higgins & Davies 1996). In breeding plumage, the head, neck and underbody to rear belly are a rich chestnut-red with narrow black bars on the belly and flanks. There are black streaks on the crown, a dusky loral stripe, and white around the base of the bill. The head, neck and underbody have a pale-streaked appearance due to white tips on the feathers. The feathers on the mantle and scapulars are black with large chestnut spots and grayish-white tips. The back and upper rump are dark brown, with a prominent square white patch across the lower rump and uppertail-covert (Higgins & Davies 1996). The non-breeding plumage is similar to the breeding plumage. Differences are that the cap, ear-coverts, hindneck and sides of neck are pale brownish-grey with fine dark streaks, grading to off-white on the lower face, with white on the chin and throat. There is a narrow dark loral stripe and white supercilium from the bill to above the rear ear-coverts. The mantle, back, scapulars, tertials and innerwing-covert are pale brownish-grey with fine dark streaks. The underbody is white with a brownish-grey wash and fine dark streaks on the foreneck and breast (Higgins & Davies 1996).
Size:		18 – 23 cm in length and 57 g in weight.
BAMP size:		Medium
Population estimate:		The Conservation Advice for Curlew Sandpiper (Department of the Environment 2015) states: The number of mature individuals in Australia is estimated to be 115 000 with a decreasing trend (Bamford et al., 2008; Garnett et al., 2011 in Department of the Environment 2015), however these estimates are out of date and likely to be an overestimate. The *Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016) estimates the population to be 90 000.
Behaviour:		Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters (Higgins & Davies 1996).
Flight or demographic factors	**Species presence: general**	**Migratory -** In Australia, Curlew Sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers. Records occur in all states during the non-breeding period, and also during the breeding season when many non-breeding one year old birds remain in Australia rather than migrating north. In SA, Curlew Sandpipers occur in widespread coastal and subcoastal areas east of Streaky Bay. Important sites include ICI and Price Saltfields, and The Coorong. Occasionally they occur in inland areas south of the Murray River and elsewhere.
	Species presence: within the Project Areas	**Desktop:** This species was identified in the EPBC PMST. No BDBSA records occur within 25 km of the Project Areas. However, there are over 50 records within 100 km of the Project Areas, mainly along the coast of SA (refer to Figure 21). **Field surveys:** The Curlew Sandpiper was not observed during any of the field surveys undertaken for the Project.

	Flight paths (including migratory flight paths)	Most birds migrate south via the western route, probably overland across Siberia and China, and south Asia. The northern migration occurs much further east, mainly along the south-east and east coasts of China, where staging occurs, then continue overland to breeding areas. Males depart breeding grounds during early July, followed by females in July and early August, then juveniles in August, with juveniles usually then arriving in non-breeding range later than adults. They reach the northern shores of Australia in late August and early September. After a stopover in northern Australia migration continues on a direct route to south-east Australia, the first birds arriving in late August, but the majority not until September. The return north begins in March, the northern route being further to the east than the southern route.
	Soaring / flocking	**Flocking -** This species is gregarious, often occurring in large flocks. They mix freely with other small waders when feeding and roosting.
	Flight heights	The species was not observed during targeted survey works at the site, so there is no specific flight height data available for the species. Migrating shorebirds typically travel at relatively high altitudes, however, from 500 m to 5,000 m (Geering *et al.* 2007).
Project Area use:		**Transient -** No wetland habitat is present within the Project Areas and the species is more commonly found in Northern parts of Australia. As such, the occurrence of this species within the Project Areas is expected to be limited to flying birds transiting between areas of suitable habitat.
Proximity of Project to	**Nesting areas**	N/A - The Curlew Sandpiper breeds in the Northern Hemisphere.
	Roosting areas	Curlew Sandpipers generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh. There is no known Curlew Sandpiper roosting habitat within the Project Areas. The closest potential roosting habitat (Lagoons) is located approximately 1.17 km from the Project Areas. Curlew Sandpiper may utilise this habitat for roosting, when conditions are right for foraging (i.e., the lagoons have water in them), which occurs sporadically.
	Foraging areas	Curlew Sandpipers usually forage in water, near the shore or on bare wet mud at the edge of wetlands or nearby shallow water. In non-tidal wetlands, they usually wade, mostly in water 15–30 mm, but up to 60 mm, deep. They forage at the edges of shallow pools and drains of intertidal mudflats and sandy shores. There is no known suitable Curlew Sandpiper foraging habitat within the Project Areas. The closest foraging habitat (Lagoons) is located approximately 1.17 km from the Project Area. Curlew Sandpiper may utilise this foraging habitat occasionally, when conditions are right (i.e., the lagoons have water in them), which occurs sporadically.

Table 36. Pectoral Sandpiper (*Calidris melanotos*) characteristics.

EPBC Act Listing Status:		Listed marine Listed migratory
Description: (Source: Department of the Environment 2023e)		The Pectoral Sandpiper is a small-medium sandpiper and member of the Scolopacidae family. The species has a length of 19–24 cm, a wingspan of 37–45 cm and a weight of 85 g for males and 60 g for females. The species is characterised by a flat back and a plumpish body that tapers to a drawn out rear end. The head is small and rounded, situated on a long neck. The legs are short and the bill varies from short and straight, to medium-length and gently decurved. When at rest the folded primaries (flight feathers) are level with, just short of, or slightly longer than the tip of the tail. Also, the folded primaries are short in breeding adults and long in juveniles (Higgins & Davies 1996).
Size:		19 – 24 cm in length and 60 - 85 g in weight.
BAMP size:		Medium
Population estimate:		There is no approved Conservation Advice for Pectoral Sandpiper. There is no population estimate on the Species Profile and Threats Database profile for Pectoral Sandpiper (Department of the Environment 2023e). The *Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016) estimates the population to be 1 220 000 - 1 930 000.
Behaviour:		In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum. They forage in shallow water or soft mud at the edge of wetlands (Higgins & Davies 1996).
Flight or demographic factors	**Species presence: general**	**Migratory** The Pectoral Sandpiper is found in Australia from September to June (Higgins & Davies 1996). The species mainly occurs in Queensland, NSW and Victoria, and is rarely recorded in Tasmania and WA. In SA, the Pectoral Sandpiper is found mostly in the south-east, from north to the Murray River and west to Yorke Peninsula. Outside of this region the species is occasionally recorded in Innamincka, Welcome Bore and Mintabie.
	Species presence: within the Project Areas	**Desktop:** this species was identified in the EPBC PMST. No BDBSA records occur within 25 km of the Project Areas. There are no records within 100 km of the Project Areas. **Field surveys:** Pectoral Sandpiper was not observed during any of the field surveys undertaken for the Project.
	Flight paths (including migratory flight paths)	The species is transient through Central America and the Caribbean while on route to the non-breeding areas in South America, from Peru to Bolivia, south to south-central Chile and from southern Brazil and south to Argentina. In the tropical Pacific, there are scattered records from Hawaii, Polynesia, Micronesia and Australasia. The species occurs in small numbers through east Asia, including Ussuriland, Japan and the Korean Peninsula. The species is vagrant to the Yenisei River, Transbaikalia, continental Europe, the British Isles, the Azores and the African continent.
	Soaring / flocking	**Flocking** – The Pectoral Sandpiper moves in small flocks.
	Flight heights	The species was not observed during targeted survey works at the site, so there is no specific flight height data available for the species. Migrating shorebirds typically travel at relatively high altitudes, however, from 500 m to 5,000 m (Geering *et al.* 2007).

Project Area use:		**Transient** No wetland habitat is present within the Project Areas and the species is more commonly found in Northern and eastern parts of Australia. As such, the occurrence of this species within the Project Areas is expected to be limited to flying birds transiting between areas of suitable habitat.
Proximity of Project to	**Nesting areas**	N/A - The Curlew Sandpiper breeds in the Northern Hemisphere (northern Russia and North America).
	Roosting areas	There are no records of Pectoral Sandpiper within 25 km of the Project Areas. There is no known Pectoral Sandpiper roosting habitat within the Project Areas. The closest potential roosting habitat (Lagoons) is located approximately 1.17 km from the Project Areas. Pectoral Sandpiper may utilise this habitat for roosting, when conditions are right for foraging (i.e., the lagoons have water in them), which occurs sporadically.
	Foraging areas	There is no known suitable Pectoral Sandpiper foraging habitat within the Project Areas. The closest foraging habitat (Lagoons) is located approximately 1.17 km from the Project Areas. Pectoral Sandpiper may utilise this foraging habitat occasionally, when conditions are right (i.e., the lagoons have water in them), which occurs sporadically.

Table 37. South-eastern Hooded Robin (*Melanodryas cucullata cucullata*) characteristics.

EPBC Act Listing Status:		Listed as Endangered
Description: (Source: DCCEEW 2023 2023b)		Hooded robin is a large Australian robin reaching 17 cm in length. The male is strikingly marked in black and white, with a bold black hood extending down a white breast. The back is black with distinct white shoulder and wing-bar. The tail is black, with prominent white side-panels. Females and immatures are duller, with light brownish-grey upperparts, but the same striking black and white wings. Flight is short and swiftly undulating. The call is a series of descending, fading, mellow notes. The adult male is unmistakable, but the female and young males may be confused with other species. Hooded robins (south-eastern) are distinguished by their larger size, distinctive white wing bar and different shaped tail markings ('hourglass' shaped).
Size:		17 cm in length.
BAMP size:		Small
Population estimate:		The Conservation Advice for South-eastern Hooded Robin (DCCEEW 2023b) states: *The total number of mature individuals is estimated to be 68 000 (36 000 – 113 000), however the reliability of this estimate is low (S Garnett pers. comms. 9 Nov 2021).*
Behaviour:		South-eastern Hooded Robins are described as shy and largely sedentary, and are mostly seen in pairs or small groups. They prefer dry eucalypt and acacia woodlands and shrublands with an open understorey, some grassy areas and a complex ground layer. They avoid woodlands with tall trees or dense tree cover but sometimes occur in tall, dense heaths with scattered open areas. While they can occur in patches as small as 2.9 ha (Montague-Drake et al. 2009), in agricultural landscapes they prefer larger patches greater than 10 ha (Watson et al. 2000) with moderately deep to deep soils (Priday 2010).
Flight or demographic factors	**Species presence: general**	**Ongoing** The South-eastern Hooded robin occurs in south-eastern Australia from far south-east Queensland to Yorke Peninsula, South Australia, intergrading with *Melanodryas cucullata picata* (northern inland Hooded Robin) in the southern Murray Darling basin (Schodde & Mason 1999). The subspecies is now absent from many formerly occupied sites, particularly in the wetter areas of the south and east (Barrett et al. 1994; Paton et al. 1994; Ford et al. 2009).
	Species presence: within the Project Areas	**Desktop:** The South-eastern Hooded Robin was identified in the PMST. Numerous BDBSA records occur within 25 km of the Project Areas (Figure 19). **Field surveys:** The South-eastern Hooded Robin was recorded within the Project Areas during the initial flora and fauna assessment (in 2019), but prior to their listing under the EPBC Act.
	Flight paths (including migratory flight paths)	South-eastern Hooded Robin flight is short and swiftly undulating.
	Soaring / flocking	N/A – It does not soar or flock.
	Flight heights	Although South-eastern Hooded Robin were recorded during field surveys for the initial flora and fauna assessment, flight heights were not recorded at the time as the species was not listed under the EPBC Act at the time of the surveys (2019). As such, there is no specific flight height data available for the species.
Project Area use:		**Nesting, roosting and/or foraging** Habitat within the Project Areas may be suitable for nesting, roosting and foraging (but limited to woodlands and shrublands).
Proximity of Project to	**Nesting areas**	Nests comprise small, neat cups of bark and grasses bound with webs and are situated in a tree fork or crevice, from less than 1 m to 5 m above the ground. South-eastern Hooded Robin may nest within the Project Areas.

	Roosting areas	South-eastern Hooded Robin may roost within the Project Areas.
	Foraging areas	Birds tend to forage on insects and small lizards taken from the ground (Antos et al. 2008). They hunt for invertebrates by 'perch and pounce' in grassy clearings where rocks and fallen timber litter the ground (Sullivan 1993). South-eastern Hooded Robin may forage within the Project Areas.

Table 38. Satin Flycatcher (*Myiagra cyanoleuca*) characteristics.

EPBC Act Listing Status:	Listed marine Listed migratory
Description: (Source: Department of the Environment 2023f)	The Satin Flycatcher is a member of the Dicruridae family. They have a length around 17.5 cm, a wingspan of 23 cm and a weight of 17 g. The species is characterised by an upright posture, short erectile crest, and a distinctive habit of quivering the tail when perched. Males are glossy blue-black above, with a blue-black chest and white below, while females are duskier blue-black above, with a orange-red chin, throat and breast, and white underparts and pale-edged wing and tail feathers. Young birds are dark brown-grey above, with pale streaks and buff edges to the wing feathers, and a mottled brown-orange throat and chest (Higgins et al. 2006).
Size:	Approximately 17.5 cm In length and 17 g in weight.
BAMP size:	Small
Population estimate:	There is no approved Conservation Advice for Satin Flycatcher. While there is no specific population estimate on the Species Profile and Threats Database for Satin Flycatcher (Department of the Environment 2023f), it states: *Satin Flycatchers have been recorded at densities of 0.08 birds/hectare (ha) near Armidale, NSW, 1.25 birds/ha near Bathurst, NSW, 0.43–0.66 birds/ha in the Bondi area near Bombala, NSW, 0.2–0.5 birds/ha at Bombala, NSW, and at a maximum density of 0.23 birds/ha in the Olinda State Forest, Victoria (Blakers et al. 1984; Ford & Bell 1981; Mac Nally 1997; Taylor et al. 1997b). The species is said to have become increasingly common in Tasmania in the late 1940s and early 1950s, with records in areas where they have not previously been recorded (Sharland 1952). Over the period of the two Australian Bird Atlases, the Satin Flycatcher showed no significant regional variation between Atlas 1 and Atlas 2, and no significant difference in reporting rate between the two Atlases, indicating no significant change in abundance (Barrett et al. 2002).* However, as an ecologically significant proportion of the Satin flycatcher population is estimated at 17,000 (1%) and 1,700 (0.1 %) (Commonwealth of Australia 2015a), a population estimate of 1,700 000 can be extrapolated.
Important habitat and ecologically significant proportion of a population	The draft *Referral guideline for 14 birds listed as migratory species under the EPBC Act* (Commonwealth of Australia 2015a) defines important habitat for the species as: "*Eucalypt forest and woodlands, at high elevations when breeding. They are particularly common in tall wet sclerophyll forest, often in gullies or along water courses. In woodlands they prefer open, grassy woodland types. During migration, habitat preferences expand, with the species recorded in most wooded habitats except rainforests. Wintering birds in northern Qld will use rainforest – gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps.*" Satin flycatcher's typically breed in south-eastern Australia and winter in north Queensland and Papua New Guinea. As such any individuals which may be using the Project Area are likely to be on migration when their tolerance for habitat is more diverse. As such all wooded habitats within the Project Area are considered to be 'important habitat' for this species. An ecologically significant proportion of the Satin flycatcher population is estimated at 17,000 (1%) and 1,700 (0.1 %). The species is likely to be a seasonal visitor to the Project Area when in transit to breeding grounds in south-eastern Australia. The Project Area is not of suitable size or value to support an ecologically significant proportion of the population.
Behaviour:	The species occurs as single birds or in pairs. The species mainly inhabits eucalypt forests, often near wetlands and watercourses. Habitat includes heavily vegetated gullies in forests and taller woodlands, usually above the shrub layer. During migration the bird inhabits coastal forests, woodlands, mangroves, trees in open country and gardens. The Satin Flycatcher is mainly insectivorous, feeding in the middle and upper layer of tree canopies and sub canopies on arthropods, mostly insects and occasionally on seeds.

		Birds are active and readily observable darting about the branches of trees and chasing flying insects. Breeding occurs from November to early January in south-eastern Australia. Breeding territory occurs in the Southern hemisphere, mainland Australia, and ACT, but it breeds mostly in south-eastern Australia/Tasmania Satin Flycatchers nest high up in the forks of outer branches of mainly eucalypts such as Tasmanian Blue Gum (*Eucalyptus Globulus*) and Broad-leaved Stringybark (*Eucalyptus Caliginosa).* Nests are in the same locality each year and are on average 12.3 m above ground. Satin Flycatchers are mainly insectivorous, preying on arthropods, mostly insects, although very occasionally they will also eat seeds. They are arboreal foragers, feeding high in the canopy and subcanopy of trees, usually sallying for prey in the air or picking prey from foliage and branches of trees, flitting from one perch to another, constantly wagging their tail (Frith 1969; Green 1995; Loyn 1980, 1985a; Officer 1969; Taylor et al. 1997b). On Kangaroo Island, South Australia, they have been recorded sallying for flying insects in the middle and upper layers of 5 m tall eucalypt mallee.
Flight or demographic factors	**Species presence: general**	**Migratory** Satin Flycatchers move north in autumn to spend winter in northern Australia and New Guinea. They return south in spring to spend summer in south-eastern Australia.
	Species presence: within the Project Areas	**Desktop:** this species was identified in the EPBC PMST. A BDBSA record from 1998 occurs within 25 km of the Project Area (refer to Figure 20). **Field surveys:** A pair of Satin Flycatchers was observed in a patch of *E. odorata* Woodland (VA 4) in the Project Area during the April 2019 survey.
	Flight paths (including migratory flight paths)	The species' arrival in Australia is strongly synchronous in October, with most appearing more or less simultaneously. Most birds migrate along the Great divide with some following the coast in NSW. Departure times vary depending on location. Typically, they depart in either February or March from the ACT, Victoria and Tasmania and in April from Queensland. Satin Flycatchers migrate back any time between August and November inclusive depending on location. They migrate across the Bass Strait arriving in Tasmania around October. Occurrence is sparsely scattered in inland Australia.
	Soaring / flocking	N/A - Satin Flycatchers mostly occur singly or in pairs and only sometimes in groups of three or four.
	Flight heights	The species was not observed during targeted survey works at the site, so there is no specific flight height data available for the species. The opportunistic record for this species was made within a woodland area with a pair of birds observed within the woodland. Therefore, no information could be recorded in relation to flight heights at the site.
Project Area use:		**Transient and/or foraging** Suitable habitat is restricted to woodland areas (VA6, VA10 and VA24).
Proximity of Project to	**Nesting areas**	There are no known breeding records of Satin Flycatchers within 25 km of the Project Areas. As breeding mostly in south-eastern Australia/Tasmania it is considered highly unlikely that the species utilises the Project Area or areas in the vicinity of the Project Areas for breeding.
	Roosting areas	This species may on occasion utilise the Project Areas for roosting, in particularly woodland areas.
	Foraging areas	There are no known foraging records of Satin Flycatcher within 25 km of the Project Area. This species may on occasion utilise the Project Areas for foraging when in transit, in particularly woodland areas.

Table 39. Blue-winged Parrot (*Neophema chrysostoma*) characteristics.

EPBC Act Listing Status:		Listed as Vulnerable Listed as marine
Description: (Source: DCCEEW 2023c)		Up to 24 cm in length with a weight of less than 50 g, the blue-winged parrot is a slender parrot with an olive-green head and upper body, grading to light green on the fore-neck (Higgins 1999). The upper tail is green-blue, with yellow sides. The underparts are yellow, and there may be orange in the centre of the belly. A yellow facial patch extends back to the eye (Higgins 1999). A narrow, dark blue band runs from eye to eye across the forehead. The blue-winged parrot gets its name from the large, dark blue patch on the wings. The female is similar to the male, but with slightly duller colours (Higgins 1999).
Size:		24 cm in length and less than 50 g in weight.
BAMP size:		Medium
Population estimate:		The Conservation Advice for Blue-winged Parrot (DCCEEW 2023c) states: *There are currently an estimated 10 000 (range 7500 – 15 000) mature blue-winged parrots in the wild with a declining trend (Holdsworth et al. 2021).*
Behaviour:		Blue-winged parrots inhabit a range of habitats from coastal, sub-coastal and inland areas, through to semi-arid zones. They tend to favour grasslands and grassy woodlands and are often found near wetlands both near the coast and in semi-arid zones (Higgins 1999). The species can also be seen in altered environments such as airfields, golf-courses and paddocks.
Flight or demographic factors	**Species presence: general**	**Migratory** Blue-winged parrots breed on mainland Australia south of the Great Dividing Range in southern Victoria from Port Albert in Gippsland west to Nelson, and sometimes in the far south-east of South Australia, and the north-western, central and eastern parts of Tasmania. During the non-breeding period, from autumn to early spring, birds are recorded from northern Victoria, eastern South Australia, south-western Queensland and western New South Wales, with some birds reaching south-eastern New South Wales and eastern Victoria, particularly on the southern migration.
	Species presence: within the Project Areas	**Desktop:** This species was identified in the PMST. A single BDBSA record from 2001 occurs within 25 km of the Project Areas (at Red Banks Conservation Park). **Field Survey:** The species has not been observed within the Project Areas during field survey.
	Flight paths (including migratory flight paths)	A partial migrant, variable numbers of birds migrate across Bass Strait in winter, apparently making the flight non-stop based on the scarcity of records from the Bass Strait islands. Before migrating from Tasmania in autumn, many birds congregate on saltmarshes and agricultural land before departing north (Higgins 1999). While on the mainland, mobile flocks feed in saltmarsh and rough pasture in coastal Victoria. Birds are known to move more than 100 km inland during winter to feed in semi-arid chenopod shrubland and sparse grassland (Holdsworth et al. 2021). Many aspects of the movements of the blue-winged parrot are poorly understood. Researchers know that most blue-winged parrots that breed in Tasmania migrate to the mainland, leaving a handful behind. However, detailed information about their wintering migration routes is lacking.
	Soaring / flocking	**Flocking** – The Blue-winged Parrot is known to move in flocks.
	Flight heights	The species was not observed during targeted survey works at the site, so there is no specific flight height data available for the species.
Project Area use:		**Nesting, roosting and/or foraging**

		Habitat within the Project Areas may be suitable for nesting, roosting and foraging (but limited to grasslands and grassy woodlands).
Proximity of Project to	**Nesting areas**	Nests are made in hollows, preferably with a vertical opening, in live or dead trees or stumps. Blue-winged Parrots may nest within the Project Area.
	Roosting areas	Blue-winged Parrots may roost within the Project Areas.
	Foraging areas	Pairs or small parties of blue-winged parrots forage mainly near or on the ground for seeds of a wide range of native and introduced grasses, herbs and shrubs (Higgins 1999). Blue-winged Parrots may forage within the Project Areas.

Table 40. Diamond Firetail (*Stagonopleura guttata*) characteristics.

EPBC Act Listing Status:		Listed as Vulnerable
Description: (Source: DCCEEW 2023d)		The diamond firetail is a large (length 10 to 12 cm, weight 17 grams), striking finch with a bright red bill, and red eyes and rump. The white throat and lower breast are separated by a broad black breast-band that extends into the strongly white-spotted, black flanks. It has a grey back and head, and ashy-brown wings. The female is similar to the male although sometimes smaller. The juvenile diamond firetail has a black bill and is duller in colour.
Size:		10 – 12 cm in length and 17 g in weight.
BAMP size:		Small
Population estimate:		The Conservation Advice for Diamond Firetail (DCCEEW 2023d) states: *There are currently estimated to be 136 000 (range 68 000 – 272 000) mature individuals in the wild, however the reliability of this estimate is low (Hodder et al. 2021; S Garnett pers. comms. 9 Nov 2021).*
Behaviour:		Diamond firetails occur in eucalypt, acacia or casuarina woodlands, open forests and other lightly timbered habitats, including farmland and grassland with scattered trees (Higgins et al. 2007). They prefer areas with relatively low tree density, few large logs, and little litter cover but high grass cover (Antos et al. 2008).
Flight or demographic factors	**Species presence: general**	**Ongoing** Diamond firetails occur on the south-east mainland of Australia from south-east Queensland to Eyre Peninsula, South Australia, and about 300 km inland from the sea (Higgins et al. 2007). Their range once extended to north Queensland inland from Cardwell, but they now occur only in the very south of the state (Hodder et al. 2021). They have disappeared from many of the more settled parts of New South Wales, Australian Capital Territory and Victoria, and birds in South Australia appear to have been separated into three isolated subpopulations (Eyre Peninsula, Mt Lofty to Southern Flinders Ranges, and the south-east) (Higgins et al. 2007), with few records from a fourth (Yorke Peninsula) in the last decade (Hodder et al. 2021).
	Species presence: within the Project Areas	**Desktop:** The Diamond Firetail was identified in the PMST. Numerous BDBSA records occur within 25 km of the Project Areas (Figure 19). **Field surveys:** The Diamond Firetail was recorded within the Project Areas during the initial flora and fauna assessment (in 2019), but prior to their listing under the EPBC Act.
	Flight paths (including migratory flight paths)	The species appears to be sedentary, though some populations move locally. Their flight is described as low and direct in long lines with slight undulations.
	Soaring / flocking	**Flocking** - Diamond firetails usually occur in flocks of between 5 to 40, and occasionally more.
	Flight heights	Although Diamond Firetail were recorded during field surveys for the initial flora and fauna assessment, flight heights were not recorded at the time as the species was not listed under the EPBC Act at the time of the surveys (2019). As such, there is no specific flight height data available for the species.
Project Area use:		**Nesting, roosting and/or foraging** Habitat within the Project Areas may be suitable for nesting, roosting and foraging (but limited to woodlands and grasslands with scattered trees).
Proximity of Project to	**Nesting areas**	Nests are bottleshaped and are made of green grass blades and stems lined with fine grasses and feathers. To safeguard their eggs and nestlings, diamond firetails often build their nests into the base of the large stick-nest of a bird of prey such as a whistling kite (*Haliastur sphenurus*), white-bellied seaeagle (*Haliaeetus leucogaster*), wedge-tailed eagle (*Aquila audax*), brown falcon (Falco berigora), nankeen kestrel (*Falco cenchroides*) or a square-tailed kite (*Lophoictinia isura*). Others choose to build their nests among the prickly foliage

		of shrubs such as hakeas, rose bushes, boxthorn and the sea urchin hakea (*Hakea petiolaris*). Diamond Firetail may nest within the Project Areas.
	Roosting areas	Birds roost in dense shrubs or in smaller nests built especially for roosting. Diamond Firetail may roost within the Project Areas.
	Foraging areas	Diamond firetails feed predominantly at ground level, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially during the breeding season) (Blakers et al. 1984; Read 1994). As such, birds are often observed hopping around on the ground (Higgins et al. 2007). Diamond Firetail may forage within the Project Areas.

Table 41. Common Greenshank (*Tringa nebularia*) characteristics.

EPBC Act Listing Status:	Listed marine Listed migratory
Description: (Source: Department of the Environment 2023g)	**General** The Common Greenshank is a heavily built, elegant wader, 30–35 cm in length, with a wingspan of 55–65 cm and weight up to 190 g for both males and females. The bill is long and slightly upturned and the legs are long and yellowish-green. In flight, all plumages show uniformly dark upperwing and contrasting white rump extending in a white wedge up the back, whitish tail and tips of toes projecting slightly beyond the tip of the tail. The sexes are alike (Higgins & Davies 1996). The species is seen singly or in small to large flocks (sometimes hundreds) in a variety of coastal and inland wetlands. Wary, noisy and excitable, the Common Greenshank bobs its head in alarm and flushes with ringing calls, often long before other species. Flight is rapid and often zigzagging. The usual flight call is a distinctive, quick ringing whistle of two, three or four syllables (Higgins & Davies 1996). **Adult breeding** Head and neck are white with heavy black streaking, the interwing coverts are mostly brownish-grey with white fringes. The underbody is white with fine black streaks on chin and throat and there are bold black chevrons on breast and flank. The underwing is white with faint brownish barring on covers and the bill is bluish grey or greenish grey, legs and feet are pale greyish-green (Higgins & Davies 1996). **Juvenile** Like adult non-breeding but head and neck slightly darker with heavier, darker streaking. Bare parts are similar to the adult, but juvenile legs and feet are occasionally bright pale-yellow, dull yellow or dull slate-grey (Higgins & Davies 1996).
Size:	30 – 35 cm in length and up to 190 g in weight.
BAMP size:	Large
Population estimate:	There is no approved Conservation Advice for Common Greenshank. The Species Profile and Threats Database for Common Greenshank (Department of the Environment 2023g) states: *The East Asian-Australasian Flyway (the Flyway) population of the Common Greenshank is thought to be approximately 110 000 (Hansen et al. 2016), of which 18 000–19 000 spend the non-breeding season in Australia (Bamford et al. 2008; Clemens et al. 2008). The species shows significant regional variation but no overall change between atlases 20 years apart (Barrett et al. 2002). Numbers in Victoria have fluctuated but the latest population estimate of 1430 is similar to the previous estimate of 1530 birds (Wilson 2001a). In the Coorong, South Australia, counts in 1981, 1982, 1987 and 2000 ranged from 557 to 717 birds but only 305 were recorded in 2001 (Wilson 2001b).* The *Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (Hansen et al., 2016) estimates the population to be 110 000.
Behaviour:	The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. The edges of the wetlands used are generally of mud or clay, occasionally of sand, and may be bare or with emergent or fringing

		vegetation, including short sedges and saltmarsh, mangroves, thickets of rushes, and dead or live trees. It was once recorded with Black-winged Stilts (*Himantopus himantopus*) in pasture, but are generally not found in dry grassland (Higgins & Davies 1996).
Flight or demographic factors	**Species presence: general**	**Migratory** The Common Greenshank is found in Europe, Africa, Asia, Melanesia and Australasia. The species does not breed in Australia, however, it occurs in all types of wetlands and has the widest distribution of any shorebird in Australia (Higgins & Davies 1996). In South Australia, the species is found throughout the area east of 145° E, but there are a few records from the Flinders Ranges. It is also occasionally seen inland west of 145° E. It is found in all coastal regions west to, at least, Streaky Bay, with scattered records elsewhere along the coast (Higgins & Davies 1996). The Coorong, Penrice Saltfields and Clinton Conservation Park are important sites for the species, along with Gulf of St Vincent and the West coast of the Eyre Peninsula.
	Species presence: within the Project Areas	**Desktop:** this species was identified in the EPBC PMST. No BDBSA records occur within 25 km of the Project Areas. There are some records within 100 km of the Project Areas, on the coast of the Gulf of St Vincent. **Field surveys:** Common Greenshank was not observed during any of the field surveys undertaken for the Project.
	Flight paths (including migratory flight paths)	The Common Greenshank is a migratory species, breeding in the Palaearctic and flying south, in a broad front, overland and along coasts to non-breeding areas for the boreal winter. It arrives in Australia from August, possibly mainly in the west, though it also passes through Torres Strait. The Common Greenshank appears to move elsewhere in Australia from WA by November, but there is no apparent difference in timing of arrival between coastal and inland, or northerly and southerly sites. Numbers increase slowly at most sites during August and September with larger increases at some (widely scattered) sites in October and November. The Common Greenshank overwinters at only a few sites which reach expected wintering numbers from late April to early May. In winter they are found as far south as south-east Tasmania (Higgins & Davies 1996). The proportion of the summer population that winters, varies between years at some sites, e.g., in south-east Tasmania none of the preceding summer population remained in 1965, 11% remained in 1966, 17% in 1967, and 5% in 1968 (Thomas 1970a). At two sites in South Australia, with significant wintering populations, numbers were stable through winter, indicating little movement (Alcorn 1988). However, in the Hobart region, wintering birds showed considerable movement (Thomas 1968). During non-breeding season, most birds within Australia do not seem to move long distances, although dispersive movements may sometimes occur (Higgins & Davies 1996). Northward migration occurs from March, but mostly in April when numbers decline at sites throughout Australia. Influxes have been recorded in Victoria, South Australia and along the east coast.
	Soaring / flocking	**Flocking** - The species is seen singly or in small to large flocks (sometimes hundreds) in a variety of coastal and inland wetlands.
	Flight heights	Flight is rapid and often zigzagging. The species was not observed during targeted survey works at the site, so there is no specific flight height data available for the species.
Project Area use:		**Transient -** No wetland habitat is present within the Project Areas. As such, the occurrence of this species within the Project Areas is expected to be limited to flying birds transiting between areas of suitable habitat.
Proximity of Project to	**Nesting areas**	N/A – The Common Greenshank does not breed in Australia.
	Roosting areas	The Common Greenshank roosts and loafs round wetlands, in shallow pools and puddles, or slightly elevated on rocks, sandbanks or small muddy islets. Occasionally the species will perch and roost on stakes (Higgins & Davies

		1996). The species is known to have roosted on an inland claypan near Roebuck Bay, Western Australia. There is no known Common Greenshank roosting habitat within the Project Areas. The closest potential roosting habitat (Lagoons) is located approximately 1.17 km from the Project Areas. Common Greenshank may utilise this habitat for roosting, when conditions are right for foraging (i.e., the lagoons have water in them), which occurs sporadically.
	Foraging areas	The species is known to forage at edges of wetlands, in soft mud on mudflats, in channels, or in shallows around the edges of water often among pneumatophores of mangroves or other sparse, emergent or fringing vegetation, such as sedges or saltmarsh. It will occasionally feed on exposed seagrass beds (Higgins & Davies 1996). There is no known Common Greenshank foraging habitat within the Project Areas. The closest potential foraging habitat (Lagoons) is located approximately 1.17 km from the Project Areas. Common Greenshank may utilise this habitat for foraging, when conditions are right (i.e., the lagoons have water in them), which occurs sporadically.

Appendix 4. Risk assessment criteria and associated matrix

Table 42. Likelihood of risk occurring.

Likelihood	Description
Highly likely	Is expected to occur in most circumstances
Likely	Will probably occur during the life of the project
Possible	Might occur during the life of the project
Unlikely	Could occur but considered unlikely or doubtful
Rare	May occur only in exceptional circumstances

Table 43. Consequence of risk occurring.

Consequence	Description
Minor	Minor incident of environmental damage that can be reversed
Moderate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts
High	Substantial instances of environmental damage that could be reversed with intensive efforts
Major	Major loss of environmental amenity and real danger of continuing
Critical	Severe widespread loss of environmental amenity and irrecoverable environmental damage

Table 44. Risk assessment matrix.

		Consequence				
		Minor	**Moderate**	**High**	**Major**	**Critical**
Likelihood	**Highly Likely**	Medium	High	High	Severe	Severe
	Likely	Low	Medium	High	High	Severe
	Possible	Low	Medium	Medium	High	Severe
	Unlikely	Low	Low	Medium	High	High
	Rare	Low	Low	Low	Medium	High

Appendix 5. WTG monitoring quadrat

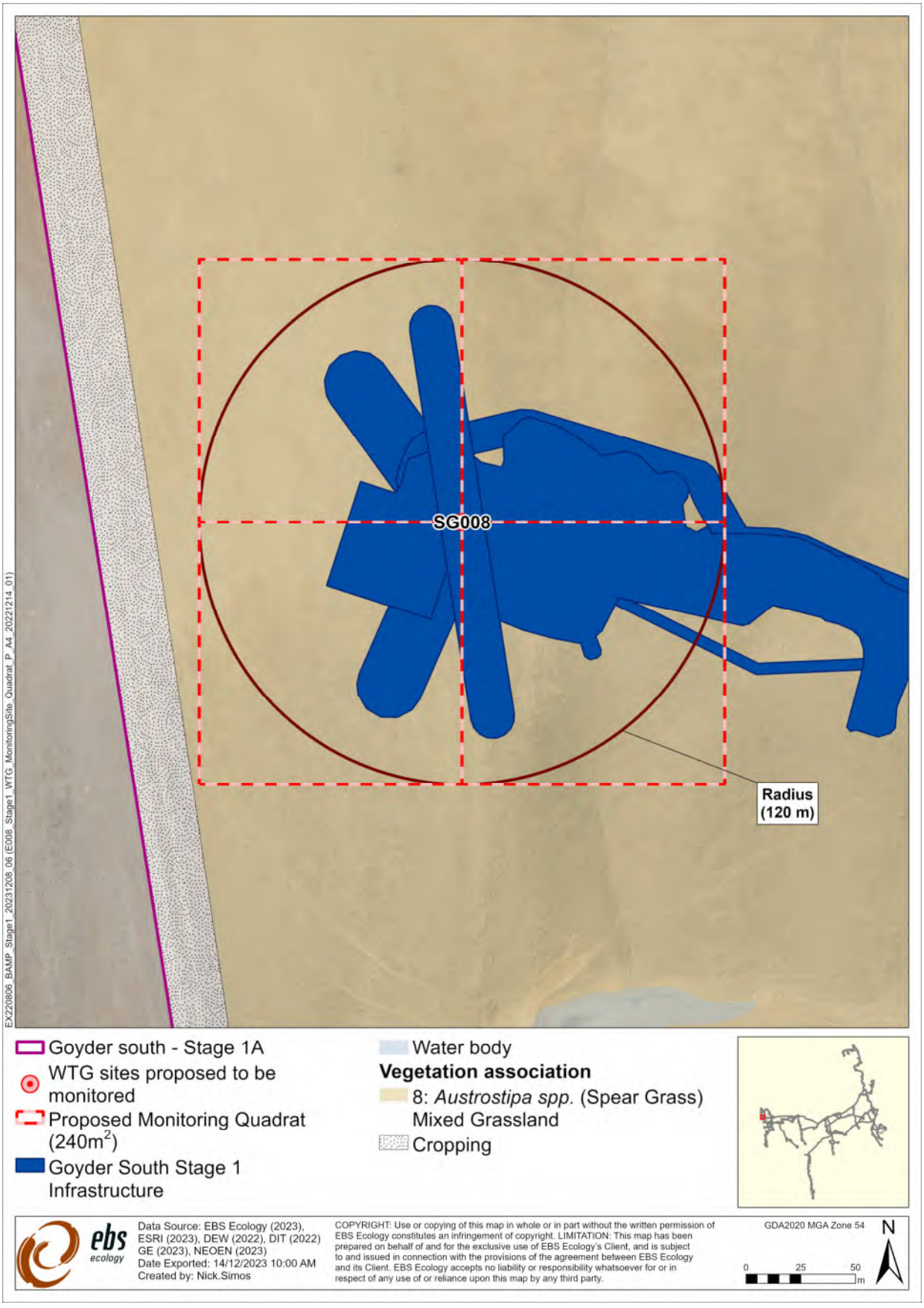

Figure 26. Example of WTG collision monitoring quadrat.

Appendix 6. Bird size classes

Table 45. Bird size classes

Common name	EPBC Act Listing Status	Size (length in cm)	Size Category*
Common Sandpiper	Migratory	19 - 21	Medium
Southern Whiteface	Vulnerable	11.5	Small
Fork-tailed Swift	Migratory	18 - 21	Medium
Sharp-tailed Sandpiper	Migratory	17 - 22	Medium
Curlew Sandpiper	Critically Endangered; Migratory	18 - 23	Medium
Pectoral Sandpiper	Migratory	19 - 24	Medium
South-eastern Hooded Robin	Endangered	17	Small
Satin Flycatcher	Migratory	17.5	Small
Blue-winged Parrot	Vulnerable	24	Medium
Diamond Firetail	Vulnerable	10 - 12	Small
Common Greenshank	Migratory	30 - 35	Large

***Size Category: Small = <18 cm; Medium = 18 – 25 cm; Large = > 25 cm.**

Appendix 7. WTG monitoring survey datasheet

This datasheet (or similar) should be completed for each WTG monitoring survey undertaken (at each individual WTG site).

If a dead or injured bird, or feather-spot is found, then the "Dead or injured bird datasheet" should also be completed.

Date and time details:			
Date: / /	**WTG ID:**	**Observer(s):**	
Start time:		**Finish time:**	
Survey details:			
Survey method (circle): *Dog search (at WTG)*	*Human search (at WTG)*		
If dog search, provide dog ID:			
Ground visibility (circle): *High*	*Moderate*	*Poor*	
Was entire WTG search area surveyed? *Yes / No*	**If not, estimate area surveyed as a percentage (%) of total search area:**		
Survey limitations (e.g., long grass, any areas that were inaccessible/not surveyed and why):			
General photo overlooking search area taken: *Yes / No*	**Photo details** (e.g., photo direction, camera number, photo number, time of photo, location of saved photo):		
Weather details:			
Temperature:			
Precipitation (circle): *Fine*	*Showers*	*Rain*	
Wind (circle): *Calm*	*Gentle breeze*	*Moderate breeze*	*Strong*
Wind direction:		Cloud cover (%):	
WTG bird mortality record:			
Dead / injured bird recorded? *Yes / No*	**If yes, number recorded:**	**Dead or injured bird datasheet completed?** *Yes / No*	**Photographs taken?** *Yes / No*
Any additional comments / notes:			

Appendix 8. Dead or injured bird datasheet

This datasheet (or similar) should be completed for every dead / injured bird found during WTG mortality surveys and for any dead/injured bird observed incidentally (i.e., not during routine WTG mortality surveys).

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 a suitably qualified and experienced ecologist and/or suitably qualified bird expert.

Date and location details:			
Date: / /	**Time of find:**	**Observer(s):**	
Location: (WTG number or description)		**Easting & Northing of carcass:**	
Survey and detection details:			
Survey method (circle): *Dog search (at WTG)*	*Human search (at WTG)*	*Incidental find*	
For dog or human searches at WTGs: WTG survey datasheet must also be completed.			
For incidental find: Describe activity that resulted in incidental find (e.g., driving along track):			
Distance of carcass / injured animal from observer when first detected:			
Describe ground visibility within a 1 m radius of where carcass / injured animal was found:			
Photo and camera details (e.g., camera number, photo numbers, time of photos, location of saved photos):			
Weather at time of detection			
Temperature:			
Precipitation (circle): *Fine*	*Showers*	*Rain*	
Wind (circle): *Calm*	*Gentle breeze*	*Moderate breeze*	*Strong*
Wind direction:		Cloud cover (%):	
Carcass / injured animal details:			
Species (if unknown, insert details of closest taxonomic group, e.g., raptor):			
Age (circle): *Unknown*	*Adult*	*Juvenile*	
Sec (circle): *Unknown*	*Male*	*Female*	
Condition (circle): *Dead (carcass)*	*Injured but alive*	*Feather spot (5 feathers or more)*	
Degree of decay (circle): *Fresh*	*More than a week old*	*Very or highly decayed*	
Describe location and type of any injuries evident:			

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